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Untitled

W. Scott Tebb

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TEA

AND THE

EFFECTS OF TEA DRINKING.

BY

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In March, 1904, the Southwark Borough Council at the request of Sir William Collins gave permission for an inquiry to be made into the constituents of tea in order to ascertain what injurious ingredients were present, and if it were possible to obtain the characteristic effects without subjecting tea-drinkers to any of the deleterious symptoms. The subject will be seen to be of importance and I propose to include a brief history of the use of the Tea plant, together with a general review of the experience gained by those best competent to judge of the effects since its introduction of what has now come to be considered a necessity of life. In addition there are set forth the results of examination of different samples of tea and the general conclusions to which I have arrived.

What we call tea, is called by the Chinese tcha, tha, or te, and by the Russians tchai. The original English word was tee, at least this is the name used by Samuel Pepys one of the earliest to allude to the herb in this country. Tee was afterwards altered to tay, as will be seen from Pope’s lines in the “Rape of the Lock.”

Soft yielding minds to water glide away And sip, with nymphs, their elemental tay.

Or again,

Hear thou, great Anna! whom three realms obey Dost sometimes counsel take, and sometimes tay.

Some of the modern editions of Pope have altered the spelling at the expense of the rhyme.

The tea-plant, Thea Sinensis, botanically speaking a close ally of the Camellia is in its natural state a tree which attains to 20 or 30 feet in height. Under cultivation it remains a shrub from three to six feet high. It grows in all tropical and sub-tropical countries, and roughly it takes the labour of one man a day to produce a pound of tea. The leaves--the only part of the plant used in commerce--vary from two to six inches long, are evergreen, lanceolate and serrated throughout nearly the whole margin; the leaves are stalked and arranged alternately on axis, the flowers somewhat resemble apple blossoms but are smaller.

The shrubs are planted in rows three or four feet apart and look like a field of currant or gooseberry bushes; at the end of the third year the bushes become large enough to allow of the first picking and in the eighth year the plant is cut down, when new shoots spring up from the old roots. In Ceylon and parts of India the first picking is in March and there may be as many as 25 pickings in the season until October; in China the first picking is in April, and in Japan late in April or early May. The early pickings make the finest quality of tea, and the very late leaves are not usually exported at all, but are used by the peasants locally. In preparation for commerce the leaves are subjected to various processes of drying, rolling and roasting, into which it would not be necessary at any length to enter; the essential point to remember is that black tea differs from green in that after a short preliminary rolling and roasting, the leaves are exposed to the air in a soft moist state, when they undergo fermentation with the result it is said that a portion of the tannic acid is converted to sugar. Robert Fortune,[1] an authority on the cultivation of the tea plant thought that the

differences of manufacture “fully account for the difference in colour, as well as for the effect produced on some constitutions by green tea, such as nervous irritability, sleeplessness, &c.”

When we come to look into the early origin of the practice of tea-drinking we find that the subject is shrouded in the mists of antiquity. There are many legendary stories of the discovery and use of tea by the Chinese, but the only authentic and well-attested accounts were given by two Mahommedans who travelled in India and China in the ninth century. The original manuscript was found in the Comte de Seignelay’s library by Eusebius Renaudot and published in 1733. There is plain internal evidence that the manuscript was written about 1173, for there are observations upon the extent and circumference of the walls and towers of Damascus and other cities in subjection to the Sultan Nuroddin, who is spoken of as living at that time. This prince died in 1173 which fixes the date of the narrative before that time. The account speaks of the Arab merchants having been present in China in the years 851 and 867 respectively. On page 25 occurs the following important passage “The Emperor also reserves to himself the revenues which arise from the salt mines and from a certain Herb which they drink with hot water, and of which great quantities are sold in all the cities, to the amount of great sums. They call it _sah_ and it is a shrub more bushy than the pomegranate tree and of a more taking smell, but it has a kind of bitterness with it. Their way is to boil water, which they pour upon this leaf, and this drink cures all sorts of diseases; whatever sums are lodged in the treasury arise from the Poll-tax, and the duties upon salt, and upon this leaf.”[2]

Tea was therefore much in vogue in China in the 9th century. From China the knowledge was carried to Japan, and there the cultivation was established at the beginning of the 13th century; from that time until the 19th century China and Japan have been the only two tea producing countries. As with all innovations Europe and particularly England was very slow to take to the practice, for tea is hardly mentioned by any of the writers prior to the 16th century.

One of the earliest to allude to the subject was Giovanni Botero[3] in 1596, in his treatise on the causes of the magnificence and greatness of cities; he remarks that “they (the Chinese) have also an herb, out of which they press a delicate juice, which serves them for drink instead of wine, it also preserves their health and frees them from all those ills that the immoderate use of wine doth breed unto us.”

It will be observed that in these early accounts much stress is laid on the beneficial action of tea in preserving health and curing disease, and this was in all probability the first use to which the shrub was applied. Thus one of the Sloane Manuscripts, dated 1686, gives a long list of “qualities and operations,” attributed by the Chinese to the tea plant. It was said to purify the blood and kidneys, cure giddiness and pains in the head, vanquish superfluous sleep and heavy dreams, open obstructions, clear the sight, strengthen the memory, sharpen the wits and quicken the understanding.

About the year 1657, Thomas Garway of the Exchange Alley issued a sheet proclaiming the virtues of tea; the alleged qualities being almost identical with those given in the Sloane Manuscript just mentioned. This was a sort of advertisement of his place of business and he tells us that “many noblemen, physitians, merchants, and gentlemen of quality” sent to town for the “said leaf,” and “daily resort” to his house in Exchange Alley to drink tea. He informs us that prior to 1657 it was only used as a “regalia in high treatments and entertainments,” and for presents for princes and grandees.

Another early reference is from an advertisement in the “Mercurius Politicus” for 1658. “That excellent, and by all physitians approved _China_ drink, called by the _Chineans_, Tcha, by other nations _Tay alias Tee_ is sold at the _Sultaness-head_, a _Cophee-house_ in _Sweetings_ Rents, by the Royal Exchange, London.”[4]

A further early reference is by Thomas Rugge[5] which may be seen in a manuscript at the British Museum. “About this time the parliment that was forced out the 13th day of October, 59; it was called by all sorts of persons the Rump, because they war soe few in number; and there war also att this time a Turkish drink to be sould, almost in every street called Coffee, and another kind of drink called Tee, and also a drink called Chocolate which was a very harty drink.”

It is rather difficult to reconcile this account of the prevalence of the use of tea as a drink with that of other writers of the period. Thus Pepys writing a year afterwards under date September 25, 1660, says: “I did send for a cup of tee (a China drink) of which I never had drank before.” This clearly points to the novelty of the practice in 1660 for Samuel Pepys was Secretary of the Admiralty, and a public man of keen observation, and it is almost impossible if tea was commonly sold as a drink at this time that he should have been unaware of the fact. Macaulay[6] also mentions that about this time tea “had been handed round to be stared at.” It seems therefore clear that the herb was quite recently introduced in 1660, and it is possible that Rugge under the name of “tee” is referring to hot infusions of other leaves for it is well known that herbs were commonly used for making different sorts of teas as

sage tea, &c.[7]

The first official notice of tea is in the Act of Parliament (12 Carolus II., c 23), by which a duty of eightpence was charged on every gallon of coffee, chocolate, sherbet, and tea made for sale. In 1662 Charles II. married Princess Catherine of Portugal, and the Poet Waller has immortalised tea-drinking by a birthday ode in her honour.

The muse's friend, tea, does our fancy aid, Repress those vapours which the head invade, And keeps that palace of the soul serene Fit, on her birthday, to salute the Queen.

Two years later the King was a recipient of the then valuable gift of 2lb. 2oz. of tea from the East India Company.

In Pepys Diary under the date of June 28, 1667, we read "Home and there find my wife making of tea; a drink which Mr. Pelling, the Potticary, tells her is good for her cold and defluxions." Tea, therefore, was just coming into vogue. In 1669 the East India Company received two canisters containing 143½■ pounds; the price at this time was sixty shillings a pound. The Company imported 4713 pounds in 1678, but this amount probably glutted the market, for in the six subsequent years the imports were quite inconsiderable. In 1697-99 the imports averaged 20,000, in 1700-08 they reached 80,000 pounds, in 1728 over a million pounds, in 1754 four and a half million, in 1763 six million, and in 1779 nearly ten million pounds.[8] It is not necessary to follow the imports during the whole of the 18th century, speaking generally it was found that excessive duties led to smaller imports, and at the same time to a large increase of smuggling and other irregularities.

Since 1800 there has been an enormous increase of consumption in the United Kingdom, as will be seen from the following figures:--

TABLE A.

Average number of Average Average number of Year-Periods. pounds of Tea annual pounds of Tea consumed consumed per annum. Population. per head per annum. 1801-10 23,717,882 16,794,000 1·41 1811-20 24,753,808 19,316,700 1·28 1821-30 28,612,702 22,433,900 1·27 1831-40 34,441,766 25,257,200 1·36 1841-50 44,286,600 27,566,300 1·61 1851-60 65,160,456 28,172,400 2·31 1861-70 97,775,548 30,027,600 3·26 1871-80 144,462,622 33,055,020 4·37 1881-90 178,130,836 36,178,144 4·92 1891-1900 224,076,800 39,440,316 5·70 1901-03 255,270,472 41,550,773 6·10

Since the beginning of the last century therefore the average consumption per head has increased from 1·4 to 6·1 pounds. In our Australian and New Zealand Colonies the quantity consumed is even much larger than in the United Kingdom as will be seen from the table below:--

TABLE B.

Average number of pounds of Tea consumed per head per annum. New South Wales 8·01 Victoria 7·38 South Australia (except N. Territory) 8·87 South Australia (North Territory) 6·44 Western Australia 10·07 Queensland 7·09 Tasmania 6·62 All Australia 7·81 New Zealand 6·78

The enormous quantity of tea consumed in Great Britain and our Colonies will be better appreciated if comparisons are made with other Countries:--

TABLE C.

Average number of pounds of Tea consumed per head per annum. Russia 0·93 Germany 0·12 Holland 1·48 France 0·06 United States 1·09 Canada 4·64

I should like to say a few words concerning the sources of tea supply to the United Kingdom. Of course until fairly recent times practically all the tea came from China. Early in the last century it was found that the tea plant was indigenous to India. In 1825 the Society of Arts offered their gold medal "to the person who shall grow and prepare the greatest quantity of China tea, of good quality, not being less than 20 pounds weight"[9] in the East Indies and British Colonies. In 1832 Dr. Wallick made a report on the cultivation of tea in India and said "that under a well-directed management the tea plant may at no distant period be made an object of extensive cultivation in the Honourable East India Company's Dominions." Several years afterwards in 1839 the Society of Arts Medal was awarded to Mr. C. A. Bruce "for discovering the indigenous tea tracts and successfully cultivating and preparing tea in the British possessions in India." In 1840 the first Indian Tea Company was formed, in 1853 tea was growing in Cachar, in 1856 in

Sylhet, and in 1864 in Darjeeling and other places. Much more recently Ceylon has become prominent in supplying this country with tea. It came about in this way; the coffee plantations were destroyed by disease in 1868 and the planters succeeded in growing cinchona and tea as alternative crops. This experimental growth of tea in Ceylon has now become a flourishing industry.

The following table shows in five year periods since 1866, the proportion of each 100 pounds of tea imported into the United Kingdom from India, Ceylon, China and other countries respectively:

TABLE D.

Five Year Other Periods. India. Ceylon. China. Countries. 1866-70 6·62 0·00 91·44 1·94 1871-75 10·50 0·08 85·62 3·80 1876-80 18·26 0·06 80·18 1·50 1881-85 26·73 0·86 70·71 1·71 1886-90 39·66 10·96 47·07 2·32 1891-95 47·10 29·30 21·04 2·56 1896-1900 50·25 36·30 10·52 2·93 1901-03 58·45 33·28 4·74 3·53

It appears that China which formerly supplied 90 per cent. in 1866, now contributes less than 5 per cent. of our tea. During the same period the Indian supply has gone up from 6 to 58 per cent., and Ceylon which only commenced to send tea in 1875 now sends the substantial proportion of 33 per cent. of the total importation.

From the above tables it will be seen that of the yearly average of six pounds consumed in the United Kingdom, one third of a pound comes from China, three and a half pounds from India, and two pounds from Ceylon. The Dutch the next largest tea-drinkers to the British consume a pound and a half each person per annum, half of this comes from Java and the remaining half from the United Kingdom (principally of Chinese origin). Most of the tea drunk in Russia comes from China. In Australia two-thirds of the tea is imported from India and Ceylon, and the rest comes from China. In the United States more than half the tea comes from China and the bulk of the remainder from Japan.

I now proceed to deal briefly with the constituents of tea which are generally believed to impart to the tea infusion its special characters.

Alkaloid. The alkaloid which is present in tea to the extent of 3 or 4 per cent. is thought to be identical with that found in Coffee, viz: caffeine. It has the well-known stimulant and invigorating qualities with which the taking of tea is associated. Thus the brain is stimulated, the intellect becomes clear; there is removal of languor and fatigue with increased wakefulness and alertness. The following is by a Chinese writer, who lived over 1,000 years ago and he writes so well, and so much to the point, that we must not quarrel with him if he has omitted to give us the reverse aspect of the question.

It tempers the spirits, and harmonises the mind, Dispels lassitude, and relieves fatigue, Awakens thought, and prevents drowsiness, Lightens or refreshes the body, and clears the perceptive faculties.

We shall also forgive Cowper’s strong prepossession in favour of tea when we call to mind the cosy, comfortable picture which he describes:

And while the bubbling and loud hissing urn, Throws up a steamy column, and the cups That cheer but not inebriate, wait on each So let us welcome peaceful evening in.

I suppose that this verse has been as much quoted as anything in our language, and the homely picture of the evening meal has done much to wean the English people from stronger drinks.

The following article from the _Lancet_ of 1863 presents all the arguments, and very important arguments they are and very well stated which can be placed to the credit of tea-drinking:--

“It has a strange influence over mood--a strange power of changing the look of things, and changing it for the better: so that we can believe and hope, and do under the influence of tea, what we should otherwise give up in discouragement and despair,--feelings under the influence of which tissues wear rapidly. In the language of the poor, who in London we are told spend one-eight of their income in buying tea, it produces a feeling of comfort. Neither the philosopher nor the philanthropist will despise this property of tea, this power of conferring comfort, or removing _ennui_, of promoting those happier feelings of our nature under which we can do most and bear most. There is no denying the considerable dependence of our moods and frames upon substances; and as moods are as important as muscles, as they affect as largely a man’s ability for the great ends of life, we cannot regard the cheapening of such substances, when devoid of noxious qualities, as other than a most important benefit to the poor.”

This feeling of comfort, this power of changing the aspect of affairs, of appealing to the happier side of our nature, in other words of putting us at our best, is undoubtedly due to the alkaloid of tea. Since I have been interested in the subject I have conversed with a number of friends, and many have told me that the best time of day to do any writing or intellectual work is after a cup of tea in the afternoon, and I must confess to feeling more myself at this time than at any other; but, on the other hand if no afternoon tea is taken, this period of the day is when most people feel fagged and tired and incapable of mental exertion. This shews the great influence exercised by tea over our moods and feelings; and if tea is taken in moderation this property may be of great help and a mental stimulus to us in our daily vocation.

Tannin.--The other important constituent of tea, viz.: tannin is present to the extent of 10 or 20 per cent. and it is this substance to which most of the injurious effects of tea have been attributed. In excess tannin tends to depress the action of the digestive fluids and ferments. It interferes with the normal activity of secretion by constricting the blood vessels and diminishing the circulation, and lastly it tends to combine with the nitrogenous principles of the food rendering them insoluble and incapable of digestion. The tendency therefore of this substance is greatly to impair digestion and it gives rise to palpitation of the heart, headache, flatulence, loss of appetite, constipation and other symptoms so well-known at the out-patient departments of our general hospitals; on inquiry it is often found that the patient is accustomed to drink large quantities of tea, which has stood for long periods and consequently extracted excessive amounts of tannin.

In addition to the alkaloid and tannin the older writers asserted that tea contained a volatile oil to the extent of 0·6 to 1 per cent., and many of the qualities and deleterious effects of tea have been traced to the presence of this substance. The latest experiments, however throw some doubts on these early results. Thus in the report of Schimmel & Co. for April, 1897, it is stated (p. 39) that “in former years we endeavoured on several occasions to distil various kinds of tea in order to introduce tea oil ... we have, however, in no case succeeded in obtaining more than mere traces of oil,” and they conclude that in the hands of the early experimenters the oil found on distillation was due to the artificial flavouring of tea which was common at that time. Schimmel & Co. in their Report for April, 1898 (p. 50) refer to a report of the Botanical Gardens in Buitenzorg for 1896. It appears that experiments were made on a large scale, thus 2500 kilograms of freshly fermented tea leaves were submitted to steam distillation and 130 cubic centimetres or 0·0052 per cent. of oil was obtained.[10] It must be remembered that this oil was only found in freshly fermented leaves and from the minute quantity I think we may conclude that tea oil if present has little or no connection with the qualities and attributes of tea, or the deleterious effects to which it may give rise.

A word or two with reference to the adulteration of tea. In former times a good many samples and especially of green tea were faced; this consisted in the addition of some colouring matter as Prussian blue, turmeric, or indigo; and sometimes black tea was faced with graphite. Another practice formerly prevalent was the addition of various leaves having a resemblance to tea leaves; and then there was the use of exhausted or spent leaves. All these forms of adulteration are now happily very seldom practiced. To shew the extreme rarity of tea adulteration in this country, in the 17 years from 1887 to 1903, 7595 samples were purchased under the Food and Drugs Acts and of these only 23 were found to be adulterated. These figures include 15 cases in 1898, and according to the report of the Local Government Board for this year many were of the description known as caper tea. This is one of the China varieties and consists of small granular masses made up by the aid of gum and starch, and this lends itself to the addition of sand and stones as actually happened in the cases in question. I think that with this exception of mineral matter, tea adulteration in this country may now be said to be practically non-existant.

We have glanced through the general effects of the important constituents of tea. I now propose to consider the amount of harm which can be justly attributed to this popular article of daily consumption.

The opposition to tea on the ground of injury to health is almost as old as the introduction of tea itself. One of the earliest objectors was Dr. Simon Pauli,[11] the Physician to the King of Denmark, in a commentary he wrote on the abuse of tobacco and tea. He objected on the ground that “tea is moderately heating, bitter, drying and astringent.” He felt it incumbent on him to warn Europeans against the abuse of tea, especially as the herb he said by no means answered the encomiums bestowed upon it by the Chinese and Japanese. “I wish all persons especially such as are old would obstinately reject _tea_, which so dries the bodies of the _Chinese_ that they can hardly spit.” Pauli was also a strong opponent of Coffee and alleged that it produced “sterility.”

Another powerful writer on the subject was Dr. Cohausen a learned and ingenious German physician. The works of this author were numerous and bore evidence of the vigour of his intellect and of his application to letters. His work entitled “Neothea,” and published in 1716, was written to shew the folly of sending to China for tea, when we had so many herbs to hand, just as pleasant and far more healthy. His wit for which he was justly celebrated was not sufficiently powerful to render the use of tea unfashionable.

Boerhaave, the great Dutch physician, and follower of Hippocrates and Sydenham had an objection to tea, but not so much to the herb itself as to the practice of drinking of hot liquids. He refers to those persons who “weaken their bodies with perpetual drinking of aqueous liquors; such is the very bad custom which prevails amongst the Dutch, who indulge themselves in a sedentary life, and all day long use those Asiatic drinks made of the berries of coffee or leaves of tea.”[12] He also attributed to these drinks certain nervous disorders. “I have seen a great many, so enervated by drinking too freely of those liquors (tea, coffee and the like) that they could hardly move their limbs, and likewise several who were seized with the apoplexy and palsy from that cause.”[13]

An early lay opponent of tea-drinking was John Wesley. He tells us that when he first went to Oxford with an exceedingly good constitution “he was somewhat surprised at certain symptoms of a paralytic disorder.” His hand shook especially after breakfast, and he observed that if he gave up tea-drinking for two or three days, the shaking ceased. On inquiry he found that tea had the same effect on others, and particularly on persons whose nerves were weak. This led him to lessen the quantity and to drink weaker tea, but still for about 26 years he was more or less subject to the same disorder. In 1746 he began to observe that a number of people in London were similarly affected, some suffering from the nerves with decay of bodily strength, and he asked them if they were hard drinkers, and learnt in reply that they drank nothing but a little tea, morning and evening. He came to the conclusion that they suffered from the effects of tea like he had himself. Wesley thought he should set an example and broke himself of a practice which had lasted for 27 years. The first three days he suffered from headache more or less all day long, and was half asleep from morning to night; on the third day his memory failed but the symptoms abated in the following day and his memory returned. He felt great benefit from the abstinence, and found that his hand was as steady at 45 as it had been at fifteen.

One of the most determined opponents of tea-drinking in the 18th century was Jonas Hanway, the eminent philanthropist and “father” of Sunday schools. His views may be gathered from the title of his work.[14] Owing to the results of this beverage he said “men seem to have lost their stature and comeliness; and women their beauty ... what Shakespeare ascribes to the concealment of love, is _in this age_, more frequently occasioned by the use of _tea_.... I am persuaded the inhabitants of this island will never increase in number nor enjoy a blooming health whilst they continue such an extravagant use of tea.” Hanway’s exaggerations succeeded in drawing Dr. Johnson into the controversy. The great man in a review of Hanway’s work said “he is to expect little justice from the author of this extract, a hardened and shameless tea-drinker who has for twenty years diluted his meals with only the infusion of this facinating plant, whose kettle has scarcely time to cool, who with tea amuses the evening, with tea solaces the midnights, and with tea welcomes the morning.”[15]

We learn from Boswell that “no person ever enjoyed with more relish the infusion of that fragrant leaf than Johnson. The quantities which he drank of it at all hours were so great, that his nerves must have been uncommonly strong, not to have been extremely relaxed by such an intemperate use of it.” Boswell says that Johnson assured him he never felt the least inconvenience from it. In a footnote to page 105 of Boswell’s “Life” we are informed that a Mr. Parker of Henley was in possession of a tea-pot which belonged to Dr. Johnson and held “above two quarts.”

At the end of the eighteenth century Dr. Lettsom, a well-known authority on the subject, published a work on the “Natural History of the Tea Tree.” He found that amongst the less hardy and robust complaints were ascribed to the drinking of tea “there are many who cannot bear to drink a single dish of tea without being immediately sick and disordered at the stomach, ... and that in irritable constitutions it speedily excited the nerves to such a degree as to give rise to uneasy sensations and bring on spasmodic affections.” He also says “I know people of both sexes, who are constantly seized with great uneasiness, anxiety, and oppression as often as they take a single cup of tea.” For children he thought it decidedly harmful; “children and very young persons in general, should as much as possible be deterred from the use of this infusion. It weakens their stomach, impairs the digestive powers and favours the generation of many diseases.” On the whole however, he was not altogether opposed to the practice in strong healthy vigorous adults, “to such it is undoubtedly wholesome and equal at least if not preferable to any other kind of regale now in use.” On another page we read that “if not drunk too hot, nor in too great quantities it is perhaps preferable to any other vegetable infusion we know.”

Quite at the end of the eighteenth century, Dr. Buchan, who was something of a medical reformer, and had naturally observed the results of tea-drinking thought that the ill-effects proceeded rather from the imprudent use of it than from any bad qualities in the tea itself. In his “Domestic Medicine” (p. 74) he says, “good tea, taken in moderate quantity, not too strong, nor too hot, nor drank upon an empty stomach, will seldom do harm, but if it be bad, which is often the case or substituted in the room of solid food, it must have many ill effects.” He observed that “females who live much on tea and other watery diet, generally become weak, and unable to digest solid food; hence proceed hysterics, and all their dreadful consequences.”

In the early part of the nineteenth century we have the opinion of William Cobbett, a vigorous writer and acute observer of the habits of the time in which he lived. In his “Advice to young men” Cobbett remarks “Let me beseech you to resolve to free yourselves from the slavery of the _tea_ and _coffee_ and other _slop kettle_, if unhappily you have been bred up in such slavery. Experience has taught me that those slops are _injurious to health_. Until I left them off (having taken to them at the age of 26) even my habits of sobriety, moderate eating, early rising, even these were not, until I left off the slops, sufficient to give me that complete health which I have since had.”

The most complete but painful description I have come across of the distressing symptoms occasionally associated with tea-drinking is given by Dr. James Henry[16] who writes in 1830. He refers to the case of a gentleman who commenced the use of tea of ordinary strength at the age of 14. Shortly afterwards sleep became less sound, and he became nervous and easily agitated about matters of small consequence. Afterwards he suffered from uneasiness even while sleeping, also from nightmare and palpitation of the heart. His sleep was disturbed during the whole period of ten years; during this time he took three cups of tea in the morning and three cups in the evening. At the age of 24 or 25 he used tea more freely and his sleep became more and more disturbed. He sometimes took tea twice in the same evening. The suffering was very great; he did not fall asleep at night until two o’clock and the agitation of mind and body was indescribable. The pulsations of the heart were sometimes quick and faint, and sometimes so violent that he could not lie on his left side. Sometimes the pulsations became scarcely perceptible for several moments, at such times the patient felt as if he were dying and if he fell asleep he awoke with a violent start. He wished to sleep that he might avoid the distressing sensations which he felt while awake, but feared to do so lest his awakening should be accompanied by frightful agony. After a time the distressing sensations were so marked especially just before going to bed that “in the society of my family I felt myself so agitated without any apparent cause that I was unable either to speak or think deliberately, or even to remain in one position and have been obliged that I might not be thought insane to rise abruptly, hurry out of the house and take violent exercise in the open air.” At 30 years of age he renounced tea and never suffered afterwards, “the very first night I slept soundly and I have never had any return either of sleeplessness or of starting or of the sensation of imminent death, unless on the rare occasions when I have returned to the use of tea.” Dr. Henry argued from the above case that “tea and coffee act as a poison upon some persons” and on turning his attention to the subject he found that such cases were far from uncommon, and concluded that like alcohol tea may be indulged in for a series of years without apparent ill consequences, but that sooner or later it undermines the health, and renders life miserable. As with alcohol he recognises two stages. The first stage was characterised by agreeable sensations in the stomach, moderate perspiration, quickened pulse and increased vivacity of mind and body. In the second stage there was irregular pulse, sometimes rapid, sometimes slow and intermitting, with palpitation and pains in the region of the heart--a vivacity of thought and action which is quite uncontrollable by the will, a painful insensibility to impressions of all kinds, twitchings of the muscles, disturbed sleep, frightful startings especially in the evening, irregular and sometimes cold perspiration, impaired appetite and defective circulation in the extremities. He concluded “that the immoderate use of tea and coffee produce a disease which bears a close resemblance to the _delirium tremens_ of whisky drinkers, and which is almost identical with the diseased state induced by the excessive indulgence of opium.”

We now come to the opinion of the more recent authorities and a few remarks are necessary concerning the symptoms liable to result from excessive tea-drinking. In the _Boston Medical and Surgical Journal_ for September 10th, 1868, a writer Dr. Pratt explains the effects on himself of 12 grains of the alkaloid of tea. After two hours there was great physical restlessness, a very uneasy state of mind which has been described by Lehmann as “mental anguish.” Soon after there was marked tremulousness of the hands and arms; the hand trembled so violently that it was impossible to write with any regularity. The mind was excessively uncomfortable and anxious which admitted not of the slightest rest; it was in a state of most active and persistent thinking in spite of all attempts at forgetfulness. The severe symptoms lasted about two hours. Dr. Pratt spoke to one of the most prominent New England lady writers. She had tried green tea when pressed to do a large amount of writing in a short time. Some time after taking a large quantity of tea she felt as “if there was nothing left but her head which furnished rapidly language or ideas of the best quality, and in goodly quantity all night long.” The next day there was headache and more or less prostration.

An important article on the “toxic effects of tea” was contributed by Dr. Morton[17] in 1879. He said that the bad effects of tea tasting were known and recognised by the tea tasters themselves and that few could carry on the business for many years without breaking down. The immediate effects of moderate doses were increased rapidity of pulse, increased respiration, agreeable exhilaration of mind and body, a feeling of contentment and placidity, and an increase of intellectual and physical vigour with no noticeable reaction. The immediate effects of an excessive dose, were a rapid elevation of the pulse and marked increase of respiration; there was no period of exhilaration, but immediate and severe headache, dimness of vision, ringing in the ears, and dulness and confusion of ideas. Following this a severe reaction with exhaustion of mind and body, tremulousness, nervousness

and dread of impending harm. The effects of continued doses were--continuance of tremulousness, extreme susceptibility to outside impressions, constipation and diminution of urine.

Dr. Morton concluded that tea--like other potent drugs--had its proper and improper uses, in moderation it was a mild and pleasant stimulant followed by no harmful reaction but that continued and immoderate use led to serious symptoms including headache, giddiness, ringing in the ears, tremulousness, nervousness, exhaustion of mind and body, disinclination to mental and physical exertion, increased and irregular action of the heart and also dyspepsia.

Dr. Bullard[18] of Boston made inquiry into the subject of poisoning from excessive tea drinking and found that the prominent symptoms were loss of appetite, dyspepsia, palpitation of the heart, headache, nervousness and various forms of functional nervous symptoms of an hysterical or neuralgic character; he found that usually speaking five cups of tea a day on an average were required to produce symptoms of tea poisoning.

A more recent investigator Dr. Wood[19] found in his practice at the Brooklyn Central Dispensary that of 1000 consecutive cases applying for general treatment, 100 or 10 per cent. were found to be “liberal indulgers in tea,” and suffering from its deleterious effects; of those 100 patients:--

45 complained of headache. 20 ” persistent giddiness. 20 ” despondency. 19 ” indigestion. 19 ” palpitation of the heart. 15 ” sleeplessness.

Dr. Wood found that when tea had been used for a considerable period in excess, the symptoms were giddiness, mental confusion, palpitation of the heart, restlessness, sleeplessness, hallucinations, nightmare, nausea, neuralgia, with prostration and anxiety. In three of Dr. Wood’s cases there was a tendency to suicide.

Mr. Jonathan Hutchinson, a great authority thinks that it is only the abuse of tea which is attended with serious consequences. “For my own part I have not the least hesitation in recording the conviction that the development of the tea trade has been in the past and will be in the future a most important aid to the progress of civilisation. Nor do I believe that it will be attended by any serious drawbracks.”[20] But he sounds a note of caution when he says “there can be no doubt whatever that the injudicious use of tea may produce not only alarming attacks of disturbance of the heart, but seriously impair the digestion, and enfeeble the nervous system.”

Sir Andrew Clark, who gave much consideration to the subject, in a lecture delivered at the London Hospital said, “I may remark incidentally that it has always been a matter of surprise to me how it is that we English people do not suffer more than we do from our indulgence in tea, especially tea prepared as it usually is, and taken after a prolonged fast early in the morning. It is a great and powerful disturber of the nervous system, and no one who has any regard for his or her nervous system would take it in that way. Its immediate effect may be all that can be desired. It relieves the _malaise_ which is in itself a sign of warning, and it thus enables the consumer to disregard it. Beware gentlemen, of thus sitting on a safety-valve. Nature provides a warning in most cases of impending disaster, and if you wilfully disregard or stifle them, you do so at your peril. This pernicious habit of taking strong tea after a night’s fast, repeated day after day, week after week, year after year, leaves its stamp on the nervous organism of the individual, and this stamp is handed down, in part at any rate, to the generation that follows.”[21]

Sir Lauder Brunton[22] who has also given much study to the question made some remarks in his Lettsomian Lectures on the “Disorders of Digestion.” He said that tea was very apt to cause a feeling of acidity and flatulence. Sometimes the acidity comes on so soon after the tea taken that it is difficult to assign any other cause for it than an alteration in sensibility of the mucous membrane of the stomach or œsophagus. The effect of tannin he said was to interfere very considerably with the digestion of fresh meat, and there were many people in whom tea taken along with fresh meat will upset the digestion. It did not interfere with the digestion of dried meat such as ham or tongue, the fibres of these have already become shrunk or toughened in the process of curing. He thought that tea at breakfast was not so apt to cause indigestion, but that tea in the afternoon two or three hours after lunch would sometimes bring on acidity almost immediately. A part of the mischief wrought by tea in the lower classes was due to allowing it to infuse for a long time so that a large quantity of tannin was extracted. Another reason was that the poor were accustomed to drink tea very hot. Heat was a powerful stimulant of the heart, and a cup of hot tea was therefore much more stimulating and refreshing than a cold one. The practice, however, of sipping the tea almost boiling was apt to bring on a condition of gastric catarrh. Sir B. W. Richardson was probably more opposed to the practice of tea-drinking than any of our leading modern physicians and as one of the most distinguished medical reformers of recent times his opinion is entitled to carry much weight.

“The common beverage tea,” he says, “is often a cause of serious derangement of health, if not of actual disease. The symptoms of disturbance occur when even the best kind of tea is taken in excess, and almost inevitably from the mixture called ‘green tea’ when that is taken even in moderate quantity.... Tea first quickens, and then reduces the circulation which is the action of a stimulant. But tea does more than this; it contains tannin, and is therefore styptic or astringent in its action from which circumstance it is apt in many persons to produce constipation, and interfere with the function of the liver. In some persons this astringent effect of tea is very bad. It gives rise to a continued indigestion, and what is called biliousness. The most important agent in tea, however, is the organic alkaloid, theine. The alkaloid exercises a special influence on the nervous system, which, when carried to a considerable extent, is temporarily at least if not permanently injurious. At first the alkaloid seems to excite the nervous system, to produce a pleasant sensation and to keep the mind agreeably enlivened and active. The effect is followed by depression, sinking sensation at the stomach, flatulency, unsteadiness with feebleness of muscular power, and not infrequently a lowness of spirits, amounting almost to hypochondriacal despondency. Poor people meet the craving for natural food by taking large quantities of tea. A strong craving for it is engendered which leads to the taking of tea at almost every meal, greatly to the injury of health. Poor women in the factory and cotton districts become actual sufferers from this cause. They are rendered anæmic, nervous, hysterical, and physically feeble. In the better classes of society similar if not such severe injury is effected by tea in those who indulge in it many times a day, and especially in those who indulge in what is called afternoon tea.... The afternoon tea or drum causes dyspepsia, flatulency, nervous depression and low spirits, for relieving which not a few persons have recourse to alcoholic stimulation.... Tea taken late in the evening, except immediately after a moderate meal, interferes with the sleep of most persons by causing indigestion, with flatulency, and sense of oppression. Some are kept awake entirely by the action of the tea on the nervous system; others get off to sleep, but are troubled with dreams, restlessness, and muscular startings. In a few incubus or nightmare is a painful symptom induced by tea.” In old people however, Sir Benjamin Richardson had not noticed such serious results “as persons advance in life the bad effects of tea sometimes pass away or are greatly modified.” But for the generality of people Sir Benjamin certainly felt very strongly about the matter for elsewhere he says “it causes in a large number of persons a long and severe and even painful sadness, there are many who never know a day of felicity owing to this one destroying cause.”[23]

Having generally reviewed the question of injury to health I now come to our own experiments. I first made inquiry into the strength of tea, as commonly consumed, and found that the usual quantity of black tea added was about eight grammes to the 600 cubic centimetres of boiling water. I next approached two well-known firms who kindly supplied me with samples of pure unmixed Indian, Ceylon and China teas.

Eight grammes of each sample were weighed out and were then infused in a tea-pot for five minutes with 600 cubic centimetres of boiling distilled water. At the end of five minutes the infusion was poured off and analysed for the percentage of extract, alkaloid, and tannin, and the following tables show figures for the Indian, Ceylon and China teas respectively.

TABLE E.

ANALYSIS OF INDIAN TEAS.

(Infusion of 8 grammes with 600 cc of boiling distilled water for 5 minutes.)

Wholesale Proportion Price Per Per Per of tannin No. Description and without cent. cent. cent. corresponding District. duty Extract. Alkaloid. Tannin. to 2·8 per lb. per cent. Alkaloid. 1 Orange Pekoe, 1/10 24·75 3·11 6·87 6·18 Deamoolie, Assam 2 Broken Orange Pekoe, 1/10 28·87 3·07 9·45 8·61 Powai, Assam 3 Orange Pekoe, Tara, 2/6 26·62 3·32 7·55 6·36 Assam 4 Pekoe, SS/U 1/4 21·75 1·86 5·42 8·16 Darjeeling 5 Fannings Badulipar, 9d. 30·37 3·30 10·46 8·87 Assam 6 Pekoe, Singlo, Assam 9d. 27·37 2·79 9·87 9·90 7 Pekoe, Rungamuttee, 7d. 23·25 2·70 5·35 5·55 Sylhet 8 Pekoe, Assam 6¾■d. 27·90 2·86 7·26 7·11 9 Broken Orange 1/- 30·60 3·60 7·90 6·14 Pekoe, Assam 10 Broken Orange 1/9½■ 25·90 2·62 8·92 9·53 Pekoe, Assam 11 Broken Orange 7¾■d. 29·10 3·20 7·34 6·42 Pekoe, Sylhet 12 Orange Pekoe, 7½■d. 27·90 2·61 8·72 9·35 Assam 13 Pekoe, Sylhet 5½■d. 24·18 2·70 6·40 6·64 14 Broken Pekoe, 10d. 23·20 2·41 7·15 8·31 Darjeeling 15 Pekoe, Darjeeling 6½■d. 21·92 2·21 5·72 7·25 16 Pekoe, Dooars 6d. 25·08 2·92 7·20 6·90 17 Broken Pekoe, 7d. 25·65 3·14 6·52 5·81 Dooars 18 Orange Pekoe, 6½■d. 25·53 2·62 5·70 6·09 Cachar

TABLE F.

ANALYSIS OF CEYLON TEAS.

(Infusion of 8 grammes with 600 cc of boiling distilled water for 5 minutes.)

Wholesale Proportion Price Per Per Per of tannin No. Description and without cent. cent. cent. corresponding District. duty Extract. Alkaloid. Tannin. to 2·8 per lb. per cent. Alkaloid.

1 Orange Pekoe, Great 9d. 25·50 2·53 6·98 7·72 Western, Unware Eliya District. 2 Broken Orange 1/3 28·61 2·64 10·10 10·71 Pekoe, Concordia, Unware Eliya District. 3 Broken Pekoe, 1/0 27·90 2·49 7·92 8·90 Pedro Unware Eliya District. 4 Pekoe 7⅜d. 26·92 2·58 8·65 9·39 5 Pekoe 5d. 22·68 2·86 5·82 5·69 6 Pekoe 6⅜d. 24·70 2·48 7·09 8·00 7 Broken Orange 7½d. 25·68 2·63 7·39 7·86 Pekoe 8 Broken Pekoe 9d. 26·50 2·77 7·91 7·99 9 Broken Pekoe 6d. 24·41 2·98 6·46 6·07 10 Broken Pekoe 6⅜d. 25·01 2·67 8·39 8·80 11 Broken Orange 11⅜d. 28·80 2·94 10·66 10·15 Pekoe 12 Orange Pekoe 7⅜d. 25·83 2·55 6·86 7·53

TABLE G.

ANALYSIS OF CHINA TEAS.

(Infusion of 8 grammes with 600 cc of boiling distilled water for 5 minutes.)

Wholesale Proportion Price Per Per Per of tannin No. Description and without cent. cent. cent. corresponding District. duty Extract. Alkaloid. Tannin. to 2·8 per lb. per cent. Alkaloid. 1 Fine Moning, 1/5 18·80 2·59 3·48 3·76 Hankow 2 Oolong, Formosa 1/1 24·00 2·46 8·76 9·97 3 Souchong -- 18·30 2·60 2·44 2·63 4 Moning 1/1 20·43 2·23 2·96 3·71 5 Scented Orange 1/2 23·81 2·68 7·70 8·04 Pekoe Canton 6 Gunpowder, Green 1/4 29·47 2·55 9·54 10·47 Tea 7 Caper, Green Tea 10⅜d. 21·45 1·87 9·08 13·59 8 Oolong 10d. 23·62 2·47 8·80 9·97 9 Hyson, Green Tea 1/4 26·81 2·32 9·62 11·61 10 Pakling 5½d. 18·77 1·81 3·19 4·93 11 Pekoe Souchong, 1/5 19·31 2·36 2·33 2·76 Lapsang 12 Panyang 4½d. 21·00 1·93 4·71 6·83 13 New make 8½d. 21·78 3·40 6·42 5·28

The last column in the above tables or the proportional amount of tannin is arrived at in the following manner. I first calculate the average amount of alkaloid in tea as consumed on a basis of the above figures. Thus the average amount of alkaloid in Indian teas as seen in Table H calculates out to 2·84 per cent. This is multiplied by the proportion of Indian teas on the market, viz. about 60 per cent. in the same way the average Ceylon alkaloid 2·68 is multiplied by 30, and the China average 2·40 multiplied by 6. If we add these products together and divide by 60 + 30 + 6 = 96 this will give us the average percentage of alkaloid in tea as consumed and this amounts to about 2·8 per cent. The last column in Tables E, F and G, gives the proportion of tannin corresponding to 2·8 per cent. alkaloid; that is to say the tannin in each case is multiplied by 2·8 and divided by the amount of alkaloid actually present. This figure which represents the proportional amount of tannin present renders the comparison of the different teas possible so far as the astringent action is concerned.

The following table summarises the results of analyses of the three classes of teas:--

TABLE H.

Proportion of Tannin Class of Number of Per cent. Per cent. Per cent. corresponding Teas. Analyses. Extract. Alkaloid. Tannin. to 2·8 per cent. Alkaloid. Indian Teas 18 26·11 2·84 7·43 7·32 Ceylon Teas 12 26·04 2·68 7·85 8·20 China Teas 13 22·12 2·40 6·08 7·09

Thus the Ceylon teas under the conditions of experiment part with slightly more tannin than the India or China teas. It will be noticed that the proportional tannin figures for the India and China teas are not very different, although some of the individual China teas give out less tannin than any of the India or Ceylon samples. It is possible that the China average is rendered rather high by an undue proportion of green tea which of course shows excess of tannin. The question will naturally be asked whether as a nation we do not drink too much tea, and there is a very simple means of solving the problem. As shown in table A the average consumption per head per annum in the United Kingdom is 6·1 pounds, or 117 grains of tea per diem. The average percentage of alkaloid in tea, as consumed, I calculate to be 2·8 per cent., and of tannin 7·5 per cent. This will mean that each person will take a daily dose of 3·28 grains of alkaloid and 8·8 grains of tannin. According to the last Census 3,716,708 out of 32,527,843, or 10 per cent. of the population of England and Wales, are under five years of age; these might almost be neglected as far as tea-drinking is concerned, so that we must add one-tenth to the average daily dose of the alkaloid and tannin, which will come to 3·6 grains of alkaloid, and 9·7 grains of tannin. The dose of caffeine according to the British Pharmacopœia is from one to five grains and of tannin from two to five grains. And hence on an average each person in the United Kingdom is constantly day by day consuming half as much alkaloid, and nearly as much tannin as would be permissible to be taken occasionally as a drug. Therefore I have no hesitation whatever in saying that we drink far too much tea, and the question has been raised in Ireland whether the excessive drinking of strongly infused tea has not had something to do with the increasing prevalence of insanity in that country. Thus in the Forty-third

Annual Report of the Inspectors of Lunatics, Ireland (1894), the Inspectors dwell on the ill effects of decocted or over infused tea on persons who make it a staple article of dietary, thus leading to the production of dyspepsia, which in its turn tends to states of mental depression highly favourable to the production of the various forms of neurotic disturbance.

Thus Dr. William Graham of the Armagh District Asylum refers to the recent changes of dietary having an unquestioned influence on the increasing prevalence of insanity. He refers to the use of Indian tea as a beverage between meals. “The tea,” he says, “is stewed, not infused, as a consequence the use of increased amount of nervine food leads to a peculiar form of dyspepsia, which in its turn leads to a general debility of the nervous system. This change is therefore to be considered as a factor in the increase of insanity.” Dr. G. W. Hatchell, the Resident Medical Superintendent of the Castlebar District Asylum, stated that “amongst the female inmates, I believe many cases of insanity may be attributable to the frequent consumption of decoction of tea, taken generally without food and for lengthened periods.”

Again Dr. Thomas Drapes of the Enniscorthy Asylum, said “there is not much evidence of the excessive use of this beverage (tea) being directly provocative of insanity, but I think there is very little doubt that its too liberal use excites or aggravates a predisposition to neurotic disorders, including insanity, making the nervous system more vulnerable in regard to such maladies, by the increased excitability of the nervous system which tea undoubtedly produces. A neurotic organisation may also be transmitted to their progeny by parents who drink tea to excess.”

Lastly, Dr. E. E. Moore of the Letterkenny Asylum, said “As to the consumption of tea, it seems to be enormous and increasing rapidly all over the country. I am informed that it is taken by young and old alike, and even by babes in the cradle. It is drunk as often as it can be got, at every meal and between meals, often six times a day, and especially by females and usually without milk, and often without food. I may safely say that it is never taken as an infusion, but is generally stewed for hours, the old leaves being left in the teapot and fresh added as required. In some places I am told the way the tea is made is by putting the leaves down in a saucepan of cold water, and then boiling it until the decoction is black enough to be palateable.... I can speak from practical experience of the terrible effects of this system of tea drinking both among the sane and insane. It gives rise to a severe form of chronic dyspepsia, and if persisted in to dyspepsia of an incurable and painful form. The result of all this is that the health of the people all through the county is deteriorating more than most people imagine. In fact the people are starving themselves on tea, and the weaker they become the more they rush to the teapot for the fillip the draught therefrom may give them for the moment. This tea-drinking is becoming a curse, and the people are developing a craving for tea, just as great as that which a drunkard has for alcohol, or a drug-taker for his own particular drug. There is no manner of doubt but that the condition of bodily health affects the mental health of every man, woman and child, and if the starved stomach becomes a prey to chronic dyspepsia the chances are very great that the mind will, before long, be materially affected especially where there is a predisposition to insanity of an hereditary type.” With these important testimonies from responsible officials, it is difficult to resist the conclusion that the abuse of tea drinking has acted as a factor in the increased prevalence of insanity.

As a general conclusion from my investigations I have no doubt that in the first place we drink too much tea; this is shewn by a simple calculation from the average annual amount imported for consumption. Of course children of tender years should obviously be given no strong stimulants (such as tea or coffee) and adults would be acting wisely to very much limit the amount taken. With regard to the best method of preparation it should be infused, (neither stewed or decocted) and certainly for no longer period than five minutes, and a good plan is to pour the tea off at the end of this time into another vessel so as to save further exhaustion from the leaves. In reference to the variety of tea best to use, although it is not certain that the average of China teas contains less tannin than Indian teas, there is no doubt that individual samples of China tea can be procured comparatively free from this deleterious substance.

With a view of discovering the constituent parts of the tea popularly consumed, I procured samples from each of the four leading Companies, which probably amongst them, supply nine-tenths of the tea drunk in London Restaurants. The infusion was made in exactly the same way as described above and the analyses came out as follows:--

TABLE I.

RESTAURANT TEAS.

(Infusion of 8 grammes with 600 cc. of boiling distilled water for 5 min.)

Proportion of Tannin No. Description Retail Per cent. Per cent. Per cent. corresponding and District. Price Extract. Alkaloid. Tannin. to 2·8 per lb. per cent. Alkaloid. 1 “China” Tea 2/2 20·20 2·51 4·85 5·41 2 Ordinary Black 2/2 25·60 2·04 9·03 12·39 Tea 3 “China” Tea 2/0 20·06 2·15 3·02 3·93 4 Ordinary Black 2/0 27·90 2·69 9·74 10·13 Tea 5 “Russian” Tea 2/6 23·50 2·30 5·36 6·52 6 Ordinary Black 2/8 24·60 3·02 6·03 5·59 Tea 7 “China” Tea 2/4 24·50 2·22 5·85 7·37 8 Ordinary Black 2/2 28·31 2·72 8·44 8·69 Tea

It will be observed that the China teas exhibited a fairly low proportion of tannin. The numbers for ordinary black tea in two of the Companies’ samples were, however, considerable. This points to the advisability of teas being analysed before being placed upon the market, and this is a reform much needed in the interest of the public. The tea should be examined for the amount of the alkaloid, and also the tannin extracted by infusion, and the price based on the proportion of the essential ingredient, viz: the alkaloid and if it is desired to place the matter on any sort of scientific basis, the public should in each case be informed of the weight of tea required to be used with boiling water (this being regulated by the quantity of the alkaloid), and at the same time an indication should be given of the proportion of tannin liable to be extracted in a standard infusion. My general recommendations from the foregoing experiments, and also from the experience of the various authorities are that if tea is to be no longer a source of injury to health we should drink much less, and infuse for a briefer period. The dealers also should more frequently submit samples for analysis as in the case of other foods and drinks; thus when we _do_ drink tea we should be in a position to avoid those varieties which are especially harmful; and there is no doubt that if these recommendations are carried out we shall be saved from a number of distressing complaints which, although very rarely fatal, have in the past occasioned much ill health, and have been a source of discomfort and misery both of mind and body to thousands who might otherwise have enjoyed the comfort to be derived from a carefully regulated use of the infusion of the leaves of the tea plant.

FOOTNOTES:

[1] A journey to the Tea Countries of China, p. 281, London 1852.

[2] Ancient Accounts of India and China, by Eusebius Renaudot, London 1733.

[3] Delle cause della grandezza delle citta. Giovanni Botero Milan 1596, p. 61.

[4] MERCURIUS POLITICUS, comprising the sum of Foreign intelligence with the affairs now on foot in the three nations of England, Scotland and Ireland. For information of the people. From Thursday, September 23rd to Thursday, September 30th, 1658. Number 435.

[5] MERCURIUS POLITICUS REDIVIVUS. A collection of most materiáll occurances and transactions in publick affaires, A.D. 1659 to 1672. Add. M.S.S. 10116, p. 14.

[6] History of England, iv. 132.

[7] Dried sage leaves were used for making infusions even up to the year 1750.

[8] See Report from Select Committee on Commercial Relations with China, 12th July, 1847, p. 501.

[9] See Article by Bannister in the Journal of the Society of Arts, October 31, 1890 p. 1030.

[10] The oil was found to contain small quantities of methyl salicylate or oil of wintergreen.

[11] Commentarius de abusu tabaci americanorum veteri et Herbae Thee Asiaticorum in Europa novo 1665.

[12] Van Swieten’s Commentaries, xvii., 450.

[13] Ibid., x., 274, 275.

[14] “An Essay on Tea, considered as pernicious to health, obstructing industry, and impoverishing the nation,” London 1757.

[15] THE LITERARY MAGAZINE, 1757, ii., 161.

[16] “A letter to the Members of the Temperance Society” James Henry, M.D., Dublin, 1830.

[17] “Medical Record,” New York, 1879, xvi., 43.

[18] “The Boston Medical and Surgical Journal,” 1886, cxiv., 314.

[19] “Medical News,” 1894, lxv., 486.

[20] Archives of Surgery, 1892, iii., 366.

[21] “Medical Press and Circular,” 1894, i., 188.

[22] “British Medical Journal,” 1885, i., 270.

[23] Sanitary Record 1883, v., 199.

Transcriber’s Notes

Minor errors and inconsistencies in punctuation have been fixed.

Page 3: “nervous irritibility” changed to “nervous irritability”

Page 10: “impare digestion” changed to “impair digestion”

Page 18: “that an alteration” changed to “than an alteration”

The column headers for Table F were added.

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MRS. C. S. PEEL'S COOK-BOOKS

DISHES MADE WITHOUT MEAT

BY MRS. C. S. PEEL

Author of "10/- a Head for House Books," "The Single-handed Cook," "How to Keep House" and "The New Home"

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NOTE

Fish dishes are not treated of in this book, as they will be found in the Volume of the series--entitled _Fish and How to Cook it_. Also, as these little cook-books are intended primarily for households where both time and money must be economized, the recipes are neither over elaborate nor over expensive.

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CHAPTER I

VEGETABLE DISHES

There is undoubtedly a great and growing liking for _maigre_ dishes, not only amongst those people who eat them from religious motives, but amongst the general public. Nowadays at most of the smart restaurants vegetable and cereal dishes are a feature of almost every meal, and at private houses no luncheon and few dinner menus are considered complete unless a vegetable or cereal dish is included.

But apart from fashion the value of these dishes is great; they are good for the health and good for the pocket of the housekeeper, provided they are ordered with discretion.

In the country, where vegetables are plentiful and money is not, I have often noticed that sufficient use is not made of vegetables, while where fresh green food is a luxury its place is not taken--as it should be--by such food stuffs as rice, macaroni, haricot beans and corn.

As the housekeeper whose weekly income is limited knows only too well, there often comes a day when the supply of meat falls short. Then comes the question, can it be eked out in a presentable manner or must more be bought and the desired cost exceeded. Now the woman who caters carefully will realize how such inexpensive materials as rice or macaroni, potatoes or cabbage may be pressed into service.

For example, the only available meat dish for luncheon is a hot pot of mutton and the party is suddenly augmented. Add to the menu a dish of macaroni au jus, or a rissole or corn curry, and supplement the homely pudding with a little cheese savoury, and what more can any one desire?

Then if the meat for a veal and ham pie is scarcely sufficient add a liberal quantity of partly cooked macaroni cut into short lengths, while should the quantity of minced mutton available seem sadly little, add an ample border of savoury rice or an extra dish of

potato and cheese balls. If rissoles are required add to them by means of mashed potato or rice.

Then never allow small quantities of cooked vegetables left over from lunch or dinner to be thrown away. Place them on clean plates in the larder; they will prove useful additions to the next day's bill of fare.

For example, you have two or three young carrots, a cupful of peas, even a smaller quantity of broad beans. Slice the carrots and arrange all three vegetables in china shells, mask with mayonnaise sauce, sprinkle with coralline pepper, and serve with cold meat, or reheat them by steaming, place them in a hot fireproof dish, cover with boiling hot maître d'hôtel sauce, and garnish with rolls of bacon, and serve as a luncheon dish; or add a little onion and use for a vegetable curry, and serve surrounded by well-boiled rice; or reheat, mix with parsley and butter sauce, cover with mashed potato, score the top and brown in the oven, and serve for luncheon in the guise of vegetable pie.

If some new potatoes are left over, slice, fry, and serve with or without bacon for breakfast; while should you have some old boiled potatoes to use up they may be mashed and employed in half a score of ways; incorporated with cabbage, pepper, salt, and a little butter, formed into cakes, and fried to serve with bacon, grilled chicken or ham, for instance.

Thus the clever housekeeper economizes and yet does not allow her economies to be apparent.

Before passing on to the recipes which are the _raison d'être_ of this little volume, I would say a word on the treatment of vegetables.

It is the habit of gardeners to pick fruit, vegetables, etc., in the morning, and to bring in the day's supply at about eleven o'clock, and on Saturday to provide sufficient for two days' consumption. Except in the case of strawberries (which should be gathered, if possible, on the day on which they are to be eaten) and asparagus (which is infinitely better when cut just before the time for cooking), there is no objection to this plan, provided the garden produce is stored in the best manner. Carrots and turnips, leeks and onions should be placed in wire racks; and lettuces should be arranged root-end downmost in a shallow pan of fresh water. Cabbages and cauliflower may be treated likewise. Parsley should be placed in water as if it were a flower--not soused head over heels in that liquid. Whether the stalk-end of a cucumber should be placed in water, or whether the vegetable should be left dry in a cool, airy place, is a moot point. I do not feel competent to say which course should be followed, but my cook, who is clever at cooking vegetables, opines that cucumbers should not be placed in water; and, in any case, that they should not be kept long when cut.

Mustard-and-cress should be arranged in a shallow pan of water.

Peas and broad beans should not be shelled unnecessarily long before eating, and if it is necessary to keep them they should be placed in a wire rack in a cool, well-ventilated place.

All vegetables should be eaten while young, or they lose considerably in flavour. When French or runner beans are quite young it is better merely to remove the strings and to cook them whole; but when old age approaches they are more palatable when sliced.

To Boil Vegetables

When boiling vegetables remember that all fresh vegetables should be plunged into boiling salted water, the proportions being 1 tablespoonful of salt to 1 gallon of water.

Dried vegetables should be placed in lukewarm water.

A piece of sugar put into the water in which green vegetables are cooked helps to bring out the flavour.

Leave the cover off the pan in which vegetables are cooked, or, at all events, leave it half off, so that the steam can escape easily.

Do not allow vegetables to stay in the water in which they are boiled, but drain them at once, pressing out all the water possible.

Green vegetables take on an average about 20 minutes to cook, though 10 minutes is often long enough for young peas, while cabbages sometimes take nearly an hour.

The best way of cooking peas is as follows:--Shell a pint of peas and place them in a jar with a closely-fitting lid, put in with them a saltspoonful of salt, a tablespoonful of butter, a teaspoonful of powdered white sugar, a sprig of mint and a shake of black pepper. Cover the jar closely and place it in a saucepan of boiling water. Boil briskly, until done, which should be in ½ an hour to ¾ of an

hour.

Peas with Béchamel Sauce (Hot)

Cook the peas as in the preceding recipe, and just before serving pour over them a small quantity of Béchamel sauce.

Petit Pois au Beurre (Hot)

Peas with Butter

Having cooked the peas either by the method described above or having boiled them in the ordinary way, drain off the water and shake the peas to dry them well, return them to the hot dry pan they were cooked in, and at the last moment before serving throw in a pat of butter, let this just melt, and serve.

French Beans

À la Crême de Fromage (_Hot_)

Cook the beans in the usual way by throwing them in boiling salted water in which a teaspoonful of sugar has been placed. If young, cook them whole, only removing the spines and pointed end, or if stock can be used, place them in a pan which has been buttered, sprinkle them with salt, and just cover them with stock. When tender place them on a hot dish, make a white sauce with ½ oz. of butter and ½ oz. of flour mixed with ½ pint of the stock in which the beans have been cooked, add a good pinch of salt and stir well, adding one well-beaten egg and two tablespoonsful of finely-grated cheese. Do not let the sauce boil after the egg has been added or it will curdle. Pour round the beans and serve.

French beans can also be served with Béchamel sauce or quite plainly with a small quantity of butter melted and run over them, with a shake of pepper and salt, or again with a plain melted butter sauce.

Flageolets

Flageolets are the beans of the kidney bean, French bean, etc., and when shelled and cooked in various ways are excellent eating. They should be boiled in the same way as peas, simply omitting the sprig of mint, and can be served in various ways.

Flageolets au Beurre (Hot)

Having boiled and drained the beans, place a pat of butter in the saucepan just before serving.

Flageolets au Maître d'Hôtel (Hot)

Make a butter by mixing 1 oz. of butter, the juice of ½ a lemon, a teaspoonful of chopped parsley, a pinch of salt and pepper, mix well and form into a pat. When the beans are cooked and drained, place this with them, shake and serve.

Flageolets à la Crême de Fromage (Hot)

(_With Cheese Sauce_)

Follow the directions for French beans, substituting flageolets, and boiling in the ordinary way.

Cabbage with Cheese Sauce (Hot)

Boil a cabbage, cut it in 8 pieces, then place it in 1 pint of cheese sauce, make it thoroughly hot, and serve with the sauce poured over it.

Cabbage à la Crême (Hot)

Drain a boiled cabbage, cut it up small, put it into a saucepan with 1 oz. of butter, 1 gill of cream, and a seasoning of pepper and salt, stir it all together over the fire till thoroughly hot, then turn it out on to a hot dish, and serve with fried croûtons.

Brussels-Sprouts

can be served in various ways. For au beurre after boiling, drain well, taking great care to squeeze every drop of water possible from the sprouts, return to the pan and toss in butter, and dust with pepper and salt.

Brussels-Sprouts à la Maître d'Hôtel (Hot)

Follow the above recipe, substituting maître d'hôtel butter for ordinary butter.

Brussels-Sprouts au Jus (Hot) with Stock

Blanch the sprouts, by dipping them in boiling water and letting them remain in it for a few minutes. Remove them and drain well, placing them in a pan with just enough stock to cover them. Simmer until tender, drain and serve.

Boiled Nettles (Hot)

Choose very young nettles, and wash them well in two or three waters; chop them up very fine, and put them into a stewpan with a little water, and steam until quite tender. Meanwhile toast as many slices of bread as required, trim these neatly, lay them on a hot dish, drain the nettles well, serve on the hot toast, dusted with pepper and salt, and serve with a beurre fondue sauce, made as follows:--Put 2 oz. of butter into a clean saucepan with ½ a teaspoonful of salt, and half as much pepper, and 1 dessertspoonful of lemon juice; stir these all together over the fire until half melted, take it off the fire and continue stirring until the butter is all dissolved.

Stewed Nettles (Hot)

Wash the shoots and young leaves of nettles very thoroughly in slightly salted water, dry well and mince very finely. Put this into a stewpan with 1 tablespoonful of finely-chopped onion, a suspicion of brown sugar, season with pepper and salt to taste, pour in a little stock or water, and stew gently at the side of the fire until quite tender; then mix together 1 oz. of butter and 1 teaspoonful of salt, till perfectly smooth, add this to the nettles, with ½ a tablespoonful of thick cream or new milk, stir it all well together till quite hot, and serve on slices of hot toast. If liked, the onion may be omitted, when the nettles are treated exactly like spinach.

Purée of Watercress (Hot)

Wash some watercress well, getting rid of all faded or discoloured parts, then put it on in plenty of boiling salted water, and boil it till almost cooked; lift it out, and drain on a sieve or colander to get rid of as much water as possible. Meanwhile melt about 1½oz. of butter in a pan, put the watercress on in this, sprinkle it lightly with flour, and stir it all together over the fire for about 10 minutes, then add about 2 gills of good stock, season with pepper and salt; cook it for 10 minutes longer, stirring it continuously, rub it through a sieve and serve very hot, garnished with quartered hard-boiled eggs, and fried croûtons.

Stewed Lettuce

Treat exactly as in the previous recipe.

Purée of Turnip Tops

Proceed as for watercress or lettuce.

Cauliflower with Tomato Sauce (Hot)

Clean and soak the cauliflower in salt and water for 1 hour, then plunge it into boiling water, returning it again to cold water. After this put it in a pan of boiling water slightly salted (½ oz. of salt to 1 gallon of water) and boil it until tender, 20 to 25 minutes. In the meantime make ½ pint of tomato purée by the following recipe, and when the cauliflower is cooked place it on a hot dish, pour the purée over it, sift some finely-grated brown crumbs over it and serve.

Tomato Purée

Six smallish tomatoes. Cut them into slices and place them in an enamelled saucepan, add 1 oz. of butter, a teaspoonful of chopped parsley, salt, pepper, and a tiny pinch of cayenne. Pour over one pint of stock. Boil until quite soft, and then pass through a sieve, add 1 oz. of anchovy essence, thicken with ½ oz. of butter and ½ oz. of flour previously mixed together in another pan with

some of the tomato mixture. Stir over the fire until the sauce thickens, and it is then ready for use.

Cauliflower Fritters (Hot)

Break a cooked cauliflower up into neat pieces, dip these in frying batter till well covered, and fry in boiling fat. Drain them well, sprinkle with grated Parmesan cheese and coralline pepper. Serve at once on a napkin.

This is an excellent way of serving cauliflower which has been left over.

Cauliflower au Gratin

Boil the cauliflower as before, place it in a fireproof dish, pour over it an ample quantity of cheese sauce, sprinkle with grated cheese and brown crumbs and bake until slightly brown on the top. For cheese sauce see the recipe for French beans à la crême de fromage (page 12).

Cauliflower with Soubise Sauce

Boil the cauliflower, place in a fireproof dish. Cover with delicate onion sauce (Soubise sauce, p. 47), sprinkle with brown crumbs and make very hot in the oven.

Spinach Patties (Hot)

Take 1 lb. of spinach leaves, pick and wash them well, and after this blanch them by plunging them for 5 or 6 minutes in boiling water, drain them and place them in cold water, remove, press, and strain, to get rid of as much moisture as possible. Chop them up, place in a stewpan a pinch of salt and sugar, ½ oz. of butter and ¼ oz. of flour, and after stirring this for a few minutes add the spinach. Stir for 5 minutes then add ¼ pint of milk, stir for a few minutes longer, and then add ½ pint of milk, stirring steadily until the liquid is almost dried up. Remove from the pan and pass through a sieve, then return to the fire and add a small pat of butter and keep very hot. Have ready the required number of pastry patty cases. Quickly make some buttered egg, place some of the spinach in each case, with a spoonful of buttered egg on the top, and serve at once very hot.

Spinach and Tomatoes (Hot)

Prepare the spinach as in the preceding recipe. Bake six small tomatoes carefully in the oven with a piece of butter on each. When ready arrange the spinach in a dish in the form of a border, place the tomatoes in the centre and serve.

Épinards (Spinach) à la Crême (Hot)

Wash the spinach in six or seven waters, so as to prevent its being gritty; put it in a saucepan on the fire, with a very little water and salt; when done strain very dry and chop it up very fine. Warm 2 oz. of butter in a stewpan, put the spinach in, stir till the moisture quite evaporates, then add a very little salt, a tiny pinch of sugar (a very little nutmeg, if liked), a pinch of flour, and 1 large tablespoonful of cream, and let the whole simmer for a quarter of an hour. Then put through a sieve and keep hot. In the meantime, fry in fat some bread cut into fingers, about 2½ in. long and ½ in. square, and plant them in little rows all over the spinach when dished.

Spinach cooked thus is delicious and a very different matter from the stringy green mass generally served.

Turnip Tops à la Crême

Cook as in the previous recipe for spinach.

Almost any greens, including cabbage and Brussels-sprouts, are excellent when served thus.

Asparagus.

Asparagus is really almost at its best served plain boiled with oiled butter; but when it first comes in, the big kind, which is best for boiling, is rather expensive, and few people seem to know how good the more “grasslike” kind is if treated properly.

Boiled Asparagus (Hot)

Although every one will at once say they know how asparagus should be boiled, yet it is a melancholy fact that it is not by any means an invariable rule to find this vegetable properly treated. If, however, the following directions are carried out the result is certainly worth the little extra trouble. Cut the stalks of a bundle of fresh asparagus evenly and tie them up into a bunch, put them upright into a pan just large enough to hold them comfortably and with boiling water to within about 3 in. of the tops. Keep them on the fire for from 30 to 40 minutes, then lift them out, drain well, remove the string, and dish them on a neatly folded napkin or square of toast. Treated in this way, the heads are not so apt to come off, and the stalks, instead of being tough, are quite tender and eatable. Excellent asparagus cookers are now made, but if one of these is not to hand its lack will not be felt if the instructions already given are observed. Asparagus should be served with

Plain Oiled Butter, or Beurre Fondu,

which is made as follows:--Put 2 oz. of fresh butter into a pan with 1 saltspoonful of salt, ½ a saltspoonful of pepper, and ½ a tablespoonful of lemon juice; stir this over the fire with a clean wooden spoon till the butter has rather more than half melted; then lift it off the fire, and continue the stirring until the butter is entirely melted, when it will have a creamy taste, quite different from the ordinary oiled butter.

Asparagus au Jus (Hot)

Cut the young, green, small asparagus diagonally into equal lengths (like French beans), and toss these lightly in bacon fat; when slightly crisped, season with white pepper, salt, minced parsley, and chervil, and add a little stock; simmer gently till cooked. Now add a spoonful or so of good beef or mutton gravy, and serve. The great secret of this dish is only to put in enough stock in the first instance to cook the asparagus, for it should all be absorbed by the time you add the gravy.

Asparagus Sprue à la Pompadour (Hot)

Steam the sprue, or small asparagus, in boiling salted water (_see_ p. 21), cut into lengths as above, and let them dry in a well-heated napkin, in a warm place, to keep hot. Meanwhile stir together some fresh butter, the yolk of 1 or more eggs, a spoonful of vinegar, a dust of salt, and some freshly-ground black pepper; stand the pan containing this in another pan half-full of boiling water, and stir it over the fire till thoroughly blended. Place the asparagus in the dish, pour the sauce over it, and serve.

Iced Asparagus

For this the large asparagus is required. When cooked lay on ice or keep in an ice cave. Serve in an entrée dish and hand very cold mayonnaise sauce.

CHAPTER II

VEGETABLE DISHES

(_Continued_)

Potatoes

A favourite kitchen superstition is that which forbids the use of left-over potatoes. For many dishes cooked potato is required. Why then cook fresh potatoes for the purpose and thereby waste time and money?

The sensible cook keeps all left-over potato, and makes use of it in some of the ways here described.

Potato Croquettes (Hot)

Take 1 lb. of cold cooked potato and place in a mortar. Mash it until all the lumps have disappeared, add a pat of butter and enough milk or cream to make the potato soft, and of the right consistency to form into balls, add a tablespoonful of chopped parsley, a very small quantity of chives (if liked), mix well and form into balls. Coat them with egg, roll them in finely-grated breadcrumbs, fry a golden brown, drain and serve.

Potatoes à la Crême (Hot)

Having washed and peeled the number of potatoes required, cut them into very thin slices and as much the same size as possible. Place them in cold water for ½ hour, then drain them and dry on a soft clean cloth. Have ready a fireproof dish with a closely-fitting lid, butter the bottom and sides of it, and place a layer of potatoes in it, laying them to overlap each other, and also to stand round the sides, place on these a layer of soft butter, and a sprinkling of salt, and continue in this way until the dish is full, ending with a layer of butter. Place the lid on firmly, and place the dish in a moderate (350 deg.) oven for ¾ of an hour.

Cheese Potatoes (Hot)

Follow the previous recipe, the only difference being that grated cheese should be sprinkled between each layer of potato in addition to the butter.

Potatoes à la Crême (Hot)

(_A Method of Using up left-over new Potatoes_)

Put into a pan from ½ to 1 oz. of butter, add a good dessertspoonful of flour, some parsley and minced chives, with salt, pepper, and a dust of nutmeg to taste; when the whole is smoothly blended, pour in sufficient single cream or new milk, and stir it all together till it boils up, then add as many cold, cooked new potatoes as you want, and allow them to heat thoroughly in the sauce without actually boiling, which would break them; serve with a dust of coralline pepper.

Potatoes au Gratin (Hot)

Well butter a gratin dish, and dust it liberally with minced parsley, white and coralline pepper, and, if liked, a little grated Parmesan; cover this with a layer of thinly sliced, cold, cooked new potatoes, moistening them as you do so with a little cream, milk, or, failing either of these, a little oiled butter, dusting the whole with minced parsley, pepper, salt, and a very little cheese; repeat these layers till the dish is full, finishing with a very light sprinkling of fine white breadcrumbs, a little spice, grated cheese, and, lastly, some tiny morsels of fresh butter, and bake till the surface is nicely covered.

Potato and Cabbage Cakes

Take any cold potato and cabbage, mash it smoothly together, adding beaten egg, white sauce, or melted butter to moisten. Flavour rather highly with pepper, add a little salt. Form into round cakes, flour, and bake or fry.

Curried Potato Cakes

Have ready some curry sauce with which to moisten the mashed potato, and proceed as before.

Potato Cromeskies (with Mushroom)

Have ready some well-flavoured mushrooms stewed in white sauce (the mushrooms cut into small pieces). Make some smoothed mashed potato and add to it a beaten yolk of egg. Form balls of the potato. Hollow out a place in each, fill with the mushroom mixture. Cover with more potato, egg, crumb, fry and serve very hot.

Potato Mould (Hot)

Mash 1 lb. of well-boiled potatoes with the same quantity of boiled mashed carrot, pass through a fine wire sieve, mix all well together with warm milk, and a lump of butter; place in a buttered mould, and set in a hot oven for 10 minutes, turn out on a hot dish, and brown in the oven.

Artichokes au Gratin (Hot)

Wash and peel the artichokes and place them in cold salted water, then put them in a pan full of boiling salted water. Boil for 20 minutes. (If the artichokes are old they should be put into cold water, which must be brought to the boil and kept so until they are cooked.) Take the artichokes out and drain them, cut into pieces, then place them in a fireproof dish, covering them with a good white sauce. Sprinkle with grated cheese. Place in a moderate oven, and bake about 10 to 15 minutes until of a golden brown.

Scalloped Artichokes

Cook as in the previous recipe, but omit the cheese and bake in shells which have been buttered and sprinkled with brown crumbs. Sprinkle the artichoke mixture with crumbs also, place a little butter on the top and brown as before.

Artichoke Soufflé

See page 48.

Artichoke Chips

Cook as before; slice, fry in boiling fat. Drain and leave till cold. Fry, drain, and serve very hot.

Cream of Artichokes (Hot or Cold)

Boil 1 lb. of artichokes until quite tender, then pass them through a sieve. Make a custard with ½ pint of milk and the yolks of four eggs, pepper and salt. Whisk up the white of 1 egg, and whisk this into the custard, mix it with the artichoke and place all in a well-buttered mould and steam for an hour. Serve hot with anchovy sauce, or set the mould on ice, and when quite cold turn it out on to a dish and serve with iced mayonnaise of hollandaise sauce.

Eggs and Artichokes (Hot)

Boil 8 artichokes and cut them into slices, place them in a fireproof dish. Hard boil 4 eggs. When cold shell them and chop them up, place the eggs on the top of the sliced artichokes, and pour over the whole a good white sauce flavoured with Parmesan cheese. Dust over with breadcrumbs and make thoroughly hot in the oven.

Bouchées d'Artichauts (Hot)

Prepare the green artichokes by cutting off the leaves close down to the fond and trim off any that may adhere, cut off the stalk as closely as possible. Plunge the artichoke bottoms into boiling salted water, and leave them for five minutes, then take them out and remove the choke. Place in boiling water and boil them until tender. When cooked take them out, drain them, and put them through a sieve, season with pepper and salt, moistening the whole with enough white sauce to make a purée. Have ready some pastry patty cases, ready cooked, fill each with the mixture, and serve very hot.

Fonds Artichauts au Gratin (Hot)

Boil the artichoke bottoms in the manner described above, mash them and season with pepper and salt, adding a little cream and butter, place some of the mixture in china shells or small fireproof dishes, grate some cheese over each, and bake in the oven until a golden brown.

Stuffed Artichokes.

Take the cooked artichoke bottoms and fill with mashed potato flavoured with cheese. Brown in the oven and serve with cheese sauce.

Artichokes with Cream Cheese

Fill the artichoke bottoms with cream of cheese (_see_ page 71), and serve on buttered toast very hot.

Mushrooms au Gratin (Hot)

Peel the mushrooms and cut off their stalks, and place them in a buttered fireproof dish. Peel the stalks and wash them, add the peelings, dry them and cut them up. Make a sauce with 1 oz. of butter, and when melted add ½ oz. of flour, stirring into it ½ pint of milk. Stir well, bring to the boil, and then throw in the chopped stalks, a dessertspoonful of finely-chopped parsley, a teaspoonful of finely-chopped onion, a dusting of pepper, and ½ a teaspoonful of salt. Simmer the sauce until it thickens, strain and add some browning. Pour the sauce over the mushrooms, sprinkle some browned breadcrumbs over the whole, and bake in a quick oven for 10 minutes.

Mushroom Croûtes (Hot)

Cut some rounds of bread about ¾ of an inch thick and scoop them out rather thinner in the centre, fry until a golden brown, drain, and keep hot. Place the required number of mushrooms on a greased baking-tin with a piece of butter in each, and place in the oven to cook. In the meantime mince one or two mushrooms and place them in a pan with a small quantity of good brown sauce. When cooked place a spoonful on each croûte, and a whole mushroom on the top of each. Serve very hot.

Roes and Mushrooms on Toast (Hot)

Make the necessary number of round croûtons of lightly-fried bread, and choose a like number of mushrooms the same size as the croûtons. Peel the mushrooms, rinse them in warm water, to remove any grit, and remove the stalks. Place them on a greased baking sheet, stalk side uppermost. Put some small pieces of butter on each mushroom and a little pepper and salt. Cover with buttered paper and cook in a moderate oven for 10 to 20 minutes. Serve a mushroom on each croûton, and on each mushroom place a cooked bloater roe curled round.

Stuffed Aubergines (Egg Fruit)

Boil the aubergines until tender (25 to 30 minutes), and then half them lengthwise. Scoop out the pulp carefully, sieve it, and mix it with some fine brown crumbs (about a dessertspoonful to each half-pint), pepper, salt, and some oiled butter. Fill the skins with this mixture, sprinkle with crumbs and oiled butter, and bake in a moderate oven until browned.

Tomatoes au Gratin (Hot)

Take four tomatoes as nearly the same size as possible, and a slice off the top of each. Scoop out the middle of the tomato as much as possible, leaving the frames for cases. These set on one side. Work the pulp through a sieve, and mix into it a heaped-up tablespoonful of finely-grated breadcrumbs, add the yolks of 2 eggs, and mix well. Fill the tomato cases, heaping the mixture up, grate a layer of cheese over them, place on a buttered baking dish and bake for 10 minutes.

Tomato Pie (Hot)

Slice a good-sized onion thinly, blanch it, and fry in fat till lightly browned. Take 1 lb. of ripe tomatoes, skin and cut in slices. Place a layer of onions in the bottom of the pie dish with a good seasoning of salt and pepper, then a layer of tomatoes, with white breadcrumbs scattered over and a few pieces of butter, and so on until the dish is almost full. Have ready some well-mashed potatoes, and spread thickly over so as to form a crust, and bake until brown.

Tomatoes à la Crême de Fromage (Cold)

Whip ½ pint of cream until stiff, season it with celery salt and pepper. Add 3 oz. of grated cheese, then whisk in by degrees ¼ pint of cool but liquid aspic jelly, which has been flavoured with tarragon vinegar. Continue to whisk until the mixture begins to stiffen. Previously peel and halve some small round tomatoes, and remove the seeds from the halves when cut open, and drain for a little. Place each piece of tomato, when filled, on a cheese biscuit, and ornament it round the edge with a piping of cheese cream. Garnish the dish with cress, and put a tiny bunch into the middle of the cream with which the tomatoes are filled.

Tomato Canapés (Cold)

Cut some slices of bread 2½ in. in diameter, and ■ in. thick. Soak in milk and then fry a pale colour. Spread when cold with grated cheese and butter made into a paste. Dip some small tomatoes into hot water, skin them and put one on each piece of bread, placing some finely-minced parsley and grated Parmesan on each.

Beignets of Vegetable Marrow (Hot)

Peel the vegetable marrow and strain it without removing the seeds. When three-parts cooked, take it out of the pan and cut it into neat pieces, as much one size as possible, remove the seeds, dip each piece of marrow into batter and fry until a golden brown in boiling fat.

To Make the Batter

Whip two eggs and mix them with about two tablespoonsful of flour. This is generally sufficient to make a stiff batter. Then add by degrees ■ of a pint of milk, salt and pepper, cover and put by for an hour or two. Be sure that the article to be fried is quite dry

before being dipped in the batter.

Salsify Scallops (Hot)

Boil the salsify for 50 minutes, then place in a mortar and mash to a pulp, add a few drops of anchovy essence and some milk or cream, to make it the consistency of a thick custard. Place the mixture in buttered shells, sprinkle some finely-grated breadcrumbs over it, place a piece of butter on each and brown in the oven.

Salsify Fritters (Hot)

1½ lb. salsify, 2 oz. beef dripping, lemon juice. Wash and lightly scrape the salsify roots and put them in cold water. Put the dripping, a little salt, and the lemon juice in a saucepan with enough water to cover the salsify. When it boils put in the roots and let them simmer gently until they are tender. This will take 30 to 40 minutes. Do not cover the pan. When tender drain off the water and cut the roots into pieces about 2½ in. long. Sprinkle the salsify with a little pepper, oil, and vinegar, and then dip the pieces into batter. Fry in boiling fat until a golden brown, then take out, drain and serve.

Glazed Carrots (Hot)

Blanch some small, young carrots, as much of a size as possible, dry them well, and if necessary, trim them evenly; put them into a pan, with just enough stock to cover, and a lump of loaf sugar; boil them up sharply till the stock is reduced to a glaze, then add to this 1½ oz. of butter and a seasoning of salt, and stir them in this till the liquid is all absorbed, and the carrots are quite glazed with the butter.

Carrots à la Flamande (Hot)

Take about 12 young carrots, blanch them in scalding water, and rub them well. Then put them into a stewpan with about 1 oz. of butter, a saltspoonful of castor sugar, some finely-minced parsley, a seasoning of pepper and salt, and sufficient water to cover them liberally; simmer the carrots in this for about 15 to 20 minutes, when they should be quite tender, shaking them once or twice in the process. Remove the pan from the fire, and stir in the yolk of 1 egg beaten up with 2 spoonsful of cream or new milk, and serve very hot.

Glazed Turnips (Hot)

Peel about 1 lb. of young turnips, wash them well, cut into quarters, and put them on in salted water; bring this sharply to the boil, then place them in a well-buttered small frying or sauté pan, sprinkle them liberally with castor sugar, and directly the turnips begin to colour pour a little stock in, and season with pepper and salt, and a little more sugar if liked; let them stew slowly till quite tender, and serve them with the sauce poured over them.

Turnips à la Poulette (Hot)

Peel about 1 lb. of young, fresh turnips, wash them well, trim into olive or pear shapes; put them on in cold, salted water, and bring them sharply to the boil; then drain them, rinse in cold water, and dry them in a clean napkin. Have ready some velouté (i.e. melted butter made with 1 oz. of butter, 1½ oz. of flour, and about ¾ pint of vegetable stock instead of water), drop the turnips into this, and cook them till ready, very gently, for about 20 to 25 minutes according to size. When ready lift them out, and keep hot. Add a spoonful of castor sugar to the liquor, boil it up sharply, and just before serving stir in the yolk of an egg and a little piece of butter cut up small; do not let the sauce reboil after adding these; season to taste with pepper and salt, pour the sauce on to the turnips, and serve very hot.

Onions au Gratin

Blanch (by placing in boiling water) 1 lb. of onions, then divide them into quarters and boil in milk and water until tender. Cut them up, moisten them with some of the liquid in which they were boiled, mash them smoothly, add a cupful of cream, or one of milk enriched with the yolk of an egg, pepper and salt. Place the purée in a fireproof dish, which has been buttered, strew some grated cheese over, and sprinkle a little melted butter over all. Bake until hot throughout, and until the top is coloured.

It is worthy of note that where grated cheese is mentioned, it is quite unnecessary to buy Parmesan for the purpose. Any dry ends of cheese, grated, will serve.

Celeri à la Duchesse (Hot)

Cook some celery slowly in equal parts of milk and water, seasoned with salt and pepper; when cooked, lift out, cut it up, and place a layer of it in a fireproof dish, seasoning with salt and pepper, and moistening with some béchamel or any good white sauce, and continue these layers until the dish is full, taking care to raise it up in the centre; strew it rather thickly with grated Parmesan cheese; moisten it with some oiled butter, and put it into the oven for 10 minutes, to colour nicely.

Fried Celery (Hot)

Thoroughly wash three heads of celery, remove the leaves, and cut into 4 inch lengths, then put in a stewpan with ½ a pint of stock and a seasoning of pepper and salt. Simmer gently for a quarter of an hour. Let the celery cool, then take it out, dip it in egg and breadcrumb, and fry in butter. Serve very hot, and hand tomato sauce with it.

For the following vegetable dishes, _see 10s. a Head for Housebooks_:--

Potato Cakes, Ribbons, à la Maître d'Hôtel, Balls, Cones, Eggs au Gratin, Tomato Savoury, and Cabbage Cakes.

Cauliflower au Gratin, and Curried.

Artichoke Chips.

Tomato Rice.

Vegetable Marrow au Gratin. Fried.

Turnip Tops.

Purée of Green Peas.

Salsify or Celery au Gratin.

Onion Purée.

Haricot Bean Curry, Patties, Croûtons.

Cabbage and Eggs.

The Single-handed Cook.

Scalloped Artichokes.

Asparagus and Eggs.

Stewed Cabbage.

Glazed Carrots.

Cauliflowers, Aigrettes au Gratin, Croûtons, Fritters.

Celeriac au Gratin, Purée, with Brown Sauce.

Croûstades of Broad Beans.

Beetroot with Parsley Sauce.

Brussels-sprouts au Gratin.

Purée of Flageolets, with Parsley Sauce.

Mushrooms and Tomatoes, Baked, Stewed.

Parsnip Cakes.

Peas à la Française, and Carrots à la Crême.

Potatoes Lyonnaise, à la Donna, Puffed, Soufflé.

Seakale au Gratin, Curried, Fried, with White Sauce.

Onions en surprise.

Tomatoes, with Eggs, Roasted.

Vegetable Pie.

CHAPTER III

How to Cook Corn, Haricot Beans, and Lentils, and to Make Vegetable Soufflés.

Of all the cereals none, I think, yields a better result than corn--known to some people as green, and to others as Indian corn or maize. Freshly cut, boiled, and eaten with salt, pepper, and oiled butter, it is delicious; but every one, alas, does not grow it, and many folk have to be content with the tinned corn, which, nevertheless, is excellent. It may be bought in tins of two sizes, and is quite inexpensive.

To Cook Corn

Open a small tin of corn and strain off the liquid, and then simmer the corn until tender, but not “mashy,” in 3 tablespoonsful of milk, ½ oz. of butter, pepper and salt. About 10 minutes will suffice for the cooking.

Corn with Buttered Egg

Have ready the buttered egg, and pile it in the centre of a hot fireproof dish, surround with the cooked corn and garnish with small circles of fried bread.

Egg and Corn Toast

Prepare the egg and corn as before, stir them together and serve very hot on buttered toast.

Corn with Poached Eggs

Spread the cooked corn flat on a hot fireproof dish, and arrange the poached eggs neatly on it, and serve very hot.

Corn au Gratin

Cook the corn as before, and have ready a delicate white sauce as below. Heat a fireproof dish, butter it, and sprinkle with fine brown crumbs. Heat the corn in the sauce, and place it in the dish, cover with grated cheese and crumbs, and bake for 20 minutes in a hot oven.

White Sauce

Melt 2 oz. of fresh butter, and sprinkle into it 1½ oz. of dry sifted flour. Stir until the sauce will leave a clean place in the pan when lifted in the spoon. Add quite gradually ½ pint of milk, stirring all the time. Bring to the boil, and cook for 10 minutes. Season with salt and white pepper and a squeeze of lemon juice. Half water and half milk or stock may be used instead of all milk, and a spoonful or two of cream added just at the last is an improvement. If a

Cheese Sauce

is required add a piled-up tablespoonful of finely-grated cheese, stirring it in well so that it shall be smooth.

Corn au Gratin with Tomato Sauce

Prepare as before, using tomato sauce instead of white sauce.

Tomato Sauce

Take 6 small tomatoes, slice them and place in a pan with 1 oz. of butter, salt and pepper, and 1 pint of stock and water, or milk and water. Boil until soft, sieve, and thicken with 1 oz. of white roux (flour and butter cooked until smooth, as described in “White Sauce”). Stir until smooth and very hot.

Corn Fritters

½ tin of corn, 2 eggs, 2 tablespoonsful of flour, 1 tablespoonful finely-chopped parsley, seasoning to taste. Drain the corn into a bowl; stir in the flour carefully, add the parsley, season, and lastly, well beat the eggs, and stir those in. Have ready some boiling fat in a frying-pan, into which the batter should be dropped in dessertspoonsful. Drain on kitchen paper, and serve at once on a hot dish.

Corn Rissoles.

Take the cooked corn and beat it in white, cheese, or tomato sauce, and then leave until cold. Form into rissoles, egg and crumb and fry. Serve very hot, garnished with fried parsley.

Omelette with Corn

Prepare the omelette as usual, and have ready some corn heated in white sauce. Just before serving the omelette spread the inner portion with the hot corn.

Curried Corn.

Prepare the corn as before, and heat in a good curry sauce. Pile in the centre of a hot dish and surround with boiled rice garnished with sieved yolk of egg.

Curry Sauce

Slice an onion and ½ a small apple finely, and fry them in 2 oz. of clarified dripping or butter. Stir in ½ a dessertspoonful of curry powder and the same of flour. Salt to taste. Add ¼ pint of stock or milk, cook gently for 30 minutes, then put all through a sieve, add a few drops of lemon juice, and reheat.

“Humitas”

(_A Chili dish_)

Grate some fresh green corn, add a little sugar and red pepper.

Fry this slightly in clarified dripping. Arrange two leaves from the sugar-corn, the broad part lapping over the other. Fill this with about a tablespoonful of the mixture, then fold it up neatly in the leaves, tying it with a thin strip from another, and bake.

When the fresh corn is not in season, the corn in tins will answer the same purpose if cooked and passed through a wire sieve and wrapped in vine leaves.

Corn and Cheese Cream

Cook the corn, mix it into the cheese cream, and serve very hot on buttered toast. For the Cheese Cream _see_ page 71.

The serving of these recipes may be varied: for instance, instead of sending corn au gratin to table in one large dish, bake and serve it in small brown or green earthen pipkins, one to each person, or in the centre of a croûton of fried bread.

It is worth noting, too, that haricot beans may be substituted for corn in any of these recipes. They should be soaked for 2 to 4 hours, and then boiled in stock or water for 3 hours.

Haricot Beans

Haricot beans must be soaked for quite 12 hours in cold water, then put into a pan with cold water slightly salted, (½ oz. of salt to 1 gallon of water,) brought slowly to the boil, then drawn aside and simmered for about 2 hours.

Haricot Beans à la Milanaise (Hot)

Boil the beans as directed and serve with a covering of sauce à la Milanaise, which should be made in the following manner: Scald 4 onions for 5 minutes in boiling water, then dry them and cut them up, place them in a saucepan with a pinch of sugar, 1 oz. of butter, and a saltspoonful of salt. Boil a tablespoonful of rice, and when cooked add it to the onion; moisten with ½ pint of milk or water, cook slowly, stirring occasionally; when the onions are soft add 1 tablespoonful of finely-grated cheese. Mix well and pass through a sieve, add to this ½ pint of white sauce, mix thoroughly, repeat and pour over the beans.

Haricot Beans with Tomato Purée

Cook the beans as before and serve covered with tomato purée (_see_ page 18.)

Haricot Beans with Soubise (Onion) Sauce

Cook the haricots as before and serve with onion sauce poured over and croûtons of fried bread arranged round.

Soubise Sauce

Take 2 large onions, peel them and put them in boiling water for 5 minutes. Strain, slice, and place in a pan with 1 oz. of clarified dripping and stew until tender. Lift the pan from the fire and stir in ½ pint of melted butter sauce. Let it boil, stir for about 7 to 10 minutes, and then rub through a hair sieve.

Lentils

Soak the lentils for at least 12 hours in cold water. Then drain and place them in a pan with cold salted water (1 gallon of water to ½ oz. of salt), bring them to the boil, then draw aside the pan and simmer, until the lentils are quite soft, about 1 hour. After having been cooked like this they can be served in any of the methods advised, for haricot beans or plain, save for the addition of a pat of butter melting among them, a sprinkling of chopped parsley, and a shake of pepper and salt.

Lentils with Curry Sauce

Cook the lentils as before and serve with plenty of curried sauce poured over. For the curry sauce _see_ page 45.

Maigre Soufflés

There is no nicer way of serving such vegetables as cabbage, spinach, artichokes, or celery, than in the form of a soufflé, which may appear as an entrée or second course dish, or as a vegetable to accompany meat or poultry.

Savoury soufflés of rice and of macaroni are also delicious, and although all soufflés require care in the cooking, a cook of moderate abilities will soon master the art of making these delicious dishes.

Vegetable Soufflé

Have ready about ½ lb. of any carefully made and well-flavoured vegetable purée--spinach, cabbage, turnip tops, Brussels-sprouts, carrot, turnip (or both mixed) artichoke, tomato, or celery. Then put 1 gill of water and 1 oz. of butter into a pan with a pinch of salt. Directly this comes to the boil, stir in 1 oz. of flour, stirring it well with a wooden spoon for 2 or 3 minutes, put in the purée, and just remove the pan for a little, add the yolks of 2 eggs, 1 at a time, and 1 whole egg, and finally the whites of 2 eggs beaten to a stiff froth. Have ready a papered soufflé dish, fill it three-quarters of the way up, bake in a hot oven for 10 minutes, and serve at once, first removing the paper and wiping the dish.

The purée may be prepared at any time, but the eggs should only be added just before the soufflé is to be baked. The dish (china or tin) in which the soufflé is baked must be well greased and a greased paper tied round. The mixture rises so strenuously that if the dish is 3 parts full (and it should be to look well when served), the paper is required to prevent the mixture from falling over, as it rises just above the edges of the dish. When baking the soufflé do not bang the oven door, and open it very gently, and, by degrees when taking the soufflé out. If kept waiting the soufflé will fall and become tough. So with these dishes the diners must wait for the soufflé rather than the soufflé for the diners.

Vegetable Purée

This is merely the vegetable boiled in water or stock, and then put through a sieve so that it forms a preparation resembling a very thick custard. Spinach à la crême (page 20) and purée of watercress, lettuce, and turnip tops (pages 16 and 17) are excellent foundations for soufflés. Such vegetables as artichokes and celery should be treated as follows:--

Celery Soufflé (Hot)

Wash some celery well, and remove all the outside parts, cut up ½ lb., put it on in cold, salted water, bring this to the boil, take out the celery and drain. Put the celery into a pan with 1½ gills of milk, half a bayleaf, a blade of mace, a slice of onion, and boil it all till tender, then sieve the celery, and it is ready for the soufflé.

Savoury Rice Soufflé

Wash 2 oz. of rice and then place it in ¾ of a pint of boiling stock (fish or vegetable stock), and cook until the rice swells and is soft without being pulpy. Drain it and let it cool, and then stir into it 1 oz. of fresh butter, 2 or 3 tablespoonsful of tomato purée, salt and pepper the beaten yolks of 2 eggs and then the frothed whites. Bake in a soufflé dish prepared as already described.

Mushroom and Rice Soufflé

Proceed as before, but use stewed mushrooms instead of the tomato purée.

Rice and Cheese Soufflé

Proceed exactly as for Savoury Rice Soufflé but add 2 oz. of grated cheese.

Macaroni Soufflé

Proceed as for Rice Soufflé, using about the same bulk of cooked macaroni (cut into half inch lengths) as of cooked rice.

CHAPTER IV

DISHES MADE WITH MACARONI AND SPAGHETTI

Macaroni and Spaghetti

To Boil.--Macaroni or spaghetti should be boiled in the same way as rice, namely, thrown into boiling salted water, and should never under any circumstances be soaked or placed in cold water previously. They should be tested occasionally with a fork, and when tender a teacupful of cold water should be thrown into the pan to stop the boiling, the pan should then be lifted from the fire, the macaroni or spaghetti drained of all liquid and returned to the hot dry pan and kept hot until wanted. The time for boiling is from 20 to 30 minutes. The following dishes can be made of either preparation:--

Macaroni à la Napolitaine (Hot)

Boil 3 oz. of macaroni in the manner described above, and after it has been returned to the pan in which it was boiled, stir into it 2 oz. of Parmesan cheese finely grated and 1 oz. of butter. The cheese should be stirred in half at a time and well shaken amongst the macaroni. Season with black pepper and salt and serve at once very hot.

Macaroni à la Italienne (Hot)

Follow the preceding recipe for boiling the macaroni, and having returned it to the pan, stir into it 1 oz. of cheese finely grated, 1 oz. of butter, and then ½ pint of tomato purée (_see_ page 18). Mix well and serve very hot piled on a dish.

Macaroni au Gratin (Hot)

Boil the macaroni by the directions given above, then mix into it 1 oz. of grated cheese and 1 oz. of butter, stir well and place the mixture neatly in a fireproof dish, sprinkle over it ½ oz. of grated cheese and the same amount of dried breadcrumbs. Melt ½ oz. of butter and pour it over the whole. Place in the oven (until a light brown colour) for 10 minutes, then serve.

Macaroni Cheese (Hot)

Butter a fireproof dish and in it place 3 oz. of macaroni previously boiled, dust it with pepper and salt. Make a good white sauce and add to it 2 oz. of grated cheese. Pour this all over the macaroni and sprinkle the top with grated cheese and a few dried breadcrumbs. Place in the oven and cook until a golden brown and serve in the dish in which it is cooked.

Macaroni au Jus (made with Meat Stock) (Hot)

Boil 3 oz. of macaroni for 10 minutes, drain off the water and pour into the pan ½ to ¾ pint of brown stock, simmer the macaroni until tender, pour off the stock; but should the macaroni have absorbed it all, take enough to moisten the whole, thicken it in the usual way, and add browning to colour it. Place the macaroni on a hot dish--it should be kept hot in the pan while the sauce is making; pour the gravy over it and serve.

Buttered Macaroni (Hot)

Boil 2 oz. of macaroni and drain it well. Put 2 oz. of butter into a thoroughly warmed pie dish, put the macaroni on top of this, and mix it all well together with two forks, sprinkling in at the same time freshly-grated cheese and coralline pepper. When thoroughly mixed and the butter all absorbed, sprinkle it with more pepper and cheese, and serve at once.

Poached Eggs and Macaroni (Hot)

Break some macaroni up into inch pieces, rinse it well; put 2 oz. of butter into a fireproof dish, put the macaroni in, and pour enough milk over it to thoroughly cover it, stirring it now and again. When three-quarters cooked, lift it out, and put it into another dish, seasoning it well with pepper and salt, and pour over it ½ pint of good brown gravy, then put it back in the oven again and leave it till cooked. When ready lay some poached eggs on it, sprinkle liberally with Parmesan cheese, coralline pepper, and serve.

Macaroni Cutlets (Hot)

4 oz. macaroni, 4 oz. grated cheese, 1 oz. flour, ½ oz. flour, ½ pint of milk, 1 teaspoonful French mustard, breadcrumbs, 1 egg, cayenne and salt. Boil the macaroni in water until it is quite tender, then cut it into pieces of half an inch in length. Melt the butter in a stewpan, add the flour gradually, stirring until there are no lumps, add the milk and stir over the fire until the sauce thickens. Mix the macaroni, cheese, mustard, pinch of cayenne and salt to taste, with the sauce, then turn out on to a plate and leave until cold. Form into cutlets or small rolls, roll in breadcrumbs, then dip in beaten egg, and again roll in crumbs. Fry the cutlets in boiling fat until they are a golden brown colour, then serve with a garnish of fried parsley. If the mixture is formed into cutlet shape place a small piece of raw macaroni at the thin end to represent the bone.

Fish and Macaroni (Hot)

Cook the macaroni until quite tender, then cut it into small pieces; meanwhile flake ½ lb. of cooked fish, free from shin and bones, and make a good stock from the bones and trimmings of the fish. Melt 1 oz. of butter, stir into this ½ oz. of flour, strain in ½ pint of the fish stock, and bring it all to the boil; then put in the fish and macaroni, season to taste with salt and pepper, turn into a buttered fireproof dish, and bake in the oven for 10 minutes.

Macaroni with Tomatoes

Remove the stalks of the tomatoes, cut each one into four pieces, then put them into a saucepan with a little water, a bayleaf, and a sprig of basil, and season with pepper and salt to taste; now boil till thoroughly done, when you turn them out on to a hair sieve, allowing them to stand for a minute or so, in order that all the water may drain off and be thrown away; then pass the tomatoes through a sieve with a wooden spoon, heat up the pulp well with a good lump of butter, and then dress the previously-boiled macaroni with this, and plenty of grated Parmesan, or any good, strongly flavoured cheese which will grate well.

Italian Cake (Hot) (made with Suet)

Boil 2 oz. of macaroni till tender, drain well and cut into small pieces, then pound it with 2 eggs, 8 oz. of grated Parmesan cheese, 4 oz. mutton suet, and season to taste with pepper and salt; steam in a basin or mould for 70 minutes. Turn out and serve with tomato or any other savoury sauce to taste. 2 beaten yolks of egg may be substituted for the suet.

Spaghetti Pudding (Hot)

Cook 4 oz. of spaghetti as previously directed, drain it and place half of it in a pie dish, grate 2 oz. of cheese (a good cooking one should be chosen), and sprinkle some of it over the spaghetti, slice 4 or 5 small tomatoes and place them on the bed of macaroni, sprinkling them with cheese, pepper and salt, and finish with the remainder of the macaroni, placing the rest of the cheese on the top. Pour carefully over this ½ pint of milk and cover the dish with a plate or small dish, cook in a moderate oven. A fireproof dish with a fitting cover would be useful for this dish, but if not procurable a pie dish can quite well be used.

Baked Tomatoes and Macaroni (Hot)

Cut 4 or 5 tomatoes of the same size into halves and place them in a baking-tin with a small piece of butter on each and dust them with black pepper and nutmeg. Bake from 15 to 20 minutes. Have ready 6 oz. of macaroni boiled and hot, place this in a circle on a hot dish, arrange the tomatoes inside this and pour over the spaghetti a rich cheese sauce. Serve very hot.

Spaghetti à l'Indienne (Hot)

Make a curry sauce by slicing 2 small onions and frying them in butter until a light brown, add to them 2 teaspoonsful of curry powder and a tablespoonful of lemon juice or rather less of vinegar, a tablespoonful of sugar, a pinch of salt and two raw apples chopped very finely, stir in 1½ pints of water and simmer until the ingredients have become a pulp. Place ½ lb. of spaghetti in boiling water, and when partly cooked remove it, drain, and finish cooking it in the sauce. Serve very hot.

CHAPTER V

DISHES MADE WITH RICE

Rice

To Boil.--Place the rice in a pan of fast boiling water and be careful to choose one large enough for it. 1 to 1½ oz. of rice should be cooked in a quart pan, which should be three-parts full of water, and have ½ a teaspoonful of salt and a few drops of lemon juice in it, the latter to preserve the whiteness of the rice. Stir occasionally. Boil the rice for 10 to 15 minutes, but test it at the former time by pressing it between the finger and thumb. When the grains feel soft remove the saucepan from the fire at once and drain off the water; return the rice to the pan and set it on the corner of the stove to dry, shaking it occasionally. Some grains of rice will always stick to the pan, and to remove these put a small pat of butter in the pan, and as this melts the grains will fall away. The rice will take quite 10 minutes to dry and should never be served until the moisture has been got rid of and the grains separated. Remember always that rice swells very much in the cooking process, hence the necessity of the large pan and amount of water required. Carolina rice swells more than Patna and so requires rather more water than the latter. If the rice is boiled too slowly or for too long a time the result will be a sticky mass. A good plan is to pour in a pint of cold water when the rice is sufficiently cooked. This stops the boiling at once and helps to separate the grains; if put close to the stove when the rice is first put into the pan, the cook will be able to throw it into the pan the moment the rice is tender. If the rice is to be served with meat in place of a vegetable, the rice should only be partly cooked and the water all drained off, and then ½ pint to 1 pint of stock put in the pan. This should be simmered until quite cooked, drained and served.

Another method of boiling rice, though totally different to the foregoing, is equally successful. Place the rice in cold water and allow it to come to the boil. After boiling for a few minutes and when the grains are tender when pressed between the finger and thumb, throw in a jugful of cold water, remove the pan from the fire, and pour both rice and water on to a wire sieve, shake well, and when the water has run away sufficiently, place the sieve with the rice upon it in the oven to thoroughly dry it. The grains will fall away from each other and the rice is ready for use.

Rice is even better as a vegetable if it is cooked some time before being wanted, covered over, and reheated in the oven before use; the grains are drier than when only cooked and served at once.

Fried Rice

Served as a vegetable

Boil ½ lb. of rice as directed, and when it is thoroughly dried fry it in 1 oz. of butter until slightly browned. Dust with pepper and salt and serve piled in a dish.

Devilled Rice

Proceed as for Fried Rice, but mix in a pinch of curry powder with the hot liquid butter.

Rice à l'Italienne (Hot)

Boil the rice in the manner described on page 60, and to 4 oz. when cooked and drained, stir in 1 oz. of butter, dust with salt and pepper and stir well, mixing thoroughly; add sufficient tomato sauce to moisten the whole, and add 2 oz. of finely-grated cheese. Mix well and serve very hot.

Risotto à la Milanaise (Hot)

Fry 3 oz. of chopped onion in 2 oz. of butter or clarified dripping until of a golden brown colour, then add 6 oz. of rice, stir without stopping for 2 or 3 minutes, add by degrees 1 pint of stock, stir occasionally and simmer gently until the rice is just soft, add a very small amount of grated nutmeg and 1½ oz. of grated cheese before the rice is cooked; after this stir and cook for 3 or 4 minutes until the rice is quite soft. Take off the pan, add a small pat of butter, stir well and serve very hot.

Risotto, No. 1 (Hot)

Place in a saucepan ½ pint of milk, a small teacupful of raw rice, 4 small Portugal onions, 6 good-sized tomatoes, these latter ingredients chopped finely, pepper and salt to taste. Boil all together until soft, stirring occasionally, and just before serving stir in 1½ oz. of finely-grated cheese.

Risotto, No. 2, made with Stock (Hot)

Chop half an onion very finely and fry it in ½ oz. of butter. Place 4 oz. of rice in a saucepan with ½ pint of stock, add the onion and cook until the stock is absorbed. Stir in 1 oz. of grated Parmesan cheese, pepper and salt to taste. Make very hot and serve.

Stewed Rice and Cabbage, made with Stock (Hot)

Boil in the ordinary way separately equal quantities of rice and cabbage. The latter cut into small pieces before they are quite cooked, remove them from their respective pans and place them together in a stewpan with just as much stock as will cover them, simmer until quite cooked (probable time, 5 minutes), and serve with a covering of grated cheese.

Rice Savoury (Hot)

Boil 3 oz. of rice in ½ pint of milk, season with pepper and salt; butter a pie dish, lay in a layer of rice, sprinkle this with 1 oz. of grated cheese, add the rest of the rice, sprinkle with another ounce of cheese, dot some small pieces of butter all over the top; bake in a quick oven till nicely browned on the top.

Rice Balls (Hot)

Boil 4 oz. of rice in cold water, taking care to let it absorb all the liquid; to this add 1 tablespoonful of finely-grated cheese, 1 teaspoonful of chopped parsley, 1 oz. of finely-grated brown breadcrumbs, 1 tablespoonful of tomato sauce, pepper and salt to taste; bind all the ingredients with the yolks of 2 eggs, mixing thoroughly, form into balls, brush over with white of egg, roll in breadcrumbs and fry a golden brown.

Rice and Fish Toast (Hot)

Fry an onion, finely-sliced, in butter with a few shrimps or pieces of lobster, stir into it 1 dessertspoonful of mustard. When thoroughly hot, add a teacupful of rice previously boiled and dried and a tablespoonful of grated Parmesan cheese. Stir and serve very hot on rounds of buttered toast or fried croûtons.

Savoury Rice Pudding (Hot)

Simmer 2 tablespoonsful of rice in 1 pint of milk until nearly cooked, then add 1 oz. of finely-grated cheese, ½ oz. of butter, 1 teaspoonful of made mustard, a pinch of salt and a dust of cayenne pepper. Mix all together and pour into a buttered pie dish, sprinkle ½ oz. of finely-grated cheese on the top and bake in a moderate oven for ½ hour.

CHAPTER VI

CHEESE DISHES

Welsh Rarebit (Hot)

Note.--As a general rule where Parmesan cheese is mentioned, any well-dried and finely-grated cheese serves the purpose.

Slice down some good, rich cheese rather thinly, into a delicately clean stewpan, with some morsels of butter, and 2 or 3 spoonsful of porter, good ale, or new milk as you please, according to the quantity of the cheese; flavour to taste with freshly-ground black pepper and English mustard. Stir it all till thoroughly melted, pour it over hot buttered toast, browning the surface if you like with a hot shovel, and serve at once.

This requires careful watching, because if it be in the least over-cooked it will be leathery.

Irish Rarebit (Hot)

Add a few drops of vinegar and a finely-minced pickled gherkin to cheese treated as above, and serve very hot.

Baked Cheese Sandwiches (Hot)

Cut some slices of good, rich cheese about a third of an inch thick, season lightly with freshly-ground black pepper, and a drop or two of tarragon vinegar; then place them between two slices of brown bread and butter; trim these neatly, and set them in the oven, serving them directly the bread is toasted.

Parmesan Puffs (Hot)

Mix 4½ oz. of breadcrumbs, 4 oz. of Parmesan cheese, 2 oz. of butter, ½ a teaspoonful of cayenne pepper and salt, and 2 eggs; pound these all thoroughly in a mortar, bind them with a well-beaten egg, shape into balls about the size of a walnut, egg and breadcrumb them, and fry a golden brown in plenty of boiling fat. Drain well, and serve at once very hot, garnished with parsley.

Parmesan Eggs (Hot)

Take a flat fireproof dish and put into it the yolks of 2 eggs, a small pat of butter, some spice, and a tablespoonful of finely-grated Parmesan cheese. Stir over the stove. Then break into it five or six eggs and sprinkle the whole with grated cheese. Brown and serve.

Cheese Balls (Hot)

Put 1 pint of water into a pan with 1 oz. of butter when quite hot, dredge in 4 oz. of flour, and pepper and salt to taste, draw to one side and when cooled a little add the yolks of 4 eggs and 4 oz. of grated cheese. Have ready a pan of boiling fat, take the mixture up in tablespoonsful, drop in and fry a golden brown. Serve very hot.

Cheese Butterflies (Cold)

Take 2 oz. of flour, 1½ oz. of Parmesan cheese, 1 oz. of butter and the yolk of 1 egg. Make a pastry of the above ingredients and roll out thin. Then with a crinkled round cutter cut out double the number of rounds you require to use and bake a light brown. Allow them to become cold. Mix some grated cheese with a little whipped cream to a nice thick consistency, season with salt and cayenne pepper, pile lightly on the rounds of pastry. (Some of the rounds must be cut into halves _before baking_ to provide the wings for the butterflies.) Dip the crinkled edges of the halves into carmine to colour them, and arrange them as wings on the rounds of pastry. Put a piece of stalk of parsley to form each antennae; also arrange or ornament the back of each butterfly with a little of the green leaf of the parsley.

Cheese Pudding (Hot)

Place 1 pint of milk in a saucepan and let it become hot, then pour it on to 1 tablespoonful of ground rice previously mixed with a little cold milk, return to the pan and stir until the mixture thickens. Remove the pan from the fire and add 4 oz. of finely-grated

cheese, a pinch of salt and cayenne, the yolks of 2 eggs, and 2 oz. of butter. Mix all well together and then add the beaten whites of the eggs. Butter a pie dish and pour the mixture into it, and bake in a moderate oven for 20 minutes. Sprinkle grated cheese over the top before serving.

Cheese Aigrettes (Hot)

Place 1 oz. of butter in a pan with ½ pint of water; when boiling add 3 oz. of flour. Stir over the fire until the mixture leaves the sides of the pan quite clean. Remove the pan from the fire and when slightly cool add the yolks of 3 eggs and the whites of 2, cayenne and salt to taste. Stir in 2 oz. of grated Parmesan cheese, and place the mixture on a plate to cool. Take a small piece of the mixture in a spoon and drop it in hot fat and fry a golden brown; continue this until it is used up. Serve on a dish paper garnished with parsley and sprinkled with grated cheese.

Cheese Patties (Hot)

Line some patty pans with puff pastry and fill them three-parts full with the following mixture. Place 2 oz. of finely-grated breadcrumbs in a basin and mix into them 1 raw egg and a tablespoonful of milk; then add 2 tablespoonsful of finely-grated cheese and 2 teaspoonsful of butter, 1 teaspoonful of made mustard, ½ a teaspoonful of salt and the same of pepper. Mix very well. Place the patties in the oven and bake until a pale brown. The mixture will swell slightly in baking. Serve very hot.

Cheese Mushrooms (Hot)

Take ½ lb. of rich toasting cheese, slice it, place it on a soup plate. Cover it with flap mushrooms--on each mushroom a nut of butter and a dust of pepper and salt. Cover with another soup plate and bake in a moderate oven for half an hour. Dish up on buttered toast.

Cheese Custard Pudding (Hot or Cold)

Put 2 oz. of finely-grated cheese into a basin and add to it 2 well-beaten eggs and ¾ pint of milk. Trim the edge of a pie dish with cheese pastry and pour in the mixture. Place 2 or 3 pieces of butter on the top and bake in a quick oven (400 deg.) for 20 minutes.

Cheese Croûtons (Hot)

Take 6 rounds of bread ¾ inch thick and about the size of a five shilling piece, fry them a golden brown colour, sprinkle over them a dust of dry mustard, a layer of grated cheese, salt and pepper to taste. Place them in a quick oven until the cheese is cooked, then place a spoonful of hot rice on each, garnish with capers and serve very hot.

Cheese Canapés (Cold)

Grate 2 oz. of cheese and mix it smoothly in a basin with a dessertspoonful of mustard, the same of anchovy sauce, a shake of cayenne, a pinch of salt, a dessertspoonful of anchovy vinegar, a tablespoonful of fresh butter and the yolks of 2 hard-boiled eggs. Mix this until it is a smooth paste, then spread it on rounds of buttered white or brown bread. Chop the whites of the eggs finely or press them through a sieve on to the paste. Serve cold.

Little Cheese Custards (Hot)

Grate finely 3½ oz. of cheese and mix it with 1 egg, add ¼ pint of boiling milk, pour the mixture into small fireproof dishes and bake for 10 to 15 minutes. Serve hot in the dishes.

Cheese Patties (Hot)

Line the required number of patty pans with puff pastry. Boil 1 oz. of macaroni in just as much water as it will absorb. When soft cut it into tiny pieces, mix with it 1 oz. of finely-grated cheese, a pinch of salt, a pinch of cayenne, and bind the mixture with a little cream or cheese sauce. Bake for 10 minutes.

Tomato Cheese Croûtons (Hot)

Stew ½ lb. of tomatoes in butter until tender with onion cut up finely, put them through a sieve, adding a small quantity of cream, or milk if the former is not procurable. Replace the tomato in the pan and add to it enough grated cheese to make it like a thick cream, season with pepper and place a little of the mixture in croûtons of fried bread. Serve very hot.

Cream of Cheese

Make some squares of hot buttered toast, place on a hot dish and keep hot. Melt ½ lb. of cheese in a little saucepan with 1 oz. of butter and 3 tablespoonsful of cream (or milk), pepper and salt. When of the consistency of very thick custard pour it over the toast and serve.

For the following Cheese Dishes, _see 10s. a Head for House Books_:--

Cheese Balls, Biscuits (hot or cold), Creams, Croûstades, Croûtons, Egg Toast, Pastry, Pudding, Ramekins, Straws.

The Single-Handed Cook:--

Cheese and Potato Fritters, Cream Croûtons, Cream Tartlets, Custard, Fingers, Pufflets, Quenelles, Soufflé, Tartlets, Zephyrs.

CHAPTER VII

OMELETTES AND CURRIES

Omelette

Break two eggs into a basin, season with salt, pepper, minced parsley, and chives, etc., and beat these all together for about 1 minute. Melt 1 oz. of butter in an absolutely clean pan (it is best to keep a pan on purpose for omelettes), and when this smokes, pour in the eggs, and do not touch them for a few seconds, till the liquid has set a little at the bottom of the pan; tilt the pan a trifle to one side, and if there is a small puff of steam, lift the edge up carefully with a knife to allow as much of the liquid as possible to run underneath; repeat this till there is no more egg liquid left, and the top just set, slip a knife under the omelette, fold it over, and slip it at once on to a hot dish, and serve immediately. This can be varied, of course, to any extent, by, just before folding it over, slipping in any kind of vegetable mixture, such as mushrooms, chopped up and previously lightly fried in a little butter.

Potato Omelette

To 4 eggs add 2 tablespoonsful of very smoothly mashed potato, add a tablespoonful of cream, a small piece of butter, pepper and salt, whip all together and then fry as before.

Green Pea Omelette

Place between the omelette a few green peas, made very hot, and tossed in butter, salt and pepper.

Asparagus Omelette

Fold the omelette over a few cooked asparagus tops, which have been made hot.

Tomato Omelette

Make an ordinary omelette, and before serving pour this mixture into it. Take two or three tomatoes and cut them into pieces, cut an onion into very thin slices, melt a tablespoonful of butter into a saucepan and place the onion in it. Cook them, but do not brown, add pepper, salt and the pieces of tomato. Stir all together for 10 minutes, take out the mixture, pass it through a sieve, and return to the pan, thoroughly reheat and it is ready for use.

Cheese Omelette

Add an heaped-up tablespoonful of grated cheese to the ordinary omelette mixture, sprinkling some over it just before serving.

French Bean Omelette

Heat some cooked French beans in butter and place them between a plain omelette.

Recipes for omelette made with flour, anchovy, cheese, mushroom, and sardine omelettes will be found in _Savouries Simplified_, by Mrs. C. S. Peel.

Some Maigre Curries

There are, of course, many varieties of curry. The recipe for one of worth is given in my _10s. a Head Cookery Book_, and I here add another, but before giving detailed recipes let us deal with the broad rules for curry making, the most important of all being--

Do not attempt to make curry in a hurry.

2 hours is the least in which you can make a vegetable curry worthy of the name, and it is far wiser to allow 3 or 4 hours.

Do not ask your cook to make curry on a day when she is very busy with other matters, for it will take an hour or more of undivided attention as well as a certain amount of attention throughout the time of cooking.

There is, however, no reason that curry should not be made the day before it is wanted, for it improves by keeping, and by being reheated.

A Delicious Vegetable Curry

Weigh 5 oz. of butter (or if economy must be studied, 3 oz. of clarified dripping, and 2 oz. of butter). Choose four medium-sized onions, and chop them very fine. Melt the butter in a stewpan and add the onions and cook them until they are of a deep golden brown, stirring often. Meanwhile, put 1 tablespoonful of curry powder in a saucer in the oven for 10 minutes, then mix it to a smooth paste with a little cream, or if this cannot be allowed, some milk, and add it to the onion mixture, and stir well. Cook slowly, stirring frequently for 2 hours in all. During this time the onions will become quite pulpy, and the butter like oil, and the colour of the mixture will slowly deepen to a rich mustard yellow. While this “ghee,” as it is called, is cooking, take 1 small vegetable marrow, cut in squares; ½ lb. of French beans, strung and broken in half; 2 large tomatoes, quartered; ½ a small cucumber, peeled and sliced; 1 small apple, peeled and cored and sliced; ½ a small carrot, sliced. Boil the vegetables as usual, cooking the larger and firmer longer than those of a more delicate kind. Make the curry mixture given above, and add the vegetables during the last ½ hour of cooking. Serve with a border of rice.

This recipe does not make a sloppy curry, but one in which the solid ingredients are coated with the thick sauce.

Other dishes, not properly curries though flavoured with curry powder, are often termed curry. They provide a quick and easy method of serving various materials. For these a curry sauce is needed.

Curry Sauce

Chop an onion and a few slices of apple finely and fry them in 2 oz. of clarified dripping or butter. Stir in ½ a dessertspoonful of curry powder and the same of flour. Salt to taste. Add ¼ pint of stock or milk, cook gently for 30 minutes, then put all through a sieve, add a few drops of lemon juice, and reheat.

Curried Cabbage

Take all the outer leaves off a young cabbage and boil it until it is half cooked. Drain it and chop it finely, place it in a pan with some curry sauce and simmer it gently for 1 hour. Serve in a border of boiled rice.

Curried Potatoes

Slice some hot boiled potatoes and pour over them a curry sauce.

Curried Macaroni

Boil the quantity of macaroni required until tender, drain it and cut it into pieces 1 inch in length. Place it in the curry sauce already described for 10 minutes, and serve in a rice border.

Lentil Curry

Take the cooked lentils (_see_ page 47) and heat them in curry sauce. Serve very hot in a border of rice.

Haricot Bean Curry

Proceed as for Lentil Curry.

CHAPTER VIII

SALADS

The English salad is not as a rule a success, and undoubtedly the chief fault in its making lies in the inferior quality of the oil used.

Provided with good oil the next point of importance in a green salad is the condition of the material. If the lettuces, endive, cress or watercress are faded the salad is ruined. The lettuce, etc., should of course be freshly cut, if possible, but where this is not feasible it should be chosen with care, and at once put into water--not soused into a basin, but placed with its root only in water--as if it were a flower--in a cool place. In this way a lettuce will keep in perfect condition for two or three days, if needs be. Cress and endive should be treated likewise. Let us now consider the making of

French Salad

Choose crisp lettuces, cut off the stalk and remove the outer leaves (when well washed these may be used for lettuce purée), tear the lettuce in pieces (on no account cut it), and wash it in a bowl of cold water. Place it in a clean cloth and swing it round until dry. This method of drying by centrifugal force gets rid of the moisture and does not bruise the lettuce.

Now rub the salad bowl very thoroughly with a slice of onion, and if the flavour is liked place half a small peeled onion in the centre of the bowl. Mix in the bowl 1 dessertspoonful of the best wine vinegar and 2 tablespoonsful of oil, and add a little salt and a good dusting of freshly-ground black pepper. Stir the lettuce round lightly in the mixture and serve. This quantity of oil and vinegar is sufficient for about 2 medium lettuces, but only experience teaches the exact quantity to use. The lettuce should not be swimming in the mixture: the leaves should merely be coated with it, and no remains of it should be left at the bottom of the bowl when the salad is mixed.

The chief faults of the average salad, next to the use of inferior oil and flabby lettuce, are the excess of dressing, the excess of vinegar, and the use of pepper which is not freshly ground. A salad prepared in the manner described is as different as chalk is from cheese from the salad which is generally put before one, and no more difficult to make. Salads of endive, corn, Batavian lettuce, or cress, should be made in just the same manner.

For orange salad and orange and cherry salad a similar dressing is used, and I notice how these fruit salads are growing in favour.

Orange Salad

simply consists of the sections of oranges free from pith and skin, string and pips, arranged in a bowl and dressed with oil and vinegar.

Orange and Cherry Salad

consists of glacé cherries arranged in the centre of the bowl surrounded by sections of oranges, and dressed with the same mixture.

Another excellent salad, not very generally known, consists of sliced apple and shred celery; it is known as

Apple and Celery Salad,

and is dressed with mayonnaise sauce, or with whipped cream flavoured with salt and pepper. This

Cream Dressing

is newer than mayonnaise, and is generally appreciated. Another delicious salad on which it is used is

Nut Salad

This is made of Brazil nuts broken into pieces, shred celery, and tiny dice of bread and butter. This salad is equally good if dressed with cream or with mayonnaise sauce.

As mayonnaise is generally spoiled by too overpowering a use of vinegar, I give here an excellent recipe in which the special oil and vinegar already mentioned are employed.

Good Mayonnaise Sauce

To make mayonnaise sauce, first rinse the basin in very cold water, and make the sauce in a cool place, if possible keeping the basin on ice while you mix the sauce. See that the oil is perfectly good, and add it drop by drop. This is important, otherwise the sauce may curdle. Use the very best vinegar, as a very little of this will suffice and prevent the sauce from becoming thin. Put the yolks of 2 raw eggs in a basin, and add to them a pinch of salt, ½ a saltspoonful of white pepper, and ½ a teaspoonful of French and English mustard in the dry state, and a tiny pinch of cayenne. Work these together, then stir in drop by drop 3 gills of olive oil. When quite thick add ½ a teaspoonful of lemon juice, and 2 dessertspoonsful of the best vinegar drop by drop, and set in a cool place, or on ice, until required. In case the sauce curdles the yolk of another egg must be beaten up, and the curdled sauce added to it little by little.

Oil and Vinegar Dressing

Mix 1 saltspoonful of salt and a good pinch of black pepper with 1 tablespoonful of tarragon vinegar. Stir until the salt has dissolved, then add drop by drop 3 tablespoonsful of olive oil.

The other dressings generally used are sauce tartare, salad dressing and sauce vinaigrette, for which I give the following excellent recipes:--

Sauce Tartare

Chop 1 shallot very fine, with ½ a tablespoonful of chervil, the same of tarragon, and 12 capers, also finely minced. Place these ingredients in a bowl and add ½ a teaspoonful of mustard powder (English), the yolks of 2 raw eggs, and drop by drop 1 teaspoonful of vinegar; then a pinch of salt and ■ the quantity of pepper. Pour in by degrees, stirring all the time, a teacupful of oil. If too thick add drop by drop a little more vinegar, and if too salt a little more mustard and oil.

Salad Dressing

Beat the hard-boiled yolk of 2 eggs with 1 teaspoonful of dry mustard. When smooth add by slow degrees 8 dessertspoonsful of oil, 5 of vinegar, 1½ of sugar, and ½ a teacupful of cream. Beat together with a silver spoon until smooth. If bottled this dressing will keep for some days.

Sauce Vinaigrette

Mince very finely 1 shallot, 2 good sprigs of parsley and the same quantity of chervil and chives. Place with them about 1 tablespoonful of salt, 1 teaspoonful of fresh black pepper and 3 tablespoonsful of vinegar. Stir well together, add by degrees, stirring all the time, 4 tablespoonsful of oil.

In salads where chives, onion or garlic are mentioned, it is best, unless the taste of those about to partake of the dish is known, to omit them, and either to rub the salad bowl with onion or garlic or to prepare what is called a chapon:--

Chapon

Cut a neat square of crust from a French loaf, sprinkle it with salt and rub it with raw onion or with a clove of garlic. Put this at the bottom of the salad bowl, place the salad on it and mix thoroughly. Serve immediately.

Vegetable Marrow Salad

Boil or steam the marrow, drain, and when cold cut into neat pieces, place in a salad bowl with a dressing of oil and vinegar.

Artichoke Salad

Boil the number of Japanese artichokes required for 5 minutes, and when cold place in a salad bowl with slices of cold boiled beetroot and celery. Cover with mayonnaise sauce. Garnish with beetroot and celery.

French Bean Salad

Boil the beans whole, drain them, and dry them on a cloth, when quite cold place them in a bowl and pour over them some salad oil, shake some black pepper over them and a small amount of salt, then drop over them a few drops of the best wine vinegar, and if liked a sprinkling of very finely-minced tarragon and chives.

Lettuce Stalk Salad

Take the stalks from lettuces running to seed, and tie them in bundles, cutting them more or less the same size. Place in a saucepan and boil until tender, 10 to 15 minutes. Take out and drain them, and allow them to get quite cold. Then cut up into slices of the same size, place in a salad bowl and cover with mayonnaise sauce.

Nut and Celery Salad

Crack some Brazil nuts and cut the kernels into 3 or 4 pieces. Take an equal quantity of crisp cleanly-washed and shred celery. Mix together and dress with mayonnaise sauce. Pile in the centre of the salad bowl and garnish with sliced tomato or beetroot.

Winter Salad

Scald and then boil one or two large onions till soft. When cold, slice the onion, mix it with shred celery and sliced beetroot. Dress with oil, vinegar, salt and pepper.

Walnut and Celery Salad,

which is simply ■ celery to ■ walnuts tossed in mayonnaise sauce.

Russian Salad, No. 1

Cut up some beetroot into shapes, add to this a little chopped celery, some turnip, carrot, potato, all cooked and cut into dice; pour some mayonnaise over it all, mix well, and garnish with bunches of cress. If liked, a French vinaigrette dressing may be used instead of the mayonnaise.

Russian Salad, No. 2

Cut in thin slices a few small cold steamed potatoes, 1 small beetroot boiled, 1 small carrot, a few cold peas or French beans, 1 little pickled cabbage, 1 sardine filleted and chopped fine. Mix all well together. Rub the salad bowl with onion. For the dressing take a teaspoonful each of raw mustard and salt, a little coralline pepper, a pinch of curry powder, ½ a wineglass of sherry and the same of Lucca oil. Mix all well together and pour over the salad.

Haricot Bean Salad

Soak the haricots for 6 or 8 hours and then boil them until tender. Leave until cold. Pile them in the centre of a salad bowl and surround with shred tomato or beetroot and some shred celery. Cover with whipped cream flavoured with salt and white pepper. If liked dip the haricot in oil and vinegar in addition to the cream. Decorate the cream with a little coralline pepper, and arrange the beetroot so that it makes a red border to the white pyramid of cream.

Salade d'Estrées

Take some cold boiled roots of celeriac, some cold potatoes and beetroot. In the middle of the salad bowl make a heap of endive and blanched celery stalks, frizzed, in short lengths. Surround with the vegetables sliced. Pour over the whole a good mayonnaise sauce.

Garnished Salad, with Imperial Mayonnaise

Pound and press through a sieve 4 large anchovies (no bones), boil 6 eggs hard, halve them and neatly remove the yolks, which pound to a paste with butter, the powdered anchovies, ¼ teaspoonful of mace, a little pepper. Mix well, and roughly fill the egg cases. Fill almost to the top the salad bowl with finely-shred lettuce, endive, cooked beetroot, sliced (very thin) artichoke (cooked), and finally add some cucumber ribbons. Then arrange with care the egg baskets and pour round, but not over the halved eggs, the following dressing (imperial mayonnaise):--Put into a basin ½ pint of aspic, and add 1 tablespoonful of olive oil, 2 teaspoonsful of vinegar, and a trifle of salt and pepper. Beat with an egg whisk until all the ingredients are well blended. Set the salad in a pan of ice water if possible, or in a very cold place until served.

Celery Salad

Wash some fresh crisp celery and use only the inner sticks. Cut it in ½ inch lengths, place in a salad bowl which has been rubbed with onion and dress with mayonnaise sauce. Decorate with a little chopped truffle.

Salade d'Asperges à la d'Aumale

This is a way of using cold cooked asparagus with mousseline sauce. Put ½ gill of new milk into a pan with the yolks of 4 eggs, and 3 crushed long peppercorns; place this all in a bainmarie, or larger stewpan, half filled with boiling water, and whisk it all together well for a few minutes; now add 1 oz. of butter, adding it bit by bit, and only putting in another piece when the first is thoroughly melted and worked in. Season it as you whisk with a dust of salt and nutmeg, and a tiny squeeze of lemon juice at the last. When it is finished this sauce should look like frothed cream.

Another salad which is suitable for hot weather is

Lettuce and Tomato Salad

For this proceed exactly as for a plain lettuce salad, but add a ring of fresh tomato, peeled, and not too thinly sliced.

Other nice salads are--

French Tomato Salad

Take 6 ripe, sound tomatoes, wipe them, and place them in boiling water for a minute; drain, peel, let them cool, quarter them (this should be done while they are in the salad bowl, so that the juice is not wasted); add a teaspoonful of finely-chopped chives or a chapon; dress with oil and vinegar.

Tomato and Egg Salad

Proceed as before, but to each tomato add ½ a hard-boiled egg, quartered, and dress with mayonnaise sauce.

For the following salads _see_

10s. a Head for Housebooks.

Green Pea. Russian. Haricot Bean. Tomato. Broccoli or Cauliflower. Potato. Tomato and French Bean. Simple Lettuce. Mixed.

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Inconsistencies in hyphenation have been standardized.

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AN EMBROIDERY BOOK

ANCIENT EGYPTIAN, ASSYRIAN, AND PERSIAN COSTUMES AND DECORATIONS.

By =Mary G. Houston= and =Florence S. Hornblower=.

Containing 25 full-page illustrations, sixteen of them in colour, and 60 line diagrams in the text.

Small crown quarto.

In this volume the history of Costume is traced from the earliest ages. The illustrations (which are taken chiefly from the British Museum) are given in facsimile from the drawings of the artists of the period, and, where the drawing is too primitive to be easily understood, a garment is also shown drawn in modern style; in addition, every type of garment illustrated is accompanied by a flat pattern showing the _cut_. Information of this special character on Ancient Costume is usually very difficult to obtain, and it is anticipated that the volume will be of first-rate importance to dress designers, to theatrical designers, and also to the schools in which historical costume and the history of the progress of the human race are subjects for study.

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[Illustration: PLATE I.

A TABLE MAT. (_See page 41._)]

AN EMBROIDERY BOOK

BY ANNE KNOX ARTHUR GLASGOW SCHOOL OF ART

CONTAINING SIXTEEN FULL-PAGE ILLUSTRATIONS --EIGHT OF THEM IN COLOUR--AND EIGHTY- SEVEN LINE ILLUSTRATIONS IN THE TEXT

A. & C. BLACK, LTD. 4, 5 & 6, SOHO SQUARE, LONDON, W. 1. 1920

“_Go, little booke; God send thee good passage_”

TO MY MOTHER

NOTE

The Author’s thanks are due to the owners of the pieces of embroidery illustrated in this book who kindly lent them to her for reproduction:--Miss Beatrice Brooks, Miss Marion Boyd, Miss Janetta S. Gillespie, Miss Mary A. Gill, Miss Martha Stevenson, Miss Elspeth Stewart, Miss Jessie Gibson (students of the Glasgow School of Art); also to Miss Kay, Parkhurst, Cedars, Derby, for the loan of three pieces worked by her pupils.

FOREWORD

Now that many of our busy working people have better regulations as regards the hours of the day's work, there is great need to provide occupation for the day's leisure; and needlework, as a leisure craft, is one of the most refreshing and pleasant and profitable sources of entertainment--provided always, that those who undertake it realise that, with right thought and consideration on the part of every worker, each should become, as it were, a law unto herself, so that she should realise also that she need, under no circumstance, be the slave of old traditions, if she can give fitting reasons for making a change which is to the purpose of her work.

To be in a healthy and living state, our art should be constantly changing its fashion; if it stands still, it is retrograde, and for some few generations we may say this of British embroidery. What changes it has undergone are due almost entirely to the commercial enterprise of manufacturers of printed patterns--usually foreign ones. The importation became very considerable with the introduction of so-called Berlin woolwork, and since that period the British needlewoman has set aside her own ingenious arrangements and follows blindly where the merchant leads, and British design for needlework, as an expression of its people, is almost a dead thing.

Most people have a superstition that in knowledge of a multitude of stitches lies the whole mystery of needlework. This is emphatically not the case. There really is no mystery about stitches; they are but the letters of the needleworker's alphabet, and the words of her language--to be used according to her own ideas. One may embroider poems; another may embroider prayers and praises for her church; another may beautify a fair woman's garment or sing a little song in stitches for a baby's robe; yet another may be like a treatise on surgery, repairing and restoring that which has been damaged. But needlework does not exist for the stitches. It is the stitches which--as they are well or ill-used--express the worker, and, if she is a wise worker, she can find out for herself most of the stitches she needs. Nor is it necessary to be at great expense in needlework, indeed, for those who take it up as a recreative craft half the interest may lie in the fact that no material is too common or too homely to be made into something fitting and, therefore, beautiful--since the truest art is to make a thing pleasing to the eye and yet entirely suited to the purpose.

The commonest failing of the designers of this country is that they think that beauty lies in the elaboration of ornament, and this is why the fashions of British dressmakers fall short of those abroad. It is the little simple contrivances, that are almost no more than a sort of loving finish to the actual construction of a piece of work, that give the highest standard of style in garments: and the best training a needlewoman can have is to make her seams, hems, openings and fastenings of garments or household fitments things of beauty, while, at the same time, she considers the uses and purpose of her work. It is as a piece of engineering we should consider the construction of our household hangings and covers of our garments--planning that decoration should be coarse or fine, as fits the material, and taking thought also for the washing and wearing of it.

The fashions of to-day show a very marked tendency to decorative construction, due in great measure to a change in the needlework for school children introduced a few years ago. The tendency shows most interesting results, especially in the fact that the shaping of clothing has become very simple and that garments depend almost entirely on stitchery for their decoration, rather than on manufactured braids and trimmings; and the styles and shapes are infinitely less stereotyped, so that clothing for women tends to express more nearly the personality of the wearer than it has done for many generations.

The work of the hand--as apart from that of the machine--is more and more in demand, and decorative needlework, even in our shops, is becoming more to be desired, for unique and personal characteristics and expression, than it has been for a very long period. This being the case, let our needlewoman take courage and realise that in each mind there are possibilities of new ideas and new inventions--that all materials open up new opportunities, and that with little labour she may greatly enhance and beautify the things she works and find appreciative opening for her skill. Never was there such universal demand for handwork of every kind, and for such household fittings, which tend towards economy and labour saving in particular, the need is almost unlimited. Some of the most interesting embroideries done during the last few years have been planned and carried out in some of our Scottish schools by untrained workers--designs so simple that the workers do not realise that they are designing at all--since they draw largely with needle and thread alone, and have little assistance from chalk and other markings. And it is this type of work, usually sewn in coarse yarns and on rough canvas, flannel or homespun, that is perhaps the most happy and most stimulating for a designer of needlework to begin on. The work is so quickly achieved--so gallant and bright in colour--so utilitarian in purpose and of so little cost in outlay, that it is above all others to be recommended. It needs no experience in stitchery to work in bright wools, if the material is firm and strong, and the writer has pleasant experience of maid-servants and village wives in the north country making admirable rugs, garments, and other embroideries, which command good prices at the Artificers' Guilds and other places where a high artistic standard of design is required.

It is only by means of such counter attractions in stimulating leisure crafts, which pay their way as well as give pleasure to the workers, that we can contend with the spirit of restless excitement and craving for mere pleasure-giving that is so marked a sign of the early days of peace, and reconstruction can only come by countering this mischievous tendency in young people by giving them something that gives stimulus to their longing for brightness and yet does not unduly tax those whose days may be occupied in strenuous employment.

How desirable it is that such gatherings of women and girls as church sewing meetings, guilds and clubs, should take up such new ideas in needlework and apply for a competent instructor. How almost more desirable is it that men might realise the pleasure a needle can give if applied to bold construction and original work.

It is by no means universal over the world that needlework is a women's craft; in many countries it is done quite as much, if not more, by the men, and it is probable that if our men took up this craft, it would show a very marked tendency to individual and original expression.

The power of invention is so great and serious a factor, that it is almost too big a thing to touch upon here. We do not exaggerate its importance when we say that this faculty in human beings is what we can justly call the Holy Ghost, for it is that in us which comes, not of ourselves, but from direct inspiration, and the first principle of education ought to be to open our minds to it, in howsoever small and humble a fashion it comes, and to make clear the way for its development and growth towards greater things.

ANN MACBETH.

GLASGOW SCHOOL OF ART.

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AN EMBROIDERY BOOK

CHAPTER I

INTRODUCTORY

“Give her of the fruit of her hands; and let her own works praise her in the gates.”

Needlework, as an artistic and practical craft, is highly interesting from a decorative point of view, and well within the scope of any intelligent worker. It has distinct advantages over most crafts--it neither requires great initial outlay for apparatus or materials, nor does it demand a special workshop; thus, as a domestic art, it commends itself to many of us on account of its adaptability to the conditions of life, as well as for its decorative value--as a means of adding grace and beauty to our daily surroundings.

During the thirteenth and fourteenth centuries England was famed for the beauty and magnificence of its ecclesiastical embroideries. These wonderful works found their way into many countries and were eagerly sought after by patrons of the beautiful; many pieces still exist, preserved in our museums, churches, or in private collections, to show us what extraordinary ability and invention these ancient embroiderers must have had. After the Reformation, when there was no longer the great demand for ecclesiastical work--embroiderers turned their attention to the decoration of garments to be worn by the wealthier classes. In the “Golden Days of Good Queen Bess,” and for some time later, all the ingenuity and skill formerly applied solely to church work was bestowed on the decoration and beautifying of personal clothing--dresses, cloaks, coats, waistcoats, caps, gloves, etc.; neither time, labour, nor expense was spared, the worker’s ideal evidently being to obtain the highest result of which he or she was capable. Some of the quaint pattern books of those days still exist, and they consist mostly of elements--dainty flower sprays, sprigs, fruits, birds, animals, fishes, border patterns and geometrical forms--all intended to assist the workers in the composition and building up of their designs and patterns.

In the busy world of nowadays, we cannot hope ever to attain to such perfection, nor to regain for embroidery the high position it once held in this country; but we still have many clever needlewomen who could produce beautiful work provided they had a better knowledge of how to set about it.

This book has been planned with the hope that it may be of use to many, and that it may create in both girls and women the desire to construct and decorate for themselves those simple articles of daily use which cost so much to buy and which can be made and embroidered, in simple patterns, with a little knowledge of construction and stitchery, at a moderate expenditure of time and money.

Perhaps the reason why so many workers buy their materials already stamped with a design, which often proves unsuitable to the purpose for which it is intended, and which gives small satisfaction when embroidered, is because of a certain distrust of themselves, a want of knowledge of their own powers of invention and ingenuity; or it may be a lack of energy and initiative, a reluctance to plan and create for themselves, due to the fact that they have never been taught to express their own ideas, but rather to depend on those of others. Nevertheless, the sense of beauty is, in a greater or less degree, common to us all. Why, therefore, should a needleworker not develop her own ideas rather than those of other workers? The designer, for example, who may have as little knowledge of stitchery as the needlewoman has of design, and who, therefore, cannot realise the labour involved in its execution, may lose much of his effect and may waste the time of the embroiderer. It is generally agreed that no two people have the same ideas; it is surely, then, of considerable importance that each one should at least make some attempt to express his or her own. If scope is given to the creative and inventive powers they, like other faculties, will grow in a most inspiriting manner; new ideas, inherent instincts, perhaps dormant hitherto, will spring up like flowers to encourage the beginner on the upward path, and as interest becomes keener and confidence grows, difficulties which at first appeared insurmountable will quietly disappear as the worker plans and thinks out a piece of embroidery from the foundation. How interesting and attractive it will be to execute such a piece of work, which will express the personality of the worker in all parts, design, colour and stitchery. Greater technical excellence, as well as charm, must accrue; the embroideress will work with more judgment and understanding, and because it has gained so much in interest to her, she will be able to express herself more freely, and her work will convey and suggest more to others.

CHAPTER II

THE ART AND CRAFT OF EMBROIDERY--THE SIX POINTS

“Chaires, Stooles and Screen, the same, all of Satten Stitch done in Worsteads.”

We shall now consider the six important points of design.

=Art and Craft.=--Many women have an inherent instinct for needlework--that is, the craft of the needle--for the knowledge of how to use a needle and thread is generally easily acquired; but it is quite otherwise when the design, the artistic or imaginative part, has to be carried out, as it ought to be, by the worker. Then all sorts of difficulties arise, mostly imaginary, as those who make an attempt may find.

Let us here consider the design as a necessary part of the workmanship. We shall be ambitious enough to study embroidery from an artistic point, for the art and the craft ought surely to go hand in hand.

=The Habit of Design.=--A special knowledge of drawing is not essential for pattern making--a child will make delightful patterns--nor for simple designs composed of straight lines and geometrical forms, such as might be happily applied to borders for articles of daily household use or for personal wear. A ruler, a compass and a sheet of squared paper are sufficient for initial efforts: and once the habit of simple designing is acquired it can become a wonderfully absorbing pastime, for eyes that are opened to see will find designs on every side.

=Good Taste and Common Sense.=--To carry out a piece of work successfully, however, the embroideress must possess good taste and common sense; these are indeed important qualities, the possession of which will help the beginner enormously: add to these an eye for colour and form, a practical knowledge of the stitches commonly in use, some acquaintance with materials, their utility and adaptability, and the worker will find herself fairly well equipped to start her design.

=The Six Points.=--There are about six points to be considered in connection with a piece of embroidery:--

The Object and its Use.--We must decide this, bearing in mind the position the work will occupy when finished; choosing a material suitable for the purpose, and with due regard to the restrictions of economy.

The Colour Scheme.--Consider the environment, and let the scheme be in harmony with or in contrast to the background and surroundings.

The Construction.--Plan carefully and arrange for the decoration, which should never interfere with the usefulness of the finished work.

The Building up of the Pattern.--This should always be done with a view to the limitations of the material.

The Stitchery.--This must also be adapted to the material--with bold, effective types for the coarser woven stuffs, and daintier, closer stitchery for the firmly woven textiles.

Finishing Touches.--A beginner rarely realises the importance of these, yet it is well worth while bestowing thought on them; interest may be considerably heightened by such additions or an otherwise good piece of work rendered less attractive by lack of care and thought at the final stages.

It will now be seen that the design--the least mention of which strikes terror to the soul of the uninitiated--does not consist in the drawing or the making up of the pattern alone, and that there are important preliminary stages to be gone through. Indeed the design is well on its way by the time the worker reaches the fourth point, _i.e._, the building up of the pattern.

THE FIRST POINT: ON THE CHOOSING OF MATERIALS, THREADS, TOOLS, ETC.

=Materials.=--Materials, threads, and needles are important items, and should be chosen carefully; to spend time and labour on embroidery on a poor foundation is an extravagance rather than an economy--the tendency being to make up for the poorness of the quality by the profuseness of the decoration. Materials need not be costly, but they should be good of their kind.

=Homely Materials.=--Charming things can be made out of homely cloths, remnants and oddments. Texture, tone and colour should be considered, both from a practical and an artistic point of view; a background that is pleasant to work upon is always an advantage. Linens, of varying quality and texture, can be relied upon for domestic purposes--they make for good stitchery, they wash well, and are very durable. (Plate VII.) Some unbleached materials are extremely economical.

=Greenhouse Shading.=--A soft creamy netting used for greenhouse shading, which may be obtained from any of the large seed merchants, is made in different widths from 54 inches to 72 inches. It has an open mesh and lends itself to all types of darning and needle-weaving--the narrow widths make excellent semi-transparent sash curtains, which may be brightened by applied bands of coloured linen or chintz, and finished with rows of simple running or tacking stitch in wools or in some of the coarser makes of embroidery cottons. (Plate VIII.) The thicker quality has a closer mesh and is admirable for coverlets and hangings. These, when edged and decorated with lines of bright-coloured washing braids, and wide borders of coloured cretonnes--which again may be connected with bars of needle-weaving or darning, or any simple stitchery--make charming and economical articles, such as any housewife might well be proud to possess. (Plates V. and VI.) Covers and runners to match might complete the set. This would be a pleasant and instructive work for a girl’s leisure hours; she might make just such a set for her bedroom, with the addition of chair covers and cushions, adorning them beautifully with some simple design and a colour scheme of her own choosing.

=Damask and Huckaback.=--Damask linens, with simple-patterned backgrounds, twilled sheetings, of various makes, and huckabacks, can be used most effectively for runners, mats, and luncheon sets; the soft, warm, creamy tone of the unbleached material blends harmoniously with bright-coloured threads and wools.

=Titian Canvas.=--Many coarser and more loosely woven textures make most charming and desirable backgrounds for bands of needle-weaving. (Plate VI.) Coarse canvas in various colourings, woollen hopsacks, floor-cloths, etc., are adaptable for many household articles.

=Russian Crash.=--A common roller towelling, or Russian crash, as it is also called, is a delightful material (Plate III.), and may be had in narrow widths, varying from 12 inches to 24 inches; it is woven by the Russian peasantry in small handlooms and varies considerably in texture and quality--but in all cases it is a most durable and suitable linen for domestic purposes.

=The Scottish Blanket.=--Another pleasing material for wool decoration is the well-washed, worn-out Scottish blanket; with the smaller pieces one can make hassocks and cushions which look wonderfully well in strong colours in any flat stitch; the larger single blanket can be used for coverlets or hangings--with applied decoration where the material is too frail for general hard wear. Decorated with edgings of woollen braids, etc., these will look almost new, and certainly will give immense satisfaction to the worker.

Threads are to be had in great variety and in different makes, many of which are excellent for embroidery. Cottons and flaxes in various sizes and thicknesses in a large range of colours can be combined most successfully.

=Embroidery Wools.=--Wools and yarns, particularly the types known as fingering, in three, four, and five-ply, are reliable both in colour and quality. It is always advisable to shrink wools before using them for embroidery if they are to be applied to articles which require frequent washing. Crewel and tapestry wools, to be had in hanks, “white heather” mending in balls, are very convenient for needle-weaving and canvas work, and they may be had in beautiful colours.

=Silks.=--Silks of different makes, embroidery or knitting, filosel, filo-floss and a soft, thick variety known as “Tyrian,” are all good for various purposes. The latter is particularly useful for couching lines; filo-floss--a bright, glossy silk with no twist in it--requires some skill in the manipulating of it, therefore filosel or mallard floss, each of which has a slight twist on it, is better for the less-skilled worker. Carpet chenilles in colours, both cotton and woollen, applied to coarse canvas or sacking, are used for the making of mats and rugs. Woollen and mohair, cotton and brush braids of the common skirt type, carpet and binding braids, cords and French tapes, coloured and washing gimps, all may be used with advantage for embroidery. It is better to shrink some of the loosely woven skirt and carpet braids before applying them to the material, or they are apt to pucker the material after washing.

Good needles should always be used, with well-drilled, good-sized eyes. Care should be taken to choose them so that they may be exactly suited to the thread and to the material; the eye should be large enough to hold the thread easily, in which case it will make a hole in the foundation of a sufficient size to allow the thread being pulled through without roughening it. Scientific sharps are very pleasant to use--numbers four, five and six, are suitable for cotton and flaxes, crewel and chenille, and long-eyed sharps for general embroidery and needle-weaving. For openwork backgrounds such as are shown in Plate XI, H, I, J, K, L, where no threads are withdrawn from the material, a special needle with a large thick stem and a small eye is used; it separates the threads of the material and makes them easier to gather into groups by means of the tightened thread.

In working on loosely woven materials--such as canvases--and for weaving patterns, tapestry, chenille, or rug needles with blunt points are the most comfortable to use; if these are not to hand, work with the eye of the needle foremost.

A well-fitting thimble, preferably vulcanite or silver lined with steel, is necessary. It should be deeply pitted to catch the eye of the needle and well finished, so as not to roughen the thread. Scissors of different sizes are required: a large pair with one sharp and one rounded point--these for the cutting and preparing of the material; a small sharply pointed pair for the snipping of threads; a special pair with a little square knob on the one blade and a sharp point on the other for cutting out threads and sections between embroidered and openworked parts; these are a safeguard and prevent the snipping of the work.

Frames are not necessary for the simpler types of work, but for wide borders in needle-weaving, particularly for the novice, a frame will fix the warp threads by keeping them taut, and prevent puckering of the material--little tambour frames which consist of a couple of rings, the one fitting into the other, will serve the purpose.

Finally, a small emery cushion, for polishing the needle should it get sticky or rusty, a piece of beeswax is useful for flax threads, a stiletto for piercing eyelet holes, a yard measure, a bodkin, and some small pins, are all necessary items, which should always be at hand when wanted.

THE SECOND POINT: THE COLOUR SCHEME.

Colour lends an inexpressible charm to our daily life--it is in nature that it exists in greatest beauty. The wonderful robe of colour which she displays for us throughout all seasons and in all countries, through the flowers and fruits, trees and foliage, sea and sky, the birds, animal and insect life, all under different aspects and ever-varying circumstances, increase our admiration and pleasure. We reflect and gratify our need for colour in our intimate surroundings--dress, hangings, furniture, carpets, pottery and pictures. The embroideress who has a fine instinct for colour will arrange a scheme wherein beautiful combinations of hues, tints, and shades will mingle and produce a harmonious whole. It is for those less favoured that the following hints are given. A knowledge of the principles of colour will serve as a guide, while the use of a chromatic circle, _i.e._, a colour circle, will be invaluable to the beginner. This convenient arrangement wherein successive strips of all the colours are placed concentrically in their due proportions--as in the prismatic spectrum--will enable her to study the varieties, the relations and the peculiarities of colour and help her to arrange and select those hues, tints and shades which will combine well together; it will aid her to obtain happy effects with some appreciation of its harmonies and contrasts.

The three primary colours, green, red and blue--green being now generally accepted as a primary instead of yellow--offer the greatest contrast to each other. They are the strongest and most powerful and exercise a greater influence on the mind than any of the others; add to these, orange, yellow, violet, white and black--the sum of these six colours constitutes white, and the absence of all, black--and we have the eight from which all the other colours and their modifications can be made, easily and systematically.

=Red= (=Complementary Colour, Bluish-Green=).--Red, the strongest and most powerful, excites and stimulates the eye. It was the first colour to be used for decorative purposes by primitive man, and the first to receive a name: it is the most predominant of the warm colours, and on account of its fresh, bright, cheerful character, is much used by beginners; but this very assertive quality makes it rather difficult to combine with other hues, therefore it is well to use it in small quantities for general purposes. Red, in different hues, has always been the symbol of power and distinction. Scarlet has been used for regal robes and state ceremonials, as well as for military purposes--it indicates bloodshed and war, fierceness and courage. Red of a rosy hue signifies divine love. It has been a favourite colour with the poets from the days of Homer to our own time. The complementary of red is bluish-green.

=Blue= (=Complementary Colour, Yellow=).--Blue followed red--it is of a quiet retiring nature, soft and soothing in effect, imparting the same quality to all the hues in which it predominates. It is one of the cool colours and is symbolically emblematical of heaven, piety, and intelligence. The complementary of blue is yellow.

=Green= (=Complementary Colour, Purple=).--Green, the most prevalent colour in nature, and the least stimulating, has a remarkably distinct and striking effect on the eye. It is highly refreshing as well as soothing, and is the necessary restful colour, the opposite of red. Yet the nervous power of the eye is sooner exhausted by strong greens than by any other hue; thus, a piece of work with a preponderance of green is not so pleasing to look at constantly as the piece where blue predominates. Symbolically, green is the emblem of bountifulness, youth, happiness and prosperity. The complementary of green is purple (violet-red).

=Yellow= (=Complementary Colour, Blue=).--Yellow approaches white, and is therefore a brilliant and advancing colour. It possesses the greatest power of reflecting light; is rather difficult to combine unless modified. Bright yellow has been used emblematically, to express charity, joyousness, plenteousness and old age--greenish-yellow is the symbol of jealousy and envy. Its complementary is blue.

=Orange= (=Complementary Colour, Greenish-blue=).--Orange, coming between red and yellow, partakes of the nature of both--it expresses warmth, fruitfulness and wealth. The complementary colour is blue with a tinge of green.

=Purple= (=Complementary Colour, Green=).--Purple is the quietest of the rich colours, being composed of red and blue. It varies in tone according to the amount of its constituents. When blue is predominant it is symbolical of mourning, expressive of sorrow, sadness, and is called violet; when inclining to red it becomes warmer and richer. It expresses dignity, pomp, and regal power. Its complementary colour is green.

These six bright colours, when used in conjunction with black and white, with each other, or with their complementaries, will strengthen, intensify and enrich each other without altering their true value--when such vivid effects and sharp contrasts offend the taste of the worker, when they appear too crude, too conspicuous and too obtrusive--which they are apt to do--they may be harmonised quite simply, either by modifying the complementaries or by using a tint or a shade, that is, a lighter or a darker tone of the same colour. The strength and potency of these startling contrasts are in this way tempered; they become less glaring, less assertive, pleasanter and simpler to arrange, and lose the jarring effect they might have if used in their full brilliancy. For simple household articles with little decoration these bright colours may be used with charming effect. It is well to remember, in choosing the tints and shades of a colour, that the foundation material will have a considerable influence on them. On a white ground they will appear stronger and brighter, their tone being heightened by the white or light background, while on a black ground they appear more distinct and brilliant, particularly light ones, the contrast being greater. Dull hues gain in brightness when used with black and lose accordingly when combined with white.

=Juxtaposition of Colour.=--Colours, then, when associated, influence each other simultaneously in various ways, darkening and lightening, adding to or detracting from, as the case may be--thus, by placing a light and dark one in contact, for example, black and white, the former looks blacker, intenser, while the latter looks more startlingly white on account of its dark neighbour.

It is advisable, also, in arranging the colour scheme--after taking materials and positions into consideration--to determine at the very outset what the leading features are to be, and to have _one_ colour in the scheme more predominant than the others, either in intensity or in area. There should be some central point or points of interest which will attract the eye to certain parts of the

construction.

=A Dominant Colour.=--A liberal use of a dominant colour, by conveying a definite impression, will give decision of character as well as beauty of tone to the work, while a vague, uncertain, or too equally distributed arrangement will leave an unsatisfied and indefinite impression on the mind.

[Illustration: PLATE II.

SOME USEFUL STITCHES (_See p. 29_)]

There are abundant suggestions to be had from fields, hedgerows, flowers, plumage of birds, etc., for the embroideress who can adapt them to her purpose, but a simpler plan for the beginner is to choose her colour scheme from a good picture, a coloured illustration, a piece of chintz, cretonne or good brocade, or, when possible, to study the various pieces of old embroidery preserved in our museums, as a record of the time when we could compete with other countries, when embroidery was almost the sole occupation of women of rank, as it was of the occupants of the convents.

=Green.=--If we were to use one of the primaries as a dominating colour, say green, a bluish-green, we might have as a background a deep pomegranate red, the design could be worked out in bluish-greens, grey-greens, soft blues and purples, with touches of pale chamois yellow here and there; all the colours should have a tinge of bluish-green, the combining colour.

=Blue.=--Or we might choose blue, the pleasantest, simplest and most harmonious combining colour, and select as a background a warm white or cream. The decoration could be carried out in various tones of blue, deep rich blue, turquoise, deep and pale orange, and a blue grey--much would depend on the tones used in combination and the manner in which they were employed. Always avoid a spotty effect, and do not contrast colours too suddenly in an endeavour to emphasise special points.

=Red.=--Red, when used as the predominant or combining colour, looks best on a dark blue or a cream background. With a dark blue ground, white or cream, bright greens and a touch of dull orange will work in well with the reds, the former combining to make the latter less assertive. With a white ground and the same colours, the work becomes suggestive of some of the beautiful Bokhara embroideries in which reds, greens, blues and yellows--the latter used sparingly--are combined so gaily and instinctively.

CHAPTER III

CONSTRUCTION AND DESIGN

“A cunning workman, an embroiderer in blue and in purple and in fine linen.”

We shall now discuss the decorative points.

The construction and the building up of the pattern may be taken together.

=A Simple Pattern in Needle-weaving.=--The simplest design for an initial effort should be one which could be executed in needle-weaving such as is illustrated in Plate I. Here the spaces for the decoration are marked off on the material, there being no necessity to put any design on to paper--the weaving may be done in any simple primitive pattern, or from some of the more interesting darning pattern samplers, or it may follow some idea or fanciful invention of the worker. It should be more or less symmetrical in colour and form, and provided that sufficient thought is taken in arranging the colour scheme and that the technique is good, the result should be both pleasing and decorative. (See Chapter V. on needle-weaving.) Supposing the material and the colour scheme to have been already decided, and that a loosely woven texture--which demands a simple conventional pattern with bold stitchery and bright colour effects--has been chosen (let it be a runner, table cover or any article suitable for household use). It would be best, as simplicity must be the keynote, to have a marginal or border design, built up entirely on straight lines and geometrical forms. First plan out the material and arrange for the decoration; decide whether the pattern is to be placed on to a wide hem, or inside a narrow one, or whether it is to be applied as wide bars at the ends and edges of the runner. The limited space at the disposal of the designer will often aid and suggest the pattern.

The decoration should, when possible, strengthen the construction. Be careful at all times to place it where it will not interfere with the usefulness of the object. A cushion, for example, ornamented with raised embroidery or with large beads, conveys the idea of _dis_comfort rather than of comfort, which is, after all, the _raison d’être_ of a cushion, the addition to a room, by means of colour and decoration, being a secondary point.

In the early days, when decoration was so freely applied by primitive peoples to seams, hems, shoulder-straps, indeed to all objects, it was their aim to increase the usefulness of the article rather than to decorate it.

=A Border Pattern.=--When the above-mentioned points have been decided, take squared paper, ruler, and pencil, and draw a few nicely spaced lines; duplicate the outer ones to give weight to the edges. All these lines crossing at the corners will form the framework of the design. Regularity and order are as essential in needlework as in most crafts, therefore the care and precision taken in the earlier stages will aid in the working of the later.

=The Construction.=--Plan carefully and arrange for the decoration, which should never interfere with the usefulness of the finished work.

=The Corners.=--The treatment of the corners presents the greatest difficulty. In a frame they are structurally the weakest parts; for this reason the ornamentation is placed at these parts to bind and strengthen, as well as to decorate them. In a piece of needlework with a simple border design they are again the most important. One expects to find unity, enrichment and massiveness there where the lines cross; we add, therefore, a few extra lines or chequers to the corners. By this means we enlarge them, and by so doing append dignity and importance. Still greater emphasis and the necessary note of interest will be given by the colour and the stitchery--the treatment of which should always be in the foreground of the mind of the designer.

=Principle of Repetition.=--Do not aim at great variety of form; repetition is one of the first principles of design. The beginner will save herself much worry and labour if she keeps this principle before her, instead of striving--as she invariably does--after variety. She should make her form--a square, an oblong, or whatever simple element she may have chosen--recur at regular intervals, and all corners should be alike.

=Masses connected by Lines.=--Masses should be joined by connecting lines and the spacing so arranged as to give value to the rest of the work.

=Value of Spaces.=--A form or element should never be cramped into a space nor stretched out unduly in order to fill one; it should be planned and balanced to look as if it just belonged to it. A design is well balanced when the elements are so adjusted that they are neither too monotonous by over repetition nor confused by too much variation.

=Diagonal Lines.=--It is safer at the earlier stages to avoid diagonal lines, or forms made up of such lines, for several reasons: they give a restless effect which should be avoided if possible, they present to the embroideress considerable difficulty of manipulation--coming, as they must, on the bias of the material, which may easily be tightened, puckered or pulled out of shape in the working by the inexperienced hand.

=The Game of Design.=--There is really no limit to the possible patterns which may be built up on straight lines and geometrical forms. The needlewoman has only to try with a ruler, pencil and squared paper in order to discover that she may, after some little practice, make most elaborate designs with interesting results. There are, of course, certain fundamental principles which will help her, but they are not many, and with the suggestions already given she should be able to arrange many simple designs suitable for her own use. It might be quite a pleasant occupation for the younger members of a household, on a winter’s evening, to start and play at design. A time limit, perhaps a quarter of an hour for the first effort, and a longer period as the patterns became more elaborate, might be given; afterwards all the designs could be exchanged, compared, criticised, and then judged by an older member. In this way a “habit” of pattern making might be cultivated. Many of the designs should prove valuable to the craft worker as well as interesting to the youngsters.

=Circles.=--From the making of patterns with straight lines we go on to circular forms, with radiating lines. This opens up a wide field to the embroideress, allowing her to extend and vary her simple designs indefinitely.

With this new element, the circle, she can formulate some of the more definite floral shapes, and arranging them in an orderly manner, symmetrically, can make a geometrical pattern suitable to her purpose; she can make use of compasses, or if these instruments are not at hand, any circular form, such as a plate or a coin, will suit admirably. Should these prove too small, there is always the simple device of the fixed pin encircled by a thread, with the pencil at the opposite end, which, when the pin is held firmly in the centre of the space--as the thread must remain taut--will form a circle, the size being fixed by the length of the thread.

Circles at once suggest natural forms and growth, but to begin with the young designer must keep to the geometrical side of Nature; natural floral forms will come later. If she examines carefully a number of the flowers of the field or hedgerow she will find

that many of these beautiful forms are built up on a geometrical basis--she will note the radiating lines of the flowers, the sepals, petals and stamens, the venation of leaves, the manner in which the mid-rib gives off, gradually, the beautiful curving lines which flow into the outer edges, and the wonderful orderliness of the little seeds clinging to the sides or centre of the seed vessel, and thus she will realise that all curving lines are but segments, or parts of circles of various sizes.

To aid the designer in her first efforts let her turn to an elementary text-book on botany--she will probably find there a number of diagrams of horizontal sections of the commoner wild flowers. These give the plan of each flower typical of the family to which it belongs--all the parts are arranged symmetrically in circles or whorls, and show how the flower is built up. The embroideress should find these sections full of suggestions; she might take the simpler forms to begin with and elaborate them, adding fresh details where necessary for the development of her design. By comparing the sections of one flower with another--of the wild rose with the poppy, the purple loosestrife with the forget-me-not, the primrose with the daffodil--she will be able to obtain variety with simplicity and balance; then she will connect and join all the masses with straight or curved lines, and thus give completeness to her design.

With increased knowledge of the structure of flowers the embroideress will gain a keener sense of observation which will be of great value when she studies the natural forms.

Setting forth once more on the high adventure of making her own design, she will bring to her aid the principles already learnt in the making of straight lines while she was building up her patterns and designs.

THE FIFTH POINT: THE STITCHERY.

We express ourselves and our ideas in embroidery by means of stitches and colour.

To have pleasure in the craft, the needlewoman must have a fairly accurate knowledge of the technique. Stitchery should at all times be as simple as possible, and carefully adapted to the material and the design.

=Simpler Types of Stitchery.=--The commoner types, those which by experience and long use have been proved to be the most beautiful or the most practical, are the best. All the more complicated forms are merely modifications or combinations of these simple types, many of which are used in “plain” needlework. There are, in fact, few stitches which a careful worker cannot master in a very short time.

=Stitchery not the Most Important.=--It is wise to remember that stitchery is not the most important factor, but only one of the many which go to the making of good and artistic work. Beauty, in needlework, consists, not in the variation and elaboration of stitch, but in the harmony of material and technique, as well as of form and colour.

=Unity of Stitch.=--Where coloured threads are used it will often be found advantageous to adopt one stitch only. Many of the charming pieces of embroidery stored up in our museums give us an idea of what can be done in this way, and though we lack, perhaps, both time and patience nowadays, there is no reason why we should not, by cultivation of our tastes, raise the level of the art considerably above its present standard and prove that we can still produce embroidery--of the modest, reticent type--adapted to our own conditions of life, which will reveal both refinement and artistic delight.

To execute a piece of work in one stitch would be excellent practice for the young embroideress, whereby she would learn to know and use a stitch in all its varied aspects. She need not fear monotony--the coloured threads will give sufficient variety. Let her take the simplest of all stitches to begin with--the tacking or basting stitch--and keeping it and its many varieties in her mind when planning out the pattern, she will find that she has many delightful ways of executing it. Tacking or basting stitch, worked in rows, becomes simple darning, a background stitch with which she may make charming patterns and fillings, _ad libitum_. (Plates II. and XII.) Worked closer, it is a running stitch, wherewith braids may be tacked in place (Plate IV.), frills gathered up, seams of frocks connected, or smocking prepared. Finally, when worked with the same quantity of thread on the under and upper surfaces of the material, it attains a new dignity, and becomes satin stitch--the stitch beloved of the young modern needlewoman, who is generally inspired and stimulated by the wonderful skill and precision of the Eastern needleworkers.

=White Backgrounds.=--White backgrounds, when embroidered in white or with only a little colour, may have much greater variation in stitchery; it is a relief to the worker and an improvement to the work--indeed, should the embroideress feel so disposed, she has here the opportunity of displaying her knowledge of stitchery to a considerable extent, always keeping, of course, within the limits of good taste.

She should endeavour to suit the stitchery to the work, to produce the desired effect without too much labour--not that work should ever be done in a hasty or untidy manner--but, as said before, she should adapt it to its purpose. It is well to remember that large pieces of embroidery, generally seen from a distance, demand bold, effective treatment; detail is lost, so can be omitted; smaller pieces, seen at closer range, should bear inspection, therefore more delicate treatment may be applied; detail and finer stitches can be seen to advantage. (See Chapter XII. for stitches and the method of working.)

THE SIXTH POINT: THE FINISHINGS.

The aim of the embroideress is to make her work beautiful, as well as suitable for her purpose. If she has the gift of originality she will also make it distinctive, possibly unconsciously, by adding here and there those little touches of individuality which will mark the work as characteristic of herself.

It is in the finishings that she has most scope for these dainty devices; for by their means she may add interest and artistic detail to the simple garment or article of domestic use and render them charming things to look at. She may attain this end, not by obtaining expensive fitments, rich cords and silk tassels, such as are sometimes applied, most unsuitably, to embroidered cushions, table squares, and other objects that require frequent washing, but by the use of braids (Plate VI.), and bindings (Plate VIII.), and bands (Plate IV.), hand-made cords and tassels, linings, edges, fringes, beads and buttons, raffia and plaited straw.

Thus, the amateur will find it well worth while giving some thought to the making-up and finishing off of her embroidery. She will soon realise, too, the possibilities of making many of these ingenious devices herself wherewith to adorn her work, and she will feel well repaid in the end when she has contrived some simple embellishment at little extra cost.

Hand-made cords and tassels (Figs. 38A and 41), fringes and edgings (Figs. 34 and 42), may soon be made by skilful fingers; bright-coloured skirt braids and carpet bindings and hand-made cords of dyed string or wool give a decorative effect to hems and borders--a wide hem looks well with a heading of brush braid or a piping of coloured galoon or narrow Russian braid oversewn with wool, or a narrow band of needle-weaving. Material and edges may be joined, chair backs and runners may be brightened, dress fitments may be completed simply, artistically and economically, by means of these braids, connected with dainty joining stitches (Figs. 26 and 29).

Wools of various qualities may be brought into service to make fringes and cords for cushions, etc.; seams may be decorated and joined with insertion stitches, worked by hand (Fig. 25), or by the crochet needle (Fig. 63); fastenings may be secured by latchets of wool, thread, or silk, or cord, all of which are easy of manipulation and much prettier than machine-made articles.

By referring to Plate XIII., it may be seen that much may be achieved by means of braid in the decoration of a useful bag; for description, see page 153.

Charming hand-made braids which may be used for many purposes, such as waist cords, latchets, ties, belts, hat bands (Fig. 40), may be made by means of an embroidery frame, a lace cushion or a small hand loom.

For the handles and joinings of bags, see chapter on needle-weaving.

Beads and buttons are useful for ornamentation--they give richness and weight wherever they may be placed; and as an addition to fringes (Fig. 35), tassels and ties, they are most effective. Flat beads and buttons may be applied to embroidery provided they do not interfere with the use of the object; this they would do if it were in such constant use as to require frequent washing.

Small beads may often take the place of French knots, giving much the same appearance to a border or hem.

Washing galoons and gimps, bindings and trimmings, may be effectively applied to dainty little tea and luncheon sets, as well as to children’s dresses and overalls, they may be further embellished with narrow borders of needle-weaving worked in coloured cottons or in flax threads.

For method of making fringes, tassels and braids, etc., see Chapter XI.

CHAPTER IV

DARNING STITCHES--BACKGROUNDS AND FILLINGS

“The needle’s work pleased her, and she graced it.”

There is an infinite variety of pattern to be made with darning stitches, and fortunately many needlewomen have sufficient originality to invent little variations to suit their work and material. Most of the patterns on Plate II. are intended to be worked on a loosely woven foundation where the threads are easily counted, such as some of the coarser linens, single thread canvases, greenhouse shading, and tammy cloth for finer work. These darning patterns are better worked with a blunt needle and a long thread, as it is rather awkward, at times, to join new threads in the middle of a pattern, especially an openwork one (see Fig. H). Simple fillings like these may greatly enhance the effect of a piece of embroidery. It will be seen by referring to Plate II. that they might be worked so as to form quite a number of patterns in straight lines (Fig. A), in waves or chevron pattern (Fig. C), in clusters or stars (Fig. F), in lines of slanting stitches (Fig. D), in groups of squares or chequers (Fig. E), in vandykes (Fig. G), or in any of the openwork stitches as Figs. J and L.

=A Simple Openwork Filling.=--Fig. J is a pretty little pattern suitable for a border, for the foot of a child's frock, for a jumper, for table mats, or for any article where a dainty openwork appearance is wanted. It consists of straight lines in a vertical overcast stitch, worked in rows, from left to right and from right to left.

These upright stitches are in groups of two, worked over four threads of the material; each row is separated from the other by two strands of the material.

=To Work Fig. J.=--Unfortunately the Fig. J does not show this filling to advantage. When the pattern is worked it will be seen that the intervening strands, in conjunction with the open spaces, form tiny little crosses, which add transparency to the work.

A filling more tedious to work, but with a more open appearance, is got by overcasting every stitch on the advancing row, and on the return row working the upper part of each stitch into the lower space of the row above, thus leaving no strands between the stitches or rows.

=Vandyke Border, Fig. G.=--This pointed pattern, worked in a single row, makes a good finish for a border or hem.

To work as Fig. G, each group requires seven stitches to form it, the shortest covering four threads and the longest twelve; the last stitch of each group forms the first of the next one.

=Pyramid Filling.=--The size of the groups may vary; large and small vandykes may alternate. Another filling somewhat similar may be made by taking the stitches horizontally instead of vertically; in this way groups of little pyramids are formed. Each row should be worked with alternating pyramids. The simplest method is to begin at the top with a short stitch over two threads, work five more horizontal stitches, increasing in width, right and left, by one thread, so that the sixth stitch covers twelve threads of the material. Work in oblique rows.

Strips of vandyke pattern may be worked over large backgrounds with good effect. Make five horizontal stitches over five strands of canvas, each stitch being below the other, but one thread to the right of the last; then work four stitches beneath these, each stitch being this time one thread to the left of the one above it; continue for length required. Start the second row on a level with the first and six or seven strands to the right of it.

=Fig. B, Arrow-head Filling.=--This is a useful stitch for covering the ground quickly. The three stitches are here formed over six vertical and ten horizontal threads, but, of course, the number must always depend upon the quality of the material. The vertical stitch is worked first, then the left slanting stitch, followed by the right. In working with loosely woven cloth, it is necessary to carry the working thread up behind the material to the top to start each stitch. This uses rather more thread, but the stitches lie better and the work is not puckered.

=Fig. F, Star Filling.=--Here, a number of stars are worked in successive rows. To make them quite regular, each one should be begun at the same point. In the Fig. F they are worked over sixteen strands: start at the top left corner with a double stitch, then make the horizontal stitch below, and so on till complete. By tightening the working thread a little a hole is formed at each corner, and in the centre of each star, which makes the pattern an open one, provided the working thread is not too thick, in which case it would fill up the hole.

An equally good background for a firmer material is to work stars in two rows, diagonally, one up, one down, leaving always an equal number of strands between each star. In this way the material itself is formed into little diamond-shaped panels or lozenges.

=Fig. C, Wave Pattern.=--This is one of the more elaborate darning patterns. It makes a more solid filling and takes rather longer to work than some of the others. Many pleasing variations may be formed with darning stitches, where the background weft or warp threads are utilised to form the pattern.

=Damask Darning.=--Materials may be repaired by a linen, twill, or damask darn, in which case the weft threads have to be put in first by the worker before the pattern can be woven.

Work Fig. C by lifting two weft threads in descending rows and passing over seven; after working six rows the pattern is changed by the two weft threads being lifted in ascending rows, the last of the descending counting as the first of the ascending row.

In a twill darn, the pattern of weft threads descends all the time in regular diagonal lines.

It is quite worth while copying some of these damask patterns from table napery, and reproducing them on a larger scale in bright colours--in order to see what effective designs they are; they might well be utilised as fillings for squares, stools, or cushions.

[Illustration: PLATE III.

A RUNNER IN CRASH (_See p. 63_)]

=Fig. A, Single Darning.=--A simple grounding pattern, such as that of Fig. A, is useful; it is quickly worked, too, a number of threads being lifted by the needle at each stitch. Start at the left corner; pass over four and lift two weft threads alternately for the first two rows; for the next two rows, lift the two weft threads in a line with the centre of the long stitch, and so on.

=Basket Pattern.=--A basket or brick pattern may be got by working four rows with the lifted threads in a line, instead of two, as Fig. A, before changing the stitch. This pattern looks very well when the chequers are worked with contrasting colours. Work four vertical stitches first, in lines, and in one colour, over eight strands; then take the contrasting colour and fill in all the horizontal stitches. If one colour only is used these squares may be worked in rows, the vertical and horizontal sections alternately.

=Fig. H.=--This type of work makes a rather more open background than some of the others; it is very suitable for filling in small spaces, for handkerchief sachets, nightdress bags or borders for collars or handkerchiefs.

It should be worked with a fine coloured or white lace thread, sufficiently strong to draw the strands firmly together, yet fine enough to leave the spaces as clear as possible. As a filling it is easily and quickly worked, as no threads are drawn out, which is a recommendation.

The pattern is worked over six threads both ways--with the exception of the first stitch--and in two horizontal lines. It will be noted that the stitches are not quite vertical, being inclined towards each other in twos.

=A Good Filling.=--To form the first stitches, bring the needle out at the top left corner; count down over six strands and three to the right; insert the needle and take a horizontal stitch under six strands to the right. The slanting stitch is now formed by inserting the needle into the hole on the upper line made by the first stitch, and taking a horizontal stitch under six strands to the right on that line--the upper one; proceed in this way to the end of the space. The next row is worked from right to left. The thread should be tightened after each stitch to increase the open space.

=Fig. D, Diagonal Filling.=--This grounding pattern consists of rows of slanting stitches, worked downwards over six strands of material; the working thread is taken across from corner to corner of a square, each successive stitch being taken three strands below the upper one; a strand of the material forms a mid-rib between the inverted rows. If preferred, these rows might be separated by a line of backstitching, in which case two threads should divide each row of slanting stitches; this gives a clear line for the backstitching.

These backgrounds and darning stitches described above are well suited for working on coarse materials with thick threads--as well as with finer ones; although the patterns for the majority of workers are too laborious for very fine stuffs, they may be used for small spaces in linen embroidery such as fillings for flowers, or initials.

Charming open groundings may be worked without removing the threads of the foundation material, but by drawing them in clusters tightly together, by means of stitches. Compare Plate II., where the fillings, Figs. H, I, B, K, L, and M, are worked in this way.

These patterns can be only shown properly on a loosely woven cloth, such as canvas, linen, or cambric. For fine material a fine lace thread is required.

=Fig. I.=--This pattern consists of little squares and crosses. In Fig. I it has been worked with a thick thread and the strands have not been pulled together--in order to show the method of working; but as already explained, it requires a fine thread and tightened strands to show to advantage.

=A Filling in Squares.=--Begin the pattern with vertical stitches, in horizontal rows over six strands, exactly as in Fig. 10, until the required space is filled, drawing each group of threads tightly together; then work the horizontal stitches over five strands to complete the squares, tightening them also, but not to such an extent as to pucker the material. The squares may be made smaller and the open spaces larger if each stitch is worked over twice with a very fine thread.

=Fig. K, Squares and Stars.=--Here, each square takes up sixteen strands of linen, and each one is completed before going on to the next. Work by overcasting all round the outside of the square over four strands, and make an inner square, as Fig. I, with a cross stitch in the centre, taking care to finish with the needle in a position to begin the next square.

=Fig. L, Square Stitch and Rhodian Embroidery.=--This pattern is made up of rows of square stitches separated by vertical ones. It is usually worked without removing any threads from the material, although with a very firm cloth it is rather an advantage to do so when an insertion is wanted; in the latter case the vertical threads connecting the rows of square stitch are left out.

This is a stitch one frequently finds in old linen embroideries, particularly of old German and Italian work--where it is used either as a border or insertion, or as a separating line between squared or diamond-shaped forms; there is a similarity in the working of it to the stitches used by the people of the Island of Rhodes--latterly known as Rhodes embroidery or punch work--the only difference being that it covers the entire background in Rhodian embroideries and the threads are more closely drawn together. In these Rhodian embroideries the rose is frequently to be met with. It is the symbol which invariably accompanies the head of Helios on its coins, and to which the classic isle owes its name. Square stitch can be worked in straight or in slanting lines, see Fig. M--the former is the simpler, as each square is completed in one row, while the latter requires two rows to complete it.

To work on horizontal lines, Fig. L, begin at the right-hand side and make an upright stitch over six threads; take a slanting stitch at the back and bring the needle out six threads to the left at the base. Take a horizontal stitch to the right, inserting the needle at the foot of the vertical stitch; take an upwards slanting stitch at the back to the left and insert the needle into the top of the first stitch. This forms three sides of the square. Now bring the needle out in position to start as for the first upright stitch. If properly worked, the reverse side forms a series of crosses. Fig. L has a row of these square stitches with an alternate row of upright stitches worked from left to right between them. This is a pretty and unusual combination of stitches, and it makes a charming border worked in colour on a loosely textured material for a collar or other small article. Another variation of the same type, and still more open, is to have double rows of square stitch between each row of vertical stitches, the lower row of little squares coming between those of the upper row.

=Fig. I, Square Stitch in Slanting Lines.=--To work this stitch in slanting lines is rather a slower process. The first row forms a series of zig-zags or little steps on the right side, while on the wrong side it forms two single lines on the bias of the material. Begin at the right-hand side of the work; take a horizontal stitch from left to right over six threads; a slanting stitch at the back to the left brings the needle out six threads below the starting-point. Take an upright stitch and put the needle into this point--two sides of the square are now formed. Take a slanting stitch at the back and bring the needle out six threads to the left of the base of the upright stitch and continue for the distance required. This slanting line of square stitch is easily acquired if the worker remembers the appearance of the stitch, on the “wrong” side as well as the right.

=A Table Scarf in Russian Crash.=--This design is another of the direct type in which the needle-woven border forms the principal subject. The material is very pleasant to work--it is of a soft greyish-cream colour, which combines well with the wools and braids, and the texture is sufficiently open to allow of the threads being easily removed, which is a recommendation when preparing for the needle-weaving and the fringe. The stitchery is all done in wools, and the colours are dark heliotrope with two lighter tints, blues (two tones), greens, a dark and light emerald, and deep orange. The broad braid is of soft blue, the narrow of straw colour. The design forms a deep border divided into panels by bands of braid; the bands are tacked into place by short button-hole stitches in the darker shade of emerald green, between which are tiny little loop stitches (Fig. 3), in orange. The centre panel has a wide band of needle-weaving, about three inches deep, which is divided up into five groups; the groups are worked from the outside, inwards, as in Plate I., and the various colours are introduced into them. The most prominent colour in the scheme is blue, accentuated in this case by the blue braid, the blue edging, and the second and fourth groups of weaving, which are worked in two shades of blue. The first and fifth groups are woven in heliotrope with orange in the centre; the middle group has light heliotrope on the outer parts

and pale green on the inner. This same green is worked in oriental stitch on each side of the central 3-inch bar, while the stitchery between the rows of wide blue braid is in the lightest tint of heliotrope, tacked down with tiny stitches of the darkest shade. The two side panels are worked in satin stitch in two tones of heliotrope, each row of chequers being connected by small chequers in light green--they also are worked in satin stitch. The lines of straw-coloured braid are sewn down with French knots in heliotrope (Figs. 22A, 22B). The pattern of the stitching on the bands of braid which border the design is worked in the same way as loop or oriental stitch; the needle is brought out on one side of the braid and inserted on the other side, just opposite, then brought out again in the centre to the right, where the wool is tacked down with a tiny stitch; the needle is again brought out on the edge of the braid, about half an inch further on, inserted on the lower edge and brought out in the middle again in order to tack the wool down. These two stitches reversed give the diamond shape of the insertion; three satin stitches in orange give a bright little note to the edging. These looped or petal stitches worked in different ways can be used to form many pretty headings. The narrow edging on the selvedges between the lines of blue braid is charming; it consists of two loops of heliotrope in two shades--the one worked within the other--with a closed looped stitch in orange between each pair. When all the embroidery is finished, the weft threads are withdrawn from the remaining ends of the material, which have been left for the fringe. Sometimes a fringe of a closer texture or of a different type is worked, or the material may be too short to allow of one--in all of which cases a strip of cloth could be inserted under the braid and sewn down with the pattern, then fringed.

It is generally advisable when working with narrow braids to take the ends through the material where they can be stitched firmly in place; wider ones are often tied at the ends to prevent spreading, then turned in and stitched.

CHAPTER V

NEEDLE-WEAVING--RUSSIAN OPEN-WORK--LINKED STITCHES

“A web made fair in the weaving.”

Needle-weaving is a form of decoration common to all countries; it was practised by primitive peoples and must have preceded embroidery. It was a means of adding richness and colour much in favour with t This eBook is for the use of anyone anywhere in the United States and most other parts of the world at no cost and with almost no restrictions whatsoever. You may copy it, give it away or re-use it under the terms of the Project Gutenberg License included with this eBook or online at www.gutenberg.org. If you are not located in the United States, you will have to check the laws of the country where you are located before using this eBook.

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*** START OF THE PROJECT GUTENBERG EBOOK MY SECRETS OF BEAUTY ***

MY SECRETS OF BEAUTY

A thing of beauty is a joy forever; its loveliness increases; it will never pass into nothingness. --KEATS

[Illustration: MME. LINA CAVALIERI]

MY SECRETS OF BEAUTY

BY MME. LINA CAVALIERI

THE MOST FAMOUS LIVING BEAUTY

Including More Than 1,000 Valuable Recipes for Preparations Used and Recommended by Mme. Cavalieri Herself

ILLUSTRATED WITH NEW PHOTOGRAPHS OF MME. CAVALIERI AND OTHER FAMOUS BEAUTIES

[Illustration]

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DEDICATED TO EVERY SEEKER AFTER BEAUTY

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FOREWORD

In this volume is presented what we confidently believe to be the most complete collection of authoritative information on the subject of personal beauty and the best methods of acquiring and preserving it ever offered to the public in compact, handy, inexpensive form.

All the newest and best ways of helping a woman to retain her youthful charm for an indefinite period are clearly described in these pages, and with them are given more than one thousand tested recipes which will be found of the greatest assistance in attaining the desired end.

Every statement made in this book is based on long and thorough practical experience; every recipe has the endorsement of the greatest living authorities on aids to beauty. Madame Lina Cavalieri herself has followed the advice which she here generously passes on to other women. The preparations for which recipes are given are all ones the famous prima donna herself uses, and to their use she owes the fact that for so many years she has been acclaimed the most beautiful woman on earth.

The woman who owns this book will be freed forever from dependence upon unreliable “beauty doctors” and expensive cosmetics of doubtful value. Here she has all the best advice the world affords to help her make the most out of the skin, the hair, the eyes, the teeth, the figure and all the other charms with which Nature has endowed her.

Most of the thousand and more recipes this volume contains can be easily prepared at small expense right in your own home. And no one need have the slightest hesitation about using any of them. Not only are they personally recommended by Madame Cavalieri but they have the endorsement of all the greatest beauty specialists of both America and Europe.

Great pains has been taken in their selection and any whose value seemed doubtful or which might by any possibility have harmful effects have been rigidly excluded.

The world to-day places a higher valuation upon personal appearance than ever before. And this is why a book like this, which explains just how to make the most of your physical self, is certain of a warm welcome from the public.

THE PUBLISHERS.

MY SECRETS OF BEAUTY

CHAPTER I

THE CARE OF THE COMPLEXION

For every woman--or, for that matter, every man--who wants to have and retain a good complexion, the one thorough toilet of the day should be made in the evening. This done, the other toilets throughout the day may be brief and more or less perfunctory.

The real housecleaning, particularly of the face and neck, should take place at night. The reason for this is apparent. The skin has been in contact with the dust and smoke and countless other soiling agents out of doors. At night, immured in the bedroom and swathed in bed clothes, there is slight chance of vagrant dust settling on the skin.

Another reason is that if the day's grime is allowed to remain upon the face or neck, it becomes imbedded in the pores, and a part of it, at least, is taken into the circulation, and thus carried through the body.

Wash the face most thoroughly at night. First, with a coat of cold cream which may be wiped away after leaving it on for a few minutes. Second, with tepid water and a mild soap. If you use a face cloth, let it be of soft silk or muslin or cheesecloth, but personally I prefer just the palms of the hands.

Do not rub the face hard. A hard rubbing loosens the skin, causes the muscles to sag and makes wrinkles form.

Last of all, give the face its cold cream bath. This is indispensable to the person who would have a good complexion. A skin food such as lanolin may be used instead of cold cream for the face bath if preferred. A cold cream that is excellent for softening and cleansing the skin is made as follows:

Cocoa butter, 32 grams; spermaceti, 32 grams; oil of sweet almonds, 160 grams; white wax, 16 grams.

A more elaborate and expensive cream that is also a helpful skin food is compounded as follows:

Lanolin, 2½ ounces; spermaceti, ¼ ounce; oil of sweet almonds, 2 ounces; fresh mutton tallow, 2½ ounces, cocoanut oil, 2 ounces; tincture of benzoin, ½ dram; Portugal extract, 2 ounces; oil of neroli, 10 drops.

Almond milk is an old-fashioned favorite still in use in some of the best formulae for complexion emollients and bleaches. A good astringent cream that both bleaches and softens the skin is this:

Almond milk from 50 crushed almonds; rosewater, 1 pint.

If the mixture is not smooth, it should be strained through a cheesecloth or soft silk before using. In this form it is softening and whitening. With the addition of ½ ounce of alum it is strongly astringent besides.

With the cold cream or the skin food massage away the wrinkles made by a hard day. With rotary motion, massage away from the corners of the eyes to the hair line. In the same way, with the tips of the fingers, iron out the lines which concentration has written between the eyebrows. With the tips of the middle fingers, massage the lines upward from the corners of the lips to the nostrils, and try to eradicate the ugly little lines in front of the ears by rubbing gently upward.

[Illustration: MARY GARDEN The author of "My Secrets of Beauty" selects the famous prima donna as one of the best examples of the "well rounded" woman.]

The care of the complexion in Winter differs considerably from that in Summer. For example, to counteract the coarsening, drying effect of the Winter winds, I use more than the Summer quantity of cold cream. Winter, too, is a greater promoter of wrinkles than Summer, because it dries the skin, and the wrinkled skin is always a dry skin. The following formula will be found a valuable aid when the skin shows a tendency to dryness:

Oil of sweet almonds, 60 grams; cocoa butter, 12 grams; white wax, 6 grams; spermaceti, 12 grams.

For a few complexions cocoa butter is an irritant. For these I would recommend this cream as more soothing:

Oil of sweet almonds, 100 grams; white wax, 20 grams; spermaceti, 100 grams; rosewater, 10 grams.

Whatever cream is used it should be well rubbed into the skin, after which what remains--all that the pores will not take up--should be wiped off with a soft cloth. The skin that is much exposed to the cold air should be especially well fed.

In Winter, more than Summer, the face marred by unsightly red blotches shows its unlovely bent. First, I should try for this internal remedies of a cooling, laxative nature. Sour or buttermilk drunk in large quantities, say six glasses a day, is much used at present to that end. It has the effect of cooling the blood and is milder than many such agents.

Another help in clearing a mottled skin is the complexion mask. There are many mask pastes of various sorts which are admirable for this purpose. From them I select this one as the most worthy and effective of all:

Liquid honey, 1 ounce; barley meal, 2 ounces; white of one egg.

After thoroughly cleansing the skin at night, first with cold cream, then with warm water and a mild soap, apply the paste, spreading it smoothly and evenly with the fingers upon the cheeks, nose and forehead. In the morning add ten drops of tincture of benzoin to a quart of warm water and with this remove whatever paste remains on the skin.

It is easy to do the complexion irreparable injury in Summer. One too long fishing jaunt, one automobile dash with the skin ill protected against the burning sun; a too long dawdling on the toasting sands, and the evil is done. The once beautiful complexion has become a memory. In its place is only a dry, withered remnant of what was once a fresh, soft, rose-like skin.

How to prevent such a tragedy to beauty--for no woman was ever beautiful without a good complexion, and no woman with a good complexion can be less than attractive--I shall try to tell you. First and last and always, vigilance.

First prepare your skin for an outing. It is best never to use hot water on the skin. But if you insist upon that pernicious habit, at least do not use it shortly before going out, for the hot water renders the skin acutely sensitive to any new influence. The wind cuts more deeply into it. The sun’s rays burn farther. They reach the danger line to which I have referred, and that really exists.

To prepare the skin for its battle with the elements of a long Summer day, the face should be cleansed with tepid water and almond meal instead of soap. The action of the almond meal upon the face is soothing and cooling. Before going out into the heat dust the face lightly with rice powder, which will adhere better if a very light coat of cold cream has first been administered.

This famous old English cream is one of the best for the purpose:

Cocoa butter, 2 ounces; lanolin, 2 ounces; glycerine, 2 ounces; rosewater, 3 ounces; elderflower water, 1½ ounces.

If sweet cream is available, bathe the face freely with it. If this doesn’t quickly allay the burning, try this cucumber cream:

Almond oil, 1 ounce; olive oil, 1 ounce; white wax, 1 ounce; spermaceti, 1 ounce; essence of cucumber, 2 ounces.

If, as may happen in a country resort, this excellent milk of cucumbers cannot be procured, follow the face bath of sweet cream with one composed of:

Slices of one cucumber; sweet milk, 1 pint.

If the case is not hopeless but obstinate, this “honey balm” should relieve the brown hue of tan that follows a deep but not irremediable skin burning:

Orange flower water, 3 ounces; strained honey, 1 ounce; cold cream, 2 ounces; white almonds (pounded to paste), 1½ ounces.

If the hands have suffered equally with the face this lotion is effectual in reducing the unlovely redness:

Lemon juice, 1 ounce; strained honey, 1 ounce; cologne, 1 ounce.

Should the unusual exposure result in freckles the application with a small sponge or bit of cotton, of either of these I recommend:

Powdered borax, ½ dram; sugar, ½ dram; lemon juice, 1 ounce.

Another application that may be used is made of:

Muriate of ammonia, ■ dram; lavender water, 1 dram; distilled water, 4 ounces.

If the case is less severe, I recommend for freckles this:

Peroxide of hydrogen, 1 ounce; ammonia, 10 drops.

These may all be more deftly applied with a camel’s-hair brush than in any other way.

Strawberry water, which was the bath of some of the court beauties of an extravagant age, may be used in season by American beauties for the freshening of the facial skin discolored by tan or withered by too great exposure or by lack of care after that

exposure to sun or wind. It is made thus:

Crushed strawberries, 2 pounds; alcohol (95 per cent.), 1 pint.

Before retiring it is well to give the face three baths, first with pure cold cream to remove the coarser dust; second, with tepid, if possible, distilled water--if not, water softened with borax or benzoin--and, last, a light coat of cold cream.

If the danger line has not been reached, nor even approached, these applications should restore the complexion to its former delicacy in a few days. If the case is not hopeless but obstinate, this paste should relieve the brown hue of tan that follows a deep but not irremediable skin burning. I have given to this, which I have often used after an automobile tour, the fitting name, “Honey Balm”:

Orange flower water, 3 ounces; strained honey, 1 ounce; cold cream, 2 ounces; white almonds (pounded to paste), 1½ ounces.

This is one of the cooling creams desirable for use in summer.

Oil of almonds, 1 pint; olive oil, 1 ounce; cucumber juice, 1 pint; white wax, 1 ounce; spermaceti, 1 ounce; cucumber juice (which has been boiled, skimmed and strained), 2 ounces.

Excellent for freckles, tan and other discolorations is this:

Sour milk, 1 cupful; horseradish, 1 teaspoonful. Scrape the horseradish into fine shreds and let stand in the sour milk for six hours before using. Then wash the face freely in it.

Fresh buttermilk is a cleansing, freshening, tan and freckle removing face bath to be taken at night.

This, too, is a lotion which has been recommended by many:

Citrine ointment, 1 dram; oil of almonds, 1 dram; spermaceti ointment, 6 drams; attar of roses, 3 drops.

For either freckles or liver spots this has been in many instances curative:

Solution of ammonia, 1 ounce; bay rum, 1 ounce; rosewater, 1 ounce; powdered borax, 1 ounce; glycerine, ½ ounce; distilled water, 10 drops.

Still another formula for freckles and tan is this, which has a great popularity:

Ammonium chloride, 1 dram; distilled water, 4 ounces.

Some faces, otherwise pretty, are disfigured by a greasy or oily skin in the summer. The need is met by this lotion, which is at once cleansing, cooling and drying. It should be used as a face bath twice or oftener a day, according to need:

Rosewater, 5½ ounces; alcohol, ½ ounce; boric acid, ½ dram.

After using any tan or freckle lotion containing acid, cool the skin by massage with a pure cold cream.

For sunburn I would suggest, as an old and tried remedy:

Equal parts of oxide of zinc ointment and cosmoline.

Cooling for the sunburned surfaces is rosewater or a solution of bicarbonate of soda. Apply them with a sponge or bit of cotton, using them repeatedly until the burning sensation disappears.

For the removal of freckles these have been recommended after much use:

A solution of powdered niter, or a solution of bicarbonate of soda. These should be applied to the face night and morning.

Once after motoring on the Italian Riviera, I saw some most unwelcome spots on my nose--light, yellow, obtrusive--resembling the dots with which a turkey egg is flecked. A chauffeuse sent me this prescription, which I have since used many times, always successfully:

Lactic acid, 4 ounces; glycerine, 1 ounce; rosewater, ½ ounce.

This also is as efficacious as it is simple:

Glycerine, 1 ounce; juice of ½ lemon.

For the excessive and odorous perspiration that troubles many in summer, I recommend this formula for a dusting powder. Its use should be preceded by a sponge bath of the affected portions. Afterward apply the powder with a soft cloth or powder puff:

Powdered alum, ½ ounce; powdered boric acid, ½ ounce; oil of eucalyptus, 20 drops; subnitrate of bismuth, 1 ounce; oil of verbena or orange, 5 drops.

For a refreshing bath in mid-summer this lotion, either sprinkled freely into the bath or splashed upon the body by handfuls immediately after leaving the bath, is my choice among a score of such recipes:

Strong vinegar, 200 grams; tincture of benzoin, 200 grams; tincture of red roses, 200 grams.

My favorite cold cream is this, which I have prepared under my eye:

Lanoline, 10 grams; oil of almonds, 100 grams; rosewater, 100 grams; white wax, 5 grams; spermaceti, 5 grams; oil of rose geranium, 5 grams. Melt the lanoline and white wax and spermaceti. Add the oil of almonds. Warm again and add the rosewater, little by little, stirring all the time.

This is my favorite face powder:

Best talcum powder, ½ pound; boracic acid, ½ dram; calcine magnesia, 1 dram; powdered Florentine orris root, 1-5 ounce.

This skin lotion I have used in the summer with much benefit to my complexion. I have found it cooling and healing:

Bitter almond water, 6 ounces; orange flower water, 4 ounces; glycerine, 2 ounces; boracic acid, 1 dram.

This is excellent for sunburn:

Sweet milk, 1 teacupful; juice of 1 lemon. Squeeze the juice of the lemon into the milk and let it stand in a cool place until it curdles. On retiring apply the mixture to the face with a silk sponge or a bit of cotton.

A face bath every night of buttermilk is helpful. Like the preceding it should be washed off with tepid water after it has been on the face for a half hour. If the sunburn is deep and obstinate better try one of the milk baths several times a day.

Another good treatment for sunburn is the application of a stiff paste made of Fuller’s earth and rosewater.

This is a cooling face lotion, preventive and cure as well of sunburned skin:

Orange flower water, 2 ounces; rosewater, 2 ounces; tincture of benzoin, ½ ounce; borax, 1¼ drams.

For freckles this simple preparation is one of the best I have ever known.

Horseradish root, 1 ounce; borax (powdered), 2 drams; hot water, 1 pint.

This more complex mixture is effective for blackheads and tan as well as freckles:

Ammonia water, 1 ounce; bay rum, 1 ounce; rosewater, 1 ounce; powdered borax, 1 ounce; glycerine, ½ ounce; distilled water, 10 ounces.

For the cornerstone of the care of my complexion I depend upon the body bath. We who would be beautiful get many hints from our physician, who is himself not at all beautiful, but who, if we obey him, can make us so. He talks about “local treatment” and “general treatment,” and he tells you that in most cases general treatment is far more thorough than local.

That is the reason that I depend upon the body bath more than anything else for my care of the complexion. It is general treatment, while massage and the application of lotions and creams are local treatment. Both are needful, but the daily body bath is indispensable.

To make the bath tonic stimulant and agreeable I have made many experiments. The most successful I have found to be this:

To a tub half full of water add one pound of table salt and one pint of violet ammonia.

The bath should be prepared ten minutes before one enters it, for the salt should be thoroughly dissolved and the ammonia should have been thoroughly mixed with the bath.

This I vary by the use of one pound of sea salt and half a pint of aromatic vinegar.

These preparations being of an astringent nature should not be used every day. Three times a week are enough for their tonic effect. For a soothing bath I leave off the salt and pour into the tub:

One ounce of tincture of benzoin and two bath pastilles, scented to your taste, but never colored.

This is the way I take it. As soon as I rise in the morning I plunge into my tepid bath. The temperature I take myself, to be sure that my maid has made no mistake. When the thermometer which I thrust into the water registers about 98 degrees Fahrenheit I am satisfied. If higher, it is too warm. If lower, it is too cold.

I permit myself just twenty minutes in the tub. More than that is weakening. While in the tub I play about as joyfully as a young porpoise. I plunge and flounder and toss up a shower of water with my hands; for to lie lazily in a tub of water is to invite rheumatism and neuralgia. I rub upon the brush quantities of the purest scented soap I can get. I try first this, then that soap. I am always trying to find something I like better than the last. I scrub my body vigorously--as vigorously as the women of the Loire pound their clothes upon the stones on the river.

I rise, streaming with rills of soapy water, and take a cold shower bath upon my shoulders. Perhaps I use the hose attached to the bath. Perhaps I catch the water as it flows from the cold faucet in my hands and throw it over my shoulders. Perhaps my maid dips a sponge in the cold water and dabs the upper part of my body quickly with it. Then out of the tub I spring upon my bath mat and give to myself, or my maid gives me, a quick rub with eau de cologne. Thus the three purposes of my bath are fulfilled. The warm water is cleansing. No one but an Englishman believes that a cold tub cleanses the body. It merely galvanizes it. To be clean we must use warm or hot water, and hot water weakens the bather.

From the tepid water I am clean. It has left the pores open as so many hungry mouths. The dash of cold water closes them. It shocks and stimulates the skin, making the blood, which has rushed to the centers of the body, bound back again to the surface. The eau de cologne rubbed slowly opens the sealed pores again. Then comes the fourth and final stage of my bath. It is the exercise.

The exercise may be running about my bedroom a dozen times, taking the sun bath. The body is too much clothed. This is the only time that it ever drinks in the sunlight. To take the sun bath at any other time would be dangerous; but immediately after the tub it is beneficial. If the day be a cloudy one I take, instead of the sun bath, my breathing exercises.

Twenty-five times I raise my arms slowly in front of me until they are stretched straight and high over my head. Then slowly I drop them again heavily, as though my hands were of lead, at my sides. This at a distance of about three feet from the open window. I am wrapped in a woolen bathrobe. Always a woolen bathrobe.

Thus for the general treatment. Now for the local. I sit in my dressing chair, which has a back reaching halfway to my shoulders. If the back were higher it would prevent a free movement of my body when I brush my hair or massage my face.

While I have been in the tub I have not washed my face. It is now to have its first bath. The bath is still not a liquid one. It is of cold cream. I give you here one of my favorite recipes:

Rosewater, 500 grams; oil of sweet almonds, 500 grams; white beeswax, 20 grams; spermaceti, 20 grams; oil of rose, 3 grams.

All these articles should be absolutely pure. If you do not trust your druggist, send them to a chemist to be analyzed. It is expensive, but it never pays to economize in the complexion. Let me tell you how to prepare the cold cream:

Place the beeswax and the spermaceti in a steamer. The steamer should not be placed upon the stove, for the fire would be too harsh for it and would taint the cream with its odors. Place the steamer, instead, in a pan of hot water and let the mixture be gently heated. With a long-handled wooden spoon stir in slowly the oil of sweet almonds. Drop the rosewater, little by little, into the mixture and stir again. When it is thoroughly mixed, pour it into a stone jar or a china vessel, and when it has cooled add three drops of oil of rose. If you use the oil of rose before the mixture has cooled, the perfume will evaporate.

You will have when you have done this an ounce less than a pound, or fifteen ounces, of absolutely pure cold cream, which will last for many months if not wasted.

I massage my face sitting before the mirror of my dressing table. This, I have found, is far better than the lazy way of massaging it while in a reclining position. I want light for massage. I want a stream of it over my shoulder, my left shoulder preferably, falling upon the mirror and showing me any line that I might have acquired since the morning before. Sitting there before the mirror I give my face vigorous inspection. I mercilessly scrutinize it. Wherever there is the slightest tracery upon the smooth surface, upon that spot I concentrate. I massage my face for ten minutes, always keeping in mind the purpose of the massage.

That is, that wrinkles are caused by defective circulation in one spot, and that the way to remove them is to increase the circulation in that spot. Sending a fresh supply of blood to the sunken region will tend to fill out and plump it.

Therefore, I concentrate on the region from the corners of the lips to the nostrils, that region where the ugly diagonal lines come and hint of ill temper or illness or old age; on the space between the eyebrows where the lines of worry form; on the area about the outer corners of the eyes, an area corrugated by too much laughter; all these and the rest of the face I massage by quick, light pats of the cushions of the ends of the fingers--light, but firm.

Always with a motion round and round. A lengthwise motion causes the muscles to sag and pulls the skin loose from the muscles. It is very bad. After the rotary movement I go over the face with quick, light, but stinging slaps. With a square of thin, soft linen I remove any surplus of grease that has not been absorbed in the pores.

For the skin that becomes overheated and looks feverish after massage, this cooling, soothing lotion may be used:

Extract of violet, 350 grams; extract of rose, 35 grams; tincture of orris, 80 grams.

Dashed upon the face after the morning massage, it is deliciously cooling and refreshing. If you do not care for the liquid face bath, fluffing daintily over the face a powder puff dipped in rice powder is sufficient.

To the window I go, hand mirror in hand, for a further inspection before applying the rice powder. I see, perhaps, acne, a bit of what you in this country call “blackhead,” at the side of my nose. I hasten to remove it. How? Not by pressing it out. No, no. That leaves an ugly hole in the skin. It is a mutilation of the face. No; I search for a match or a wooden toothpick. Then I take from my toilet table one of two preparations--each is good:

Rose water, ½ wineglass; peroxide of hydrogen, ½ wineglass. Shake well in a glass. Dip the match into the mixture and press the dampened end upon the blackhead. It does not remove it, but cleanses its color to white.

Or I use this, which I think is milder:

Rosewater, 2-3 wineglass; ammonia, 1-3 wineglass. Shake well together in a tumbler. Dip the end of the toothpick or match in it and use as other preparation. Like the other this cleanses without removing the acne.

If my plans for the day include a railway journey or an automobile spin, I prepare my complexion for the ordeal. Before going out I massage the face again with cold cream and dust it once more with rice powder. This fortifies the face for the whirlwind of smoke or dust it encounters. When I return, to thoroughly cleanse the face, I steam it. Into my stationary wash bowl I pour two quarts of boiling water and one ounce of tincture of benzoin. I bend forward and place my face as close to this as possible. I wrap about my head a towel and swathe the towel--a big, Turkish one--about my shoulders and the edge of the bowl, so that no steam can escape. So I remain until I feel that my face drips with perspiration and until I am nearly suffocated by steam. Then, sitting up straight, I dab one of the linen squares about my face and cool it by a hand bath of eau de cologne.

Or, if the journey has been taken in summer, and I am tanned or freckled in consequence, I apply this:

One wineglass full of rosewater; fifteen drops peroxide of hydrogen.

I bathe the face with this preparation and leave it on the skin for fifteen minutes, then remove it by massaging the face with the cold cream for which I have given a prescription, or with rosewater. The peroxide is drastic, and should only be used in emergencies.

And now the day is passed and I am ready to retire. Again I think of my complexion. For the first time that day I really wash my face.

First, it has its bath of soap and water. I use plenty of soap, but make a lather of it in the bowl, instead of placing it directly on my face. Plunging my hands into the soapy water, I bathe my face with the palms of my hands. Never do I use anything else. A sponge or a cloth is too harsh. There is nothing softer than the palms of a woman's hands. They are softer than silk, and because they are the softest objects I know I bathe the delicate skin of the face with them. After the warm water face bath I rinse the bowl and the face with cool, not cold, water. Cold water is too severe.

Then, again, the ten minutes of massage, with the cold cream. Then to bed. I feel that I have done for my complexion the duty I owe it. I owe it but one more, to sleep for eight hours in a room where the windows are as wide open as possible, my bed being out of the draught and myself well covered with blankets, for to be cold is to commit a crime against the complexion.

One other precaution I may take if the morning inspection has revealed that there are pimples on the face. It is a remedy, most simple, but efficacious.

In the morning bath a handful of starch. Before retiring a paste spread over the face and made thus:

One tumbler half full of water. The remainder filled with starch. Stir to a thick paste.

Every woman who gives her complexion the right care has to spend many hours at her dressing table. This should be low, so that you can sit before it with comfort. It should be wide, and long, and flat, so that it may hold all of those accessories of the toilet which a woman wants within reach as she sits before her mirror.

It should have a large mirror, and a good one, a just mirror, but not a merciful one, that will reveal every blemish, but will not exaggerate it. The faults of our faces trouble us enough without being exaggerated by our mirrors. Money spent for a good mirror will yield you a good return in honestly showing you how you look. If you know exactly how you look, you can build upon that foundation of knowledge a new and better appearance.

Being sure that your mirror is reliable place it where it will have the best light in the room. This should be opposite, if possible, but certainly near to the window. The best light for writing is the best light for dressing. The light should fall over the left shoulder. Arrange your electric lights, or candles, or lamps, or gas jets, whatever are your lighting facilities, so that the light will fall in that direction. Don't dress by a poor light any more than you would read or write by a poor light.

The mirror should be as large as possible and should be adjustable. Attached to supports on the table it should be easily swung back and forth, according to the angle of view you wish to get upon yourself.

Even if the table be of the plainest sort, of home manufacture, the table and mirror frame should be white. The effect of daintiness and cleanliness is given by a white table and mirror frame. Spots and stains can be more easily removed from it. Some young women have a fancy for draping their dressing tables in muslin or silk tied back with ribbons, or in silk finished by tassels of the same shade, each to match the curtains at the windows and the draperies of the bed. Personally I prefer the white painted or enameled dressing table to any other. Draperies are elegant, but besides their elegance I always see their other significance--that of dust traps. In furnishing rooms I try to put the money into rich woods and rugs, and shun draperies.

If the owner's means permit it a duplex or triple mirror is better than a single one. I would allow the young woman at her toilet literally to see herself as others see her. She would study her profile and note whether her cheeks were growing too plump or too thin. She could see whether the line of her coiffure is as becoming to the sides as in front. She could study her shoulders and learn whether they are too lean and need fattening, or too fat and require thinning. Having once dressed before a duplex or triple mirror you will set about getting one.

But if yours is a good single mirror you can still make your toilet very satisfactorily with the aid of a hand mirror. This will in a little longer time enable you to scrutinize your profile and back successively, instead of seeing all three views of your head at once.

On most dressing tables we see a brush and comb. This is the worst possible place for them. Perhaps they are there merely for ornament, to complete a handsome ivory, or silver, or gold set and give the spectator a sense of the completeness of the table furnishings. But the comb and brush that are in use should be carefully kept in a drawer of the dressing table or in a toilet closet, or in one of the medicine chests with which bathrooms are now supplied. After using them, and before putting them away, be sure to cleanse them. If you neglect this your combing and brushing might almost as well not have been done, for the dust in your hair has merely been shifted to your comb and brush, and unless removed by cleansing, will be merely transferred again to the hair.

A brush can be cleaned by rubbing it briskly upon a towel. A comb can be wiped thus or with a piece of tissue paper. But they should be dipped every fortnight at least in soapy water, into which a teaspoonful of ammonia has been sprinkled.

The toilet table should be furnished also with a tray or box containing the manicure utensils. The orange wood stick should be ready for cleansing the nails and pushing back the skin that is anxious to encroach upon the nails. In a drawer there should be a package of medicated cotton. In a flask on the toilet table there should be a little peroxide of hydrogen. This not to “touch up the hair,” but to serve two worthier purposes. The orange wood stick wrapped round with a bit of the cotton and dipped into the peroxide--or better, the peroxide poured upon it--will quickly cleanse the end of the nail that has been darkened by dust. The peroxide is also valuable for a gargle, or to give the mouth one of the frequently necessary baths.

In one of the little silver or ivory or enameled boxes, of which a toilet table cannot have too many, there should be a little powdered pumice stone. When the daily scrutiny reveals dark stains upon or between the teeth, apply this pumice stone by dipping an orange wood stick or a hard round toothpick into it and gently rubbing with them the stained surface. Never use a toothpick for this purpose, for this would scratch the tooth and erode the enamel.

One of the toilet bottles on my dressing table I always keep filled with rosewater. This is soothing when the face is fevered, and is always grateful and healing to the skin. In another bottle I keep a strong toilet vinegar to inhale or to sprinkle about my neck to revive me when I am fatigued. This vinegar beauties of the time of Louis XV used to brighten their complexions by sprinkling it upon their faces when they were fatigued or indisposed. It is composed of:

Honey, 6 ounces; vinegar made of white wine, 1 quart; isinglass, 3 drams; nutmeg, ½ ounce; shredded red sandalwood, 1 dram. Place all these in a bain marie and allow the mixture to simmer, but not boil, for a half-hour. Cool, and strain through silk or cheesecloth. It is well to use this lotion after giving the face a bath of cream or of warm water. It is an excellent preparation for an evening toilet, but is too strong to leave on the skin over night.

This also is agreeable:

Rosewater, 1 quart; tincture of opopanax, 20 grams; tincture of benzoin, 20 grams; tincture of myrrh, 20 grams; essence of lemon, 8 grams.

In one of the little boxes I keep also these pastilles to freshen the mouth that has grown feverish:

Pulverized licorice, 7 drams; vanilla sugar, 3 drams; gum arabic, 5 drams.

This, if there be a tendency to sores in the membranes of the mouth, will allay them and purify the mouth:

Oxide of zinc, 60 grains; spermaceti ointment, 1 ounce; attar of rose, 2 drops.

A powder box or jar should always be kept tightly closed to keep out intruding dust that might easily slip beneath a carelessly placed lid. This powder, recommended by the famous Dr. Vaucaire, is admirable:

Rice flour, 3 ounces; rice starch, 3 ounces; carbonate of magnesia, 1½ ounces; powdered boric acid, ¼ ounce; orris root, ½ ounce; essence of bergamot, 15 drops; essence of citron, 8 drops.

No toilet table is complete without a nasal atomizer to be used night and morning, if you desire, but certainly whenever a cold approaches or is in progress. This should be filled with strong salt water or borax water in the proportions of:

Water, 2 ounces; borax, ½ ounce.

Your dressing table should be supplied with the creams and other remedies which personal experience has taught you are best suited for your skin. One of my favorite face creams was the invention of the famous Queen Elizabeth of Hungary. It is made like this:

Oil of rosemary, ½ ounce; oil of lavender, 2 drams; oil of petit grain, 30 drops; tincture of tolu, 4 drams; orange flower water, ½ pint; rectified spirits of wine, ½ pint.

Mme. Sarah Bernhardt long used this skin tonic. It was adapted to that wonderfully preserved woman’s naturally moist and oily skin. For a skin that is dry and inclined to eruptive blemishes it might prove irritating. It was composed of:

Boiling water, 1 quart; sea salt, 5 ounces; alcohol, ½ pint; spirits of camphor, 2 ounces; spirits of ammonia, 2 ounces.

This, used by the beauties of the deposed Sultan's harem, gave a complexion said to be the most beautiful in Europe:

Sweet almond oil, 4 ounces; white wax, 320 grains; spermaceti, 320 grains; powdered benzoin, 100 grains; tincture of ambergris, 60 grains; pulverized rice, 320 grains.

Adelina Patti, whose complexion has survived her voice, was long presumed, because of someone's misquotation of her words, to never use soap. The truth is, as I very well know, that she used a mild soap every night to wash her face before retiring. She insists that her face could not be really clean without it. During the day she cleanses it from dust by the use of any pure cold cream that is available.

Mrs. Langtry, too, is an advocate of soap for the complexion. A pure, simple soap she uses at least once a day, sometimes oftener.

Turkish women believe in the free use of soap. It was a princess, wife of the physician of the present Sultan, who gave me this recipe for a soap that will cleanse and soften and whiten the skin. The women of the harem regard it as the first aid to a beautiful complexion:

Shave very fine one pound of white olive (Castile) soap. Place in a porcelain kettle, covering it with cold water. When the soap has been softened by the heat and mixed with the water stir into it one-half pound of oatmeal. Mix this well. When thoroughly blended take it off the stove and when the mixture has cooled, form with the hands soap balls as large as a walnut. Or the soap can be used warm in its liquid state.

This face lotion is a favorite of the harem:

Juice of 3 lemons; glycerine, 50 grams; cologne water, 10 grams.

Egyptian women believe that the face should be bathed three times a day with hot water. The Chinese women, singularly, produce the same effect of a smooth skin by the use of cold face baths. The American habit of cleansing the face simply by cold cream had its origin in India, where women cleanse the face with vegetable oils.

A princess of the Khedive's court in Egypt told me that hot water ablutions, followed by an application of this liquid, would keep any skin fair and smooth. Certainly the clear brown of her complexion was a recommendation of the habit. The recipe is this:

Rose water, 100 grams; tincture of benzoin, 10 grams.

The women of China, Turkey and Egypt have faith in the efficacy of the juice of the beet. While in all those countries it is used as a paint many of the women have told me that they bathe their faces in it for the tonic effect of what they term the blood of the beet. They then remove the stain with tepid water.

Dust is one of the worst enemies of beauty. It settles in a dim, dingy veil upon the face, causing it to look ill kept, in a word, dirty.

To keep the face cleansed from dust keep always a bottle of olive oil and a companion bottle of witch hazel on your dressing table or toilet shelf.

Before going out pass a bit of cotton or a piece of soft linen that has been moistened in the oil over the face. Protect the face further by dusting it with rice powder.

Returning from out of doors remove the powder and dust by washing the face with yet more olive oil applied in the same way. The danger of the olive oil turning the skin yellow--for that fear exists in many minds influenced by the adage "Yellow makes yellow"--can be removed by adding to two ounces of olive oil, one half ounce of almond oil and twenty drops of tincture of benzoin. Before retiring the face should have another of these oil baths, unless you prefer to use the cold cream which is more unwieldy and so less quickly cleanses.

Strong salt water or a mixture of bicarbonate of soda in the proportions of a teaspoonful of bicarbonate of soda to a glassful of water, are admirable throat cleansers.

To keep the nails guiltless of the gray or black rim that so offends the sight, it is not enough to wrap cotton about the point of an orange stick and remove the accumulated dust. The hands must be washed often, even though not soiled, to remove the dust from beneath the nails. And if the nails have become ragged beneath the edge, which causes the dust to thickly and obstinately collect there, thrust them into soap jelly into which you have poured a half dozen drops of ammonia, or into a cake of soap well softened by

lying in the water and allow this to remain under the nails for a few minutes to do the work of cleansing.

Perhaps the skin of your face is very pale, as though every drop of blood had been drained from it, and the fact that your stock of vigor is below par is shown by the dry texture and loose condition of your skin.

Refresh it by giving it a cologne bath. Pour a few drops of cologne over a piece of gauze and pat the face lightly with it. This will coax the blood quickly to the surface. Or soak a square piece of flannel in olive oil and place it over the face. The skin absorbs this oil, and in a short time looks much fresher.

Should you, despite your tired, bloodless aspect, have to be seen in public, bathe the face in tepid water, using handfuls of almond meal, wet with a few drops of benzoin instead of soap. Then dash cold water upon the face. This soon calls back the color that has forsaken the visage.

Many Englishwomen follow the sensible practice of “giving the face a drink.” For proof of the efficacy of this carry to your bathroom a drooping, dying plant. Turn upon it with the rubber spray a shower of cool water. Instantly the fainting plant revives.

Just as grateful as was this plant for its needed draught is the skin that is parched, in the first stage of the dreaded, withering process, for its “drink.” The English woman closes her eyes, holds her breath and thrusts her face deep into a bowl of cool water. She keeps it thus submerged as long as she is able. Then, raising her head, she breathes deeply and again thrusts her face into the water. She repeats this face drink five or six times, keeping her face in the water as long as her suspended breath will permit. Wiping the moisture off with a soft cloth, she is amazed to see the response of her complexion to the treatment. Her skin seems transformed from a brownish white parchment, crossed and criss-crossed by the faint etchings that portend wrinkles, to a smooth pink and white silken surface.

Your skin should be one of the livest things in your entire makeup, yet it is that part of you which oftenest looks lifeless. A “dead” skin, as specialists know it, is pale and withered looking. It is seamed with fine lines and looks absolutely devoid of moisture.

There are many methods of remedying this regrettable appearance, which adds many years to a woman’s apparent age, and which must, by some means, be avoided.

The fundamental remedy is a change of diet. A father’s advice in a recent play, “Eat two apples and drink a glass of water before going to bed” was laughed at as old-fashioned, yet there is no better beauty rule, having the skin in mind. It gives nature prompt and powerful aid in cleansing the interior of our bodies, and without this unclogged interior there can be no clear, live skin. A mottled, pimpled skin is an infallible sign of an unclean interior.

But the apples eaten at night are not enough. Drink lemon juice slightly diluted with water in the morning. The juice of an entire lemon pressed into the glass and diluted with the same quantity of water will cleanse the stomach and aid in clearing the skin.

A remedy for a dead looking mottled skin is a teaspoonful of grape juice with the same quantity of olive oil night and morning.

A French remedy for a faded skin is to eat a small plateful of water cress with salt every day. The beauties of the harems of Constantinople rely upon any green salad eaten at breakfast with much salt for the same purpose.

Sometimes these internal remedies must be supplemented by external aids. One of the best is to moisten coarse cornmeal with milk and, filling the hands with it, scrub the face gently yet with vigor. The friction opens the pores and relieves the muddy looking skin of the poison which has choked them.

A woman whose skin at fifty is as fresh as a girl’s told me that she would as lief retire without saying her prayers as without ironing her face with ice. This causes the blood to flow to the surface, refreshing and feeding the skin.

Cold cream is needful for most complexions but not for every one. A good test of your needs is to pat cold cream into the skin and note whether it quickly absorbs it. If so the skin is hungry and requires daily feeding.

Cocoanut oil, if secured in its purest state is an admirable skin food. Olive oil feeds the skin well but there is a deep rooted objection to its too frequent use because it is charged with making the skin yellow. The owner of one of the best complexions I know, a lovely French woman, feeds her skin by nightly baths of the following:

Olive oil, 3 ounces; almond oil, ½ ounce; benzoin, ½ ounce.

In this case the olive oil's tendency to make the skin yellow, if such a tendency lies in this greatly remedial oil, is neutralized by the presence of the benzoin, which is a whitener. The benzoin has still another office useful to those whose skins have become flabby. It is an astringent drawing the relaxed skin up into the desired tightness.

Primarily the cause of most facial blemishes is indigestion. To remove an effect, one should always try first to remove the cause. Most women have some form of indigestion, and it is due to one or both of two bad habits. One is eating harmful things. The other is not drinking enough water.

Here are ten things I beg women never to eat: Sausages, dried fish, pies, bonbons, puddings, ice cream, beef, except when well roasted, pork, especially ham, oysters, unless one is absolutely certain of their freshness, hot bread, as usually made in America. I am opposed to the practice of drinking hot water. Instead of being an aid to digestion, it is a hindrance. Granted after a heavy dinner, when the sense of overfulness oppresses us, a cup of hot water, slowly sipped, aids digestion. But this should be used only in emergencies. The regular habit of drinking a great deal of hot water is harmful, for when the stomach is flooded with it the gastric juices go on strike. Finding the intruders there they refuse to do their work and retire. And the hot water is left to do the work, ineffectively and alone. So the hot-water habit seems to me a distinctly bad one.

Light foods, as chicken, fresh fish, beans, spinach and beets, containing iron, and stewed fruit, slowly eaten and well masticated, are excellent for the complexion.

Three quarts of water a day should be drunk to keep one well, which state a good complexion always follows. Drink three tumblerfuls on rising, and while you are about your morning toilet. Sip, do not gulp, it. If you are not thirsty, drink it anyway. That morning bath for the stomach is imperative. At each meal it is permissible to drink one glass of water, slowly sipping it.

For the work of cleansing the stomach I should advise a half teaspoonful of soda taken in a wine glass of water every morning. If the disorder is very pronounced I should repeat the dose after each meal for three or four days. Bicarbonate of soda, like other good things, may become a bad thing if used in excess. I am grateful to the Paris pharmacist who gave me this warning.

Pulverized charcoal is also an excellent corrective for the stomach which is tired or rebellious. One teaspoonful every morning and one after each meal is as good as a broom in the stomach.

Large, red splotches appear upon the face sometimes, seeming to try to burn their way out. This literally they are trying to do. An excess of uric acid causes this condition, and it is best to consult a physician about a cure, for it is the parent of rheumatism. If a consultation is not convenient, then diet, diet, diet.

Eat no more fruit in the morning. Eat it only at noon and night. Let the breakfast be most simple, of some coarse cereal, or crusts of coarse bread; and avoid rare meats, especially beef.

But a beauty complains that there are spots on her face and yet she must shine at a ball to-morrow. There is no time for diet, for consulting a physician, for any of the thorough roads by which one arrives at the goal of a good complexion. What she does must be quickly done.

Very well, then. A pimple mars the curve of her lovely chin. What shall be done? Use acetone.

Acetone is a colorless, ethereal liquid. It has been used chiefly to dissolve fat and resins. It is effective for asthma. Under the form of a fifty per cent. solution, with two per cent. of iodide of potassium, it has been much used in hay fever and similar irritable conditions of the respiratory tract.

Into a one-ounce bottle of acetone dip the wooden end of a match and press it upon the pimple. Then with a silk sponge or bit of absorbent cotton saturated with alcohol press the spot to disinfect it and neutralize the acetone.

Another of the hasty remedies which I would recommend is:

White zinc, 1 ounce; a pure cold cream, 1 ounce. Mix these thoroughly together and apply with a bit of cotton cloth to the pimple.

For blackheads, I have successfully used an entire face bath of a four per cent. solution of borax, wiping it off soon after and giving it a second bath of rosewater to soften the skin.

An ointment prescribed by a great French physician, whose specialty was treatment of the skin, is made up of the following ingredients:

Ergotine, 3 grams; oxide of zinc, 7 grams; vaseline, 30 grams.

Another that is quickly efficacious is:

Precipitate of sulphur, 1 dram; tincture of camphor, 1 dram; glycerine, 1 dram; rosewater, 4 ounces.

A third, that is more agreeable in its action than the last, consists of:

Bicarbonate of soda, 36 grains; distilled water, 8 ounces; essence of roses, 6 drops.

I have seen pimples removed by a half dozen applications of bicarbonate of soda, dampened slightly, and placed with the tip of the finger upon the irritated surface.

Another simple remedy for splotches or pimples is this:

Bicarbonate of soda, 36 grains; glycerine, 1 dram; spermaceti ointment, 1 ounce.

This should be applied with absorbent cotton, allowed to remain on the affected part for a quarter of an hour, and removed.

For the blotched condition of the skin, which is caused by sun in summer and wind in winter, if the skin be delicate, I recommend this:

Borax, ½ dram; glycerine, 1 ounce; elder flower water, 7 ounces.

Steaming is often recommended for cleansing the face. I do not use it because I think its tendency is to make the skin too delicate, to detach it from the muscles and to cause premature wrinkles.

I am often asked how to remove moles. I answer, “Do not remove them. In the time of Marie Antoinette they were regarded as marks of beauty. Let them alone.” But if anyone insists, I say then go to a physician and be by him guided. Probably he will remove them by electricity, but I am afraid--afraid.

Indigestion is the great foe to the complexion within. The foe to be feared without is the careless use of powders. Powder judiciously used, especially at night, is an aid to beauty. Its use in the evening is an indication of refinement. And a dainty powder fluffed upon the face before going out, especially if cold cream has first been applied, is an excellent protection from the cold or heat or from a high wind. But it is absolutely necessary that the powder be pure. Rice powder is harmless to the skin. It protects the complexion as would a fine veil. And it removes the disagreeable “shine” upon the skin that makes the best-groomed woman look vulgar at night.

This powder I have found most valuable:

Rice flour, 6 ounces; rice starch, 6 ounces; carbonate of magnesia, 3 ounces; boric acid, 1½ ounces; powdered orris root, 1½ drams; essence of bergamot, 10 drops; essence of citron, 15 drops.

CHAPTER II

HOW TO MAKE YOUR NECK BEAUTIFUL

It is a most decided advantage to be born with a beautiful neck, as it is to be born with beautiful features, a beautiful figure or beautiful hair. It is one of the compensations of being overplump that the woman of too ample lines has a beautiful throat and arms. While the thin woman, whose features are well defined, not being blanketed by superfluous layers of flesh, and whose figure is more elegant because not swathed by adipose tissue, has, as a rule, a scrawny neck and whip-like arms.

The neck to be beautiful must be neither too long nor too short, too fat nor too lean. It must be shapely; that is, evenly developed. The skin must be soft and white.

The length of the neck is one of the fixed quantities of nature. One cannot change it, but we can learn the lesson of illusion from the stage, and try to make it seem longer or shorter than it is. The best aid to this is the poise of the head. The woman whose chin is carried well up, whose poise of the head is habitually high, gives the impression that her neck is at least an inch longer than it is. Also the manner of the trimming of her high-neck gown and the line at which the low-cut gown is finished determine whether the neck looks longer than it is or shorter.

If the neck is short the collar should be of solid colors or be trimmed with perpendicular lines. The low-necked gown should be cut lower than that of the woman with the long neck, for the neck is more dependent upon its surroundings for its effect than is any other part of the body. If there is a wide sweep of the shoulders the long line from the point of the shoulder to the chin will lend itself to the neck and make the neck seem longer than it would if the gown were merely one of the collarless sort with a line of cloth defining where the neck actually begins.

If the neck is long the problem is an easier one, especially at times when much dressing for the neck is in vogue. Even an ostrich's neck could be so wrapped about with laces, with collars and ties of a contrasting color which would cut the apparent length, that it would be far less conspicuous than unadorned. I should say it could be made to look a foot shorter. The human neck can be dressed to make a proportionate change of appearance. The extremely low décolletage is less becoming to the woman with the long neck. If she must adopt it, or thinks she must, she should wear her jewels or a band of ribbon about her neck to make her neck seem shorter. The drooping Madonna poise of the head may be becomingly affected by the woman with the long neck, especially when sitting for her photographs.

The neck, I have before said, must be neither too fat nor too lean. To correct either too much or too little flesh upon the neck we must summon the aid of that lieutenant to beauty, massage. On the beautiful neck the flesh is evenly distributed. The neck should be, save for the two parallel lines about an inch apart which encircle the neck and are seen on the necks even of babes, perfectly smooth. If the flesh be uneven, persistent, skillful and gentle massage should redistribute the disproportionate bulk of flesh.

There is always a possibility that the neck will be flat in front and display thick layers of fat at the sides and back. This can be corrected by patient and careful massage. The front of the neck should be made plumper by massage. Olive oil or a pure cold cream should be freely rubbed into the skin by the first three fingers of each hand, massaging first on the right side of the neck with the right hand, then on the left with the left hand, then with both hands together. The motion should be a rotary one, always the best movement for rebuilding tissue because it induces circulation, which feeds the starved, atrophied portions.

To reduce the bulk of the back and side of the neck a reducing lotion should be applied by long, sweeping, downward strokes, the effect of which strokes is to melt the flesh downward into the larger masses of flesh on the shoulders. A lotion I have known to be used with success for the melting away of too ponderous flesh about the neck is this:

Tincture of iodine, 30 minims; iodide of potassium, 60 grains; hyposulphite of soda, 20 grains; distilled water, 7 ounces; aniseed water, 170 minims.

Be careful not to tamper with and so enlarge the large glands in the neck. Enlarging them may permanently disfigure a beautiful neck. They are the danger points of the manipulation. It is they and the gorged veins that give to a neck that aged, withered appearance which we describe by the word "ropey." Once these glands are enlarged and the veins swollen there is no art in beauty lore to diminish them. Perhaps a physician can reduce their size, but I have never known it to be achieved.

For the "aged neck" there is almost no hope. Mme. Sarah Bernhardt realized this, and while combating all the other signs of her increasing years, yielded to the demands of the neck that was no longer young, and covered it. The collarless gown is not for her. Always she wears a high-necked gown, or, if circumstances require, a costume décolleté, she wears a ribbon of velvet or a collar of jewels about her throat.

For battling against the ageing neck I can give no better recipe than this for a massage cream, which should be plentifully applied night and morning:

Glycerine, 5 ounces; mutton tallow, 1 pound; tincture of benzoin, 2 drams; spirits of camphor, 1 dram; powdered alum, ½ dram; orange flower water, 1 dram; Russian isinglass, 2 ounces.

If the neck is thin, but the veins and glands are not enlarged, there is hope. The skin must be fed by cold creams and the circulation promoted by massage. The rotary motion with the first three fingers of each hand is the desirable one. Fifteen minutes should be spent night and morning in this massage. One nourishing massage cream especially excellent for the neck is this:

Oil of sweet almonds, 10 grams; lanolin, 15 grams; tannin, ½ gram.

A successful fattening cream for the neck contains:

Alcohol (95 per cent.), 20 grams; lard or cocoa butter, 100 grams; essence of rosemary, 12 drops; essence of bergamot, 12 drops.

A third and most important essential is that the skin of the neck be white and soft. To secure this effect one must, as you say in America, “start right.” First prevent stains upon the neck.

A stained neck is always a revolting sight. A dark, shadowy rim about the neck may have been caused by dark collars and there may have been valiant efforts to remove it, but if they have not been successful I beseech you wear only high-necked collars until the stain is removed. The casual observer at a dinner or a ball will make no allowance for the cause, the stain-communicating collar of colored net or some other fabric. To him your neck will be soiled. That is all and that is very much.

To prevent such stains avoid wearing dark colors next to the neck. If the dark collar is unavoidable then line it with something soft and white, old muslin or part of an old silk handkerchief.

But, having acquired the dark, shadowy look about the neck that is so repellent remove it as soon as possible. A thorough sponging with peroxide of hydrogen, full strength, followed immediately by another bath of rose water, I have found excellent.

Or there may be frequent baths with this preparation, which is admirable for bleaching:

Glycerine, 1 ounce; rosewater, 1 ounce; carbolic acid, 10 drops; tincture of benzoin, 10 drops.

This home remedy is useful when less drastic remedies are not at hand:

One-half lemon; one small tumbler of water. Squeeze the lemon juice into the glass. Bathe the neck frequently with the mixture.

For those, and there are many, among them experts, who do not wish to use the peroxide of hydrogen full strength, I would recommend:

Peroxide of hydrogen, ½ wineglass; witchhazel, ½ wineglass.

To bleach a neck that is too oily this used once a day for three successive days is helpful:

Rosewater, ½ wineglass; ammonia, 5 drops. Use this sparingly, for the action of ammonia upon the skin is to make it exceedingly dry.

The woman who would have a beautiful neck must consider it even in repose. She should never use a high pillow, preferably no pillow at all. For when the head rests upon the pillow, the chin falls upon the breast. The muscles of the neck are contracted, wrinkles are formed and muscles become flabby. Lying on the back is the best posture for sleeping. The muscles of the neck are thus given full play and rest.

Many times I am asked “If you had a mole on the neck what would you do?” I would let it remain there, and be thankful that I had a distinguishing mark, a beauty spot. But if you insist upon removing it a physician might try electricity.

I have been asked how to remove superfluous hair from the neck. I should not remove it, for I should not regard it as superfluous. Why do American women so dislike hair upon the face and neck? There should be a fine covering of hair. It is beautiful. It is like down upon the peach.

Sometimes the collar supporter, or a pin or hook used for fastening the collar, scratches the neck. For these or any other bruises of the neck I should first bathe the injured part with absorbent cotton dipped into peroxide of hydrogen. If the bruise is severe I would apply collodion or court plaster to protect it from air-floating germs, while healing. I would remove these by moistening them with alcohol. If this precaution is not taken a bit of the skin or flesh might adhere to the application, so causing a scar. When the new skin is formed, covering the wound, and it is no longer very sensitive, I would massage it gently once a day. This relieves the congestion and gradually removes the disfiguring red line that might remain as a trophy of the adventure.

A traveling companion of mine once scraped her neck against a deck railing while the ship tossed. She treated it as I have advised and when there still remained a broad pink stain as a souvenir of the accident she massaged it very lightly every day for a fortnight, when the pink stain utterly disappeared.

If your neck is suffering from wearing a too high collar I recommend one of the following recipes:

Equal parts of peroxide of hydrogen and water. In extreme cases there is no objection to a neck bath of pure peroxide of hydrogen.

Equal parts of alcohol (95 per cent.) and water.

Equal parts of lemon juice and water.

Water, ½ pint; ammonia, 1 dram.

Still another remedy is to scrub the neck with a soft complexion brush dipped into a warm lather of Castile soap with a few drops of ammonia added.

In summer when the neck becomes tanned and blistered by the sun massage it with a pure, cold cream and bathe it frequently with a mild solution of peroxide of hydrogen.

CHAPTER III

THINGS TO DO FOR THE EYES, EARS AND NOSE

As with all other parts of the body, the beauty of the eyes depends upon their health, and their health depends upon care. The eyes have two arch enemies. They are fatigue and dust. To keep the eyes beautiful one must avoid the one and shun the other.

Do not read too much. I never read at night. Artificial light destroys the luster of the eyes. At night we constantly strain the eyes to get more light, and the strain makes a network of fine lines about the eyes. Never read on the train, no matter how long the journey. It is five days from New York to San Francisco, and many persons make that journey several times a year. But if they have regard for the beauty of their eyes they take no magazines or books on the train with them and they buy none on the way. It is quite as good a mental exercise to spend the time on a railroad journey thinking of what you have read, and of what you have learned in reading the book of life, as to read something new, and it is a thousand times better for the eyes. At its best a railway journey is a severe tax upon the eyes as upon the nerves and the complexion. I spend as much of the time as possible in a reclining position with my eyes closed.

When the journey is at its end I send at once for a solution of adrenalin. The proportions and quantity of the solution I always leave to the druggist. I would not take the responsibility of prescribing the amount for myself, and so will not for another. Adrenalin is derived from the supra-renal glands of animals. A solution of it applied frequently to the eyes rests them after a severe strain. I know of nothing more refreshing and immediately rejuvenating, but I insist that it must be used only after a physician has prescribed, or by the advice of the pharmacist, who will tell you what under the circumstances is a safe solution.

I said I do not read too much. An hour and a half a day, and that at two or three sittings, instead of continuously, is enough. Close study of a printed page is dangerous to the eyes and to other attractive features of a woman’s face.

For the sake of the beauty of the eyes--and there is no greater beauty--I utter now a different warning. If you would have beautiful eyes don’t drink too much. A glass and a half of wine at a meal is enough. A pint of wine a day is all that any woman who wishes to be beautiful should permit herself, and that only if she has been accustomed to drinking wine. Too much drinking makes the eyes bloodshot. It congests the blood vessels in them, causing disfiguring little red streaks in the whites of the eyes. It causes also a congested condition that inflames the lining of the lids.

When the eyes are tired the thing to do is to rest. Go to your room. Loosen your clothes. Lie upon your back and place upon your eyes a hot compress. Make the compress in this way:

One gill rosewater; one gill witch hazel. Heat this mixture and when it is nearly at the boiling point dip into it a bandage of soft linen, or of absorbent cotton, and press this upon the eyes.

Sometimes a friend of mine points to her yellow eyeballs and says: “What shall I do to make them white?” I answer: “You are bilious. You must cleanse the liver and the stomach. A physician or a pharmacist can best tell you how to do this. But if you do not wish to go to either try a semi-fast. Eat only half as much at each meal as you have been doing, and drink water freely. We need three quarts of water a day to keep the body in health. If the system has reached such a condition that the eyeballs are yellow then that quantity should be increased by one-half. Water drinking is a necessity that should become a fixed habit.

Every morning at rising we should drink at least two glassfuls of cold, but not ice water. If the stomach is very delicate it would be better that the water were warm. If cold it should be sipped, not tossed off at a draught, because by the time it reaches the stomach it should be as warm as the lining of the stomach itself, to prevent chilling that important organ. Throughout the day a good deal could be drunk and the remainder should be drunk in a leisurely way at night. It is well under the most ordinary circumstances to

drink two or three glasses of water before retiring. For the woman with the yellow eyeballs a half teaspoonful of bicarbonate of soda or of pulverized charcoal could be taken to advantage in a glass of the water at morning or night. Also I should advise for this woman exercise out of doors.

For the daily care of the eyes there should be two baths. The body must have its bath. The face must have its cleansing. Why not the eye, especially as the eye, with its thick lid and the fringe of eyelashes, is a dust trap, and the slightest speck of dust allowed to remain beneath the lid may cause inflammation of the lid and irritation of the eye.

For the eye's daily bath I offer you the choice of several lotions. My favorite is:

Ten ounces purest rosewater. Apply with an eyecup, turning the eyecup upside down so that the half open eye is completely washed by the contents of the cup. Hold it thus for thirty seconds, or, if not uncomfortable, a full minute. Throw away this rosewater. Rinse the glass and give the eye a second bath. If the eyes are irritated the bath can be repeated several times. Ordinarily a bath in the morning on rising and another at night on retiring are enough.

One ounce elderflower water. Some of my friends who have beautiful eyes prefer this to rosewater. It is equally good. Apply it in the same way.

Another excellent eyebath is:

One-half ounce witch hazel; one-half ounce distilled water. Shake well in bottle and apply with an eyecup.

One other bath is excellent:

Six drops boracic acid; one wineglass distilled water. Shake well before applying.

Salt has its advocates. Certainly salt is stimulating to tired eyes, but I would only use it in emergencies. Then once a day, before retiring as follows:

A pinch of salt in an eyecup of cold water. Use with the eyecup. Also bathe the lids with a bit of cotton dipped into the salt water.

A bath of borax water is beneficial and has the advantage of always being convenient. Even while traveling one may carry a box of borax. Futhermore, it is safe, because borax will only form a four per cent. solution, that is, four per cent. of it only will be absorbed by water. A borax bath is strengthening. If the eyes be delicate or the person so prejudiced against experiments that she is not willing to introduce this substance into the eyes, a silk sponge or a soft cloth dipped into borax water and pressed upon the eyelids is efficacious, soothing.

The old fashioned home remedy of cold tea leaves pressed upon the lids has value, not from the tea leaves intrinsically, but from the cool, moist contact. Cloths dipped in water are quite as good.

Whatever reduces the fever and inflammation in eyelids makes for the beauty of the eyes. And here a word of warning. If the lids become granular, that is, if tiny lumps form inside the lining of the eyelid, don't attempt to cure them yourself. Give yourself over to a physician's care.

There is nothing more disfiguring or dangerous to the eyes than these irritating little lumps. They are caused by eye strain and if the strain be removed the granules are likely to disappear. If, however, the case is far advanced it needs medical treatment.

As the greatest enemy of the beauty of the eyes is strain, so the greatest friend is rest. If my eyes were losing their brightness I should first of all rest. But rest may be taken, to use the druggist's phrase, "in small doses." If I am too much engaged to go into a dark room and rest for days I can at least rest my eyes by taking extra sleep. From the standpoint of beauty every one should retire before twelve, to give the eyes sufficient rest.

And there are twenty chances a day to close the eyes for a few minutes. Say five minutes at a time, and twenty times. There we have one hundred minutes. Those chances can be taken on the Subway, the "L" trains or in the surface cars. Often have I seen a man on a train admire a young woman for the demure, downcast glance of her eye. He thinks that is one of her individual lures. Silly man. The girl doesn't know he exists. She is merely taking an eye rest. When you are bathing your face, when you are massaging it, when you are brushing your hair, while you are being manicured or pedicured--there are countless opportunities to give the eyes the rest they need. Try it for three days and the results will amaze you.

Never use preparations in or upon the eyes, unless you have them analyzed. Do not count the cost of analysis. What are a few American dollars or French francs or Italian lire compared with beauty!

Never use any toilet article without such analysis. And even after you have used the preparation for a time it is wise to again submit it to another analysis, for when an article has secured its vogue through excellence I am sorry to say that manufacturers oftentimes increase their profits by cheapening the ingredients and adulterating the article.

The surroundings of the eyes are as important as the eyes themselves. Keep lines away from the eyes by keeping them well rested. Also massage lightly about them for four or five minutes. Never longer, because too much massage will tire the exceedingly delicate muscles about the eyes and cause them to sag. Massage them at retiring with any good cold cream.

Rub with light rotary motion, with the tips of the second and third fingers, outward and away from the corners of the eyes. With the same fingers stroke the muscles that lie along the upper edge of the cheekbone. The stroke should be a slow, sweeping one from the lower corner of the eye to the edge of the hair line. Never touch the soft, flabby skin beneath the eyes. It will make wrinkles. A third, valuable stroke is above and along the upper edge of the eyebrows. It is most soothing and restful.

The eyelashes depend for their length and beauty upon the condition of the eyelids. Do not allow them to become inflamed. If they are irritated the lashes will be weakened and will stop growing, or will fall out. To make them grow long and evenly they should be clipped two or three times a year.

If the eyelashes grow thin or unevenly it may be because the eyes are strained and the lids inflamed. To remedy such a condition I recommend either of the following prescriptions:

Rosewater, 1-3 glass; witch hazel, ½ glass. Warm and apply by opening the eye when covered by the glassful of the mixture, thus giving the eye a thorough bath.

Camphor water, 1 ounce; powdered borax, 3 grains; infusion of sassafras-pith, 2 ounces. Apply with an eye-dropper, the glass tube with rubber bulb that can be obtained in any drug store. Apply as frequently as is needed to allay the inflammation.

The growth of the eyelashes can also be promoted by frequent brushing with an eyelash brush, also by carefully clipping the ends twice a year. Brush the lashes upward and the brows toward the temples, training the arch to be high and piquant. For eyebrows that are weak and thin this lotion is excellent and should be applied frequently:

Sulphate of quinine, 10 grains; oil of sweet almonds, 2 ounces.

The eyebrows should be kept clean by brushing with a tiny eyebrow brush. A half dozen strokes upon each eyebrow is enough. The lashes should be brushed upward. That makes them curly. Sometimes eyebrows grow unevenly. They begin well, but end drearily, in a straggling line of sparse hairs or in no hairs at all. Massaging the scant parts of the eyebrow with lanolin will improve them.

Here is a most excellent tonic for the brows, and indeed for the hair. Applied three times a week it will give the hair a fine stimulus toward growth. You can get from the druggist a smaller quantity than I describe but the proportions should be as follows:

Tincture of vanilla, 6 grams; tincture of carnation, 10 grams; Peruvian balsam, O.65 grains; alcohol, 450 grams; oil of bergamot, O.45 grams; oil of lemon, O.90 grams; quinine, 0.40 grams; infusion of civet, O.10 grams; infusion of musk, 0.10 grams.

Sometimes the eyelashes show a bothersome tendency to curve inward, usually on the lower lid. To insure comfort and avoid dangerous irritation of the eyes they should be removed by careful manipulation of hair forceps especially made for the purpose.

Girls often ask me how to make their eyelashes darker. There are dyes or stains for eyelashes, but I do not recommend them. In themselves hair dyes are likely to be injurious. The application of one of them to the eyelashes by an unsteady hand might permanently injure the eyes.

Eyelashes are often too light because they are faded. To restore them to their original color, clipping the ends carefully and slightly every two months may strengthen and stimulate and so darken them. This pomade is in common use in France:

Red vaseline, 1 ounce; tincture of cantharides, ½ dram; oil of lavender, 8 drops; oil of rosemary, 8 drops. _Apply with the utmost care so that none of it gets into the eyes._

If your eyelids are encrusted when you wake up in the morning don't attempt to remove the incrustations until you have moistened them with a lotion from your eye cup. The best one for this purpose is made by dissolving an ounce of boracic acid in a pint of rosewater.

Styes are ugly and disfiguring. In their first stages they can be removed by applying ethereal collodion with a camel's hair brush. If the condition has progressed far, a tiny flaxseed poultice soon brings it to the "ripe" stage, after which it can be lanced by an ordinary needle, that has been sterilized, by passing it through fire.

If your eyebrows are straggly and uneven, and in places very thin, use an eyebrow brush twice a day. Every morning and evening brush the brows, giving them at least twenty-five strokes each and being careful to brush in the direction you want them to grow. In this way you can do much to cultivate the beautiful arch. It will also remove the dandruff that is likely to accumulate about the eyebrows. Massaging the brows at night with lanolin is also helpful.

The greatest menace to a business girl's beauty is that of eye strain. The danger that this eye strain will produce wrinkles between her eyebrows, will inflame the lids and cause the eyelashes to fall out, and will dim the brightness of the eyes and produce the tired expression of the old or of those who are devitalized by age or overwork is great.

These tendencies she must balance by greater care than the woman in her home gives to her eyes. Since the strain during business hours is excessive she should not add to that the further strain of reading on trains or by lamplight. This will cause some intellectuals to cry out: "La Cavalieri would empty our girls' heads." No, but the purpose of these articles is to reveal beauty secrets, and one of the secrets of beauty is to keep the eyes clear, bright and untired. Therefore, I repeat that the beauty in business must not read on the moving train. Nor must she read by lamplight. The best use she can make of her eyes for beauty's sake while upon a train is to close them, and her brothers or sisters would better read to her at night.

She can save the strain upon her eyes by closing them for a few seconds at a time several times a day. They as well as her face must have their daily bath, better two daily baths, one in the morning and one in the evening. The baths may be of equal parts of witch hazel and warm water, or of warm water into which a half dozen grains of boric acid have been sprinkled, or a full cupful of rose water.

And the girl who would keep her eyes beautiful must have plenty of sleep. She should sleep at least eight hours a day, more if her system requires it. If she can take a quarter or half an hour's nap after coming home from business and before her evening meal or before going to the theater or a dance, she will find her tired eyes have regained much of their luster.

Before I finish my advice about the eyes I must not forget to give still another formula which is excellent for bathing them:

Salt, ½ grain; sulphate of zinc, ½ grain; rosewater, 4 ounces. Mix with an equal quantity of water and apply with an eye cup.

The eyes tire most easily in summer and that is when they should be given an extra amount of rest and attention. Rest them from the glare of white country roads by wearing smoked glasses. Rest them by giving up the distractingly becoming but eyes-torturing, crossbarred, myriad dotted veil. Read little. Persuade your beaux, your little sisters or your maids or poor relations to read to you. Close your eyes while you listen. Don't read in a hammock nor on a lounge. Don't read on a train. Don't read in a room dimly lighted "so that it will keep cool." Rest the tired eyes by plenty of sleep at night and an afternoon nap.

Bathe the eyes night and morning with witch hazel and warm water, mixed in equal parts; or with an ounce of boracic acid in a pint of rose water.

Use an eye cup, turning the eye upward and opening it so that it will be laved by the contents of the cup. When wiping the eyes use a soft cloth, oil linen or silk, and wipe the lids toward, not away, from the nose. This will help to prevent the wrinkles about the eyes, also the wrinkling of the eyelids themselves.

For hot, tired eyes Mme. Recamier used to apply a lotion made by pouring over dried rose leaves a quantity of water of twice their bulk. If the eyes are very inflamed washing them in equal parts of witch hazel and camphor water will be found beneficial.

For granular lids many pastes have been recommended. My advice is to seek out a reliable physician and have the eyes examined and his prescription filled.

A "cold" in the eye is most annoying and liable to be expensive. You get up in the morning, look in the glass, and find that one of your eyes--or maybe both--looks much inflamed. If you do nothing about it, the condition may not pass away for a number of days,

and meanwhile you are more or less disabled.

Very possibly, in some alarm, you go to see the oculist. He frightens you at once by telling you that it is “conjunctivitis”--a long word which means simply inflammation of the membrane that covers the eye. He puts some drops in the eye, and tells you to come back the next day. You are finally cured, and the bill comes to $15 or $25.

That is well enough. Perhaps you don’t mind the bill, or the trouble of going to the doctor’s. But it is likely that you would be less satisfied if you knew that you could easily have cured yourself much quicker and without any expense at all.

If you have a “cold” in your eye, you can get rid of it within a few hours by bathing the eye freely and often with a solution made by putting _two drops_ of formaline into a teacupful of water. The formaline you can buy at any drugstore. It may be used with an eye-dropper or an eye-bath--either of which can be had from the drugstore. But it is even more effective to allow somebody else to pour it into the eye by squeezing again and again a rag or piece of cotton saturated with it.

A “cold” in the eye is nothing in the world but a germ infection. Formaline kills the germs. But don’t use formaline in any stronger solution than two drops to the teacupful. If you get it into your eye in a pure state, you might destroy the sight. At the least, you would suffer frightful pain.

Incidentally it may be said that the best eye-water known to oculists for the treatment of sore eyes or lids is made by mixing ten grains of boracic acid and five grains of tannic acid with one drachm of camphor water and enough ordinary water to make a total of one ounce. The ingredients are cheap, purchased from the apothecary, and you can prepare them yourself if you care to.

When not due to over indulgence in alcohol an excessively red nose is usually the result of indigestion or clothing that is too tight. In the first stages of the trouble Parisians bathe the unfortunate feature frequently with this, recommended by Dr. Vigier:

Distilled water, 50 grams; rosewater, 50 grams; tincture of benzoin, 1 gram; sulphate of potassium, 1 gram.

If it has become chronic, this, massaged freely into the affected organ, is recommended by M. Andres-Valdes:

Rectified alcohol, 8 grams; pure glycerine, 8 grams; precipitated chalk, 8 grams; cherry laurel water, 8 grams; precipitate of sulphur, 8 grams.

The ear is the most neglected part of the head. That a pair of ears stand out unduly from the face, making what one of your American artists term the accessories of the face, more prominent than the countenance itself, most parents regard as a wise visitation of Providence, or ignore it. Or if the ears are so jammed against the head that one can not see them without an effort, that, too, is liable to be overlooked by parents, not by anyone else who sees the child who is a victim to the malformation.

Be as careful to frame your child’s face well as you are to frame a picture, so that its colors are best thrown into relief. Some mothers are artists in the matter of the arrangement of the child’s hair, and when this is becomingly done they think their duty done. The ears are neglected.

If they stand out prominently from the head they can be trained, especially in childhood, back into the relation they should bear to the head. An ear harness made of strong cotton tape is made for this purpose and should be worn at night by children or adults who need it. It is far better, of course, to use it in childhood, when the cartilage that forms the outer part of the ear is more plastic, but it is more or less efficacious after you have reached your full growth. It is certainly well worth trying.

If the ear is packed closely against the head train it outward by gentle massage and light pulling, done by yourself. You are the best judge of whether the pulling hurts. If it does, stop. If the ears are less than the normal size they can be enlarged by the same process.

An earache that cannot be quickly relieved by placing loose, warm bandages over it should be brought at once to the doctor’s attention, for a persistent earache is often the forerunner of serious conditions, especially of deafness.

If your ears are delicate, riding in the tunnels may be permanently injurious to them. The greatly increased pressure of air under the rivers is a menace to the eardrum; may cause it to burst and bring about incurable deafness.

You do not know, perhaps, that chronic and severe diseases of the ear often begin in the nose or throat. Wherefore you are taking care of the ear when you keep the throat and the nasal passages free from obstacles. Gargling the throat every morning is a measure for health and cleanliness that no one should neglect. A tablespoonful of salt in a glass of warm water, or a pinch of borax

in the same quantity of water, will serve well. But I am inclined to the later belief that no one should douche the nose except by the doctor's order. The liquid you use for the douche might carry germs of disease into the back of the head and cause a general infection, while they might disappear in the natural way if there were no interference with nature's plan of carrying away invaders of the head. If the nose is in healthy condition it secretes a pint of liquid every day and is nature's adequate channel for clearing the head.

But the ear must not be encouraged nor allowed long to "run." A chronic discharge from the ear is a serious condition and may have a fatal end. Hasten with it to a physician. Life insurance companies, knowing how serious this is, will never insure the lives of persons with running ears.

Doctors generally advise us not to try to remove the wax from the ears. They say that if we let the ear alone the wax will finally form into a hard little ball and drop out without assistance. They advise us not to put cotton into the ears unless specially advised to by a reliable physician, who will never give the advice unless the need is imperative. They forbid poulticing or syringing the ears without special advice, and they are quite right in warning against the indiscriminate use of ear drops. Better regard the inner part of the ear as inviolate. So, too, the outer, except for keeping the folds clean. In the cleaning do not handle the ear roughly. Remove the dust from the folds of the ear with a soft cloth, soap and water. Be careful to immediately and thoroughly dry them. If you leave the neck or hair about the ears wet or chilled the earache or neuralgia that will follow may lead to deafness.

Never box a child's ears; it may cause a rupture. Do not pull a child's ears, lest injury follow. Be sure to have the adenoids removed. Adenoids in children are a cause of ear troubles, among many others. Physicians now believe that sea-sickness is due to ear disturbances.

CHAPTER IV

KEEPING THE HANDS, ARMS AND SHOULDERS YOUNG

If I were to summarize my experience and the advice I wish to give about the hands in one sentence I would say: "Never let the hands get cold." The advice is very comprehensive, and in a sense sufficient. If you never let your hands grow cold they will be soft and white and retain their natural shape and size.

For example, the fresh air curists travel the radical road to the point of keeping their bathrooms cool or cold. That is absurd. The bathroom should be kept at an unvarying temperature of 68 degrees Fahrenheit. The bather should step from tepid water into surrounding air two or three degrees warmer. Yet I have seen a famous beauty step from an ice cold tub of water upon her bath mat and shiveringly towel herself dry in a bathroom whose window opened for six inches above and below upon a court where the air was at zero. And she wondered why the skin of her hands and face were rough and purplish.

Another friend, an athletic beauty, disliked carrying a muff, and December and January found her swinging along Fifth Avenue, her pretty hands covered only with a pair of cold, thin, cramping kid gloves. She called at my atelier and showed me her hands. They were shockingly red and rough. Both she and my friend of the cold bath room had violated the first command of the care of the hands: "Always keep them warm."

For each of them I prescribed first changing their habits. "Always wash your hands in tepid or hot water," I said to the first. "Carry your muff from October to April," I said to the second. And when they had promised, I having sternly exacted that essential thing, I set about removing the ugliness. The first aid was to show them the right way to wash their hands. Not one person in fifty knows how to wash the hands.

The water should be tepid. If it is what is known as "hard water" it may be softened with a little borax, say one teaspoonful to a quart of water. Or, if possible, it would be well to use distilled water, since borax must be used with discretion.

Then dip into the water a cake of the best soap. A scented soap is not necessarily a bad soap. So I try various kinds, liking one, but seeking another that is better. When I have dipped the soap into the water long enough to make a dainty lather I plunge my hands into it.

Then I dry them, but only partly, upon a soft linen towel. Before the hands have time to dry, and especially before they have time to chill, I take from my toilet shelf or medicine chest a bottle of my favorite hand cleanser. The bottle may be large or small, but the proportions of the mixture I keep always the same. Here is how it is made:

Hydrated glycerine (glycerine mixed with water), 1 tablespoonful; any favorite perfume (mine is Italian pink), 3 drops.

Rub the hands thoroughly with this. Rub is not a strong enough word for the process. It does not suggest the thoroughness of the process. Say rather, wash your hands in it. Ten minutes is none too long for washing the hands. Five minutes should be given to the water, five to the glycerine bath. Then dry thoroughly with a towel. Observe how soft your hands are after such a bath and you will be surprised and delighted with this treatment.

[Illustration: ANNA HELD The fascinating beauty of her eyes is famous the world over.]

I am aware that there is some prejudice against glycerine. Would-be authorities will rise and say that glycerine burns an exceedingly delicate skin--that it is an irritant in some cases. So it is. The person who uses it must be a judge of that herself. It has always “agreed” with my hands, making them soft and white and supple. But for those whose hands burn and itch after using it there is this lotion for occasional, not regular, use, for I am opposed to a too free use of peroxide of hydrogen:

Peroxide of hydrogen, ¼ wineglass; witch hazel, ¾ wineglass; always shake well before using.

I should not advise this oftener than three times a week, at most. And I should vary it with rubbing with olive oil, which is of especial value to thin hands. A few weeks of using it will result in a perceptible plumpening of them.

Or, to whiten and soften the hands, this has many advocates, and I see no objection to its occasional use. Ammonia is too powerful for regular use:

Olive oil, 1 wineglass; ammonia, 6 drops.

But to assure beautiful hands, and that in the shortest possible time, massage them with a simple cold cream and wear rubber gloves at night. But the gloves should be at least two sizes larger than the 5¾ or 6 you wear in kids, and they should be punctured as freely as the top of a pepper box. Ventilation is necessary to the health of the hands and of the owner of the hands.

For a cold cream for the hands for the night toilet I should advise this mixture:

Spermaceti, 2 ounces; white wax, 1 ounce; almond oil, 2 gills.

There are two pastes that are excellent to be used as a night cosmetic with gloves:

Rosewater, 6 ounces; honey, 4 ounces; yellow beeswax, 2 ounces; myrrh, 1 ounce.

This can be prepared at home, if you desire. Melt the wax. Stir the powdered myrrh while hot. Add the honey and rosewater, drop by drop. If the preparation seems to be a bit too thick to handle comfortably thin it with a few drops of hydrated glycerine.

Another delightful paste has the following ingredients:

Tincture of benzoin, 2 drams; fresh yolks of eggs, 2 drams; rice flour, 1 dram; rose water, 1 ounce; oil of sweet almonds, 2 drams; glycerine, 1 dram.

This is a home preparation and because of the perishable nature of the eggs can only be kept for a few days.

Now as to how to massage the hands. For the face a rotary motion, but for the hands a lengthwise one. I can best describe the massage for the hands by summoning your imagination. Fancy that you are wearing a pair of gloves for the first time. That you have accurately fitted the fingers and that you have now only to see that the glove fits smoothly upon the back of the hands. You stroke the back of the right hand gently, but firmly, with the fingers of the left, and the left hand with the fingers of the right. Do this at least twenty times for each hand. Then lightly pinch the ends of each finger, pressing the sides of the fingers between the thumb and second finger.

Some excessively nervous or anæmic persons are annoyed by cold, moist, clammy hands. This is a remedy that is safe and efficacious:

Tannic acid, 10 grains; tincture of benzoin, ½ ounce; elder flower water, 3 ounces; rosewater, 6 ounces.

If there is a strong objection to soap, try the liquid sort. If your objection persists then substitute fine almond meal, a handful for one cleansing of the hands. Tincture of benzoin is also a good softening agent for the water, and its odor is refreshing. Four drops to a

quart of tepid water are sufficient.

“How can I have nice, white hands, though I do my own work?” This is the problem many housewives continually face. By wearing loose gloves as much as possible about your work. By thoroughly drying your hands after washing them, or, better still, by washing them again before they are dried, in:

Glycerine, 1 ounce; lemon juice, 1 ounce.

The beauty of the hands suffers in different ways at different times of year. In winter the cold winds frequently chap them. For this disagreeable condition I have used with good results a lotion made as follows:

Glycerine, 1 ounce; spirits of wine, 1 ounce; violet extract, 1 ounce. Pour over the hands after washing.

If the chapping has made the hands too sensitive to bear the glycerine try this:

Oil of almonds, 1 ounce; lime water, 1 fluid ounce; borax, 6 grains.

In summer the hands and arms often suffer as much if not more than the face from the sun’s burning rays. Here is a lotion which will cool them and reduce their unlovely redness:

Lemon juice, 1 ounce; strained honey, 1 ounce; cologne, 1 ounce.

If the sunburn results in freckles apply with a small sponge or a bit of absorbent cotton or a camel’s hair brush the following:

Powdered borax, ½ dram; sugar, ½ dram; lemon juice, 1 ounce.

Here is still another remedy which answers the purpose as well as the ones just described:

Muriate of ammonia, ■ dram; lavender water, 1 ounce; distilled water, 4 ounces.

For a mild case of freckles here is a simple remedy that will often prove sufficient:

Peroxide of hydrogen, 1 ounce; ammonia, 10 drops. Apply with a camel’s hair brush.

Of no part of the body is it quite so true that curves are the lines of beauty as it is of the arms and shoulders. A lovely woman in an evening gown always reminds me of a beautiful bouquet rising out of a vase. The woman’s head and shoulders and arms are the flowers, the gown and the rest of her body the vase. Fancy a bouquet with one fresh, purple pansy in the center and all about it withered yellow flowers. It is not a pleasant picture even in fancy, but that is precisely how the woman with a charming face and unlovely arms and shoulders looks.

Beautiful shoulders must first of all be symmetrical shoulders. They must be just broad enough to balance finely the figure. If the figure which they surmount be slender the shoulders also should be slender. But they should never be thin. For beauty’s sake they must be soft, not muscular. They must be overlaid with a veiling of firm flesh. They must slope gently into the lines of the arms and bust and back by almost imperceptible degrees. While they are plump in front they should be thin at the back. A roll of flesh between the shoulder blades is unsightly and gives the appearance of age.

After shapeliness of the shoulders in importance comes whiteness. Shoulders well cared for should be the whitest part of a woman’s body.

A third important element in the beauty of the shoulders is the texture of the skin. It should be of satin fineness.

To attain shapely shoulders begin with the chest. The woman with a high chest always has beautifully shaped shoulders. Form the habit of breathing deeply. A shop girl in one of New York’s department stores had so fine a development of chest and shoulders that I asked her how she achieved it. Her figure was so slender that I knew she must have built up those shoulders and the chest by some wise system of exercise.

“Yes, haven’t I done fine?” she answered. “Two years ago I was the scrawniest thing you ever saw. My neck and shoulders looked like a wood pile that had tumbled over itself. I was all sharp corners. I heard of this new deep breathing and I tried it. Most of it I did on the platforms of the “L” trains. Winter and summer I rode downtown from Harlem to work, and instead of sitting in the car I stood on the platform. At first it made me tired, but after I got used to it I began to look forward to feeling the clear, cool air rush through

my lungs. Now it's the best treat of the day. Maybe I would have got lazy and not kept it up, but I saw the flesh beginning to pad all the corners of my neck and shoulders. My chest lost its caved-in look. You just bet that deep breathing pays."

Deep breathing does pay. It pays a large dividend in health and beauty.

But next in importance comes massage. Give me an excellent masseuse and I could dispense with a doctor, except in some tremendous emergency. Thin shoulders can be plumped and fat shoulders can be reduced by massage.

If they are thin a light massage, using a rotary movement of the palms of the hands, applying olive oil copiously, will gradually plumpen them. If they are fat the massage should be much deeper and more vigorous. The masseuse should knead as near the bone as possible.

For this massage a cream may be applied to feed the tissues. Here is a good one:

Oil of sweet almonds, 20 grams; lanolin, 30 grams; tannin, ½ gram.

Yet another cream that is an excellent builder of flesh is this, so commonly in use in Europe as to be almost a household article:

Lard, 50 grams; alcohol (95 per cent.), 10 grams; oil of rosemary, 6 drops; oil of bergamot or orange, 6 drops.

If the shoulders are fat the massage should be much deeper and more vigorous. The masseuse should get as near to the bone as possible. She should use neither oils nor cream, but instead some astringent lotion, as, for instance, this:

Rosewater, 12 ounces; tincture of benzoin, 1 ounce; tannic acid, 20 grains; elder flower water, 4 ounces.

Shoulders should be white. Normally they are, and if not the general health should be looked to as a corrective. Are the shoulders yellow? Probably their owner is bilious and requires a change from a heavy meat and sweets diet to a lighter one in which cereals and green vegetables and salads predominate. The system should be irrigated by much water drinking. Try to remember that the amount of food for a day's sustenance has been estimated in the proportion of five parts to seven parts water. Are her shoulders marred by pimples or acne? Again she should look to her diet, eating less rich food. A thorough scrubbing of the shoulders with warm water and pure soap once a day, followed by a rub-down with alcohol, should be sufficient to keep them prettily white if the diet is a correct one.

If the shoulders have been tanned or freckled by much sea bathing or lolling on the burning sands, they will be improved by applications twice a day of this old-fashioned remedy:

Horseradish root, 1 ounce; borax, 2 drams. Pour over these one pint of boiling water. Apply with a sponge.

Also apply distilled water and the juice of a lemon or peroxide of hydrogen, mixed in equal parts.

The effects of a half dozen applications of these should be quickly apparent.

Arms, like shoulders, must possess symmetry. That is, they must seem to be of the body, included in the original plan instead of being hastily added as an afterthought. They must be in perfect proportion. The size of the arm depends wholly upon the size of the body.

In Paris recently a pretty little Russian, Miss Amelia Rose, won the prize for having a perfect arm. In Paris, where beauty is the chief divinity, the awarding of the prize to one not of the French nation was a momentous matter. Everyone wanted to know the proportions of the arm. The Russian beauty's height was five feet five inches. Her arms conformed to the canons of statuary. The upper arm was one-third shorter than the forearm. The circumference of the upper arm was thirteen inches; of the forearm nine inches, and of the wrist six inches.

The beautiful arm looks as though it were made for ornament, not for use. No muscle is unduly prominent. It should be as soft and smooth as white velvet. If the arm is too fat its size can be reduced by massage with the wringing motion. The masseuse should manipulate the arm exactly as though she were wringing out clothes before hanging them out to dry.

To develop the arm there are many exercises. Small dumbbells, weighing half a pound, can be swung to great advantage. Also to develop at once the muscles of shoulders and arms this is valuable. Stretch the arms horizontally from the body until the muscles are tense. Then slowly raise them above the head, trying to keep the muscles rigid. Clench the fists and, stretching the arms horizontally at the sides, raise and lower the arms. This develops the biceps. Clench the fists and turn them slowly about on the

wrists to make the wrists supple. Light massage with olive oil supplements the exercises.

I know a girl who otherwise had a charming figure, but whose arms were distressingly thin. It took two years of attention to them to make those arms attractive, but she succeeded.

The means were a change of diet to more nourishing and muscle-building food, a half hour twice a day with dumbbells, and daily massage with cold cream or olive oil. The results were soft, well rounded, pinkly white arms that charmed everyone who saw them.

An exercise that develops the arms and the back and bust as well is this: Holding the arms at the sides, inhale deeply. Clench the fists. Bend the elbows. Bring the fists to the shoulders, moving only the lower arms. With the fists resting at the shoulders raise the elbows to a straight line with the shoulders. Move the fists down slowly until they fit close into the armpits. Move the fists slowly around to the back, crossing them, and then lowering the arms to their first position. Keep the muscles tense while so doing. This is a famous resistance exercise.

If the texture of the skin on the arms is coarse, a dry rub every day with a soft flesh brush should open the pores, whose long collecting accretions have made the skin rough. This treatment will make the skin tender. If it seems sensitive apply a good cold cream every morning and evening. After the morning application powder may be added. The arms may be dusted with a pure powder. One of the best cold creams for the purpose is this:

Oil of sweet almonds, 50 grams; white wax, 10 grams; spermaceti or sperm oil, 10 grams; rosewater, 20 grams; tincture of benzoin, 5 grams; tincture of amber, 2 grams.

While reducing her arms, or before she has succeeded in so doing, the stout woman should not wear sleeves shorter than the elbow length. Her upper arm is gross and she should veil it until she has reduced it to lovelier proportions.

To keep my hands smooth and white I wash them à la Cavalieri. First in soapy water, through many waters until they are spotless as my linen. Then I dry them, but only partly, by the heat of the hands themselves, not with a towel. Then I bathe them again in this mixture:

One ounce glycerine; three ounces rosewater; ten drops lemon juice. This should be well shaken when being mixed, and also every time it is used.

Cold-roughened hands must be treated with special care at night. That is the time to give them their complete toilet. It is well for them if it has not been necessary to wash them often during the day. They must, of course, be kept clean. But better avoid soiling them during the day than wash them too often.

Buy a large pair of rubber gloves, at least three or four sizes larger than the kid gloves you are in the habit of wearing. After washing the hands in warm water, softened with a few drops of ammonia, say a half dozen drops to a quart of water, and a good, pure soap, as white castile or one of the tar soaps, bathe the hands in cooler water and, before drying them, rub thoroughly over them:

Glycerine, 1 ounce; rosewater, 1 ounce. Then draw on the rubber gloves.

If the hands be much darkened or reddened this will whiten as well as soften them:

Glycerine, 1 ounce; lemon juice, 1 ounce.

In extreme cases a paste worn for two or three nights under the rubber gloves will facilitate the work of making the hands once more presentable. This is a good paste:

Almond meal, 1 ounce; tincture of benzoin, 10 drops; honey, ½ ounce.

In similar fashion when hands have been reddened and blistered by the sun wear a pair of loose gloves at night, first covering the hands with this mixture:

Honey, 2 ounces; glycerine, 1 ounce; barley flour, 8 ounces; whites of two eggs.

Or the following lotion rubbed into the hands well will answer the same purpose:

Cologne, 2 ounces; lemon juice, 2 ounces; liquid honey, 2 ounces.

Much is asked, and much from time to time answered, about the care of the arms, yet an attractive arm may be hopelessly marred by an ugly elbow. Resolve that your arms are only as pretty as your elbows, and set to work upon them.

First examine them closely and while you examine them keep in mind the standard for a lovely elbow. To be lovely it should be little in evidence, so little, in fact, that it seems to be merely an appearing and disappearing feature--so to speak--a dimple playing peekaboo.

Instead of this what do you probably see? A sharp, bony corner, or a mass of unsightly wrinkles, in either case darker than the surrounding flesh. Almost certainly the skin covering it is dark and rough, “a patch of goose-flesh” a young girl complained when dressing for a dance.

Now what is to be done?

Try first to rid the elbows of their disfiguring redness or darker color. Rub them every night before retiring with a half grape fruit. This is better than a lemon because the elbow can settle into it and work about it. If you place the halves of grape fruit on a table and rest your elbows in them you can read or chat or meditate and leave the elbows to their bleaching for an indefinite time. Repeat this every night until you notice an improvement in their color.

But do not be satisfied with this progress. Scrub the elbows daily with warm water and a bleaching soap. One of the peroxide soaps would be useful. Or use castile soap with water, into which you have sprinkled a few drops of peroxide of hydrogen or of ammonia.

An ingenious girl I know bound slices of lemon on her elbows every night before going to bed. While this is not as quickly efficacious as the grape fruit it is cheaper.

When this gradual whitening of the elbows has been accomplished take the next step in their beautifying, which is smoothing them. If they are very rough, scrub them with a pumice stone that has been dipped into warm water. Rub the roughened spots gently with this, and slowly, lest you irritate the skin. Then apply cold cream or olive oil to allay even any tendency to irritation. Or if they are only slightly roughened, rubbing them round and round with fingers that have been spread with cocoanut oil is enough, if long continued, to soften them.

If the elbows are very sharp massaging the flesh about them with palms well greased with mutton tallow should in time nourish them into roundness.

CHAPTER V

MASSAGE AS A BEAUTIFIER

Massage is of two kinds--good and bad. It is good or bad, according to the knowledge and skill of the masseuse. I have a profound, unshakable belief in the efficacy of massage. It is my cure-all. I rarely take medicine. Almost never in all my life, in fact. For long ago I heard what your American poet, Oliver Wendell Holmes wrote: “If all the drugs were thrown into the sea it would be hard on the fishes, but it would be better for humanity.” That, from a man who knew medicine deeply impressed me.

That which will most interest readers of this book, probably, will be the consideration of massage as a beautifier. In that aspect I most earnestly recommend it. For half my life I have had my face massaged frequently, and for many years I have had it massaged every day. With what result? That my face is absolutely free from lines. That my complexion is smooth and absolutely free from blemishes. I resolved that it should approach the smoothness and clearness of an infant’s skin if care could achieve that effect, and I have succeeded.

Moreover, there is no abnormal growth of hair upon the face. With pleasure I lay the ghost of that fiction against massage. Despite all that we hear to the contrary, the friction has not caused the growth of the tiniest of beards.

If you entrust the massage of your face to a masseuse, be sure that she has had proper instruction and considerable experience. Bad massage is much worse than none, for it will cause wrinkles instead of removing them. The masseuse must know the geography, as it were, of the muscles. She must learn to follow instead of countering those muscles.

To make this quite clear, let me quote from the usually baffling words of a medical authority, Dr. William Murrell, of the Royal College of Physicians of London: “The individual muscles, or groups of muscles, are picked out or isolated and mechanically

stimulated to contraction. The movements must be made in the direction of the muscle fibers, and the tips of the fingers must be carried along in the interstitia, so as to promote the flow of lymph and increase tissue metamorphosis. The manipulations are carried out systematically in definite order with a definite object."

Massage promotes circulation. By promoting circulation it nourishes parts of the body in which circulation is ordinarily defective. The well nourished portions of the body are the last to grow old. The best illustration is perhaps those regions of the Western part of the United States where there is little rain. These regions would be waste places if it were not for irrigation. Canals are made that tap the nearest rivers. From these canals ditches are dug. The ditches form a vein-like network of little streams that feed the arid land. So massage stimulates sluggish circulation and nourishes the muscles that might otherwise grow flabby and the skin that would grow dry and wrinkled.

The face must be massaged with a nourishing cream. This is one that cleanses as well as feeds the skin, and is simple and especially grateful in midsummer:

Almond oil, 2 ounces; spermaceti, ½ ounce; white wax, ½ ounce; cucumber juice, 1 ounce.

After facial massage with a cold cream some women of exceedingly sensitive skins choose to bathe the face in this or a similar lotion:

Tincture of benzoin, 1 ounce; tincture of vanilla, 4 drams; sweet almond oil, 3 ounces; bitter almond oil, 1 dram; spermaceti, 5 drams; white wax, 5 drams; lanolin, 1 ounce; witch hazel, 1 ounce; rosewater, 3 ounces.

Having first had your face massaged several times by an expert masseuse you can learn the movements yourself and massage your own face. Some become deft at self-facial massage in a short time. Some who have clumsy fingers, or a lack of perception, never master the art. Some beautiful women never entrust their faces to a masseuse, I am told.

First look to the shadowy new lines upon your face. If there be none, consider where the lines form when you laugh, when you frown, when you sulk, or when you cry. Anticipate these lines by nourishing well the muscles in those regions.

The wrinkle regions of a woman's face are four. The first is about the outer corners of the eyes. The wrinkles there formed have been known for many ages as crow's feet, because they radiate outward in somewhat the fashion that a bird's toes are disposed. They might as fittingly be called chicken's toes, or pigeon's toes, or eagle's toes. They are supposed to be the ineradicable, unmistakable signs of age. The truth is, they are the paths of laughter, and indicate a merry disposition. I have seen them on the face of a boy of twelve. I have seen them strongly marked on the countenance of a young woman of twenty-one. They are the measures of the laughing capacity of the person who bears them. In that light they are the least ugly of the wrinkles; yet wrinkles they are, and at best wrinkles are undesirable.

To remove crow's feet, dip the tips of the fingers in one of the good massage creams, and with the second and third fingers rub the area affected with a rotary motion, working from the corners of the eyes outward.

More disfiguring than the crow's feet, because of more ignoble origin and more difficult to erase, are the diagonal lines from the nostrils to the corner of the lips. They are known variously as the "bad temper lines," the "emotional lines," the "lines of discontent." Using the middle finger, the massage should begin at the corners of the mouth, and should end where the lines end, at the nostrils. This movement should also be a rotary one. It should be deeper and firmer than that about the eyes.

The third of the wrinkle areas, and the one in which the wrinkles first appear in most faces, is the forehead. One of your American women doctors said that the signs upon the forehead are unmistakable and infallible ones. "When a woman has three transverse lines across the forehead I know that she is twenty-seven," said this woman physician. "When she has two vertical lines between the eyes I know that she is forty-five." This is interesting, but untrue. I know half a dozen women of fifty who have neither of these groups of telltale lines.

In massaging the lines of the brow, remember the general rule for massage. The movement must be in contrary direction from the line. For instance, the vertical lines between the eyes must be treated by the second finger of each hand and must be rotary and upward, branching above the eyes with a gently diminishing motion to the right and left toward the temples. The transverse lines, forming as they do by a creasing of the skin from bottom to top, should be massaged by a rotary motion from the bottom to the top of the forehead.

The fourth of the danger zones is that in front of the ears. The vertical lines in front of the ears are believed to betoken advancing age. Yet, like those about the eyes, they are misleading. They sometimes appear on the faces of infants. The manner in which the ear is set accounts largely for the presence of these wrinkles. If it is set out from the head prominently the skin is loose in front of the ear and falls readily into wrinkles. If the ear sets close to the head the skin in front of the ear is drawn taut, and the so-called age-betraying wrinkles never appear. To check this fold of skin is almost impossible if the ear stands out from the head. To retard its deepening, use the middle finger for massage, and with deep, firm motion push slowly upward toward the top of the ear.

The lines on the neck behind the ears distress some women. To correct them, massage with the first and second and third fingers deeply upward toward the hair.

Massage of the body is prescribed by many physicians for nervous disorders, for defective circulation and for reduction of flesh, for insomnia and other disorders. While invaluable, it should only be given by a skillful masseuse, preferably one recommended by a reliable physician.

Of all systems of massage the Swedish is regarded as best. Its operators must study their art for two years.

If a woman be thin this massage emollient is agreeable and adds to her weight:

Oil of sweet almonds, 6 ounces; oil of bitter almonds, 20 drops; balsam of tolu, 4 grams; benzoin, 4 grams; essence of orange, 6 drops; essence of cajeput, 6 drops.

If the patient be plump, talcum powder is the only aid to the hands of the masseuse required.

The beautiful woman has points. Let us enumerate them: A figure graceful in outline, not too thin, nor too fat. A face that is fascinating, and by fascinating I mean interesting. But to make it interesting it must have what? Features that are well proportioned, let us say regular. They must seem to belong to one’s own face and no other. The nose must not be too large nor too small, but just large enough for the face in which it is set.

[Illustration: PAULINE FREDERICK Painters and sculptors agree in giving her high rank among the most beautiful living women.]

How to keep the lines of that face as good as they were at the beginning, or better? It is most important. The nose should be massaged--intelligently massaged. The owner of the nose herself can do it quite as well if not better than any other.

If the nose is too broad, she should massage it delicately toward the point. If it is too sharp, she should massage it away from the point to the flare of the nostrils, always with the merest points of the cushions of her fingers. To keep its normal whiteness it should have often, at least once a day, a hot compress of cotton dipped in rosewater or other distilled water, spread upon it. And after that there should be a dash of cold water upon it to close the pores.

CHAPTER VI

WHAT TO DO FOR THE FEET

The beautiful foot is that of the baby. It is beautiful because it is natural, unmarred by ill-fitting, cramping, distorting shoes.

Just in so far as the foot has departed from its original shape and habit is it less than perfect. It is hard, indeed, to find a beautiful foot. The story is told of a New York sculptor who, searching for a perfect foot, dismissed three thousand models who were applicants for the honor, declaring that there was not one beautiful foot among them.

By the established modern standard, the foot should be neither small nor large, though it is preferable that it be small rather than large. The tiny foot of a large woman is absurd. It suggests deformity. So does the short foot on the tall woman. The foot should seem to belong to the woman, not to have been loaned to her for the occasion. Like her hand, it should seem to be in perfect harmony with the rest of her body. If the owner be plump, the foot should not be thin. If she be thin, the foot should not be plump.

It should be neither bony nor too fat. The bones should be well covered, but their outline should be plain, enough to give a certain distinction called “character” to the foot. The toes should spread comfortably apart, yet there should not be unseemly spaces between them. The spaces should be slight and even like those between regular and well-kept teeth. The skin should be smooth and pinky white. The nails should be strong but smooth and semi-transparent and delicately pink. Above all, there should be no blemish, no disfiguring corn on the small toes, no enlargement of the joints, nor bunions, no calloused spot upon the sole. The

high-bred foot lies, according to existing standards, not flat upon the ground, but rests upon the heel and front part of the sole, so that a rill of water may easily run under it. To correspond with this natural bridge, there must also be an arched instep.

This is the standard. Now how to achieve it. First, wear shoes that are large enough and let them be of soft, pliable leather. Large enough, I said, but not too large. The foot that slips about in large shoes is as likely to get callous disfigurements as the one that is pinched. Heavy leather and thick soles have no place on a woman's delicate feet. The stiff, unyielding boot may be all right upon the masculine foot, and it may keep more perfect upon the inch-thick sole, but the skin of a woman's foot is too tender for this. The leather should be close but fine, the soles of medium thickness. But I cannot lay too much emphasis upon the need of a straight, even heel on the shoe. The heel is to the shoe what the cornerstone is to the house. It is quite as necessary that it be well laid, straight and secure. The crooked heel threatens the health as the insecure cornerstone the security of the house.

The run-down heel disturbs the adjustment of the internal organs. It pushes some of them close upon each other, draws others away from their natural support. It destroys the balance of the foot, causing blisters and callous spots. It throws the weight where it should not be, doing violence to the center of gravity.

Watch your heels as closely as you should the running time of your watch. When the bottoms of the heels disclose an inclined plane at the back or the sides, you will find a corresponding blister or newly formed callous spot on the sole. Your ounce of prevention is sending the shoes to a cobbler the moment you see the hint of crookedness in the heels. They can be planed or built up to their former evenness at very slight expense. The money spent thus is much less than the fee of a chiropodist that you will save.

Having formed the habit of wearing comfortable shoes--and let me say here that American shoes are the best and that I always wear them--see that the feet are released often from their prison. Even the best pair of shoes is a prison. In your own room wear the Japanese sandals that protect the delicate soles from the floor, but that leave the toes free to lie loosely apart, though they are secured by strong cross bands. These give the muscles of the feet a chance to relax. They are much better for this purpose than the felt slipper or shoe, which is too closely woven to permit proper ventilation.

The feet, like that other extreme of the body, the hair, need sunlight. Think how little the poor, imprisoned feet get. They need air. How little of that they get.

Well-shaped feet are so much rarer to-day than they were in the days of the Romans and Greeks, mainly because we imprison them in unventilated, sun-forbidding shoes instead of wearing the sandal of the ancients, which gave the feet the light and air they need.

It is unfortunate that the arbiters of fashion have not seen fit to condemn modern shoes in favor of the ancient sandal. More harm is done to the feet by the present-day footwear, than is done to the hair by rats and puffs or to the vital organs by tightfitting corsets.

Some years ago it did become the fashion for children to wear sandals, but their elders were not wise enough to follow their example. But if you cannot wear sandals yourselves, there is no reason why you shouldn't have your children wear them, for it is even more important that the child's feet be properly taken care of than the adults.

In early life, the bones are naturally soft and may be readily forced out of their normal shapes by any considerable exterior pressure. It is obvious that to maintain the proper contour of the child's feet, the sandal is much more satisfactory than the shoe. The former permits the feet to be flat on the ground and spreads the toes, the latter crowds the toes and compresses the whole foot.

And adults can improve the condition of their feet by wearing sandals in the house, even if prevailing fashion does not permit of their wearing them out of doors.

To be healthy, the feet must be kept scrupulously clean. So much are they exposed to the dust of the streets, especially by those who wear low shoes, that they need more than the perfunctory share of the morning plunge or shower. They should be bathed every night in a foot-tub containing warm water. If the feet be tender, the water should contain borax in the proportion of an ounce to a gallon.

Warm salt water is also very easeful for tired feet, especially useful for reducing the congestion in swollen feet. This powder, sprinkled into the warm bathwater, affords great relief:

Borax (powdered), 1 ounce; sea salt, 1 ounce; alum, ½ ounce. Use one teaspoonful to a gallon of water.

For tired, swollen feet, lemon juice, sprinkled freely into the water, is a means of alleviation. An easier way to apply it is to cut a lemon in half and rub the soles of the feet with it.

Calloused spots may be removed from the sole by planing off the rough surfaces with pumice stone.

English women give ease to their feet after a long walk by bathing them in an infusion of rosemary leaves. Steep the rosemary leaves, a half ounce to a gallon of water. When cool, bathe the feet for twenty minutes in the mixture, adding warm water now and then, as the water in the foot-tub cools.

For feet inclining to excessive perspiration a powder made of these ingredients should be used in the footbath:

Tannin, 60 grains; alum, 2 drams; lycopodium, 6 drams. One teaspoonful of the powder to a gallon of warm water is sufficient.

Sensitive feet are much relieved by this remedy, which is popular in England:

Rosemary leaves, ½ pound; juniper berries, 3 ounces; dried mint, ½ ounce. Boil in three quarts of water.

Corns are merely hardened portions of the skin usually appearing upon the top of the toes. Each speaks loudly of pressure by shoes. No Indian ever had a corn until he began wearing the white man's boots. Corns and bunions are the record of the fact that the shoe, as many wear it, is an instrument of torture. If the corns be new and not deep-seated, they can be removed by self-treatment.

Soak the feet from fifteen to twenty minutes in warm water, softened by a few drops of violet ammonia, or of benzoin. Bind a slice of lemon on the toes, tying it securely with a bandage of white muslin. If the corn responds naturally to the treatment it should be so loose after three or four applications that you can push it out by gentle friction with a towel. Never use your finger nails in extracting a corn, no matter how loose it seems. Blood poisoning might result.

If the case is more obstinate, this, applied with a small camel's hair brush should be quickly efficacious:

Collodion, 4 grams; ether (65 per cent.), 2 grams; alcohol (95 per cent.), 1 gram; tincture of Cannabis Indica, ¼ gram; salicylic acid, ½ gram.

Less expensive is this:

Collodion, 1 ounce; salicylic acid, 1 dram; fluid extract of Cannabis Indica, 1 scruple. Apply several times a day until the corn is soft enough to be scraped away.

If the corns are of the "soft" variety that grow between the toes, absorbent cotton powdered with tannin or alum may be inserted between them. Ring plasters to protect the corn from further irritation by the shoe have their friends and foes. I think it much wiser to remove the pressure permanently by abandoning the shoes that caused it.

Bunions, or enlarged and inflamed joints, are the greatest affliction to which suffering feet can be subjected. A new broad pair of shoes with low heels is the best remedy. To assist this remedy, the joints may be painted three times a day with this simple but strong bunion lotion:

Tincture of iodine, 2 drams; carbolic acid, 2 drams; glycerine, 2 drams.

A dainty foot powder should be on every woman's toilet shelf or table, especially if her feet perspire freely. An excellent one is made like this:

Florentine orris powder, 100 grams; starch, 100 grams; alcohol, 10 grams; phenic acid, 5 grams. This should be sprinkled on the foot before dressing it, especially throughout the summer.

And here is still another foot powder which I have used for a long time, sprinkling a half ounce of it into a foot tub holding two gallons of water, or dusting my feet with it after the bath:

Powdered alum, 1 ounce; powdered boracic acid, 2 ounces; talcum, 4 ounces; starch, 6 ounces; a few drops of perfume at pleasure.

This yet simpler powder is much used for perspiring feet:

Powdered orris root, 1 ounce; powdered alum, ½ ounce; rice powder, 3 ounces.

The nails should be cut square across, except when the formation of the toes, acquired by close pressure of the toes upon each other, demands that the nail be cut round to adapt itself to the shape of the toes.

At the first sign of an ingrowing toe nail each of two simple remedies may be used. The corner of the nail at the side where the toe is inflamed may be gently lifted and cotton thrust beneath it to relieve the pressure. Also at the middle of the upper edge of the nail a tiny V may be cut. Nature in extra efforts to heal this breach in the nail withdraws her forces from the irritation of the side of the toe.

Light massage by a skillful masseuse is greatly beneficial to tired feet. Dancers, pedestrians and female cyclists have used this unguent, rubbing it well into the muscles and about the joints, to make them more flexible:

Portugal extract, 1 ounce; rosewater, 1 ounce; brandy, 1 gill; olive oil, 3 ounces; mutton tallow, 4 ounces; virgin wax, 1 ounce; ambergris, ½ grain.

Walking barefoot in the early morning is still a fad of many society women and actresses and singers who have regard for the health of their feet. Besides the beauty of the foot and the elastic carriage so secured, walking with bare feet upon the bare earth is believed by many physicians to be very beneficial in certain cases. It is recommended also as a tonic for the nerves.

A good exercise to develop the elasticity of the foot is to sit with the feet scarcely reaching the floor, and press the fore part of the sole upon the floor. This also strengthens weak ankles.

No woman is ever pretty while her feet hurt; and a horrid male person has been ungallant enough to say that the awkwardest thing in nature is “a woman with a sore foot.” That he didn’t exaggerate, we must admit.

What shall we do to stop this wearing of beauty, this most excruciating of the minor physical ills? We should first look to the cause.

Is the skin between the toes cracked and sensitive? It is possible that this is a symptom of a uric acid condition. See your physician and let him determine whether it is so. If you have joined the great army of those who have the uric acid diathesis, be treated accordingly. If the cracks between the toes are caused by the feet being excessively hot, either of these should complete a cure in a short time:

Spread zinc ointment over the cracked surfaces; or, powder them thickly with Fuller’s earth.

If the feet are bathed every night before retiring in tepid water into which a little borax or common table salt has been sprinkled, there is little likelihood of sensitive, swollen feet, or of hardened or calloused portions on the feet. As the evening foot bath is a preventative, so is it a cure for such conditions, unless they have reached an extreme stage. If so, after carefully drying the feet--being careful to dry them thoroughly between the toes so that no soft corns will form there--rub the swollen portions of the feet gently with witch hazel; or the hard, calloused portions with olive oil or cold cream.

Keep several pairs of shoes so that you need not wear the same pair on two successive days. Wear a different pair of hose each day, turning wrong side out and leaving to air the pair that you have worn the previous day.

If the feet perspire this remedy is a good one--apply it by dusting the feet with it:

Borax, 10 grams; starch, 10 grams; salicylic acid, 3 grams; powdered alum, 5 grams; talcum powder, 50 grams; naphthol, 5 grams.

This simpler preparation can be applied with a camel’s hair brush:

Distilled water, ½ pint; bichromate of potassium, 1½ drams; essence of violet, 1 dram.

The masculine habit of resting the feet upon another chair than the one occupied by the sitter has its origin in the instinct of self-preservation. The blood flows too freely into the legs and feet that remain too long in a suspended position, engorging the veins and causing discomfort. It is this condition which men seek to relieve by placing their feet on desks and chairs. It is a habit which women may well imitate when alone--at least to the limit of the height of a chair seat. The “long chair” of the French meets the need of allowing the legs to lie on a level with a portion of the body while the upper part is in a sitting posture.

Rest the feet by wearing larger shoes and only cotton stockings. Wear sandals without stockings in your room on warm days.

CHAPTER VII

THE PROPER CARE OF THE MOUTH AND TEETH

To be beautiful one must have an ideal of beauty and strive always to reach it. Wishing to make and keep the mouth beautiful, we must have ever in our minds an image of a beautiful mouth.

What must a mouth be to be beautiful? Ideals about beauty differ greatly, but there can scarcely be any difference of opinion about the attributes of an attractive mouth. It must be well shaped.

It must be red, but not too red. The teeth must be, or seem to be, perfect.

If I were harsh enough to criticise American women, I should say that their eyes are beautiful, but their mouths are not so beautiful. I should say that their lips are too thin. I should say also that their teeth are not perfect. I should qualify this by saying that I am speaking of the average, not the exceptional, American woman.

The reason for this fault of lips that are too thin and too straight lies chiefly in character, and there we have a paradox, for it is not a fault of character. American women have immense self-reliance, tremendous decision, and these are written in lips that might be carved from pink marble, straight, fine, unyielding. I would not change those admirable traits of character, but I would use massage to relax the muscles about the lips and remove that drawn expression.

The pleasing mouth has lips that curve from thin outer corners to a ripe fullness at the middle. The sweep should be upward to a fine cleft at the middle of the upper lip. A deep cleft just above the upper lip is one of the recognized marks of beauty. The lower lip should be straighter and not so full as the upper. Much has been said about the beauties of the lips, but nothing has been said more illuminative than the phrase “Cupid’s bow.”

Study the gentle sweep of a bow, held in place by a cord. It adheres to the rule, “Curves are the lines of beauty.” The curve is soft, tender. It seems to be the blending of countless curves. So the mouth. I once saw the mouth of a cruel woman described as being “like a slit in a stone wall.” I thought the phrase apt.

I believe in allowing the mouth to take care of itself. It is its surroundings, its environment, so to speak, that is important. Look to the lines from nostrils to lips. See that they are removed by massage. Massage restores circulation. Massage is like a system of irrigation for waste land. Creases are caused by lack of circulation. The muscles that hold the mouth in a firm line are thread-like, one just above and at the sides of the lips. It is most important to keep these taut by massage.

As to color, I have said that the lips should not be too red. The normal lips should be the same color as the gums, and has not your dentist said to you, “Your gums are too red, are not healthy”? So the lips should be a deep pink, or a light red. Not blood color, but three shades at least lighter than a stream of arterial blood. I make this distinction because venous blood may be bluish, and far from a model for the healthful color of the lips.

An Italian authority on beauty said the beautiful mouth must always be open enough to show five teeth. This is attractive, but not hygienic. The teeth are to the beauty of the mouth as important as the keystone to an arch. Without the keystone there can be no arch. Without lovely teeth the beauty of the mouth does not exist. The lips are a promise of beauty. The teeth are its fulfillment.

The teeth should be regular. They should not be crowded together, and there should be no aggressively noticeable spaces between them. They should be white, or seem white. The unromantic truth is that teeth are never white. They are of three shades, blue, yellow and gray, always one or the other. But in contrast with the lips they look white, and the more vivid the lips the whiter do the teeth look in contrast. Which is the reason, I suppose, that I have seen women with frightfully overcarmined lips.

Now, how to make the mouth or keep the mouth well shaped, red but not too red, and teeth to be or look perfect. The time to train our mouths to beauty is in our infancy. Our mothers should begin the work, and when we have reached years of intelligence, we should carry it forward.

If an infant’s mouth is too large it can be trained to lesser size by tender pinching of the corners. This makes the line at the corners almost indeterminate, and diminishes the size. Need I tell any mother that this must be most gently and tenderly done? Also train

the lips to deepen their beauty cleft by pushing the middle portions together with the first fingers. This light pressure four or five times a day, when you are dressing the child in the morning and undressing her at night, will marvelously refashion the mouth. I knew a Parisian mother who not only made over her child's mouth, but also the nose into good lines by this light, discreet pinching.

If your mouth is defective, improve the shape of your lips by avoiding careless habits. Many pretty women are disfigured by crude, careless habits of mouthing their words, of chewing their lips, of ridiculous labial contortions while they talk.

To correct them, practice in talking or reciting before a mirror. Note whether you draw down the lips while you speak. Note whether you catch them between your teeth and nervously chew them. Observe whether, while you make a short speech, longitudinal lines form on the upper lip. Notice whether your smile is simple, natural, unexaggerated, or whether your mouth widens vacuously, or draws into a prim resemblance to a buttonhole when you smile. When you have determined whether you have any of these bad habits, determine to cure them, and do so. There is but one way to cure them, and that is by remembering your fault and avoiding it.

The lips should be lightly massaged before falling asleep. For that massage this is my favorite pomade. You will observe that in no preparation that I advise for the lips is any camphor. I dislike camphor for the lips because it is an astringent, and the mouth is too much inclined to pucker into unlovely lines without its aid. Try this:

Oil of sweet almonds, 125 grams; white wax, 28 grams; spermaceti, 28 grams; oil of bergamot, 1 gram; oil of geranium, 2 grams.

This softens the lips, effacing the tiny lines that form in the lips, destroying their smooth surface, during the day. It can be varied by another and simpler remedy:

Hydrated glycerine (50 per cent. water), 60 grams; rosewater, 20 grams.

Do not use glycerine alone on the lips nor on any other surface of the body. It is too drying. It has the power to draw moisture from the skin, and that moisture should by replaced by the water with which the glycerine is mixed.

Leaving the shape, we come to the color of the lips. Preserve that by keeping the bodily health good. If the circulation is defective the lips will be pale. If we become anæmic, pallid lips will be one of the first signs of our state. To make them healthily red improve the tone of the system by two means. Be sure to sleep enough. You may need eight hours or nine. You yourself know which. Take it.

Eat nourishing food. Eat often and lightly. That is far better than to eat seldom and heartily. Better five light than three heavy meals a day. Eat of meat sparingly, for most meats are hard to digest. Once a day, and that at dinner, is often enough. But depend greatly upon vegetables and eggs. Eggs have much iron in them. So, too, have string beans, spinach and beets. Milk, too, is an excellent builder of new tissues.

If, after a fortnight, your lips are still pallid, try the iron injections I have before recommended. Do this under a physician's directions and you will surely be vastly benefited.

Mouth mannerisms are leaks of beauty. Self-conscious young women draw down the corners of their mouths when they talk or when they smile. They twist one corner of the mouth downward, making the mouth one-sided. They even suck the lips inward, spoiling the contour of the mouth. They rub their faces with nervous fingers. They elevate one eyebrow and pull down the other. They twist locks of their hair. They play with folds of their gowns, or with their desk ornaments. It is only the deeply learned lesson that it is vulgar to play with articles on the table that keeps them from drumming with their knives and forks or twirling their plates.

This is deplorable, for it not only mars their beauty, but shows an utter lack of inward calm. They must get into a state of peace, must harmonize inward with outward conditions. A dozen times a day they must say to themselves and must obey their own command: "Peace, be still."

Talk, if you will, but don't talk unless you have something to say. Believe me, you can be interesting though silent, by being an interested listener. Wild, aimless, excessively excited talking is one of the biggest leaks of beauty.

The mouth, if too large, may be lightly massaged by using the middle fingers of each hand to coax it toward the greater fullness at the middle and less at the corners. If it be too small, rotary massage from the corners of the lips will tend to widen it.

If the chin be too strong, the jaw too heavy, as it is sure to be in these latter days of new equality, the fact can be rendered less glaring by dressing the hair well forward above the forehead, so that there will be a semblance of brow and chin being of equal

weight, and the face seem to be well balanced. If the chin is too weak the hair should be well drawn back, so that the strength of the brow will seem to make up the character deficit.

For lips that chap easily and always have a parched look let me advise that this pomade be applied every night, freely massaged into the lips:

Cocoa butter, 24 grams; white wax, 4 grams; oil of rose geranium, 1 gram.

This should relieve an ordinary case. If it be an obstinate one, suppose you try this remedy prescribed by the famous Dr. Vaucaire, whose commandments are the decalogue of beauty-loving Paris:

Castor oil, 6 grams; cocoa butter, 20 grams; oil of birch, 4 drops; extract of catechu, 2 grams; essence of star anise, 10 drops.

To make rough lips smooth try this:

Oil of sweet almonds, 1 ounce; spermaceti, 1 ounce; white wax, ¼ ounce; oil of rose, 6 drops. Melt together slowly, then work into a firm cream.

The gums should be of a healthy red. If they look pale massage them gently for five minutes several times a day with this compound:

Woundwort water, 100 grams; horseradish extract, 12 grams; oil of cloves, 1 drop. Dilute with an equal quantity of water.

The wholesome woman tries to keep her breath as “sweet as the kine’s,” recalling the exclamation of Byron. She keeps a jar of bicarbonate of soda on her bathroom shelf and takes a teaspoonful in a glass of water whenever needed. She always drinks two or three glasses of cool water slowly on rising. This is because when the stomach is in the tubular shape that it is in the morning it lends itself easily to the work done by the water, of cleansing the stomach for its work of the day. To correct acid conditions of mouth or stomach she takes a couple of unsweetened charcoal tablets now and then, and this is her favorite mouth pastille:

Unsweetened chocolate, 1½ ounces; white sugar, ½ ounce; charcoal powder, ½ ounce.

These are more easily taken if mixed to the consistency of paste by the addition of dissolved gum arabic, cooled and cut into tablets.

For the care and preservation of the teeth four things are essential. They are: Proper diet, proper tooth brush, proper tooth powders or pastes, and proper mouth baths.

But beyond any doubt the first safeguard is to have a reliable, skillful dentist--if you can make sure of finding one. One may go on for years with false confidence in a dentist before one finds out her sad mistake.

I go to a dentist once a month to have my teeth examined. No one should let more than three months at most pass without a visit to the dentist for an inspection of the teeth.

The best dentist is none too good. The careless or ignorant or lazy or dishonest dentist may cause irreparable damage. And the saddest part of it is that we are at the mercy of the dentist, because we cannot know whether his work is good or bad until the damage is done.

There often come on the teeth, particularly between them where food is permitted to lodge, small dark stains, which really are the first warnings or premonitory signs of decay. If allowed to remain, the enamel eventually disintegrates, and we have a cavity, which must then be excavated and filled. Before this discoloration has advanced to an actual breaking down of the tooth structure, it may very properly and successfully be removed or polished away by the dentist’s engine and the sandpaper disc used for this purpose and for smoothing gold fillings.

The honest dentist will do this, and restore the tooth to its original color and soundness, after which it may be, with care, indefinitely preserved, but the unscrupulous dentist may, of course, construe this suspicious-looking spot as caries, and he may wickedly cut away sound tooth surface, fill in with the customary unsightly gold or amalgam, and the unsuspecting victim pays the bill and departs none the wiser. Of course, in front teeth it is especially a misfortune to make a cavity where it could have been avoided.

Let us consider now the diet. We must avoid extremes. The English girl’s answer to the question, “Why do you have such beautiful complexions?” might as well have been made to another query: “Why do English girls have such beautiful teeth?” The girl replied:

“Because we never eat anything very sweet or sour, nor anything very hot or cold.” That is an excellent rule.

Whoever follows it will adopt an admirable dietary. Also live if possible in a region whose soil is strongly impregnated with lime.

That its soil is so strongly impregnated with lime is the reason why the Bluegrass region of Kentucky is as famous for the beauty of its women as of its horses. Much lime in the soil means much lime in the products thereof, and whoever eats of these products has strong bones and correspondingly strong teeth. But we may not all live in Kentucky, and unfortunately there is not enough lime soil to extend over the world. So we must make up for this lack by careful attention to our diet.

Let me explain why the diet is of so great importance. Those foods which contain lime strengthen the teeth. Fifty-four and seven-tenths of the composition of the teeth is phosphate of lime, when they are in normal condition. To get as much lime as possible into the system, and so into the teeth, is as necessary as to have as much iron as possible in the framework of the house. The iron in the framework of the house will resist fire. The lime in the teeth will prevent their softening and decay.

Therefore, gluten and whole wheat bread and the cooked cereals, instead of cakes and white bread and sweets, should be eaten. These should be supplemented by various preparations of phosphates to introduce lime into the system. A simple lime water, which can be prepared by any housewife or any intelligent employé of a housewife, is one of the best of these preparations:

Clean, unslacked lime, 1 teacupful; water, 2 quarts. Put the lime into a pitcher and pour the water over it. Stir the mixture, or shake it until it looks like milk. Then pour off the water. Fill the pitcher again with pure water. Again stir or shake thoroughly. Tie over the pitcher a piece of muslin to keep out the dust and possible floating germs. Let it stand in a clean, cool place until the water is clear. Pour the clear portion into clean, glass-stoppered bottles.

Another method is to use a tablespoonful of lime water in a tumbler of milk.

If the teeth are soft from deficiency of mineral salts or sensitive from the presence of excessive acids the dose can be increased to two or three tablespoonfuls.

It is well after eating acid fruits to rinse the mouth carefully two or three times with lime water or any alkaline mouth wash. Or when the teeth have been irritated, or unpleasantly affected, or the gums irritated by a food or medicine to which they are unaccustomed it is well to rub precipitated chalk about the necks of the teeth and between the teeth. It is well also to rinse the mouth with milk of magnesia at night before retiring.

Again let me suggest that diet is of immense importance for two reasons. If the diet be an unwise one it may create an excess of uric acid, which makes itself manifest in the mouth and causes the teeth to decay about the necks, that is, the portion enclosed by the gums, a state to be avoided, for the cavities thus formed are hard to reach and are the most painful to be operated upon by the dentist.

Again, the diet is important because if there is an undue fermentation or any other unwholesome condition in the stomach the gases and acids arising from these discolor the teeth.

Therefore, avoid, as I have said, articles of diet that are very sweet or very sour, and articles of drink that are very hot or very cold. For example, do not eat candy, pastry, puddings, except those consisting chiefly of fruit; ices, pickles or sour oranges or grape fruit. Do not drink sour lemonade, nor limeade. Avoid ice water or very hot tea or coffee. I am extremely careful about my diet, quite as much for the care of my teeth as for my complexion.

As soon as I rise in the morning I place my tooth brush, which should be soft and shaped to fit the teeth, in a mug of hot water. I let it remain there for a half hour, until I have had my bath and my alcohol rub. This hint I received from my dentist, who said that it would make the bristles soft, besides swelling them so that they would fill the spaces for them in the brush, and thus prevent the bristles from loosening and detaching themselves from the brush and irritating the gums.

Always use a good tooth powder or paste which a reliable chemist has analyzed and pronounced pure. Simple, pleasant and beneficial to gums and teeth is this:

Camphor gum, 1 ounce; precipitated chalk, 5 ounces; pulverized orris root, 3 ounces.

A good variant of this is the following:

Precipitated chalk, ½ pound; powdered starch, ½ pound; powdered orris root, ¼ pound; sulphate of quinine, ¼ dram.

One of my own favorite powders is made according to this formula: Carbonate of magnesia, powdered, 3 ounces; powdered orris root, 1 ounce; powdered sugar, 1 ounce; castile soap, ½ ounce; powdered precipitate of chalk, 10 ounces; oil of roses, 25 drops; oil of lemon, 5 drops; oil of wintergreen, 5 drops; tannin, 15 drops.

I recommend also this as helpful and agreeable:

Precipitated chalk, ½ pound; powdered borax, ¼ pound; powdered myrrh, ¼ pound; powdered orris root, ¼ dram.

Another simple and effective preparation is this:

Powdered chalk, 2 ounces; oil of peppermint, 2 drops.

A good antiseptic powder for occasional use I have found to be this:

Bicarbonate of soda, 1 ounce; cinnamon, 1 ounce; oil of cinnamon, 2 drops.

If my teeth are discolored I brush them thoroughly with this powder:

Sugar of milk, 200 grams; powdered catechu, 3 grams; oil of peppermint, 4 drops; oil of anise, 4 drops; oil of orange flower, 4 drops. Pour into the sugar of milk a few drops of alcohol. Add the catechu, stirring them thoroughly. Sift them through bolting cloth and sprinkle the oil of peppermint, the oil of anise and the oil of orange flower into the powder.

Another which is less expensive, and is also excellent, is this:

Precipitated chalk, 500 grams; pulverized orris root, 250 grams; pulverized camphor gum, 12 grams; alcohol (95 per cent.), 10 drops. This should be sifted through bolting cloth to remove lumps that might irritate the gums.

It has always been my habit to use powder only once a day and that in the morning. I think it enough, because too much tooth powder in time wears away the enamel. Yet my dentist tells me that the best time to use tooth powder is at night, because the salivary glands, being quiet during sleep, when we do not talk or eat, do not then secrete the saliva, whose flow has a cleansing action.

After each meal I use dental floss, drawing it between the teeth to remove any particles of food that may have lodged between them. Hard toothpicks are liable to crack the enamel. Also I give the mouth a bath, that is, I thoroughly rinse it several times with a good mouth wash.

Of preparations for liquid dentifrices and mouth baths there is no end. This, “the bath of roses,” is my favorite, and I rinse my mouth with it after each meal and before retiring:

Tincture of orris root, 8 drams; spirit of roses, 8 fluid drams; alcohol, 95 per cent., 8 fluid drams.

An agreeable preparation for a mouth bath is made of:

Powdered borax, 3 drams; honey water, 2 ounces; castile soap (powdered), 1 ounce; warm water, 1 pint; oil of cloves, 2 drops.

Dissolve the powdered soap in the warm water. Add the other ingredients and shake well.

Either of the following washes will be found excellent for the teeth:

Tannic acid, 1 ounce; oil of wintergreen, 1 dram; powdered orris root, 4 ounces; alcohol, 4 ounces; water, 4 ounces.

Tincture of orris root, 1 ounce; tincture of musk, 4 drops; oil of rose, 2 drops; oil of neroli, 4 drops; oil of peppermint, 4 drops; oil of spearmint, 4 drops; oil of ylang ylang, 1 drop; alcohol, 3 ounces; water, 8 ounces.

Here is one which, besides being agreeable, has a medicinal value in being a disinfectant:

Thymol, 3 grains; alcohol, 3 ounces; benzoic acid, 40 grains; tincture of eucalyptus, 3 drams; essence wintergreen, 5 drops.

Easily obtainable, too, is this and very soothing to irritated gums:

Permanganate of potash, 10 grains; distilled water, 1 ounce.

Another simple mouth wash which I have frequently employed with good results is made as follows:

Chlorate of potash, 2 drams; rosewater, 6 ounces.

For a mouth bath after a meal a solution made by adding a tablespoonful of bicarbonate of soda to a tumbler of water is useful.

Use dental floss more and the toothbrush less. The toothbrush should be soft and should be shaped to adapt itself to the teeth. It should slant toward the front, with a tuft on the end so that the bristles can work their way into all the crevices between the teeth.

I am glad that toothpicks have come to be classed with vulgar things. A member of Parliament at a dinner in London played nervously with his toothpick and thrust the end of it into his finger. The toothpick had harbored some dangerous microbe, for the statesman had to have two fingers amputated. The danger of infection from toothpicks is great. Dental floss being protected from vagrant germs by its casing, and the end being cut off as soon as used, is much safer, besides being less irritant to the tender gums.

If the teeth are not straight, have them straightened. If there are wide spaces between them have them drawn closer together. Dentists can do this by fastening rubber bands about the neck of the teeth. It is tedious and painful, but it is worth while. For a tiny space, but an undue one between the teeth, may change the natural expression of the face. I know an American statesman, whose face is of the strong, noble lines of a statue of granite, but who takes on a fatuous expression when he smiles, because there is a considerable space between his two upper front teeth. After the teeth are drawn into their proper place, they are secured by small bands of gold or by a rod at the back of the teeth.

If the teeth are permanently discolored it may be because you need a dentist’s services. It is well to call on him at least every three months. Every two months is still better. His examination will show any fault in the teeth that may be a tiny one, but which if neglected for three months longer would be troublesome. Frequent visits to conscientious dentists are best for your teeth and best for your purse.

The teeth are the most important of the appointments, the furnishings, so to speak, of the mouth. They must be kept perfect at all costs of care and forethought. But they, like all portions of a woman’s body, must be delicately treated. Tooth powder should not be used more than once a day. And that in the morning. For the rest dental floss and a delicate liquid dentrifice after each meal and before retiring.

CHAPTER VIII

DUTIES EVERY WOMAN OWES TO HER HAIR

It is Monday, and I note that my hair does not respond readily to the brush; that it lies lifeless under my fingers; that instead of being a live, bushy, glowing mass, it has diminished to a wisp scarcely larger than my two fingers. It is as though some witch in a rage had plucked it, hair by hair, from my head as I slept.

But that has happened too often to give me alarm. Once I wept over it. I thought that I was to become as the shiny-headed men that sit in the first rows of the opera and stare and stare. But that was long ago. Now I know when my hair shows these symptoms that it is dead, but only temporarily, and that with care I can resurrect it, make it live again.

With this lifeless condition of the hair I have always found two corresponding conditions of the scalp. The scalp is hot and dry. Also, the brushing reveals dandruff--light, fine and profuse. It is a condition that must be corrected.

First remove the dandruff. Hair cannot thrive when that fine, light powder lies upon the scalp, obstructing its pores. To rid one’s self of it the hair must be washed, not once but often. I resolve upon washing it every day for a week. I choose the time when I have had my bath. In the water I have dissolved half a cake of the best soap I can get. If upon analysis it is proven to be made of spermaceti all the better. I always have a new soap analyzed, as I do a new cold cream.

I part my hair, and, dipping a small brush the size of an ordinary toothbrush into the water, rub the parting vigorously. I part it again, and rub that parting, and the next, and the next, scrubbing it, as you say in this country, strenuously with the brush dipped in soapy water.

When this has been done I empty the bowl, and in a second water, in which the other half of the cake of soap is dissolved, I wash the hair again, but this time rub the scalp, not with the brush, but with my fingers. Then again and again and again, until the water is as clean as when it runs from the faucet, I rinse the hair.

Now comes the problem of drying it. The hair that is dried in the hot funnel becomes brittle and cracks. If it is dried by draughts of cold air its owner contracts neuralgia. It should be dried first by a brisk toweling. The towel should be rubbed quickly through the hair and upon the scalp, taking the first dripping stage of moisture from each of them. The rest of the drying should be done by the heat of the hands. With the tips of the fingers every bit of space on the scalp should be rubbed until dry.

As the scalp dries the hair dries, too. Last, that the hair may not hang together in matted strands, but stand fluffily, each hair for itself, there should be the last stage of the drying. This is the rubbing of the hair, strand by strand, between the hands. Even this one shampoo will prove that the hair that seemed to be dead is, after all, very much alive.

After the drying the hair should, of course, be brushed--adequately brushed. But there are curious ideas among women in this country as to what is adequate brushing. American friends of mine give the hair one hundred, even two hundred, strokes. I think this is too many. Excessive brushing drags upon the hair and loosens its roots. Forty strokes of the brush I believe to be quite enough. Less brushing, more massaging, is what is needed by all heads, especially the heads on which the hair is thinning.

After the forty strokes of the brush there should be massage. Dry massage always. If you begin with dry fingers you will find that your fingers soon become oily. The sebaceous glands yield their contents quickly to the pressure of fingers, and the released oil softens the hair and sets the tide of growth pouring into it.

It is well at this time to give the hair a sun and air bath. The hair is precious, a splendid frame for the face, and you can afford to give much time to saving it. Sit or stand near an open window. Let the sunshine pour its tonic into your hair. Let the air sweep through and about it. It will respond to the treatment as an invalid to his first drive after a long illness.

Let the hair rest as much as possible. Decline invitations, or, if you have accepted them, cancel the engagements. You can dispense with a few perfunctory meetings and greetings, a cup or two of tea, rather than with so important a part of your beauty as shining, healthful hair. Remain in your boudoir, with your hair loosened and hanging. When it is necessary to be visible to the world wear it in a somewhat different way, and use fewer hairpins.

On Tuesday I would use a different and more stimulating shampoo:

Pure liquid soap, 100 grams; carbonate of potassium, 20 grams; distilled water, 2 liters. These should be boiled until the soap is dissolved, then let cool. When cool add from 200 to 500 grains of tincture of vanilla or other favorite perfume.

A handful of this shampoo in a bowl of warm water will cleanse the hair of any dust it may have accumulated since Monday. The hair is now thoroughly clean. The next step is to stimulate it. For this purpose use the camomile mixture, made as follows:

Two handfuls of camomile; two quarts of water. Boil until the mixture is as black as after-dinner coffee. Usually fifteen minutes are quite enough. Pour it into two more quarts of cold water and place in a gallon jar.

Massage the scalp with it after the shampoo. This is a favorite preparation in France. There no grease nor oil is used on the hair.

To encourage the hair to grow an application of a good quinine mixture is a great aid. During the afternoon of the second day that I go into seclusion for my hair’s sake I massage the scalp lightly with such a tonic. Or I apply it before going to bed. Many of the quinine mixtures sold in the drug stores I have used with good effect, after having had them analyzed by chemists.

Here is a preparation which a friend becoming bald used to secure a splendid new lot of hair. Were I in so serious a state I might also use it:

Precipitated sulphur, 10 grams; alcohol (95 per cent.), 10 grams; distilled water, 50 grams; rosewater, 50 grams.

And here is another which, were my case radical, I would use:

Alcohol (95 per cent.), 100 grams; acetone, 100 grams; oil of cade, 10 grams; precipitated sulphur, 20 grams; pyrogallic acid, 2 grams; chrysophanic acid, 20 centigrams; bichloride of mercury, 40 centigrams.

On Wednesday I would do that which ordinarily I should do but twice or three times a year--I would singe the ends of my hair. Then again I would shampoo it with the preparation for which I gave the first recipe, and would again give it the tonic of air and sun bath.

And again I would use the camomile, but if one prefers to have the aid of the druggist here is a preparation that is much used in London with great satisfaction. I shall give it in the English measure:

Resorcine, 1 dram; chloral hydrate, 3 drams; sweet almond oil, 1 dram; chloroform, 6 drams; eau de cologne, 6 ounces.

On Thursday, if my hair is not showing great improvement, I may vary my shampoo. Here is an excellent cleansing one:

Extract of witch hazel, 1 pint; eau de cologne, 8 ounces; chloroform, 3 drams.

On Friday and Saturday I would repeat this shampoo, the massage and the sun and air bath.

By Sunday, with every morning a shampoo, a massage of the scalp for fifteen minutes--not long enough to irritate the nerves--and the sun and air baths and the repose, one's hair should be excellently vigorous. If the rigorous treatment should have caused it to be too straight I would encourage it to curl by the application of rosewater and gum arabic in these quantities:

Gum arabic, 100 grams; rosewater, 400 grams.

Always in brushing the hair the strokes should be backward, straight back, instead of to the sides, for in that way the hair is aided to grow low on the forehead, which is a most desirable mark of beauty.

Before retiring I always braid my hair in two loose braids. I never use curling irons when I can avoid it. Use them cautiously. Better not at all, especially if your hair have a natural wave.

If your hair persistently continues to fall out, it is probably because of a generally lowered tone of your health. I should then resort to iron or arsenic hypodermic injections under the direction of a physician. When I have suffered from nervous exhaustion I have always taken this treatment at a physician's prescription. I have found the iron particularly upbuilding. I would receive an injection every day for ten days, then rest three or four days, then begin again for another ten days until seven weeks have gone. Always at the end of that time I have felt rejuvenated.

And after my complexion my hair was the first to improve. Never attempt this without medical direction, I repeat. The injections of iron I preferred to taking it internally, thereby saving the teeth from the bad effects of the iron. Also the administering of medicines in this way prevents an unpleasant disturbance of the stomach.

If there be an unconquerable objection to the injections a physician will prescribe cod liver oil, or tablets containing quinine and phosphorus that are a tonic to the system.

If the hair be prematurely gray I should first take a general treatment for the system, hoping that the gray hair would fall out and a crop of natural color appear. Or if I could gain my own consent to dye my hair, I should go to a druggist's and ask for a safe solution of henna. This is the one hair dye which I can recommend. It is harmless, but its range of usefulness is limited for it only dyes the hair red. It is prepared like this:

Henna leaves, 1 ounce; boiling water, 2 pints; henna powder, 1 ounce. Place the henna leaves in a stone jar. Pour over them the water. Allow the liquid to stand undisturbed for twelve hours. Then strain and heat until it reaches the boiling point. To the liquid add the henna powder. Stir thoroughly and strain once more. The hair must be thoroughly clean when it is applied, so the best time to apply it is immediately after a shampoo.

But do not place too much reliance upon the henna. Look to the state of your general health and be sure to keep the scalp cool, clean and moist. If this is done the next crop of hair--for we raise new hair every three years, you know--may come in the former natural color and the former unwelcome gray may disappear before the new crop. Use a good hair tonic to bring about that condition of the scalp. This is one that has been long and successfully used:

Glycerine, 2 ounces; alcohol, 1 pint; sulphate of quinine, 1 dram; oil of cloves, ½ dram; oil of lemon, 4 ounces; oil of bergamot, 1 ounce.

This, too, deserves recommendation:

Castor oil, 1 gill; alcohol, 3 pints; tincture of cantharides, ½ ounce; borax, 2 ounces; water, 2 ounces; oil of lavender, 1½ ounces. Shake well before using.

The wholesome woman has thick, lustrous, clean hair. I am sorry to say that it is necessary to use this last commonplace adjective. But some women there are who neglect the hair until it does not deserve to be so described.

“She has such clean hair,” a man said to me of an American girl who is much admired. When I saw the girl I knew his appraisement was just. Her hair was clean. It was thick, light brown and slightly curling hair, just the sort that a careless person might neglect, saying, as I have heard women say, “Mine is the kind of hair that takes care of itself.”

But this girl’s hair was as clean as her radiant young face. One received the impression that her hair, as all the rest of her person, had as close neighbor the bath.

And so it is. Her hair being light, she washes it at least once a week in borax water, made by dissolving an ounce of borax in a quart of warm water.

Borax is somewhat drying, and if she finds her scalp growing too dry she massages the scalp twelve hours before the shampoo with this:

Oil of sweet almonds, 45 grams; essence of rosemary, 45 grams; oil of mace, ½ gram.

If the wholesome woman find her hair growing prematurely gray, and this she is not at all liable to do, for gray hair is a sign of anæmia, and from this the healthy woman rarely suffers, she makes her life more than ever wholesome. She lives out of doors the more. She takes more regular sleep and more nourishing food. She is more than ever punctual and thorough as to her exercise. And having done all these she may assist nature with this remedy, which her less wholesome sister has used with success, to arrest the turning gray of her hair:

Good claret, 30 grams; sulphate of iron, ½ gram. To use the cook’s parlance, “Bring these to a boil.” Keep in a well corked jar in a cold place and wash the hair with it after each shampoo. If necessary it can be used two or three times a week. Permit the mixture to dry on the hair.

Here is another wash that has proved successful when the hair was turning gray:

Sulphur, 2 ounces; bay rum, 8 ounces.

Sulphur to a degree strengthens the pigment--that is, the natural coloring matter of the hair. Use the sulphur in lumps, for it will not adhere to the scalp as will sulphur in the powder state.

If the case be beyond such relief a French dressing, which those who use it disdain to call a dye, is used by brunettes whose hair has turned prematurely gray:

White wax, 2 ounces; olive oil, 5 ounces; burnt cork (powdered fine), 1 ounce. The white wax and oil should be melted together over a slow fire. Add the burnt cork and mix well. The mixture should be applied to the hair as a pomade, and thoroughly brushed in.

Here is a good corrective for falling hair:

Oil of sweet almonds, 2 ounces; alcohol, 2 gills; aqua ammonia, 2 ounces; good whiskey or rum, 4 ounces; gum camphor, ¼ ounce. Shake thoroughly each time before using and rub thoroughly into the scalp. Massage your scalp well, so that you can feel the skin of the scalp move.

For a scalp that is too oily use borax or bicarbonate of soda in the weekly shampoo. A blonde of my acquaintance believes that the juice of one lemon used in the last rinsing water after a shampoo adds to the brilliance of her hair while also drying it enough to make it “fluffy.”

Allow your hair to be straight, if Nature planned it so. Find some becoming method of wearing it straight. If the ends have become broken and the hair is thin and uneven set about raising a new and stronger crop. But first prepare the soil for the new crop by cleansing your scalp with frequent shampoos, one every other day if necessary, and by using on it a good oil. Olive oil is an admirable agent for loosening and feeding a heat-dried scalp. Have the ends singed or clipped. Massage the scalp every day, unless it is too tender to endure massage that often. Irritating the nerves, which protest against such treatment, does far more harm than good. A few applications of electricity by a physician familiar with your case should stimulate the anæmic scalp.

A few years ago there were almost no good hair tonics. Now there are many. Almost any tonic containing a liberal amount of quinine is a good hairgrower. Here is one much used in Paris:

Oil of almonds, 6 ounces; oil of rosemary, 2 drams; oil of mace, 60 drops.

An excellent tonic for the scalp is:

Alcohol, ½ pint; oil of mace, ¼ ounce.

One that has many advocates is this:

Fluid extract of jaborandi, ½ ounce; glycerine, 1 ounce; sulphate of quinine, 10 grains; cologne, 2 ounces; rosewater, 10 ounces; bay rum, 2 ounces.

The wash that has tonic properties in addition to being an excellent cleanser is made as follows:

Precipitated sulphur, 10 grams; alcohol (95 per cent.), 10 grams; distilled water, 50 grams; rosewater, 50 grams. Apply it to the scalp as all other tonics are applied with the tips of the fingers or a soft brush, for instance, an old tooth brush.

This tonic will keep the scalp cool, clean and moist and help prevent the hair falling out:

Tincture of cantharides (alcoholic), 1 ounce; spirits of rosemary, 1½ ounces; rose water, 3 ounces; aromatic vinegar, 1½ ounces.

Parisiennes have recently been washing their hair in gasoline. Not because they believe that it will cause the hair to grow, but for the same purpose that it is used upon a spotted garment--to cleanse the garment and remove the spots. Also gasoline makes the hair soft and silken of texture, I am told.

I have myself used gasoline a few times on my hair, but always try to keep it away from the scalp as much as possible. I cannot believe that gasoline is good for the scalp.

I take the gasoline shampoo somewhat as I do the water bath for the hair. I wash it in a bowl of the gasoline, pour out the first bowlful and wash it through another, then another, until the last bowlful is entirely clean. Let as little gasoline as possible get to the scalp. But the shampoo is always taken on the morning of a clear day. Never do I have it done while there is a light or fire in the room. If I did, there would be no more Lina Cavalieri. Gasoline is most inflammable and one cannot be too careful when using it.

Never use vaseline on the hair, never, never. It is not harmful. It is merely useless. It no more makes the hair grow than would sprinkling flour over the face make it grow. It is derived from a mineral, and nothing of mineral origin causes the hair to grow. I never use grease on the hair. After the shampoo, once a week, I use the camomile lotion I have already described, rubbing it in carefully with the points of the fingers, and on no account permitting it to touch the face, because it will make the face yellow. This cleanses the hair and tones the scalp, promoting circulation.

Hair to be really beautiful should not lie in heavy, sticky bands, but should stand out hair by hair, as separate as the down of a little chicken. To acquire this use ten drops of ammonia sprinkled in the camomile. It must be added after the mixture has boiled and cooled, otherwise the ammonia will evaporate.

This is the favorite preparation now used in France. No beauty nor fashionable woman ever uses oil upon her hair. By keeping it frequently massaged and thoroughly brushed she permits it to develop its own oil.

The Egyptian women have the most beautiful hair in the world. This they owe to henna. Sprinkle enough henna in the water to make it the color of coffee. Part the hair in little strands and, with a small handbrush dipped into it, rub the scalp.

The hair, so beautiful at its best, so disappointing and even disfiguring at its worst, has many foes. The greatest of these is the extreme heat of midsummer. Under the midsummer sun’s rays the hair’s rich hue is liable to fade. The country roads powder their dust finely upon it. The heat parches the scalp or causes it to perspire excessively, and each of these evils, separately considered, seems worse than the other. Their results are the same, and the hair rapidly grows thinner.

If you are spending your vacation at the seashore beware of the action of the salt water upon your hair. If your hair has been splashed in the surf rinse it thoroughly with fresh water as soon as you leave the beach. Be sure that no particles of sea salt adhere to it, for salt, so healing and tonic for most of the body, is the contrary for the hair.

Keep your scalp in such condition that two words, “Cool” and “Clean,” will always describe it. If the scalp be cool and clean the hair will be beautiful. If the scalp be not cool and clean the hair will speedily reveal that fact. How to keep it so during the summer is a problem that every woman must be careful to solve according to her surroundings and facilities. But somehow she must attain that

end if she would preserve the beauty of her hair.

Keep it free from dust. To do so it must be frequently shampooed--twice as often, I should say, as in the winter. If, for instance, it is your habit to wash your hair every two weeks in winter, try washing it every week in summer. If it has required a weekly shampoo in winter you will undoubtedly find it necessary to wash it twice a week in midsummer. But you must judge that yourself, keeping before you the two words “Cool” and “Clean,” which should always be your guides. When the dust from the hair soils the fingers and brush it is time for a shampoo even though for a time the hair must be washed every day. The observant one will notice that so soon as the hair is unclean it falls out.

Also, she will observe that an itching scalp precedes almost immediately the falling out of the hair. With these object lessons in cleanliness she should resolve to be vigilant. Spare the shampoo and spoil the hair.

A good shampoo, especially for an itching scalp, contains beside the usual borax for softening the water, and the castile soap for cleansing the scalp these:

White of 2 eggs; juice of 2 lemons. Apply by rubbing the whites of the eggs thoroughly into the scalp with the tips of the fingers. After this application moisten the scalp thoroughly with the lemon juice diluted in one quart of cool water.

For the usual shampoo under ordinary circumstances the essentials are:

Warm water, 2 quarts; castile soap (shaven), ½ cake; borax, 1 teaspoonful.

I have heard women say: “I washed my hair yesterday and to-day it is as bad as ever.” If that is true it is your own fault. You did not give it a thorough shampoo. For a thorough shampoo care and nicety are necessary.

First prepare the water for a head bath by pouring into the stationary wash stand, or the portable washbowl or basin, the soap shavings. Over these pour a quart of hot water. With hands or a long handled spoon stir until the soap has dissolved and the substance has become mere lather. Part the hair, which I assume has previously been well combed, from the top of the middle of the forehead to the back of the neck. Make similar partings at the sides, and transverse partings here and there, as many as possible. With the finger tips, or with a soft, old nail brush, scrub the scalp with this lather. In this way go over the scalp several times, until it tingles under your very touch, and the skin is loosened from the scalp beneath. When a fine glow convinces you that this part of the task is well done attack your hair.

Dip your hands into the lather and taking the hair between them, wash it thoroughly but carefully with light touch as you would a fine handkerchief. When this has been thoroughly done empty the bowl and wash the hair through a second water. If, to use the hair dresser’s expression, the “water runs clear” you will know that the hair is thoroughly washed. If the water is dark, showing that the lather has not thoroughly removed the dust apply more lather. Then again wash it in cool water. The rinsing is best done with a spray. It should be continued until the water pouring off the hair is as clean as when it flows from the hydrant. The clearness of the rinsing water is the only criterion of whether the hair is clean. The rinsing water should be gradually cooled, but it should never be cold. It is my opinion that cold water is too severe a shock to the scalp.

Dry the hair as carefully as you have washed it. Never dry with a hot air funnel, nor at a radiator nor fireplace nor stove. The intense heat makes the hair brittle. A good brisk toweling is a method always available. If you haven’t time to dry the hair by toweling wait for the shampoo until you have time.

If you can sun dry it so much the better. Seated at an open window shake the moisture out of the hair and as it slowly dries massage the scalp with the fingers. The process of drying will be aided and neuralgia prevented by vigorous massage of the scalp.

This is an excellent time for the hair’s daily airing. The hair needs ventilation as well as your room, your lingerie, or your bed linen. Every day it should be shaken out and allowed to blow about in the wind. A balcony of a summer cottage is admirable for this purpose.

I know an English beauty who always gives her hair its airing as she sits under an old apple tree in the back yard of her father’s home. A friend of mine shakes her hair down and, sitting on the deck of her husband’s yacht, lets the wind play hide and seek in it every afternoon. Another friend returning by steamship from her vacation trip to Maine sat up aloft and tumbling her hair about her shoulders let the wind whip it at will.

Form the habit of always letting your hair down when you sit alone in your room. This half hour or hour's airing gives the hair exercise as well. When a hair hangs by its roots it is gaining the strength it loses while the hair is being supported upon the head by pins.

If the treatment of the hair has passed the stage of prevention and reached that of cure, dry, falling hair can be helped by this variant of the shampoo I have described:

Castile soap, ½ cake; borax (powdered), 4 teaspoonfuls; bay rum, 1 ounce; Italian pink, 20 drops; warm water, 1 quart.

A dry shampoo available for blondes, but which would leave unbecoming traces in dark hair, is:

Cornmeal, 2 ounces; orris root (powdered), 1 ounce. This shaken well into the hair and brushed out carries much of the dust with it, as does French chalk when brushed upon and off a soiled frock. This I commend in an emergency, but only then, for it does not clean the scalp as does the liquid shampoo.

Another shampoo that has been successfully used to check the falling of hair contains:

Borax, 2 tablespoonfuls; salts of tartar, 2 drams; almond oil, 2 ounces; Italian pink, 12 drops.

For dry hair this tonic is one of the best:

Sweet almond oil, 3 ounces; oil of rosemary, 1 ounce; oil of bergamot, 10 drops.

If dandruff afflict you in midsummer look first to your brushes. If you have neglected to keep them scrupulously clean begin to do so. Dip them whenever the least soiled into:

Hot water, 1 quart; violet ammonia, 1 ounce.

Place the brushes on the window sill to dry. Turn the brushes upon their sides so that they will dry quickly, and the bristles will remain firm.

Brush the hair thoroughly night and morning. Use a blunt edged, large toothed comb. Do not scrape the scalp. Make your diet during this time chiefly of fruit and vegetables. Apply also this lotion:

Borax, 3 tablespoonfuls; rosemary (best), 3 ounces; steep in one quart of boiling water. When cold add ½ ounce of glycerine and 30 drops of cologne.

If the hair be moist use one tablespoonful of borax in a shampoo two or three times a week.

While in your room give the hair plenty of rest and exercise. Both are provided by brushing the hair and letting it hang loose as long as possible in the sun and air baths. Usually the hair needs in summer at least one shampoo a week, unless the hair be extraordinarily dry. One of the best shampoos is made very simply:

Shaved castile soap, 1 ounce; hot water, 1 quart.

For a dry shampoo this is good for moist scalps:

Alcohol (95 per cent.), 1 quart; table salt, 1 ounce; quinine, 1-6 ounce.

If you pass your holiday at the seashore you will welcome a formula that will keep the hair in curl. Here is one of the best I know:

Gum arabic, ½ ounce; carbonate of potash, ½ ounce; glycerine, ½ ounce; rosewater, 1 pint; Portugal extract, 2 ounces.

Fortunate are you, indeed, if you come back from your summer outing with hair thick and lustrous, and scalp cool and loose skinned as when you left. But even if you have achieved this, your hair is certain to be faded, for the sun's rays while stimulating to the scalp, diminish the richness of the hue of the hair.

The probability is that the scalp has been dried by the heat and dust. Massage with cocoanut oil or the following tonic:

Sweet almond oil, 3 ounces; oil of cinnamon, 30 drops; oil of rosemary, 1 ounce.

Let me tell you of an experience which taught me much about the hair. I was invited to an informal house party. Arriving at an early hour in the morning I was met in the hall by my charming hostess. She was as lovely as ever, but there was something odd about her, something unusual.

She laughed at the puzzled look in my face. “You are bewildered,” she said. “I look different, but you do not know how. It is this. I am resting my hair.”

“Wonderful woman!” I cried. “It is the great American common sense.”

Then I saw that her lovely blond hair, short, as is all curling hair, rested about her shoulders in a golden shower. It was parted in the middle. She had always worn it in a pompadour or some modification of the pompadour. Now it was parted in the middle, and combed as smoothly as its rebellious luxuriance would permit away from that part, and flat upon the top of the head. Glistening from its recent brushing it hung about her shoulders, fresh combed, fresh brushed, and with the faintest odor of a cleansing tonic hanging about it. It had no ribbon about it. No hairpin confined it. It was free. It was resting after the nine months’ toil of a fashionable season.

“Every morning,” she said, “it has had a thorough combing and slight brushing. Every night a slight combing and thorough brushing. The first week I gave it a shampoo every day. I continued until the last trace of dandruff was gone. A sun-dried shampoo, of course. Every other sort, except the toweling, I consider barbarous and destructive to the hair. Every afternoon when the sun shone in my bedroom window I have let down my hair and sat where the breeze and sunshine came through the open window. Sitting there I have taken my hair between my palms and, strand by strand, have rubbed it lightly until every hair has had its burnishing. When this was done I shook it out loosely between my thumb and forefingers so that the wind and sun could reach every part of the hair and scalp.”

My friend’s hair had made almost instant response to the treatment. From being dead hair it had become live as a galvanic battery. From being dull and faded it had become rich and glistening. All over her scalp was the fine first fuzz of a new crop of hair. And the old galvanized hair had grown an inch longer in one month.

She had experimented with various lotions or dry shampoos. This she found the greatest cleanser and tonic for her hair:

Peruvian bark (powdered), 3 ounces; rum, 1 pint.

Another aid to this summer rest of the hair was a new brush. She showed it to me. It was a plain wooden backed hair brush, with the bristles set well into the back in groups. The bristles in these groups were irregular, in order that they might reach all parts of the head, the long ones penetrating the hair where it was thickest, the short ones sufficing for the parts where it was thinnest.

She adjured vaseline, as I have advised my readers to do. It is a mineral oil and cannot cause the hair to grow. Instead, she rubs olive oil or beef marrow well into the roots of the hair at night, softening the scalp and fertilizing a dry area.

Also she varied these treatments with this which, being a woman of wide reading, she had copied from The Lancet:

Alcohol (95 per cent.), 4 ounces; quinine, 15 grains; castor oil, ■ ounce.

Careful to massage the head gently every night after its brushing, she kept the scalp loose. When it was hot she cooled it by applications of cracked ice in an ice cap. She shunned the tempting fine tooth comb, that removes dandruff, it is true, but perpetrates atrocities upon the scalp as painful and disfiguring as scratches upon the face. Once a month she had her hair singed, before a shampoo.

Her greatest concession to the conventions was the slipping over her shining, well curried mane a net of exactly the same shade, which she wore at dinner, “a token of respect for the soup and butter, merely,” she explained.

One hundred strokes every evening before retiring are necessary if the hair be of vigorous constitution. If delicate there is danger of its being torn from the roots by too strong strokes of the brush and too many of these and the number of strokes can be considerably lessened.

Brushing removes the dust, but is not sufficient stimulant for the scalp, which needs, beside brushing, massage. The most beautiful hair I know is that of a young woman who gives her scalp a thorough massage three times a week with a good hair tonic. This, her favorite tonic, I publish here for the use of such of my readers as are blondes. It contains one ingredient, bicarbonate of soda,

whose tendency is to make the hair a lighter shade. Therefore, I do not use it myself nor would I recommend it for any other brunette:

Borax, 1 ounce; bicarbonate of soda, ½ ounce; camphor, 1 dram; glycerine, ½ ounce; rosewater, 1 quart; alcohol, 2 ounces. The camphor should be dissolved in the alcohol. The soda, glycerine, rosewater and alcohol should be mixed and well shaken in another bottle. Then pour this mixture into the solution of camphor. Apply with the finger tips, or a soft brush, parting the hair and rubbing the tonic thoroughly into the scalp, until it makes response by a healthful tingling.

A former method of scalp massage was to rub it haphazard with the tips of the fingers. From Europe has come a later and more scientific method. It consists in treating the scalp as though it were composed of circular terraces, treating each terrace at a time separately by pressing the cushions of the fingers firmly upon the scalp all the way round the terrace, beginning with that which is the first or the outer and working toward the center. This pressure achieves that for which massage of the scalp was invented. It loosens the skin from the scalp, permitting free circulation about the roots of the hair.

For a brunette my preference is for this:

Sulphate of quinine, 20 grains; fluid extract of jaborandi, 1 ounce; glycerine, 2 ounces; cologne, 4 ounces; bay rum, 4 ounces; rosewater, 20 ounces.

The above is excellent also for hair that is too dry. For moist hair I advise a dry shampoo or tonic treatment of this:

Eau de cologne, 4 ounces; borax, ½ ounce; tincture of cochineal, ½ ounce.

Some blondes whom I know use the following methods to keep their hair light:

Washing soda, 2 tablespoonfuls; water, 1 quart. Dissolve the soda in the water and give the hair a thorough shampoo with the mixture once a week if needed, less often if necessary. The susceptibility of the hair to treatment determines the number of the treatments.

A half dozen drops of ammonia in shampoo should keep the hair light. Also one teaspoonful of peroxide of hydrogen in one quart of water will lighten without injuring the hair.

Bear in mind that whatever makes the hair dry makes it brittle, and use any preparation discreetly, studying the effect of one or two applications on the hair.

Remember that headache is one of the greatest foes of the hair. When my scalp is feverish I sometimes apply a rubber cap filled with cracked ice for a half an hour or longer, until the congestion is removed.

Never retire without brushing your hair. The hair is a dust trap, and no dainty woman would retire without removing the day’s accumulation of dust. The brush tells its own story of the day’s catch of dust, if you take the trouble to examine it. After brushing the hair, loosen the skin from the scalp by slow, firm massage, pressing the skin toward the crown.

This is the best time to apply a hair tonic. A good hair tonic is made of:

Oil of mace, 2 grams; essence of rosemary, 60 grams; oil of sweet almonds, 30 grams.

I have found that, while I may protect my skin, my eyes, my hands somewhat from the winds of winter, my hair always suffers from it. The wind I found dried the oil in it, making it harsh and brittle. Ordinary massage and brushing I did not find as useful as in the summer. I tried many remedies for the dry condition of the scalp, which, of course, produced dry hair. At last I hit upon this, which I rubbed well into the roots of the hair before retiring on the night before my shampooing day:

Lanolin, 1 ounce; sulphur, ¼ ounce.

Let me explain, I did not rub this haphazard upon the scalp. I have seen women dab a hair scalp emollient so carelessly upon the scalp, here and there, that they might quite as well have left it undone and employed their time for better purposes. I did this as thoroughly as, I think, everything we undertake should be done.

First, I combed the hair thoroughly, doing it slowly, beginning about an inch from the ends, holding the long hair near the roots so that rough combing might not pull it out. Then I brushed it slowly, beginning at the roots and brushing downward with long, slow strokes to the very end. I parted the hair into fifty strands, combing it smoothly away from each little parting.

Then, with fingers dipped into the mixture of lanolin and sulphur, I began at the hair line and, with firm, long strokes, the effect of which was to loosen the skin from the scalp, I rubbed the mixture well into the roots. From the hair line I followed the partings to the crown, from which it radiated. This done, and thoroughly done, I unbraided my hair and combed and brushed it once more, and allowed it to hang loose for an hour or more, exercising and ventilating it, until I retired, when it was braided and tied into two large, loose braids and tied at the end with narrow ribbons. I never use either elastic or thread to fasten the ends of the hair, for I think it breaks the hairs, making the ends uneven.

The next morning I have a shampoo. Ordinarily I use a lather of white castile soap and warm water. But in winter, noting the drying effects of the cold winds upon my hair, I try to use a shampoo which will aid in making the hair soft and lustrous, doing for the time the work of the natural oils, which seem to have suspended operations:

Yolks of 2 eggs; warm water, 1 quart.

I part the hair into fifty strands, as I have described, the night before, and into each of the partings and particularly around the hair line, which a woman cannot afford to neglect, I rub the tips of the fingers with the yolks of the eggs, using the tips of the first two fingers. When this has been thoroughly done I rinse the hair and scalp in warm water. After the hair has “been through the first water,” I turn upon the scalp a spray from a small hose, one of the small-size sprays now made for shampooing. This distributes the water better, and the force is not so great as when it is poured from a pitcher in the old-fashioned “home” way.

The full force of city water must never be used upon the tender scalp. The little sprays are cheap and a good investment. The shower from the spray can be gradually cooled, but I do not believe in extremes of temperature for the hair any more than I do for the complexion. I never use either cold or hot water for a shampoo, nor cold water for rinsing. Warm to cool water is a sufficient gradation that soothes the nerves of the scalp, while dashes of hot and cold water overstimulate and shock them.

CHAPTER IX

USEFUL BEAUTY HINTS FOR MEN

Men take beauty treatments. Had that been a secret heretofore, one of their own sex revealed it. David Graham Phillips, whom some critics have called the Zola, others the Flaubert, of American literature, tells of the disappearance of a wealthy broker who was taking a beauty treatment.

Of what do men’s beauty treatments consist? Like the soundest of beauty treatments given to women, some of them are the rebuilding of the constitution upon a basis of health. Muldoon, of White Plains, many a New York man considers the greatest of beauty doctors. Men of London and some men of Paris have the same unlimited faith in Sandow.

No intelligent person can doubt that rest, regular living and much out-of-door air will make a person’s beauty greater, because it will strengthen the very pedestal of beauty, which is health. Every man is justified in taking one of these beauty vacations, which is, after all, a health vacation, a tonic time for the entire system.

If I were asked what the smart man has most regard for in his appearance, I should say his baths, which the English and those who spend much time in England, call their “tubs,” and the cut of their clothes.

As to the baths, the man who is really not unkempt, by the standards of the high world, has two baths a day, in the morning a cold plunge or shower as a tonic, in the evening just before dinner a tepid or warm bath, with a shower afterward, as a cleanser.

The cold bath is not cleansing. On the contrary it merely closes the pores, shutting the gates upon the effete matter that is trying to escape from the system by means of the millions of little gateways in the skin. It is valuable as a tonic to the nervous system, by means of the shock it gives to that system. But not even my lord man, mighty in his strength, should take such powerful tonics without having consulted his physician about it.

A man who always seems to shine with the radiance of his bath pours a wineglassful of perfumed ammonia into a tub of water. This softens the water, removes the odors of perspiration and whitens the skin.

An exquisite who is the fashion in London uses a quarter of a pound of borax in his bath to soften the water and so refine his skin.

I once heard the story of the physician with so admirable a skin that all his women patients asked the secret of his complexion's perfection. He told one, who generously told many others, that knowing the mighty power of absorption of the skin, he had experimented with the use of Epsom salts in the bath. He had found it stimulating and, in consequence, had used a pound of the salts dissolved in a bathtubful of water, every day.

A salt bath is stimulating. Rubbing handfuls of table salt on the body, getting it into a fine glow before the bath, is one means of absorbing the salt into the system. Another is pouring an ordinary five-cent bag of table salt into the water and letting it thoroughly dissolve before taking the bath.

[Illustration: MAXINE ELLIOTT Whom Mme. Cavalieri admires not only for her classic lines of face and figure, but also for her admirable taste in dress.]

But ask any well-groomed man if baths are sufficient for cleanliness and he will answer, "No. No man can be clean unless he walks four to six miles a day." There must be then three baths, the cold plunge in the morning, the natural perspiratory bath at any time that is convenient between the two, and the before-dinner tub in the evening, for the cleanliness that obtains among men who are proud of their grooming.

The man who fears baldness does well to avoid a tight hat. The size should be large enough to permit ventilation of the hair and scalp. Also he should puncture the hat with fine holes for the same purpose.

A man is his own best judge of when he needs a shampoo. If the hair falls unduly, or if it feels sticky, or if the brush is considerably soiled after brushing, it is time for a shampoo, even though you had one three days before. If there is much dandruff in the hair there is need of a shampoo. A shampoo successfully used by a relative of mine who has beautifully thick and glossy hair is made of:

Tincture of green soap, 1 tablespoonful; the whites of two eggs; cologne, 10 drops.

If the hair is dark the yolks of the eggs may also be used. The eggs are beaten into the water, the soap added and the cologne sprinkled in. To prevent catching cold after a shampoo, rub alcohol into the hair about the neck and cheeks and temples.

Remember that there would be no baldness if the hair roots were properly nourished. So keep a plentiful supply of blood flowing in that direction by massage. If the scalp is dry rub olive oil or lanolin liberally into the scalp at night.

Be sure to keep the skin of the scalp so loose that it can be easily moved about, and keep it cool if to do so you must occasionally place on the head when it is overheated a bag of cracked ice or a cloth dipped into cold water, renewing it as the cloth dries.

One authority on the hair believes in a daily pulling, not by an irate wife, but by yourself. He believes that this takes the place of exercise for the hair and that it strengthens the roots as walking strengthens the muscles of the legs or rowing the muscles of the arms.

Every man fears the ugly dewlap, often called "the statesman chin." He can prevent this by carrying his head and chin well up. He can to some extent correct it by using webbing chin bandages at night.

CHAPTER X

THE CARE OF THE NAILS AND FINGERS

Dainty finger nails are Nature's finishing touch for a beautiful woman. They have always seemed to me to be the natural jewels of the hands, and if they are in good order, that other jewels are unnecessary, if not superfluous.

Let me describe these jewels at their best. They are of color pink, as the deep, fresh heart of a blush rose. In shape they are nearly like the filbert nut. In size they are in good proportion to the size of the finger and the hand. They must be neither too large nor too small. They must seem to be long. They are more like the petals of a half-blown rose, or the lining of a sea-shell, than anything else in nature. At their base must be a crescent tiny in proportion to the size of the nail, but as clear cut and silvery as a young moon on the night of its début in the sky.

Is there need to say that the other end of the nail be spotless, as utterly beyond suspicion as the character of Cæsar's wife? There must not be the slightest rim nor shadow to darken the fair pinkness of the nails.

The skin about them must seem to bear but remote and casual relation to the nails. It must be discouraged from any intimacy with the nail, any closer intimacy, shall we say, than the thorny calyx with the rose? It serves, indeed, the same purpose. It is the mere protector of its charming charge.

Thus should the nails be. But how to make and keep them so is what we must discuss to-day. In the first place, as to their daily care. If they are in normally good condition, the morning hand bath should be supplemented by soaking the nails themselves for five minutes in warm soap-suds or lather made of castile soap.

This supplemental nail bath should be followed by a careful pressing back with the towel of the skin about the nails until each portion of the skin is detached.

A third step in the daily care of the nails is to brush them vigorously with a nail brush dipped into the soap-suds.

Notice next whether any portion of the skin about the nails is still attached, or if not attached, is slightly sore. If it is, that portion of the nail should be anointed with a bit of camphor ice or with vaseline or lanolin, or a preparation containing witch hazel. If necessary, wrap it round with white muslin or white silk.

If in spite of all these endeavors there remains a faintly dark rim around the end of the nail, one further process is necessary. Wrap around the pointed end of an orange-wood stick a bit of antiseptic cotton. Moisten this with a few drops of peroxide of hydrogen. With this carefully remove the dust that may remain between the nail and the skin. Never use a steel instrument, an ivory nail cleaner, or anything harder than the cotton wrapped around the end of the orange stick. If you do, the sensitive skin under the nail is lacerated. Dust settles upon the ragged ends of the skin, and the ugly, disfiguring dark rim is evident.

If the nails become brittle it is because they are dry and they should at once be moistened by an oil bath. Into a small, shallow bowl pour a gill or more of olive oil. Soak the nail in this for ten minutes or longer every evening until the condition is corrected. If for any reason this is not feasible, massage them every evening with cold cream. If white spots appear under the nails rub the nail with slices of lemon.

Sometimes the nails grow soft and dull. In such case I have found of value this mixture, which, after having been melted on a slow fire, cooled and poured into a pomade jar, should be rubbed on the nails to restore them to their former hardness and brilliancy:

White wax, 250 centigrams; nut oil, 15 grams; resin, 5 grams; alum, 1 gram.

If a kind friend gives you a manicure set, smile outwardly, but inwardly regret that you have not the difference between the original small cost of the tools and the exorbitant price paid for the elegant case containing what is usually an inferior set of instruments.

The outfit should consist of:

One large nail brush, for the outer part of the nail; one small nail brush to go under the nail; one strong but pliable nail file; one polisher (chamois or covered); two pairs of curved scissors (one pair for each hand. There are scissors made especially for cutting the nails of the right hand, and vice versa); one orange stick; one box of powdered pumice; one box of nail powder.

First go round the outer edge of the nail with an orange stick, pressing the cuticle back firmly but softly, but do not press the nail, which is exceedingly sensitive. Any pressure upon it may injure the sensitive cutis beneath. Coax the white half-moon at the base of the nail into full view. This moon, like the other young moon, is reluctant to appear.

Then file the nail into any shape you wish. A slightly pointed effect is admissible, and is becoming to nearly all hands. It especially counteracts the plumpness of the hand that nature has made too short. Dipping the nail polisher or brush into the powder, rub the nail until my figure of their being “natural jewels of the hands” becomes apparent. Stop short of a too high polish. With the extra brush remove all the powder that has adhered.

Most manicures assist the process by soaking the hands alternately for five minutes after they have been filed. The palms of the hands add a polish to nails that are not readily susceptible to the polisher. You will find that the oftener you polish your nails the more susceptible do they become of polish.

This nail powder lends itself well to polishing:

Pulverized starch, ¼ ounce; boric acid powdered, ¼ ounce; talcum powder, ¼ ounce; tincture of carmine, 10 drops.

Another which I have used satisfactorily is composed of:

Oxide of tin, thoroughly powdered, 10 drams; oil of lavender, 60 drops; tincture of carmine, 20 drops. One-half of this quantity may be put up and will serve for many weeks.

Still another good nail polish is made like this:

Zinc oxide, 1 ounce; carmine, 4 grams; oil of violet to suit taste.

This nail rouge is excellent:

Fresh lard, 1 dram; finely powdered carmine, ½ dram; oil of bergamot, 12 drops.

This, which was derived, I am told, from the Orient, is effective:

Chippings of alkanet, ¼ ounce; alcohol, 95 per cent., 1 ounce. After this mixture macerates for one week it becomes a brilliant color. Apply to the finger tips with jeweler's cotton, blending it afterwards with more cotton.

Personally I prefer to do my own nails. They should be done every day to attain perfection. Two or three times a week are needful, and at least once a week essential.

The purpose is to keep the nails clean, to make them shapely, to preserve their color, to adorn the tips of the fingers.

I have tried to make my nails the exact shape of a filbert. I keep them very pointed, and do not sandpaper, that is, shorten them oftener than twice a month. But the daily process is this:

First, to study them in a good light and to see whether there be any stains on the fingers. If there are I rub the stains with pumice stone until they have disappeared.

Second, I look carefully to the half moons at the base of the nails. They are as illuminating to the nails as the new moon to the heavens. If they are well defined I merely press the cuticle back gently when I dry my hands. But if they be overgrown with cuticle I give them a bath in olive oil. Into a shallow vessel I pour a half pint of olive oil. Into this I dip my nails, holding them there for five minutes if they are but slightly overgrown, fifteen minutes if extremely covered with the cuticle. Then when the cuticle is softened I carefully go over each one with a linen towel, softly pressing back the skin. If it clings obstinately I do not persist, but resolve that the fingers must have several oil baths. Also I resolve that that night I will rub them as carefully with cold cream as I do any other part of the hands. In a week the half moons should stand beautifully revealed. If not I continue the oil baths in the morning and cold cream applications at night until they are visible.

Third, I twist about the point of an orange wood stick a bit of cotton, dip the end into peroxide of hydrogen and rub the dampened point of the orange wood stick along the inside of the nail. Mark that I said nail, not skin. The reason so many persons must keep their nails short to keep them clean is that they use sharp or jagged instruments to clean the nail, and pressing this upon the skin beneath the nail makes it ragged. The uneven edges of the skin catch the dust and give the gray or even black rim that is so ugly a border for the fingers.

Fourth, with a chamois I polish each finger nail by three or four strokes, using the least touch of nail rouge before the polishing. Pink nails are charming. Red nails are horrible.

Don't, I beg, allow your hands to grow old. Hands, unless well cared for, betray the age more quickly than does the face.

Study your hands well. Don't let the skin grow coarse. Don't let the veins grow large. Don't let the skin hang in folds and creases about them. Never allow the divorce of the skin from the muscles.

The young hand is smooth and firm. The old is rough skinned and loose muscled. In the youthful hand the veins are only faintly indicated. In the old hands they stand forth as whipcords. When the hand is young, the knuckles are inconspicuous. When it is old, they are more prominent than any other part of the hand. There is between the young hand and the old the same difference there is between the thin bark of a sappling and the thick, rugged bark of a storm-beaten old oak. The nails in youth are thin and pink. In old age they are thick and yellow.

Knowing these signs, the intelligent student of beauty culture will avoid them. She will discourage these symptoms of multiplying years. The cause of aged hands is the common cause of bodily decay, defective circulation. If you note signs of ageing in your

hands, attend more than ever before to the circulation. Exercise promotes circulation. Exercise your hands, particularly the fingers.

Fancy that your fingers are but loosely attached to the hands and that you are trying to shake them off. Raise them from the elbows, and, with the hands bent at the wrist, vigorously shake them, with fingers spread and loose. (1) Shake them from right to left and back again. (2) Shake them up and down. (3) Shake them round and round.

Invent exercises of your own. Any movement that will cause the blood to flow at an increased rapidity will renourish and so rejuvenate the hands. We read in poem and story that the sorrow stricken heroine wrings her hands. This may or may not be a vent for her grief, but it is an excellent means of making her hands healthier and so more beautiful.

Daily exercises, say ten to fifteen times every morning, will do much to beautify the hands and so render them prettier. The ageing hand is the hand whose muscles are shrinking. Increase the circulation and the hand will plumpen and in time resume its youthful lines.

My favorite methods of massage for the hands are two, the motion we use when washing the hands, and that we use when smoothing down and fitting fingers of a pair of gloves. Stroke the hands down the back from the spaces between the fingers, and lock the hands together, interlacing the fingers and tightly squeezing them.

The skin of the hands needs food as well as does the skin of the face. Both are exposed to drying tendencies of the outer air and the heating influence of the inner, and both need a replenishing of the natural oils thus lost. Olive oil is a good food for the skin of the hands. The large pores quickly absorb this medium and a few weeks' treatment soon works a marvelous change.

Aged anæmic hands should have an oil bath, or should be fed with cold cream every night. Wash them exactly as though they were soiled and you were trying to remove the dirt with soap and water. Either the following cream or the paste that follows serve well that purpose:

Almond oil, 1½ ounces; cucumber juice, 1 ounce; white wax, 1 dram; spermaceti, 1 ounce; oil of neroli, 5 drops.

Crushed sweet almonds, 1 ounce; crushed bitter almonds, 1 ounce; spermaceti, 2 drams; oil of almonds, ¼ ounce; white castile soap scraped fine, ½ ounce; oil of orange, 6 drops.

To relieve the congested, swollen appearance of the hands, form the habit of holding them upward so that the blood will run out of them instead of downward so that the blood will run into them.

Also to avoid this congested condition of the hands, that distends the veins unbecomingly, avoid lifting heavy weights. For lifting anything of heavy weight stretches the hands, making them larger and overfilling the blood vessels.

Even piano playing enlarges the hands that reach the octaves, and to some extent causes swollen veins. The beauties of the old French courts so well understood this that they never used their hands when it was avoidable.

Enlarged knuckles, one of the signs of age, can be prevented by avoiding overwork and carrying heavy weights. If the knuckles be naturally large, it is well to keep the hands well plumped by good circulation and much feeding of the tissues with oils and creams.

This same precaution will prevent the hands becoming unshapely. But if they were unshapely from birth, they can be improved by pinching the tips of the fingers from the sides, or by wearing clamps, or if these be not available, by wearing thimbles on all the fingers a half hour or more each day.

They can be made longer and slimmer by massaging the hands with long, slow strokes from the wrists to the tips of the fingers, always with the hands well oiled or covered with pure cold cream.

Massage of the fingers can be profitably combined with massage of the face by using a rotary motion of the finger tips. This stimulates both face and finger muscles.

Hands of any age should be kept white. Reddened hands are always unsightly, whatever the cause. There are four causes for reddened hands. One is washing in hot or cold water. Another is exposure to cold air. A third is extremely hard manual labor. A fourth is the habit of holding the hands downward.

There are a good many bleaches for the hands. One of the best is washing the hands in a bowl of warm milk every night. Another is that old friend of the dainty, which should be within reach of every toilet table--a lemon. There is no bleach better than half a lemon

rubbed on the back of palms of the hands before retiring.

This, too, is an excellent bleach which also softens the hands. The addition of perfume makes it a pleasant preparation:

Lemon juice, 1 ounce; honey, 1 ounce; eau de cologne, 1 ounce.

When my hands are soiled I wash them in warm--never hot--water with a pure soap. Lifting my hands from the bowl of warm water I pour upon them a tablespoonful from a bottle of:

Rosewater, 3 ounces; glycerine, 1 ounce; carbolic acid, 10 drops.

I wash my hands thoroughly again in this and dry them upon a soft towel, a piece of cheesecloth or an old silk handkerchief, and am careful to wipe them thoroughly dry. Chapped hands are the penalty of careless drying. To further whiten the hands carbolic acid may be added to this mixture: 10 drops to 4 ounces of the rosewater and glycerine.

The woman who does her own housework often finds the skin about the joints of her fingers getting loose and flabby and the skin at the sides of the nails becoming calloused. For these troubles I advise wearing large, loose gloves while sweeping and dusting. Don't put your hands in hot water more than is necessary. Massage the hands as I have directed and soak them every day in a bowl of milk or olive oil. Use one of the bleaches I have recommended, and wear big, loose rubber gloves, three or four sizes larger than your kid gloves, at night.

At luncheon one day in London I saw a girl trying to hide her hands. Some one had remarked that hands may look old when their owner is not. The discussion of the subject threw the girl into acute embarrassment, and her hands sought to screen themselves beneath the damask of her dinner napkin. Interested, I studied those hands when I could do so without embarrassment to the girl. They were large and red, but what made the unhappy guest try to hide them was that they were what every beauty specialist knows as "old hands."

Had I judged the age of their possessor by those hands I should have said she was fifty. They were deeply wrinkled. The skin had formed in deep creases about the knuckles. The texture was coarse. There was the resigned look of accepted age in their contour. Yet when my eyes traveled up from those hands to the figure of the girl I saw that it was slender and undeveloped, and as my scrutiny extended to the face I saw that it was fresh and sweet as an English primrose that grows in one of the deliciously romantic English lanes. She was young as the unblown rosebud, as the fledgling just peeping over the nest, as the silver crescent moon is young. But she had old hands. Why?

A keenly observant man said to me: "I was traveling to Cherbourg. I was in the same compartment as two women. My eyes tired of the landscape, and came back to my fellow travelers. One of the women had drawn off her gloves. Her hands lay in her lap. Idly I speculated about their owner. I guessed by those hands that she was forty. Her face showed she was not more than eighteen. Next I glanced at her companion's hands. They, too, were ungloved and, lying relaxed in her lap, were aged hands. She must be eighty, I thought, and a glimpse of her face confounded me. It was that of a woman in middle life. She was of that opulent beauty whose midsummer is prolonged indefinitely. She was probably forty-five. And the girl beside her was her daughter. She was an exact replica of her, even to her hands. The girl had inherited those aged hands."

My friend the traveler is clever, but I do not agree with his conclusions. At least not fully. Hands age prematurely because they are neglected. We inherit certain tendencies rather than any unchangeable physical appearances. And the girl had inherited her mother's tendencies to neglect her hands. Doubtless they kept them clean. Perhaps they used the nail brush quite often and as vigorously as necessary. Probably they used the orange stick around the edges of the nails to loosen the skin. Nevertheless, I insist that these prematurely aged hands were neglected.

Why? Because they were hungry.

You are surprised? But consider. Have you looked at your own face in the mirror when you were hungry? Hunger had cut deep lines about your lips and beneath your eyes and in your cheeks. Had it not? And you had merely missed a meal because a train was delayed or because you had a headache.

This is what happens to the hands that are not well fed. A great American specialist on nerves said that the hand is a delicate instrument of the body and needs especial care. He insists that much thought should be given to their care. An important part of caring for them is to feed them so well that the tissues worn out by continuous using of the hands is quickly replaced.

Cocoa butter is a nourishing article of diet for the hands. When you have removed the dust and powder from the hands by bathing them in warm, not hot, water--hot water shrivels the skin and causes wrinkles--and a mild soap, dry them on a soft towel and rub cocoa butter gently and liberally into them.

Olive oil containing a few drops of benzoin, to act as a whitener, is an excellent hand food. Wash the hands in it after the water and soap bath. It neutralizes the drying effect of the soap.

Glycerine “agrees” with some hands. If it does not redden and make them sensitive, as you can learn by two or three applications, it will be a good article of hand food. Equal parts of glycerine and rosewater will make a milder application, for glycerine alone is often an irritant. If lemon juice is used instead of the rosewater, it whitens the hands.

Well fed hands I have seen have their daily meal of cocoanut oil. Several cold creams are good hand foods. So is buttermilk.

Many of my friends complain that winter always leaves them with “disgraceful looking hands.” I do not suppose that this statement is really true. Americans, and especially American girls, are prone to extravagance in conversation. What they mean by this bill of complaint, is that the cold weather makes their hands look rough and red.

Don’t mourn those reddened, coarse-looking hands. You will only etch lines in your face and cause the muscles to sag as muscles do early in life if they have not been upheld by a cheerful disposition and the facial exercise that laughter brings. Besides all force is wasted that is not used in upbuilding new conditions or in remedying old ones.

What is to be done with those red hands? First, do not expose them to sudden changes of temperature. Don’t plunge them into hot water and draw them out of the hot water and dry them in a cold room. Sleep in a cold room by all means, but don’t dress in one. If there are no means to make your bedroom warm for the morning toilet dress in some part of the house that is warmed, if necessary by the kitchen stove. Cold followed by heat or the opposite extreme is sure to redden the hands and to coarsen the texture of their skin.

Second, do not wear tight gloves. I dislike a tightly-gloved hand. It has always seemed to me vulgar. I am glad to see that Fashion is recognizing this and giving her endorsement to the practice of wearing gloves a half or whole size too large, so that the glove will wrinkle a trifle over the hand and look as though the wearer were comfortable. Wear gloves that are otherwise comfortable, that is, that do not irritate the skin. For summer cotton or very thin suede, silk or chamois are best. Suede are best in winter, because they are softer than most other materials used by the glover in providing his stock. Woolen gloves may be worn over the gloves, but I do not advise wearing them next to the skin, for they chafe the skin, making it rough.

Third, do not wash them in water too often while they are in the coarse, reddened state. Remove the dust or grime when possible by rubbing oil or cold cream over the hands and afterwards carefully wiping them. When you wash them in water let it be in merely warm water. Into this you may drop a teaspoonful of powdered borax to a quart of water, or in the same amount of water a dessert-spoonful of liquid ammonia or a half dozen drops of tincture of benzoin. All these will whiten the skin. If you drop in the water a handful of bran or oatmeal it will soften and whiten the hands. Dry the hands gently. Don’t treat them as though you were putting them through a clothes wringer with the Monday wash.

Fourth, until the hands reach the refined condition you desire, never retire without dressing them for the night. Rub over them thickly lanolin, or nafalan, or a mixture of equal parts of vaseline and lanolin. If you have made the hands too greasy by this application wipe off the superfluous cream with a soft handkerchief or piece of cheesecloth. Or if you prefer you can use the English paste, or the French, formulas for which follow:

Pure soap shaved, ½ quart; olive oil, ½ quart; mutton suet, ¼ quart; brandy, ¼ quart. Warm the soap, suet and oil until they blend. While they are still tepid pour in the brandy. Add a few drops of any favorite perfume if desired.

Eau de cologne, 100 grams; oil of almonds, 100 grams; powdered soap, 30 grams. Warm to blending point; then shake well and pour into a jar, and keep in a cool place.

Spread one of these pastes over the hands and draw over the hands large loose rubber or large old kid gloves, before retiring.

If the hands have reached such stage of roughness that there are small cracks or fissures in the skin cover these cracks or fissures with zinc oxide plasters. If the fissures are very deep apply a salicylic soap plaster.

If your hands “take a notion to be red,” say at an evening party or at a tea, for instance, when you are expected to “pour,” shake them violently, so that if the fingers were less loosely attached they would fly off.

Also work the hands back and forth from the wrists for a few minutes. This is better than the old French custom of holding the hands up to let the blood run out, for the blood will run back into them again as soon as the hands are held as usual. On the other hand the shaking of the hands and limbering of the wrists will restore the circulation, the interruption of which has caused the hands to redden. Be sure that your rings are not too tight, for if they are they will impede the circulation and cause the redness so many of you are trying to avoid.

[Illustration: LOIS EWELL A wealth of Titian hair adds the crowning charm to the winsome beauty of this Century Opera House prima donna.]

CHAPTER XI

BEAUTY BATHS

Let me direct the baths of the body and the complexion will take care of itself.

How shall I impress upon you, my beautiful reader, who would remain beautiful, my plain reader--if ever a woman was plain--who wants to be beautiful, how necessary is the frequent bath? By this I mean the daily bath. Let me tell you that which you may have forgotten, that when we speak of the skin as “the third lung” we minimize its importance. The skin discharges twice as much waste matter from the body as do the lungs. Keep that ever in mind and help the skin in its task.

Again there is the story, which you also may have heard and forgotten, that the man whose skin has been gilded in an effort to make of him a man of gold, died in a few hours because his pores, having been filled, could not discharge their function.

The daily bath, in some instances, the bath twice a day, is not as persons advanced in some directions and pitiably behind in others tell us, a luxury. It is a necessity. It does not, as some ignorantly assume, destroy the oils of the skin. It causes them to circulate more freely through the medium of the skin.

Permit me to picture to you the condition which a bath changes. Have you ever seen a shower of ashes? How, from a disturbed furnace, a gray flurry rises, then falls thickly as snow upon the nearest smooth surface? That is what happens to the skin. The shower of white ashes, refuse from the fires in the human body, pushes its way through the pores to the surface of the body, or the skin. There, in the mouths of the pores, they remain, obstructing them as a wagonload of soil would obstruct the mouth of a sewer if poured into it and allowed to remain.

The shower of human ashes must be removed, just as the traces of a snowfall are removed from city streets, quickly and thoroughly, else traffic is impeded. The scarf skin must go, and the best and most direct way to send it is by the route of the bath.

I have described in a previous chapter my own method of bathing. I find the tepid bath in the morning, followed by a slightly cooler shower, or splash with sponge or hands, the best for my needs. Also for drying the skin I prefer a soft towel, for it is best for my skin. But I do not recommend this as a universal method.

My skin happens to be exceedingly thin and sensitive, annoyingly so. If it were one of the hardier, more durable sort, with a tendency to a coarsening and roughening, I should try this much more drastic method of removing scarf skin. If I were strong enough and my physicians vouched for the fact that I were, I would try the daily cold plunge or shower. This I would take in the morning remaining in the icy tub or under the chilling shower not more than one minute. Then I should have a brisk rubdown, not with the soft linen towel or cheesecloth, but with a big, coarse Turkish towel. For this purpose I like best the big towels that swathe the body completely, which one may wrap round herself, and, wrapped in them, sit upon a bathing stool and dry herself with immunity from chill. Unless I were to dress at once, I should briskly rub the body with alcohol to render less the possibility of taking cold. But if my room were sunny I would prefer to run about the room half a dozen times, or a rehearsal of dancing steps for five minutes, or jumping the rope. One of the greatest authorities on hygiene in your country has advocated exercise--he called it a sun bath--directly after the bath.

But this would by no means suffice for my bathing. For every one except an Englishman knows that the cold bath does not cleanse. It merely exhilarates. For keeping the skin clean there should be the warm bath. You observe that I did not say the hot bath, for it is my opinion that the hot bath enervates. For cleansing the water should be from 90 to 95 degrees Fahrenheit.

A good soap should be plentifully used. White castile, the soaps made from spermaceti and good glycerine soaps I believe to be the best. The soap need not be used directly upon the skin. Much better is it that for ten minutes or a quarter of an hour before you take your night bath a cake of soap or a quantity of it shaved be thrown into the water, so that the water becomes a milky color, or that a lather rise to the top of the water.

Thus soap will never, except in its diluted form, touch the skin. The per cent. of lye which is used in the manufacture of soaps that would actually touch the skin would be very small. A soft brush would be useful for a coarse skin. I never advocate a hard one, for it is liable to abrade the skin.

No one should remain in the bath more than twenty minutes, and this time should include the rinsing off of the soapy water by a shower or spray of cooler, perhaps fifteen degrees cooler, not cold, water. A cold shower at night, when this cleansing bath is taken, would be over-stimulative, and tend, as does the strong coffee to certain persons, to keep them awake.

Between the two extremes of gentle and drastic bathing lie many intermediaries known as beauty baths. There is, for example, that simple and efficacious starch bath, taken by women whose skins are tormented and disfigured by pimples.

To an ordinary bathtub half filled with water add one pound of pure starch. Let it dissolve in water at 90 to 95 degrees Fahrenheit. To this many French women choose to add one wineglass of toilet ammonia for its whitening effect.

The oatmeal bag is an old and admirable remedy for rough or stained skin. The best is made in this way:

Oatmeal, 1 pound; pulverized orris root, ½ pound. Stir well together and sew into a large square bag. Toss the bag into the tub and let it remain in the warm water for fifteen minutes. It will give the water that delightful milky aspect so pleasant to the luxurious bather. Bran may be manipulated in the same way with equally good results.

For whitening and softening the skin a bath powder may be made at home from these ingredients:

Bicarbonate of soda, 6 ounces; cream of tartar, 5 ounces; starch, 8 ounces; oil of lemon, 1 dram; oil of bergamot, 10 drops. If another scent is preferred to bergamot it can be substituted; for instance, 5 drops of oil of rose geranium.

For a person not strong enough to endure the cold bath, this tonic in tepid water is recommended by many European physicians:

Aromatic vinegar, 1 pint; tincture of benzoin, 1 wineglass.

A delicious bath used by our grandmothers, and that is as efficacious for their granddaughters, is made by boiling for three hours two pounds of bran. Strain the bran through a sieve. To the remaining liquor add some scent of your choice, let us say 10 drops of bergamot, 5 of rose of geranium, or 5 of oil of lavender.

A belle of limited means utilizes all the left-over bits of her toilet soap. These she grinds or chops with a knife into a fine powder. To two ounces of this powder she adds four tablespoonfuls of borax. She sifts these into two quarts of bran. A pint of this mixture poured into an old linen or cheesecloth bag and the bag used as a washcloth gives a pleasant touch of luxury to a bath, besides greatly softening and whitening the skin.

Many women prefer to make their own toilet or aromatic vinegars to be used in the bath. For them I recommend this formula:

Camphor, ½ ounce; oil of rosemary, ½ dram; oil of cloves, ½ dram; oil of bergamot, 1 dram; acetic acid, 4 ounces; alcohol, 8 ounces.

When for any reason the perspiration is odorous in spite of the bath, this sprinkled upon the offending portions of the body destroys the unpleasant condition:

Subnitrate of bismuth, 1 ounce; pulverized boric acid, ½ ounce; pulverized alum, ½ ounce; oil of eucalyptus, 10 drops; oil of rose geranium, 5 drops; oil of lemon, 5 drops.

For those of full habit I recommend a Russian bath once a week as beneficial to the complexion. I prefer those given in the cabinets. For myself, being meager, there would be after six of them nothing left.

Let me suggest this means for the invalid or the person of lean purse, of taking the Russian bath at home. There are inexpensive cabinets, folding or stationary, made for this purpose, of wood or tin. Even a packing box would suffice. But a good Russian, which

means vapor, as distinguished from the Turkish, or hot air, bath--and the Russian I think much to be preferred, because it does not involve breathing hot air--may be taken at home.

The home-made Russian bath requires: Three or more blankets; a cane-seated chair; a spirit lamp; a can containing one quart of water. Place the can upon the lighted spirit lamp, the spirit lamp beneath the chair, and yourself, enveloped in blankets, upon the chair. The water in the can can be replenished from time to time.

Drinking three or more glasses of hot water during the bath aids in perspiration. If there are more blankets available lie down swathed in from four to six dry ones, and the process of perspiration will continue for twenty minutes longer.

In Turkey baths are regarded not only as means of cleanliness but as agents of beauty. Here is a tonic Turkish women pour into the tub to tone the skin and through that the whole body:

Ammonia (pure), 100 grams; cooking salt, 500 grams.

This is of special value when one is tired and listless. It is called the Stimulant Bath:

Oil of turpentine, 100 grams; carbonate of soda, 50 grams; oil of rosemary, 10 grams; oil of eucalyptus, 5 grams.

This oil bath is rubbed into the skin to render it soft and smooth. It is an admirable remedy for a dry skin. The harem women style it “The Beauty Bath”:

Rosewater, 100 grams; glycerine, 60 grams; starch, 50 grams; oil of lavender, 15 grams.

Famous beauties were always careful about their baths, even in a period when baths were disregarded or were despised as the habits of the unduly effeminate. Marie Antoinette, for her full bath, used a mixture of wild thyme and marjory, with sea salt. In the winter the baths were taken cold, in the summer warm, it being the fancy of the court physician, Dr. Fagoni, that the temperature of the bath should correspond to the temperature of the outer air.

The wine bath is not a fiction of the imagination, but rather a fact of history. The beautiful Russian, Marie Czetwertynoska, favorite beauty of the Court of Alexander the Great, insisted upon the tonic of a weekly bath in Spanish wine. Poppæa bathed in asses’ milk, and was renowned for her complexion.

Novel was the method of Isabeau, Queen of Bavaria, for toning the body and beautifying the complexion in spring. Each morning during May, June and July she bathed in strawberry juice.

Mme. Tallien, whose skin was flawless, preferred raspberries, as at once milder in effect and yet of more lasting quality. Ninon de l’Enclos bathed alternately in chickweed water and milk, using oatmeal freely in her face bath.

Enid Wilson, often alluded to as “the most beautiful woman in the British Empire,” had a favorite bath, which she declared was the chief secret of her wonderful English complexion. “Into a wide-mouthed gallon jar I cram as many elder flower blossoms as it will hold. Over this I pour boiling water,” she said. “After letting the jar and its contents stand in a cool place for six hours, I strain the liquid and pour a few tablespoonfuls of it into my bath.”

The beautiful women of every civilized nation are nowadays taking less medicine and more baths. The medical directors, who are probably the greatest beauty doctors, because they teach that beauty depends almost wholly on health, are teaching them the tonic and sedative influences of the bath. They are teaching them that of varieties of baths there is no end. They tell them there is one sort of bath for the anæmic person, another for the too full-blooded person, one for the person who sleeps too little, another for the one who sleeps too much.

For every temperament and for every condition there is the special bath. But there are some general rules which all should know. For instance these:

The best average temperature for the bath is 68 to 72 degrees Fahrenheit. The temperature of the bath should always be tested before using.

The bath of cistern or rainwater is the best for the skin, because it is the “softest”--that is, the purest water, being unmixed with the minerals which well water collects on its tour through the various strata of earth, and which “hardens” it.

The starch bath is one of the best to allay itching or cure annoying skin eruptions. It is made like this:

Into a tub of say ten gallons of water drop one-half pound of starch.

The gelatine bath serves a similar purpose. It is soothing to an irritated skin. The proportions are two hundred and fifty grams of white French gelatine to ten gallons of tepid water.

The cold bath is a stimulant for those who are strong enough to react from it. The test is whether after the cold plunge the skin turns red. If it turns blue the vitality is not sufficient to bear such heroic treatment. Cold baths should not be taken without the advice of a competent physician.

The hot bath is soothing, but if taken too often is enervating. Once a week, under ordinary circumstances, is often enough for a hot bath.

The tepid bath, graduated to a cool bath by letting the cold water run in as the warm water runs off, is the best daily bath.

For the person who perspires excessively, a wineglass of ammonia to ten gallons of water is a good corrective.

For the seaside bath, five pounds of table salt dissolved in a tubful of water at home is a very good substitute. This, followed by a shower or spray, will lend the illusion of Ostend or Atlantic City.

But besides these simple baths, that any one may take, there are some that are complex, and that only those who have, for a time at least, some spare hours to spend at their toilets may trouble to take. This is what my physician ordered when I had come from a Russian tour, weary from travel and in that state of depression that follows extreme weariness. Used in tepid water every morning I found it invigorating:

Bromide of potassium, 1 gram; carbonate of calcium, 1 gram; carbonate of soda, 300 grams; sulphate of soda, 300 grams; sulphate of iron, 3 grams; oil of lavender, 1 gram; oil of thyme, 1 gram; oil of rosemary, 1 gram.

The same physician recommended for the skin that was too sensitive to endure soap:

Tincture of quillagac, 10 grams; glycerine, 20 grains; oil of bergamot, 3 drops.

The extremely nervous person, whose skin is much irritated, may take the starch bath I have described and add to it a pint of vinegar.

Discreet bathing, besides its first office of cleanliness, aids and even cures anæmia, biliousness, obesity, rheumatism, neuralgia and even St. Vitus's dance.

The hot water treatment for pimples is more efficacious than most medicines given for that purpose. The application of soft cloths dipped in hot water has effected a cure in a few days.

A class of skin diseases that produce postules on the skin, these postules eventually bursting and forming crusts, are alleviated and sometimes cured by a systematic course of warm baths. The falling of the crusts like dandruff, and the gradual healing, may be brought about by two warm baths daily. Tetter is one of these forms that has been cured by warm water baths and careful, tender drying with soft towels.

An object lesson in the value of the warm bath in soothing the nervous system is seen in the case of children screaming with the colic, who cease their cries and grow sleepy as soon as they are placed in a tub of warm water.

If possible, bathe not less than two hours before eating nor less than three hours after eating.

Never take a bath while very tired. There will be no reaction--that is, the blood will not leap to the surface as under favorable circumstances it makes its response to the bath, and the bath will merely reduce further the lowered vitality.

A little exercise just before bathing and a little exercise after, aids the good effects of the bath. The exercise before opens the pores for the reception of the water. The exercise afterward permits the entrance of sun and air into the pores too little accustomed to either.

Light exercise after the drying of the skin with a soft towel and before enveloping it with clothes is a splendid tonic and a wonderful beautifier. I know a half dozen beautiful Parisiennes who have had their bathrooms built in that part of the house most exposed to the sunshine, and at the top of the house, and, opening from these, have built small sun parlors, square rooms with roofs and sides

entirely of glass. Here they exercise for from five to ten minutes, jumping the rope or flexing the arms and legs and head. One vigorous beauty has a blanket spread upon the floor of her sun parlor, and upon this turns somersaults, to make her body pliant and to assure herself that her circulation is free. Some of these exercises are illustrated by the silhouettes on this page.

During the sunbaths they are unclad, or if clothed are merely wrapped in a light, loose dressing gown. After the bath and the exercise some Parisiennes repose for an hour upon a couch in the sun parlor, their hair hanging loose and their faces protected only by a delicate shade, like a fire screen, from the too strong rays of the sun.

Bathe briskly in the water. Never stay in it more than twenty minutes. Indeed, a good scrub can be taken in three minutes. A brush is better than a sponge. It pries open the pores. Do not use coarse towels. They abrade the skin. Use soft towels or bath gloves. Dry thoroughly and quickly. Many bathe the face and neck first to prevent a possible unpleasant dash of blood to the head. Bathe in a room whose temperature is at least 68 or 70 degrees. Ordinarily the room should be as warm as the water in which you bathe.

For those who dislike soaps, or if they do not dislike, at least distrust them, lanolin milk is a valuable aid or even a substitute for the bath:

Lanolin, 35 grains; water, ½ ounce; pure castile soap, 30 grains. Pour the lanolin into the water. Heat slowly. The soap should be dissolved in a half ounce of water. Mix and shake well.

Glycerine soap is one of the best for the winter. Those soaps containing bran and oatmeal are also excellent for preserving the softness of the skin in this trying season.

Almond meal poured into the wet hands and forming a paste, which is gently rubbed upon the face and hands, is the best substitute for soap for the face bath.

The ordinary daily bath is not enough for the feet, which are of coarser fiber. They have larger pores, from which much perspiration is discharged. And there is a greater discharge of dead matter from the soles of the feet than from any other part of the body of the same area. For this reason and because the feet are more exposed to dust than any other part of the body except the face, there should be a special daily footbath. It is best to take this just before retiring.

It is, by the way, helpful in calling the blood away from the head to the feet. I always take my footbath a little warmer than my body bath. I scrub them with a flesh brush well soaped, for there cannot, fortunately, be too much soap used upon the feet. A teaspoonful of borax or a teaspoonful of ammonia aids the cleansing.

CHAPTER XII

GOOD HEALTH AS A FOUNDATION FOR BEAUTY

Show me a woman who has indigestion and I will show you a person with muddy complexion, dull or feverishly bright eyes, a coated tongue and a languid manner.

None of these makes for beauty. All are signs of ill-health. Besides these outward and visible signs of ill health, it is a heavy weight upon the spirits. The girl thinks she is unhappy, and manufactures causes for misery, or exaggerates the trifles that are not to her liking, and makes them causes for unhappiness.

Besides these, indigestion causes yet graver troubles. I recall several persons I knew who have since passed from the earthly plane, whose decline in health began with various symptoms of indigestion. It was never clear to me whether the indigestion was the cause or the effect of these maladies. But I trust I have said enough to prove that indigestion is a most undesirable state. Vanity alone should forbid it.

How to prevent indigestion? I shall have a great deal to say farther on about food wrong in kind or quality as a cause of indigestion. But first let me tell you of an excellent exercise to discourage indigestion.

Knead the abdomen on retiring and several times a day when there is opportunity. Double your hands as though for kneading bread. Place the clenched hands beneath the ribs. Press firmly and regularly upon the intestines, moving the fists forward until they meet. Having done this five to ten times, allow the left hand to rest at your side and with the right hand press gently but steadily downward at the left of the abdomen until your hand is opposite the thigh. Repeat this operation several times each time you take

the exercise. This is still more effective if taken while you are lying in your bathtub. The relaxation of the muscles is aided by the fact that they are under water. The hydropathic school believes this one of the greatest aids to restoring proper digestion.

Much walking is an aid to digestion. So is this exercise, which can be taken in bed:

Lying upon your back, draw the knees slowly up beneath the chin, then let the legs fall to their former position. This is the most valuable of early morning exercises for those who have a torpid liver or some other form of indigestion.

Coarse cereals are an enemy to indigestion. Seldom does one see a case of indigestion in Scotland, and if we do, it is when we meet a queer Scot who dislikes his national dish, oatmeal. Oatmeal, whole wheat, rice, all being large fibered foods, stir the stomach and intestines to activity, which is good for digestion.

Again, every girl should know some of the principles of the values of foods. Apply to your daily food these facts. Your food should consist of these proportions:

Mixture of starches and sugars, about 16 parts. Proteids, 4 parts. Fats, 2 parts.

In other words, one-half of our daily amount of food may be made up of potatoes, rice, bread, etc. One-eighth should consist of the proteids, as milk, or eggs, or cheese. One-sixteenth should be fat, as butter or the fat to be found in meat or oil in dressing of salads. Keep this table in mind and you will find a new interest in choosing your food, and in a short time you will welcome a marked improvement in your health.

Do not decline sweets unless you are overweight, but eat them at the right time, which is as dessert for luncheon or dinner. Never eat cake or candy between meals.

Turn resolutely away from all fried foods. You have heard that fried foods are injurious, but you do not know why. It is my pleasure to tell you. They are indigestible because they form in the stomach a substance as thick and unwieldy as leather, and as difficult of digestion. Neither meats nor eggs nor milk should ever reach the boiling point. For this reason never eat boiled beef, nor a boiled egg, nor milk that has been boiled. The beef cut up in a stew that has simmered below the boiling point, an egg that has been dropped into water just below the boiling point and allowed to heat there for eight minutes instead of boiling four, and milk that has been heated but never permitted to show one of the bubbles that attend the boiling state, are substitutes for the old forms, and admirable ones.

Keep this also in mind in selecting your food: For the bones' formation we need lime, and the cereals, as oats and wheat and rice, contain elements that make it. Sugar is converted into energy, as the Russian dancers well know, for they eat inordinate quantities of candy and sweet paste, yet, because they exercise it off, remain thin. The fats, as butter and meat fat, cause warmth in the body, so should be used more freely in winter than in summer. Bread is a good food if made of coarse grain. Contrary to the general opinion, macaroni and spaghetti are good foods. Examine them in their raw state and you will see that they are yellowish. That shows the presence of gluten, which is valuable as an aid to digestion, in bread form.

Are you anæmic? Then besides mild exercise in the open air, always stopping before you are tired, and massaging the body and face with feeding oils as lanolin and olive oil, feed yourself generously with thickened broths and thick soups. Ham and bacon and mutton, chicken and game are rebuilders of the weakened system, and butter may be freely eaten. For the anæmic all kinds of fresh fish are nourishing. So are oysters. Eggs are rebuilding agents. So are bread and cakes, tapioca and hominy.

Much cream is desirable for the anæmic, and chocolate, custards, baked fruits and jellies are friendly foods in the circumstances.

Avoid what especially taxes the digestion, as veal or pork, salt meats and heavy hashes. Bananas being among the most indigestible of the foods, should be avoided.

If you are dyspeptic don't eat many things at one meal. Two or three dishes are enough. If you have difficulty in digestion lie down before or after a meal. For you vegetable soups as tomato, asparagus, pea and bean soups are aids. Oysters and fresh fish, plainly broiled, are among your dietetic friends. Squabs and sweetbreads and chicken that has been broiled are best. Your meats should be short-fibered and broiled until they are tender. Eat eggs with stale bread or dry toast. Eggs may be cooked in any way you wish except broiled or fried. Do not eat meats freely, and if you eat any butter let it be very thinly spread. If you eat bacon be sure that it is crisp and thoroughly done.

Well baked potatoes, tomatoes and spinach and boiled onions, peas, lima beans, asparagus and stewed celery and lettuce are edibles you should choose. Do not eat fruits that are either very sour or very sweet. The stomach of the dyspeptic is sensitive to extremes. Tea, if made very weak and drunk clear and hot, is beneficial. So are milk and cocoa or chocolate, if not too rich. Shun raw celery and cabbage and radishes.

If you are gouty or rheumatic be careful not to eat stimulating foods and avoid all stimulating liquors. The gouty or rheumatic condition is caused by the deposit of acids in the joints, and you should study how to eliminate these from the body. Alcohol, sweets and strawberries add to them.

Eat very slowly of the following: Thin vegetable soups, fresh fish and raw oysters, whitemeats, as the breast of chicken, sweetbreads and pigs' feet. Take the whites of eggs, preferably raw.

Toasted graham or whole wheat bread is the best for your condition. Zweiback and graham gems are also helpful. For you celery, lettuce, cucumber, cabbages, young peas and string beans, spinach, those vegetables containing much water, are excellent. Juicy fruits as oranges, lemons, apricots, cranberries, pears, peaches, better stewed or baked than raw, are medicinal for you.

But eat no beef, no fried dishes, no ragouts nor hashes, neither turkey nor duck nor goose, no omelettes and no salt fish and no desserts except fruits. If you drink tea or coffee let it be weak. Buttermilk is better for you, and you more than any other class of person, should drink water in large quantities.

If you are liverish or are troubled by bilious attacks eat less heavily than you have been doing. Choose white meats and fish, and eat no fat part of the meat. Of vegetables eat much watercress and lettuce and spinach. Drink skimmed milk and that very slowly, and eat only raw or poached eggs. Cornbread or bread made from whole wheat flour and hot water in which you have squeezed the juice of a lemon or orange will help you back to a state of health. Eat neither cheese nor potatoes, oatmeal nor dried vegetables.

If you are neurasthenic never attempt the no-breakfast plan. It is better for you if you can have your breakfast in bed. The diet should be light. Meats, fish, eggs, green vegetables and fruits are a helpful diet. Milk can be taken if the stomach does not reject it. Tea, coffee, tobacco and alcoholic drinks are forbidden to you.

Train yourself to note your symptoms and treat them by diet. When your face has a mottled appearance you may be sure that you are eating too much food of all sorts, or that you are eating too much that is greasy or rich or sweet. A chic Parisian friend of mine when she notices such symptoms limits herself to one moderate meal a day--her dinner--and the earlier part of the day contents herself with fruits and salads, drinking water moderately at these meals and copiously between them.

There are many times when we "feel our bodies" and are growing too heavy or too lazy that it is well to subsist for a few days on a liquid diet. This nourishing drink strengthens the body even while the work of removing the remaining ashes from the body goes on:

Whole barley, 1 tablespoonful; a slice of lemon; boiling water, 2 cupfuls. Place the barley and slice of lemon in an earthen dish. Over them pour the boiling water. Cover the dish and let the mixture stand for ten minutes. Then strain into another earthen dish. The drink may be flavored with a small quantity of sugar if preferred. The quantity given is ample for one nourishing meal for one person.

This is a drink often taken by athletes to refresh them during their training period in England, but is useful to women taking a semi-fast for beauty's sake:

Bran, 2 tablespoonfuls; seeded raisins, 1 tablespoonful; lemon, 1 thick slice. Chop the raisins fine and place them with the bran and lemon in an earthen bowl. Over these pour a half pint of boiling water. Let stand to cool and blend for ten minutes. Strain and drink while warm. Raisins are of special value in cleansing and toning the kidneys.

The water in which peeled apples have been stewed and to which a few currants have been added is a strengthening, cooling and cleansing drink. It is made more appetizing by the addition of a few cloves or a broken stick of cinnamon.

This is another tonic and refreshing drink during the time when you are eating little, or nothing:

Squeeze into a large coffee cup the juice of one orange. Fill the space remaining in the cup with boiling water. Add a teaspoonful of liquid honey and the same amount of lemon juice.

This, too, appeases hunger:

Milk, 1 pint; hot water, 1 pint. Slowly sip in lieu of a meal. The use of water in a way prevents the clogging of the system that sometimes follows an exclusively milk diet.

A drink much in use in England, that is half food, half medicinal, is this:

Two tablespoonfuls of whole wheat; a little caraway or celery seed to flavor. Into a pint bowl of boiling water stir the whole wheat after it has been ground. Add the caraway or celery seed. Sweeten, if you wish, with a half teaspoonful of powdered licorice.

Nut drinks are among the strengthening beverages substituted for food during a beauty fast. For example, this:

Ground peanuts, 1 tablespoonful; boiling water, 1 cupful. Flavor with equal quantities of honey or lemon juice as desired.

Perhaps you prefer meat juices in the thinning or rebuilding time. In that case:

Pour over finely chopped beef or chicken twice its bulk in boiling water if you wish the tea to be strong, three times if weak.

Some things there are that no one who wishes to be beautiful should ever take into the stomach. Those things should be contraband, as poisons and leads. They are: Sweets, pastries, anything very sweet or very sour, anything very cold or very hot, pork, puddings other than those consisting chiefly of fruits, and the doughnut, or cruller, which is fried dough.

I hear American women beseech me, “Tell us what to eat and what not to eat, so that we may be thin.” I answer, “Eat foods containing cooling properties, as limes, soda and acids. Do not eat what contains sugar, fat and starch.” Shall I be more explicit? Very well, then. Choose for your regular diet:

Green vegetables, boiled without grease and with a little salt; string beans, peas, asparagus and spinach may be cooked in this way or dressed with oil and vinegar in which vinegar largely predominates; stewed fruits, as apricots, prunelles, apples, kumquats, cherries and plums, with little sugar, better with none; lean meats, rare beef and mutton, roasted; zweiback or gluten bread, or, if these be not available, then the crust, never the inner portion of wheaten bread; green salads, as lettuce, romaine, chicory or cucumbers, with French dressing, reducing the usual amount of oil and increasing that of the vinegar.

Eat as little as you can subsist on and maintain your strength, of any of these. Remember, that while the stomach of each adult equals in size that of a quart measure, it is wise to only half fill it; that is, to take into it at no time more than a pint of food or fluid, or of both combined. The distended stomach causes many intestinal troubles. One of the results is that always unsightly spectacle, a high abdomen.

Foods it is wise for the stout beauty to avoid are: Fat meats, gravies, pastries, cauliflower, potatoes, rice, lima beans, chocolate, sweetened tea or coffee, candy, puddings and milk.

The beauty with the persistently blotched skin requires different food, less food, a more judicious dietary. For her skin indicates some form of indigestion, and the first step to cure indigestion is to give the digestive apparatus less work to do. For that reason I should advise the beauty with spots upon her countenance to try for a few hours, or, if possible, a few days, the water cure. Let her, so far as food is concerned, fast, if her physician permit, and live as long as seems judicious on air and water. The furnace of an engine must be cleansed occasionally of its clinkers. So the intestinal tract must be cleansed of its obstructions. I have said before in these pages that everyone should drink three quarts of water a day. I repeat it. If the stomach be very delicate the water may be taken hot, but, as I have also said before, I have found that, while hot water taken copiously into the stomach relieves a condition temporarily, if the stomach continues habitually to be flooded with it, it checks the flow of the gastric juices. The gastric juices refuse to work, pettishly leaving their functions to the intruder. Cold or cool water--never, let me repeat, ice water--should be taken so that when it reaches the stomach it is of nearly the same temperature. It should be sipped and slowly swallowed; never, no matter how thirsty one may be, gulped.

As well introduce a lump of ice suddenly into the stomach as a tumblerful of cold water. If you have ever by accident swallowed a lump of ice you know how painful and violent is the stomach’s protest. Never drink more than two glasses of water at a time. A pint, as I have pointed out, is all that the stomach should be asked to retain at one time. If the beauty, the charm of whose face has been eclipsed by blotches, desires, she can increase the amount of water by a quart or more, but this only when she is taking no food. If she finds it more palatable, three or four drops of lemon juice squeezed into a glass will help the cleansing process. While she is taking the water cure she should take as much exercise out of doors as her strength will permit. She must not continue the exercise

after she becomes tired.

This water cure can be assisted by flushing the colon with warm water, a subject with which I may deal more fully later. Sufficient at this time that the internal bath, given as often as her physician directs, is of great aid to her who would have a clear complexion.

The water and air cure has been continued, under medical direction, for one day, three, even five or six days, with beneficial results. The length will depend upon the strength of the person taking the cure. When she resumes food she would do well to begin with warm milk.

Beginning with one quart of milk a day, the quantity can be increased to two and even three. It should be remembered that milk is food, rather than a beverage, and should be consumed as such. Not less than five minutes should be given to drinking a glass of milk.

When food has been resumed bear in mind that if the spots upon your face are caused by acne (blackheads) tea and coffee should be avoided. So should pastry, cheese, sauces and highly-seasoned foods. On the other hand the beauty who would remove the small, black blemishes may eat freely of well-cooked green vegetables and stewed fruits. While following this cooling, cleansing régime, I would suggest that pimples, roughnesses and spots will the more quickly disappear if for three or more mornings the blood be cooled by a dose of one teaspoonful of Epsom salts in a glass of warm water.

For the beauties who are too thin a diet that will enrich the blood is recommended. For this condition fat meats, gravies, lima beans, potatoes, rice, sweets--all those things above which I have written the flaming sign “Don’t” for stout beauties--should be eaten.

When the cheeks and lips are pale, the eyes dim, the gait lagging and the body abnormally thin, these conditions all indicate that there is a lack of iron in the system. I use iron hypodermic injections myself, preferring them because they save the stomach the disturbance that follows introducing medicines. But if there is an objection to this iron may be taken in food form by eating the yolks of eggs, spinach, beets and string beans.

The same dietary will help the woman whose hair is falling or is prematurely gray. The results, though slow, are beneficent.

I believe in fasting in moderation as an aid to the good health upon which beauty depends. As fully as I indorse the beauty device of staying in bed now and then for a day or longer, if circumstances permit, one day of every ten, I am convinced that an occasional fast is conducive to well being.

Fasting confers benefits in general and in specific cases. When persons are in that condition for which you have a naïve word of description, “logy,” which means heavy and listless, fasting serves an excellent purpose. Usually the “logy” person has been overfed. Let her go back to nature for a lesson on how to cure herself of this disorder. When an animal has eaten too much it usually crawls away to some dark and quiet place and fasts. That is what the woman who has overtaxed her digestion should do. At such times the animal drinks plentifully of water. So should the human being.

When the digestion goes on strike humor it. Grant the overworked stomach and intestines a holiday. Let them suspend work for a time, but only for a short time. Better, in my opinion, a forty-eight hour fast taken four times a month than a fast taken for eight consecutive days.

In general, the body is better off for an occasional relief to the digestive organs. But there are specific instances of the fast being of great benefit.

For instance, I know a woman whose beautiful figure was seriously marred by an enlarged abdomen. When she came to me for advice I asked her to stand and to walk. I saw that she stood and walked well. Then I asked her to sit, and I saw that her habit of sitting was correct. She sat with her weight equally distributed and resting evenly on the balls of her feet. She sat somewhat, though not awkwardly, forward in her chair, so that her spine was straight. In none of these postures was there any cause for the thrusting forward of the abdomen. Her corsets were good and new, neither too tight nor too loose. Believing that this puffy, vulgar appearance was due to some form of indigestion, I suggested a short fast. I recommended forty-eight hours without food and with plentiful drinking of hot water, into each glassful of which was squeezed the juice of a lemon.

She repeated this every week for five weeks, with no unpleasant results and with the flattening of the abdomen which she desired and which has greatly added to the loveliness of her figure.

There is much in favor of the semi-fast, which is not so great a shock to the system. When persons have passed their thirty-fifth year it is wise to give no such shock to the system. Better be as considerate of our own bodies as we are of the feelings of our beloved friends. Begin gently any radical departure in the habits of the body. For this reason it is well to begin fasting by semi-fasting, or by gradually diminishing the amount of food taken.

A plan that seems to me worthy is to forego solid foods, and the first day subsist on milks, gruel or soup. Of these the milk is better because more nourishing. Some persons don't like milk, but, it being the natural food, everyone can train himself to like, or, at least, to swallow it. Some to whom milk is repellent prevent its unpleasant after effects by placing in each glass a pinch of bicarbonate of soda.

I allow my appetite to govern the amount and the frequency of these meals of milk. I always remember that milk is food and so consider that I eat, rather than drink, it. Five minutes at least for a glass I always permit myself. Sometimes I take ten.

The stomach having been gently prepared for the change, it is ready by the second day for the water and lemon. The lemon juice not only makes the water more palatable, but it stimulates the liver, so clearing the complexion.

When ready to break the fast I have found it well to accustom the stomach to the change back to food by sipping orange juice that has been pressed into a cup or glass, then to begin eating again by consuming a small, sweet orange. I returned to regular diet by the easy way of soups and gruels. My longest fast was for four days, and I consider that one or two days too long.

In fact, the safest method of fasting I consider the semi-fast, with milk, gruels and soups that I have described.

Thus of the manner of fasts. Now as to their value. Catarrh I have known to be greatly relieved, if not wholly cured, by recurrent fasts. Rheumatism in its early stages has yielded to repeated short fasts and care to avoid sweets and beef in the intervals between these fasts.

Even nervousness, that form of it which is aggravated by rich and heavy foods, I have known to disappear during one of these silent and dark room fasts, the silence and rest being, probably, the chief agents.

A fairly good rule to follow is that whenever the tongue is coated the amount of food may be reduced, or we would do well to have no food for a short time. The coated tongue indicates that there is much dead, refuse matter, like the choking ashes in a furnace, obstructing the body. If you can fast until the tongue is once more clean and red you will be the gainer.

Also when you feel your body, that is, when you are unpleasantly conscious of its weight and its handicap, a fast will usually relieve you. But a warning. Do not undertake a fast while you are doing your heaviest work. Fast when the demands upon you are lightest, and fast, if possible, alone, so that no one will be afflicted by the irritable temper that is liable to follow.

No one looks her best when she has not had enough sleep. Little lines come about the eyes, deep creases form in the flesh about the mouth, the eyes lose their light, the facial muscles their firmness, the complexion its freshness, and, what is most important, the mind loses its alertness, when we have not slept well. Irritability and supersensitiveness show in face and manner.

Lack of sound sleep is due to two causes, a brain under-nourished or over-stimulated. Sleeplessness, or fitful, restless sleep, follows nervous derangement. There may be indigestion, cause or result of nervousness. There may be worry. There may be mental fag or nervous exhaustion. But whatever form it takes the root of the matter is nearly always in the nerves. This granted, we must look to relieving the brain, the main station along the line, or we must supply it what it needs.

Banish worry. Take plenty of exercise. Breathe much fresh air. These are three excellent recipes for sleep.

If you find that you have been over-working, lighten your work a little. Try to spend a day or two in the country, if possible. But this, to a busy person, is sometimes out of the question. If that is the case with you try to retire an hour earlier. Some dread retiring earlier because they say they know they will not sleep. Try it at any rate. Lying in a dark room will bring a sense of rest that should soothe the nerves and tend toward sleep.

Make sure that the room is at the right temperature for your comfort. If it is too warm you will surely not sleep. If it is cold to the point of discomfort, you will lie awake. Sixty degrees Fahr., or less, is a good temperature for a sleeping room. Be sure that the air of your bedroom is fresh. If it seems stale or stuffy open the windows wide and either move actively about the room or go into any other one while this freshening is taking place. It would be much better if the airing had continued all day and the air were as near the freshness of the out-of-doors as you could make it.

If your head aches from the strain of the day, a bandage of cracked ice should drive the excess of blood from the head and permit sleep. If, on the other hand, you are anæmic, and your feet are cold at night thrust them into a tub of hot mustard water. Place the elbow in the water first to test its temperature. If it is too hot for the elbow it will certainly be too hot for the feet.

If you are annoyed, while lying awake, by a gnawing of the stomach, proving that it is quite or nearly empty, forestall this by sipping a cup of gruel before going to bed. This will warm the stomach and quiet the nerve disturbance, soothing the body for its rest.

A case of protracted insomnia I knew to be cured in this simple and, it would seem, did I not know the results, trivial manner. Lie flat upon the bed with a low pillow--or, better, no pillow at all--and loosen your grip upon your muscles. Uncurl them, so to speak. Relax as completely as does your house dog when he sleeps with his body stretched out, nose upon his paws, before the fire. Then breathe very deeply but gently counting six at each respiration. To aid in this deep breathing, press one nostril shut by laying the forefinger firmly against it and drawing the air through the other nostril. Repeat this a half dozen times, counting six at each drawing in and letting out of the air.

Call into use the hot-water bottle or the warming pan. Put on your bedroom slippers if you awake with cold feet. Pretend that you are sleepy, even though you are not, and let the eyelids slowly close as though drooping from their own weight or from weariness, over your eyes. This little device alone has been helpful in cases of insomnia.

The Orientals give us good advice concerning sleep: “Compose yourself. Be calm. Think on pleasant events before falling asleep,” say they, “for upon whatever plane of thought you enter sleep you will remain during your slumber. And those thoughts will stamp themselves upon the face.”

One of the greatest menaces to feminine beauty to-day is nervousness--nervousness in all its forms, neuritis, neurasthenia, nervous prostration, hysteria. All these prove that the little silver wires have been drawn too taut and that they are at the snapping point.

Old age is the specter that stalks in the path of beauty. It is the only thing of which beauty is afraid. But nervousness presages age and the appearance of age. Observe one of your friends after a nervous attack. She looks ten years older. The tumult of her emotions has etched ugly new lines in her face, from nose to lips, along the temples and between the eyes. If she catches sight of her face in the mirror at such a time she is appalled, for she has a vision of the sort of old woman she will become.

To keep young, discourage very nervous outbreak. Every woman needs a calm mental center. She must have some place of spiritual and mental retreat from her tumult of soul if it is only the reflection: “In a year it won’t matter.” She should fly to this whenever a tumult of the nerves threatens. I know a woman who cured her habit of flying into tempers, which is only another expression of jangled nerves, by saying over and over to herself:

“It is vulgar to show temper. Whatever else I am I will not be vulgar.”

Her face, which had begun to show the etching of deep, stormy emotions has become a smooth, beautiful mask, whose expression lies where expression should, in the flash of a sudden smile and the quick lighting of brilliant eyes.

Need I recount the symptoms of disordered nerves? Not to mature women. They know them too well. But for the benefit of my younger readers to whom nerves are yet happily only names, I will describe a few.

Irritability of temper is one, the most common, and the one which occasions the least sympathy.

Exceeding sensitiveness, which makes the person prone to take offense when no offense is intended, is another.

Depression of spirits as often results from tired nerves as from an overburdened liver.

The habit of “making monkey faces” which I have so often noticed in American women.

The habit of making many and needless movements. The girl who flings her head aloft in aimless little gestures may think she is vivacious, but vivacity is rather of the mind than of the body. She is merely revealing the unpleasant secret that her nervous system is impaired.

Capricious appetite is one of the symptoms. The nervous patient eats either too little or too much, and she may eat too little breakfast and too much dinner on the same day.

Insomnia is a sure and serious sign of derangement of the nerves.

The inability to sit still for a considerable time is still another and very bad sign that the nerves are as you say here “ragged” or “jumpy.”

I have seen one of your most distinguished and beautiful women suffer from this inability while at the theater, and to preclude jokes by the paragraphers, I will explain that it was at a very good play, where no person in the normal state could possibly be bored. I have seen her lovely hands twitch in her lap. I have seen her knees create a silken tempest among the folds of her gown. Into her face I have seen “that worried look” come, the look that so disfigures the average American face.

This overwrought state of nerves has many causes. Sometimes it is a bad heredity. The daughters of men with the alcoholic habit, of overworked and over-worried financiers, often suffer from this predisposition of nerves. The daughters of fashionable mothers who laced too tightly or who followed the will-o’-the-wisp of society too persistently for their health’s sake, often so suffer.

Stimulants taken by the victim herself often produce it. Beware of these stimulants in many guises. Some of the headache powders open the gate to acute nervousness. Don’t use any without your physician’s endorsement.

But I believe that the chief cause of nervousness is intemperance, not of alcoholic or other stimulants, but of mental habits. Worry causes a thousand breakdowns. I never knew work to cause one.

For those symptoms of nervous affection which I have mentioned I have tried home treatment with success. One of the best methods has been stretching. Standing on my tiptoes, raising my heels far from the floor, standing as nearly in that straight line from toe to knee which Genee does so admirably, as I can, I stretch and stretch my body, fancying I am an India rubber woman and getting great fun out of trying just how tall I can make myself. Sometimes I raise my arms above my head with finger tips extended, and play again that I am trying to reach the ceiling.

The value in stretching is largely in the pleasure one gets from it. For this reason I never continue one posture after it has become tiresome. Dropping to my heels and standing with my soles flat upon the floor, I stretch the arms out at right angles with the sides. The fact that one is always moved to yawn with this exercise shows that it is valuable. For yawning is nature’s violent means of ridding the body of an excess of impure air and securing a new supply.

If you can yawn naturally, do so while stretching or at any other time. If you cannot yawn naturally, yawn artificially--that is, simulate a yawn. It is at least as helpful to respiration as the Turkish bath is to perspiration. They are both substitutes for the natural process.

Lettuce salad, both at luncheon and dinner, or raw onions eaten with bread and butter at night before retiring, calm the nerves and aid sleep.

Light--that is surface--massage is a good corrective for nervousness. Deep, seeking-the-bone massage, which is used for liver complaint and for obesity, is too severe for the nervous patient. Besides, so many of the nerves lie near the skin that the region of the skin is the real seat of operations for cure. Light massage by coaxing the blood to the surface and inducing a new and stronger interflow among the nerves, feeds and strengthens them.

Electrical treatment applied to the seat of the nervous affection, as well as to the spine, is a means that has stimulated many depressed, nervous patients. This I advise only under the supervision, or at least by the direction, of a physician.

Long walks, and for disturbed nerves walking is better than driving, have cured many cases of nerve exhaustion.

Cold plunges or showers are recommended by many physicians for diminished nerve force. But the patient should be sure the advice is adapted to her individual case, and she should be sure of her heart. Neither the plunge nor the shower should be taken until a physician has prescribed them.

Cold sprays upon the spine given at Turkish baths are tonic to the nervous system. They, too, can be applied at home. The rubber tube fixtures for a spray can be bought for ninety cents, and can take the place of the expensive shower attachments.

For tic douloreux, for pains at the ends of the nerves, for spinal affections and for vertigo, one needs the aid of a physician. But in all nervous affections we must aid the physician by intelligent care of ourselves and conservation of our energies. Never waste your nervous force by unnecessary movements.

Deep breathing is helpful in correcting a nervous tendency, and improving the general health. This is no strange or obscure act. It is simply breathing as deeply as you can, from the very depths of your being, “clear to your toes,” a little girl put it--not breathing shallowly from a space somewhere near the collarbone.

I always recognize a shallow breather at sight. Usually she is round shouldered. Always she has a pale skin, pinched nostrils, dull eyes and a languid walk. Always she has little or no magnetism. The magnetic person is one who is most fully alive.

But how to acquire the habit of deep breathing is the important thing. Summon imagination to your aid. Stand at the open window or go to a garden or to a roof where the air is purest, and imagine that you smell the fragrance of a rose. Determine to draw into your being all the fragrance you can gather.

Stand erect and draw in as much air as your lungs seem capable of holding. Hold that breath; that is, keep the air in the lungs so that it may do its cleansing work, while you count five. That is equivalent to five seconds. Gently empty the lungs of the air. Then slowly fill the lungs again, hold as long as you can and slowly expel the air. You will learn to hold the breath longer and longer. Expert and experienced deep breathers can hold the air newly taken into the lungs for fifty seconds. But no beginner in the art should expect, nor try to do this. At first the practice may cause a sensation of dizziness. But this is not alarming. On the other hand, it is encouraging. It means that the poor, pale, ill-nourished brain is receiving as large a blood supply as it needs and it will soon become used to your new generosity.

If you are not so situated that you can get to a garden, a roof or open window, try to go alone to a room where you can recline for a few minutes. There let the muscles become limp. Folding the arms above the breast or clasping the hands loosely above the stomach will aid this.

To be sure that both nostrils are doing perfect work, press one shut by placing the finger against it and breathing through the other. Generally you will discover that the left nostril draws a larger volume of air through it than does the right. I have noticed it very frequently while doing my deep breathing.

Test the correctness of your breathing by placing your hands against your abdomen. If its walls rise and fall regularly and in obedience to every breath, you are doing deep breathing. If not, you have not mastered the art.

In two weeks, by repeating these exercises six or eight times a day for two or three minutes each time, you will not only have learned how, but you will have derived such benefit from it that you would not ever forget giving up so healthful and improving a practice.

What does it do for one? I can hear as an echo this question, impatiently put by practical American women. That is the feminine variation of the question often heard in America: “What do I get out of it?”

You get out of it free, well developed lungs. You get chest expansion. You get, if you begin early enough, immunity from that dread disease, tuberculosis. You get quieted nerves and an improved temper. You get pure blood which will make your complexion clear. You energize the whole body and stimulate your vital forces.

CHAPTER XIII

HOW TO ACQUIRE A PLEASING VOICE

If you would have a beautiful voice shun its two greatest enemies, coryza (cold in the head) and the evil emotions.

Every woman would have a beautiful voice, for it is indeed one of the most excellent things in woman. To my mind it is the most desirable possession in the world. But then I am a singer. I wish only to be a singer. If the singing voice were denied me I should choose, if I might have my choice, first a lovely face, then a lovely figure, and third a charming speaking voice.

There have been beautiful women without agreeable voices, but never a fascinating one. The voice rather than the eyes is the seat of magnetism. Many a plain woman has enjoyed that invaluable gift of personal magnetism and students of character have been baffled by it until they guessed the riddle of her voice. Plain women with low, well modulated voices with the heart note in them, are more dangerous rivals than pretty women who screech as peacocks. Painfully often the pretty face and figure are accompanied by the harsh, squeaking voice. The reason is the same that exists for the fact that pretty women seldom cultivate the power of charm. Content with what nature has given them, they make no effort to be responsive or entertaining. Their voices fall gratingly upon all

ears but their own, which have been dulled by praise of their natural beauty.

Every woman may not have a sweet voice, but every woman may have an agreeable one. The pleasantest speaking voice is more often made than born. It is susceptible of cultivation.

The uncultivated voice reflects the emotions as candidly as the eye mirror forth the soul. Culture of person and voice gradually suppress, or at least restrain, this faculty. If the voice be pleasant it should reflect only pleasant things. This, let it be understood, applies only to the speaking voice. I am not giving in this article a singing lesson.

Anger, suspicion, jealousy, covetousness, if they be felt, must be imprisoned in the spirit. As disfiguring to voice as face are these which have been called “the dark emotions.” If they cannot be eliminated from the soul they must be driven out of the voice. The dark emotions make the voice harsh. The silly emotions make it shrill. Mental and character poise are the father and mother of the beautiful speaking voice.

Coryza (cold in the head) is a menace to the voice. Hoarseness hides the beauties of a voice as a thick veil the face of a woman. Colds should be avoided. Or having been contracted, they should as quickly as possible be cured.

Many women of full habit who, as they say, “feel a cold coming on,” go immediately to the Turkish baths, and by drastic treatment rid themselves quickly of it. This, if followed by great care to prevent catching a fresh cold immediately after the bath, is a good remedy. So, too, is the ancient one of retiring early and with many blankets added to the usual amount of bed clothing to coax a heavy perspiration. This can be greatly aided by the other old-fashioned remedy of a glass of hot lemonade. A moderate dose of quinine is also effective in “breaking up a cold.”

The roots of the disease having thus been plucked up, the accompanying ugliness caused by rheumy eyes, swollen, scarlet nose and “running” nostrils, can be gradually cured by inhalations and gargles.

A yeoman remedy is the sniffing into the nostrils of quite strong salt water. Another that is excellent is the sniffing of pulverized camphor. A third is a nasal sweeping by the inhalation of ammonia.

Strong aromatic vinegars serve the same purpose. This is a valuable one, agreeable and less expensive than the elaborate one used by the beauties of the French court:

Glacial acetic acid, 1¼ ounces; rose water, 2½ ounces; lavender water, 1 pint.

This is powerful as well as pleasing and will reward the user for the pains of mixing the many ingredients:

Glacial acetic acid, ½ pound; rectified spirits of wine, 1 ounce; oil of neroli, ¼ dram; oil of allspice, ¼ dram; oil of lavender, ¼ dram; pure oil of cinnamon, ¼ dram; oil of bergamot, ¼ dram; oil of rosemary, ½ dram; oil of cloves, ¾ dram; pulverized camphor, 1¼ ounces. This is very strong and age makes it stronger. It is most advantageously used by pouring a few drops of it upon a silk sponge and inhaling. Avoid its contact with skin and clothes.

A third tonic vinegar useful for inhalation is this:

White vinegar, 1 pint; extract of lavender, 15 grams; oil of bergamot, 6 grams; oil of citron, 5 grams; tincture of benzoin, 6 grams.

Sage tea in which a small quantity of eucalyptus has been distilled is excellent for cleansing the nasal cavities after a cold.

Beauties of many courts and times have removed the husky quality from their voices by inhaling the vapor from a concoction of:

Sweet milk, 1 pint; ripe figs, ½ dozen. These should be boiled to a pulp and inhaled while hot. The mixture can be heated again and again and the vapor from it inhaled, until the cure is effected.

I am glad to see that fig and apricot paste has been imported from the Orient, for Persian women have successfully used this jam-like confection and medicine for many generations for the cure of hoarseness.

Weak elderflower tea is an admirable remedy. An infusion of chickweed is also recommended. These latter should be inhaled. The fig and apricot paste is, of course, for internal use.

Mme. Pompadour, the famous French beauty, used to clear her voice of huskiness by inhaling the fumes of:

Pulverized myrrh, 1 ounce; amber, 50 grains.

A husky voice indicates that the throat is dry. Our ancestresses knew this and made their children drink much sweet milk or buttermilk to remove hoarseness. The poor singer seeking relief from that distress by sucking a lemon has been a subject for caricaturists for twenty years. But the ludicrous practice has a basis in common sense. A lemon is a broom for the throat. A raw egg beaten with the lemon juice serves that purpose and is soothing to the burning throat.

While I was singing in Philadelphia I acquired a bad cold. One of the old families who had always extended me the courtesy of their home and friendship offered me a cough syrup they called “Stewed Quaker.” It was so quickly efficacious that I asked for the formula. Here it is:

New Orleans molasses, ½ pint; butter, 1 tablespoonful; white sugar, 1 teaspoonful; vinegar, 1 tablespoonful.

Cold compresses often cure a sore throat over night. Into ice cold water dip a fold of cotton cloth. Wring it out only dry enough to prevent its dripping. Pin this tightly around the throat with safety pins, and over the compress pin a fold of flannel. Soon the heat from the neck causes vapor and “loosens the cold.” In the morning remove the compress and massage the neck with olive oil.

If you value your voice try to avoid that protracted unpleasantness which is known as a summer cold.

To best understand how to prevent a cold, let us perfectly understand its causes. I say causes, not cause for an authority on the subject has recently said that there are four conditions that bring about the annoying and dangerous condition we call “a cold.”

There must be lowered vitality. In other words, a person may be in that state we describe as “run down.” When we are run down or “seedy,” as they say in England, our resistance is lessened; we are like a besieged town whose walls are falling. In this unprotected state we have little chance against a cold.

A similar condition is fatigue. We are more prone to catch cold when we are tired, because the good white corpuscles in the blood, the body’s defenders, are lessened by weariness. Also fatigue creates an excess of certain gases in the body, carbonic acid gas among others, and these self-poisons weaken the body and open the doors to cold.

Now, how to prevent a cold. Keep your liver active. If it becomes lazy take plenty of exercise to stir it into activity. If the liver is torpid, the poison it should take care of is cast upon the mucous membrane, irritating it and causing catarrh.

Be sure that your digestion is the best and that the intestinal tract is kept clear. Unless you do this there may be an irritation of the lining of the intestines that will cause all of the alimentary tract to become catarrhal. This, in turn, will extend to the nose and throat. To avoid indigestion, be careful that you eat only nourishing foods. Tuberculosis is more common in the poorer quarters of every city, especially of London, and physicians have concluded that this is not because they do not have enough to eat, but because they eat too many starchy foods, as pastry and potatoes, and too many sweets, as candy.

Prevent a cold by activity. Why do you catch a cold when you lie down without any covering except the garments you are wearing? Because when you are inactive your body is relaxed and the temperature is lowered. Exercise much, keep the blood flowing briskly, and you will generally avoid colds.

But be not satisfied with avoiding stagnant blood. Avoid stagnant air. Keep the air circulating in the room you occupy. Try to keep a stream of fresh air flowing through your room. At any rate, keep the window open two or three inches at the top, no matter what the weather.

Cold plunge or shower or sponge baths harden the skin and help to make one immune from colds, but before beginning to take them ask a physician’s advice. You may not have enough vitality to endure the ordeal. If you have your physician’s “O. K.,” the best time to begin is in the summer.

Avoid coughing when you can, for coughing is sometimes merely a nervous habit. Besides, a cough irritates the lining of the throat.

The old-fashioned remedy for a cold, of swallowing a mixture of equal parts of vinegar and molasses, is as good now as it was when our grandmothers dosed us plentifully and effectually for hoarseness. A pleasanter and perhaps more refined remedy is the plentiful use of honey. Use it freely on bread or with rice at table and swallow a tablespoonful of it whenever between meals you feel the tickling sensation that precedes coughing.

Gargling with strong salt water often clears the throat, saving fits of violent coughing.

A good method, and a simple one, of relief from violent coughing is to place upon the chest hot cloths, followed by cold ones, then hot, then cold, so alternating many times. This reëstablishes natural circulation and restored circulation means relief from cold.

CHAPTER XIV

HOW TO IMPROVE YOUR FIGURE

Frankly determine how far your figure falls short of perfection. Perfection, that is, according to the canons of classic statuary. The standards of the Greek sculptors have never been improved. These are their undeviating rules:

The figure should be exactly six times as long as the foot. The face from the middle point of the hair line to the point of the chin should be one-tenth of the entire stature. The hand from the tip of the middle finger to the end of the palm should be of the same length as the face, and so also one-tenth of the length of the body. From the highest point of the forehead to the beginning of the chest should be one-seventh of the length of the body.

If the face from the hair line to the point of the chin is divided into three parts the first line of division is the point equidistant from the lowest points of the eyebrows. The second division line is that directly beneath the nostrils.

The body when standing with the arms extended horizontally should form a human Maltese cross. The length of the body should be the same as the distance across the body from the middle finger of one hand to the middle finger of the other.

The ideal face of the sculptors has always been pear-shaped, diminishing from a noble width at the forehead and top of the head to a slim delicacy of chin. The trend of feature formation in this age of personal dominance is in another direction, toward a widening and increasing of the weight of the jaw. This adds to the impression of strength of character, but it subtracts much from the sum of the beauty of a face.

I have referred to the face because I wish to apply it as a determining factor in judging the beauty of the figure. The sculptor’s test of the beauty of a face is its profile. If the profile is strong and beautiful, the face is equally strong and beautiful. In other words, the beauty of a face cannot exceed that of its profile. So the determining view of a figure as to its beauties or its defects is the profile view. The woman who would improve her figure should study it critically from the side. For this reason, the woman who sells her easy chair and buys a duplex or triple mirror is an economist of her own beauty.

Determine in what respect your figure varies from the canons of beauty, and try to conform to them. Are you a little too short for the breadth of your figure? Stretching exercises should add somewhat to your height. Stand before the open window, and with hands back to back, the finger tips touching, rise upon your toes and stretch to your greatest height.

So the woman who would be taller should recline a great deal, take as much sleep as possible. Physiologists have proven that the body is considerably taller in the morning than in the evening. This is because the muscles and joints have relaxed, while during the varied exercises of the day they have contracted. The mass of muscles have much in common with india rubber--they have elastic properties.

The critical view in the duplex or triple mirror may reveal that the figure is too broad or too thick for its height. If too broad the defect is serious, and will be difficult, if not impossible, of remedy. If too thick, diet, exercise or massage, or all of these, may be summoned. Breadth reveals the framework of the body, indicating usually that it is too massive. You cannot change the framework of a bridge, nor yet of the human body. The modification must take place in that which covers it, the layers of muscles and fat. The figure that is too thick, that is from front to back of waist, or from the middle of the spinal column to the point of the bust, may be materially improved.

For this improvement I would look first to the back--I always notice instantly whether the back be straight and flat or round and full. For in that difference lies much of the elegance or lack of it in a female figure. If the back is full and the hips bulge, the waist is large the figure has no elegance; is, indeed, common. If you are the possessor of such blemishes to beauty you should at once set at work to remove the defects.

First give attention to your diet. Eat much less than usual. Say reduce your diet at the beginning by one-quarter, then one-third, and after that one-half. The slimming results will soon become apparent.

But do not be satisfied with one means of securing a flatter back and slender hips. Exercise, especially in the open air. Walk, walk, walk, beginning with a short walk if you are unaccustomed to walking, and increasing the distance each day.

And if possible have recourse to massage. I have before said in this series of articles that I consider massage the first aid to beauty. It has always seemed to me a cure-all for defects in beauty. It improves the complexion, improves the figure, brightens the expression and makes more beautiful the eyes. Therefore, to give the flat back and narrow hips that are part of an elegant figure, I advise deep massage, with an astringent liquid preparation.

Some adventurous women have taken internal remedies under the advice of their physician, which is the only safe way to take any internal obesity medicine. I have never advised reduction remedies to be so taken. By absorption, however, I consider this to be a good remedy for over-development:

Oil of sweet almonds, 4 ounces; tincture of benzoin, 1 dram; extract of Portugal, 4 ounces; oil of neroli, 20 drops.

This, too, is a good astringent lotion:

Tincture of iodine, 30 minims; iodide of potassium, 60 grams; distilled water, 10 ounces; aniseed water, 170 minims.

Also this:

Tincture of iodine, 1 ounce; alcohol, 10 ounces.

If, on the other hand, the critical side view reveals not only the back and sides as too thin, but the entire outline as too meager, then this cream, freely applied by light and frequent massage, is an aid in curve-making and flesh-building:

Fresh mutton tallow, 6 ounces; lanolin, 6 ounces; spermaceti, ½ ounce; cocoanut oil, 4 ounces.

This, too, is a good tissue-feeding cream:

Lanolin, 60 grams; oil of sweet almonds, 40 grams; tannin, 1 gram.

Women who think their busts are too large write me often asking how they may reduce them. Personally, I do not approve of any treatment, except a general dietary and general exercise, such as tends to reduce all portions of the body. In view of the many requests I receive from determined women begging such a recipe, I give this European formula, but I protest against any woman using it unless with the sanction of her physician:

Oil of sweet almonds, 100 grams; white wax, 50 grams; tincture of benzoin, 25 grams; rosewater, 25 grams; tannin, 15 grams.

After exercise and diet for improving the figure, there is nothing so important as to be well corseted. If possible have your corsets made to order. Pay less for a gown if necessary to order a better corset. Get one that is pliable and hygienic and yet molds the figure into its best lines. To fit well the hips should be the first consideration. The rest of the body can take very good care of itself. Yet the corset should not be too tight about the hips nor abdomen. For this reason I always advise that there be rubber webbing in the sides of the corset.

Every corset should have eight elastics. Yes, I mean it--four on each side. These elastics not only hold the hose in well, but they hold in the abdomen and hips. The first pair of elastics should be fastened directly in front, on either side of the steel fronts of the corset. The next pair should be about an inch, or on a very stout woman two inches, to the right and left respectively. The third pair should be directly over the hips. The fourth should be at the back. While at first this maze of garters seems a hopeless tangle, one soon acquires the knack of fastening them. They add much to the trigness and tautness that contribute elegance to the figure.

The fourth desideratum is a good carriage. Keep the shoulders and abdomen back. Keep the bust and the chin up. Swing the hips well forward when you walk. Observe all women who are stout, that is, heavily stout. There is a distinction. Women may be stout and yet carry their bodies as though they were weightless. Others of no greater bulk walk as though they were weighted down with invisible handicaps.

The heavily stout woman walks with her hips back. In this faulty carriage lies much of her awkwardness and apparent weight. Walk on the balls of your feet, lightly. This becomes a habit that renders a woman graceful and almost without apparent weight.

For the consolation of women who have shapely figures, though built upon an ample scale, let me quote this dictum of an authority on womanly beauty: “It isn’t the size, but the shape that counts. Proportion is the thing.”

Some women are really tall enough, but they look dumpy. The thing for them to do at once is to reduce their weight. “If you reduce your hips you will look taller” is an axiom of the beauty culturists. So set about it. If you are short and thin, then hasten to broaden your shoulders, expand and inflate your lungs; draw back your elbows and breathe deeply. Fill out your bust and chest. This will actually make you taller and appear more so.

Short girls generally carry themselves badly. Keep your head thrown back and your chin out. The woman who keeps her chin down in her neck always looks shorter than she is. Take physical culture lessons, all you short girls who would be tall; learn to walk gracefully, and train your muscles into suppleness. Take walks in the open air with a light, buoyant step, your shoulders thrown back, breathing deeply through your nose. And stretch yourself, every moment of the day when you can.

Three inches, real or apparent, may be added to a woman’s stature by a little common sense.

The short girl who would be tall should go in systematically for stretching exercises. Lie down flat and stretch out your arms as far as possible above your head. Also practice neck movements--keep on stretching your neck out just like a goose, to elongate it. Stretch your legs out taut and keep stretching yourself on tiptoe. Hold up your chin and your abdomen, and stretch continually. Here are some excellent stretching exercises to make you supple and straight--and taller:

Lie flat on your back on a hard mattress. Plant palms downward straight at the sides, but do not grip the ticking with them. Now draw the legs up slowly, bending at the knees, and holding the knees in the air and heels close to the body. Now, with a quick, sudden movement, thrust the legs out straight and flat on the bed, the toes stretched as far as possible and pointing down. This brings into play every muscle from the knee to the tip of the toes and sets the limbs tingling. Draw up slowly, counting seven and inhaling; hold position through seven counts, and again thrust down, exhaling through the mouth. Rest four counts and repeat.

Lie flat on the back, heels and balls of the feet together, arms at sides, palms down. Breathe slowly seven times. Now, with the shoulders or upper part of the trunk rigidly flat on the bed, raise the middle of the trunk, generally known as the waist line, by the muscles of the hips. Inhale as you lift, counting seven; exhale as you fall. Next inhale deeply and lift the lower part of the trunk and let it fall in quick succession, repeating the movement perhaps five times while inhaling once.

Reverse the exercise described above; that is, let the lower part of the trunk rest on the bed and lift from the waist line up by means of the muscles of the shoulder blades. Use the same methods of counting, inhaling while counting seven; hold the position, then lower the trunk, counting seven, and exhaling. Then work rapidly, with five quick uplifts to each breath.

It is well to scan your figure occasionally in the mirror--to satisfactorily do this you need a full length mirror--and decide what are its flaws and how to rid yourself of them.

Perhaps you have a disfiguring stoop. Rid yourself of this, if necessary, by wearing shoulder braces. You can buy strong, reliable ones at most drug stores, and you can make them for yourself with two strong stitched bands of muslin to which cross pieces are attached. Fasten these to your corsets by safety pins. Perhaps that apparent stoop is due not to actual bending of the shoulders but to a roll of superfluous fat that accumulates just below the neck on women who have attained thirty years, or even before. Remove this unsightly blemish by several methods. First, throw away your pillow and lie with head and feet on a level. Form the habit of standing very erect. Stretch your arms sideways and on a level with your shoulders and twirl them rapidly backward.

There are always several preparations which can be used to advantage if applied outwardly. Bathe the shoulders every night with this, rubbing it thoroughly into the shoulders:

Iodide of potassium, 1 ounce; alcohol, 12 ounces.

If your limbs are too heavy, as is liable to be the case in America, where women’s figures are not so well proportioned as in many other countries, the lower part of the body being disposed to stoutness, walk much. This will reduce the bulk of the fat and make the muscles solid. Occasionally I receive letters asking me to tell a girl how to make the limbs larger and more shapely. Massage with olive oil should enlarge them. To inquiries as to how to make the thin ankles plumper I make the same reply.

No figure is attractive if the hips are out of proportion to the rest of the body. They should be neither too large nor too small, but in perfect accord with the rest of the figure. If the rest of the figure is thin and the hips plump the effect is ludicrous. If the body is ample and the hips flat the hips are incongruous. Fashion may dictate broad hips one season and narrow hips the next, but their ideal size remains the same. They must look as though they belong to that body and no other.

They should be amphora shaped, as any sculptor will tell you. An amphora, you know, is a large Roman vase with lines exquisitely curved downward. Study the pictures of statues of the ancient Greeks and you will comprehend the beauty of the hip line in the natural figure. They are neither over heavy nor too thin.

The bones should be well covered, but there should be no fat creases and no loose hanging skin. If there is too little flesh applications of olive oil will increase it. But the fault in the American woman's figure is that she is unduly developed about the hips. For this figure blemish it would be absurd to bant, for her whole body would diminish under it and the hips remain proportionately as large as before. Massage and exercise are the hope of the woman of overdeveloped hips. Rub briskly and firmly, with a strong slapping motion, this mixture, prepared especially for each application.

Unsweetened butter, 1 tablespoonful; tincture of iodine, 20 drops.

Long corsets that are not too tight keep up a continual gentle friction that helps to some extent in reducing the hips, but these should never be worn so tight as to compress the inner organs nor constrict the muscles. Better too redundant hips than an interference with the circulation, which may cause varicose veins or other serious complications.

These exercises are simple, but will be found exceedingly helpful if persevered in, in diminishing the hips:

First, stand perfectly erect; the knees should not be bent. The heels should be held together. The palms of the hands should rest firmly upon the hips.

Second, swing the right leg slowly and firmly sidewise, raising the foot as high as you can. This should not be suddenly or violently done. Rest the weight of the body firmly on the left foot while so doing. Kick thus slowly a half dozen times or more, until the muscles begin to be weary. Then shift the weight to the right foot and kick in the same fashion with the left.

Third, stand with the weight on one foot and raise the other leg slowly, until it is on a level with the trunk. Lower the foot and repeat this exercise many times until you begin to grow weary. Then change the weight to that foot and repeat the exercise with the other leg.

Fourth, stand as I at first described, the body straight, the chest and head high, the heels together. Raise the hands sidewise above the head, bringing the tips of the fingers together. Then, in the posture that swimmers take before they dive, bend slowly forward, keeping the knees straight, until the finger tips reach the ground. Repeat this until fatigue warns you to stop. Never exercise until weary.

But even a perfect figure avails little unless you have grace. When I am asked how to be graceful, I answer: "Be careful of your movements when alone and unconscious of them when you are in public." Grace can be cultivated. There is no excuse for a woman who is not deformed being awkward. There are degrees in grace, but every woman may possess it to some extent.

To the woman who wishes to enhance her natural grace, or who, having none, desires to add it to her charms, I advise first of all the study of great paintings and statuary that are models of line and poise. Line is important, but I have seen women who were all straight lines, to whom nature had given not one gracious curve, who were nevertheless graceful. The long, flowing lines of grace may be assisted by careful dressing, and this a dressmaker may do for us, but poise, which is a much bigger and better word than pose, including pose and much more, comes from within and may be self taught.

I wish that every woman who reads this chapter would pay a visit to the nearest art gallery and study, if there be one, a good copy of the wonderful Venus de Milo. Let her study it until something of the inward strength which gives it its wonderful balance and power and perfect symmetry is revealed to her.

One of the secrets of that marvelous statue is the calm soul it expresses. Again and again I have said that serenity is the chief secret of beauty, and I point to the Venus de Milo in proof of my assertion. The nervous, distraught, ill-centered woman reveals her soul state by nervous, abrupt awkward movements.

Compose yourself inwardly and see with what grace and strength you stand before your mirror. Permit some emotion to disturb you, and note the ravaging, unlovely effect. Grace is poise, and poise means a calm soul center.

For a graceful carriage we must consider how to stand, how to walk and how to sit. The late Heinrich Conried, being asked to describe a beautiful woman, said: "That is simple. She is harmonious." What he meant was that she was harmonious within and harmonious without, the inward harmony revealing itself in the outer. There was no discord in her. To stand in a drawing room as

you would stand on the ledge of a mountain would be inharmonious. To sit on a high-backed chair with straight lines, as you would sit upon an ottoman, or a tête-à-tête would be strikingly discordant. To walk into a ballroom as you would set forth for a walk along the beach would be ludicrous. There must be in every movement harmony with your surroundings, and you must yourself be governed by the immediate circumstances.

Lola Montez, the enchanting dancer and the dancing enchantress, well knew the value of a graceful carriage and of the cheerful spirit of which it is an expression. She said: “A crushed, sad, or moping spirit, especially if allowed at a tender age, when the body is forming, is a fatal cause of a flabby and moping body. A bent and stooping form is quite sure to come of a bent and stooping spirit. If you would stand well, sit well, walk well, lie well, ‘sway gracefully on the poised waist’ as upon a pivot.”

Given a straight healthy spine, straight, strong bones and the serene spirit of which I have spoken, and there remains for grace two necessities, knowledge and training. One must know how to hold the body correctly before she can so hold it.

The correct position, one in which the balance of all parts of the body is perfectly preserved, is almost, but not quite, erect. It should incline very slightly forward, above the hips. The weight of the body should rest firmly upon the balls of the feet. The heels should be close together. The knees should also be close neighbors. The arms in standing should hang naturally at the sides with the elbows close to the sides.

One position only is proper for the chin. It should be well up. Notice any woman whose chin is lowered. Shadows fall about the hollows of the face, or create an illusion of hollows there. Every woman looks five years older with her chin lowered. Also such a pose of the head will make wrinkles in the fairest and plumpest neck. Nature designed woman to hold her head as proudly as that of a mettlesome horse. The chest should be held up and out.

Observe how a well-trained soldier stands on parade. That is an excellent model. He appears to have no abdomen, so well is it held in. His shoulder blades are flat as a knife.

If the shoulder blades are not naturally flat, shoulder braces should be worn to correct the projecting ones and to destroy the round-shouldered effect so destructive of the beauty of a figure. These can be purchased at drug stores and department stores, but can be made at home at slight cost. Stitch two long strips of coutil two and a half inches wide in many parallel rows to make it strong. Fasten these at the back just over the shoulders with another horizontal stitched band of the same width. A simple exercise for sagging shoulders is to draw the arms behind you, bend them at the elbows and thrust a cane between the elbows and back.

Practice the proper posture in standing before the mirror. Study not only the front, but the profile view of your figure. If the chest sags, thrust it forward. If the abdomen protrudes, determinedly shift your weight so that it recedes. The prominent abdomen in half the cases I know is simply the result of bad habits of standing. If the shoulders curve forward, draw yourself erect until they are flat.

If you find your weight resting upon the heels, your figure will look awkward and countrified. If you rest upon the toes, it will look mincing and affected. Nature has indicated that to keep the balance of the body the weight must fall upon the balls of the feet. Try all these postures and notice how much better your figure looks when you stand correctly. It will be an object lesson you cannot forget.

Five minutes a day for two weeks ought to teach the dullest of us to stand well. After that the lesson of gracefully shifting the weight when you are tired may be practiced. Move one foot slightly forward, dividing the weight equally between the two. Then rest the full weight of the body on one foot. Then, by a quick, slight shift, change it to the other. But return quickly to the position of an equal division of weight. For when the body rests upon one foot the hip and shoulders of the other side will be raised.

A good walk is a thing of beauty. A bad walk is a pain to the beholder. A bird balancing lightly on the end of a twig is the best model I have ever seen for walking. He seems weightless. He vibrates with the joy of motion. The best walkers in the world are Spanish women. They move with a slight undulation that is exquisite. Their limbs move as though they have no weight. One of your clever American women describing the good walk said: “Move as though you lived altogether in the upper story.” “The upper story” was that part of the body above the waist. The remainder she classed as “the lower story.” It was an admirable hint. The upper half of the body should be evident in the walk. The lower should be merely a means to the end of walking.

The walk should invite attention only to the fine poise of the head, the perfect carriage of the chest, the straightness of the back. The limbs should be forgotten. A walk which attracts attention to them is always an awkward walk. The upper part of the body should be as free as though it turned itself upon a pivot. The lower part should be regarded and utilized merely as a pedestal for

holding the upper. In walking as in standing the weight should rest upon the ball of the feet. The toes should be turned slightly outward. The knee joints should move easily and the movement of the whole of the lower part of the body should be a stately and apparently unconscious motion.

Some women there are who stand well and walk well, who sit badly. Indeed, they do not sit. They lounge. The same law of balance should hold in all. That is, the weight should be evenly distributed, no portion of the body having to bear the lion's share of the burden. As a rule, the comfortable attitude is the correct one in sitting, though this is not true of the lazy person who sits with chin lowered upon breast and abdomen thrust forward, as a caricature of the human form. Sit with the feet resting upon the floor or upon a footstool. Never let them swing without support. Sit straight, or rest against a straight-backed chair, with the lower part of the body pushed close against the chairback. This is a much better way to rest than the half-lying, half-sitting posture that is so ungraceful.

In standing, don't throw the hips far back. They should be straight, in easy line with the body. In walking, do not swing the arms. In sitting, keep the crown of the head up and back.

To test your carriage, pass the hand across the back. If the ends of the shoulder blades can be felt at a light touch of the fingers, the carriage is incorrect. The shoulders must be drawn farther back.

CHAPTER XV

SAFE, EASY WAYS OF REDUCING WEIGHT

In this chapter I shall try to answer that which I call "The Great American Question." In other countries where I have lived and visited, women ask, "What shall I do to remain young?" In America women have by their intelligence solved that problem. Here the torturing, ever recurring question is, "What shall I do to be thin?"

Fat is the greatest foe to American beauty. But it is a self-created foe. American women, learned in all other matters of personal hygiene, ignore that which is chief, the hygiene of the table.

I will not say that American women overeat. They eat the wrong things. In food they deal in extremes, which are always detrimental, whether to beauty or to morals. They eat what is very sweet, or very sour. They eat what is very cold or very hot. They eat foods that are too highly spiced, or underdone. Extremes, always extremes! And when they have had too much of this extreme food, and the tortured stomach revolts, they go to another extreme, and fast, which is, in my opinion, a most pernicious extreme.

One fact that the stout woman should keep ever before her mind, as a signal light before a ship battling its way to port, is that fresh air is a destructive agent to fat. Oxygen burns carbon. To make this clear, let me ask you if you have noticed how a dying fire flames up when a draught of cold air is turned upon it? That is precisely what happens when a woman who is too fat goes out for a walk. Carbon, which is in the great folds of flesh that lie upon her abdomen and blanket her hips, is also a component part of the coat. Oxygen acts upon this as a burning match applied to paper. Therefore, if you are stout, walk, walk, walk.

This will not be easy. It will be hard indeed. For the woman who is too fat is invariably ease and luxury loving and a long walk is to her at first a hardship. But she should be in this as in all things else discreet. Her first walk should be a short one. If she be one of those women who always take a street car or a carriage, her first walk should be only eight or ten blocks long. I am computing by short New York City blocks. Twenty of these are equal to one mile. I have seen a woman unaccustomed to walking come puffily into a room, drop into a chair exhausted and say: "I am tired to death. I've walked eight blocks."

But this woman persisted, or, rather, her friends persisted. They insisted that after a few hours she take another walk. To their pleasure she achieved this time ten blocks. In a walk the evening of the same day she covered twelve, and came in with a pink glow in her cheeks and a new light in her eyes. By the end of the week she could walk one mile each morning without discomfort. The second week she increased this to one and a half miles. The third week it became two and when the second month of her exercise began she walked three miles every morning and came home with heightened color, a diminished waist and no complaints.

After two months her morning walk of five miles, regardless of weather, had become a necessity of her health and spirits. It was amazing how, as her girth decreased, her beauty increased. The cheeks that had been heavy and flabby grew firm and rosy. At first, though there was a perceptible decrease in her bulk, there was little difference in her weight. Her waist measure decreased one and a half inches and her hip measure two inches, yet she was but five pounds lighter. This apparent riddle is, after all, easily

guessed. Fat is of spongelike texture and light weight. Much of it may disappear with little corresponding reduction in weight. If a woman sees that her belts have become too large and that she needs a dressmaker or tailor to take in her gowns about the hips it does not matter whether she has lost five or twenty pounds. She has accomplished that which she resolved to do. She has grown beautifully less.

I have known women who never walked more than a few blocks at a time accomplish a ten-mile walk in a morning. The wisdom of this I always questioned. Walking is of no permanent value unless it is regularly done. Better three miles every morning than ten miles twice a week. Besides an exceedingly long walk is a severe tax upon muscles unused to walking. The muscles must be treated gently as little children. They should be slowly accustomed to their task.

Riding is an excellent reducing agent. A morning gallop in the park or along country roads will soon diminish ponderous flesh. Golfing is excellent. Swimming is admirable. Driving, because the body is entirely passive, is of little use. Indoor exercise in a gymnasium is better, much better, than nothing, but outdoor exercise distances it by one hundred per cent. Although the windows of the room be opened wide the room does not provide half the oxygen yielded by the great out-of-doors.

After the burning aid of fresh air, in importance comes diet. The stout woman should try reducing the quantity of her food one-third, then one-half. She should eliminate from it these dishes:

Pork, veal, beans, peas, fat beef or mutton, cauliflower, potatoes, milk containing cream, puddings, pies, candy, sugar, white bread, eels, salmon, chocolate, beets, butter, red wine, ice cream.

She should substitute for them:

Lean meats, eggs, green vegetables (as spinach, string beans, asparagus, beet tops), oranges, whole wheat, graham or gluten bread, white bread, toasted thin and crisp, saccharine instead of sugar, fresh or dried fruits.

A famous woman rid herself of ten superfluous pounds in a month by a modification of the milk diet. She drank two quarts of skimmed milk a day, and ate but one meal. She dined at seven with her family. Her breakfast and luncheon, consisted of two glasses of skimmed milk. She sipped the milk, giving herself five minutes for each glass, for she knew milk was rather a food than a beverage, and that since it passed speedily into the consistency of cheese in the stomach it must be slowly swallowed. The remainder of the two quarts of her daily stint she sipped whenever hunger gnawed and she was tempted to return to her old diet of what in America you call “three squares” a day.

Several of my friends have reduced their weight by the expedient of taking a long walk, as long as their strength would permit, before breakfast, but the nearly uncontrollable appetite for the deferred meal created by this exercise is a discouraging element. Others have been successful in reducing flesh by foregoing their breakfast altogether. Many dieticians agree that breakfast is “the fattening meal.” And there is reason to believe the stomach needs breakfast less than any other meal, since there has been no special outlay of strength during the night of rest as during the day of activity.

The fashionable woman used to think that she should rest immediately after a meal. Now she walks slowly, or at least stands for twenty minutes after each meal, being convinced that if she sits or lies down after a meal her abdomen will become distended, one of the most unsightly forms of superfluous flesh.

Massage and baths are an undoubted aid in the reduction of flesh. Massage should not be made to take the place of exercise. It should supplement it. It is estimated that thorough massage given by a skillful operator is equivalent to a seven-mile walk. But if this be true so far as the physical effort is concerned, there is no substitute for the carbon destroying bath of oxygen.

No room can be so well ventilated as to approach the purity of the outer air. The woman who is taking massage to reduce her flesh should not rest afterward. The massage should be followed by a dip into a bathtub of tepid water, a scrub and a salt rub, a cool spray and dressing, calisthenics or a walk.

Do not allow your masseuse to use oil or cold cream. Talcum powder is best for the woman who wants to be thin.

Reduction medicines I do not advise. Certainly I should never use one of them internally without consulting a physician, and having the compound analyzed. There are drastic remedies that reduce the flesh and demoralize the digestive apparatus. Far better in this instance the ill than the remedy and its consequent evils.

Some preparations of an absorbent nature I have known to be used with good results. Most of these contain iodine. There are several soaps used for the purpose of massage, all containing iodine. After receiving my physician's endorsement and having the soap analyzed by a scrupulous chemist there would seem to be no danger attending their use.

This formula is safe, and if persistently used, should be effective as an absorbent remedy. I have known corpulent beauties who took it internally, but I should never be so daring:

Tincture of iodine, 30 minims; iodide of potassium, 60 grains; hyposulphite soda, 20 grains; distilled water, 7 ounces; aniseed water, 170 minims.

I have before recommended Turkish baths for flesh reduction. That advice I must qualify by explaining how they should be taken, for there are thin women who take Turkish baths to fatten them, and with success.

As a reducing agent the Turkish bath should be taken in a more radical way than for mere cleansing and tonic action. The bather should remain in the room as long as possible, that is until she is warned by faintness or a fluttering of the heart that she has been in the abnormal temperature long enough. These warnings she must instantly heed. The length of time is governed by her temperament and health. It may be twenty minutes, but it should be from half to three-quarters of an hour. After the scrub and massage that follow she should go instantly to a couch and be wrapped in many blankets, so that the flow of perspiration will continue. Thus while she is resting she should perspire for another half hour. This makes a drainage at the pores for between one and two hours and reduces materially the weight. But I do not advise Turkish baths oftener than twice a week at most. Taken oftener I believe them to be weakening.

A cool or cold plunge every morning is prescribed by some beauty experts. Personally I am opposed to them. They are not cleansing. The delicate person cannot withstand them. They are a tonic to the robust constitution, that does not require them.

A gentle laxative is a great aid in reducing. Various salts, with the consent of your physician and taken in a manner he advises, would be helpful in diminishing flesh. But I insist that whatever is done in this direction must have a physician's approval. I will not unqualifiedly recommend it. The tendency of salts is to render a person who takes them anæmic. Should the person who wishes to reduce be already anæmic the effect of the salts, in thinning the blood, might be injurious.

To summarize my advice upon the matter of reducing flesh, let me say that the simplest methods are the best.

Make oxygen your first aid. Spend at least two hours a day out of doors. The more active the outdoor exercise the better, stopping this side the point of exhaustion.

Reduce the amount of food one-half, and change the dietary from the fat producing foods to bone and muscle makers.

And, in conclusion, a warning. As the muscles, divested of blanketing flesh, seem to shrink, be sure that the skin follows them, instead of hanging baggily about them, in ugly wrinkles or creases.

To contract the skin that surrounds the diminished muscles bathe it frequently in cold water. Bathe with a sponge dipped in cold water, or wrap the parts about with cold compresses.

If this method, which is called "freezing the muscles," is not successful this astringent cream applied every morning and evening should be:

Glycerine, 5 ounces; mutton tallow, 1 pound; tincture of benzoin, 2 drams; spirits of camphor, 1 dram; powdered alum, ½ dram; orange flower water, 2 ounces; Russian isinglass, 1 dram.

One day not long ago a charming young woman came to see me. Her face indicated deep distress.

"You are looking charming," I assured her.

"No, no, madam," she returned. "I am looking wretched, dreadful. I am positively ashamed of myself."

"But why?" I asked.

"Don't you see? I am over weight. I am twenty-seven. My height is five feet three inches. I weigh one hundred and sixty-five pounds."

“Your curves are a bit ample,” I admitted.

“You know very well, dear madam, that I am like a pillow of feathers. I lived at a summer hotel where they had really good food, and behold me. I can hardly believe that I gained thirty pounds in six weeks. What shall I do?”

“First understand that you cannot lose the flesh much faster than you gained it. You will need at least a month to lose the thirty pounds.”

“But I must lose them, madam. Think of appearing in the opera like this? Think of dancing, not only with a man, but with thirty extra pounds. What shall I do?”

I repeated the litany of reduction: “Exercise, diet, abstinence, perspiration.”

“But how?”

“Exercise until you are tired, and then don’t rest but exercise some more. Rest from one kind of exercise by trying another.”

“What exercise?” persisted my too plump friend.

“First a series of exercises that force you to breathe deeply. Begin as soon as you rise in the morning, and, by the way, rise at least an hour earlier than usual. You fatten as much by too much sleep as from too much food. In your night robe, or if you prefer it, in a bathing or gymnasium suit, go to the window, fling it wide open, and standing with the arms raised above your head, palms outward, elbows straight, inhale deeply and slowly, counting eight. Hold the air while you count eight. This gives the air a chance to sweep through the air cells of the lungs, bathing them with its freshness. Then expel the air slowly while you count eight. Repeat this until a slight dizziness warns you that you have done enough.

“Then begin the bending exercises. With fingers extended bend slowly until the finger tips reach the floor. Then rise slowly, and raise the arms above the head. Do not raise the shoulders, but slowly bring the tips of the fingers together above the head. Then gradually bend forward until the tips of the fingers reach the floor. Then back and up again.

“This exercise is difficult, especially for the stout. But persist in it and it will reduce the overfatness of the abdomen.

“You will be tired by this time, but you must not encourage the feeling of drowsiness and torpor and disinclination for further effort that creeps over you. Banish all thoughts of going back to bed. Instead begin your rolling.

“There is no mystery about rolling. It is simply what the name indicates. Down upon the floor you go and roll over and over swiftly, not slowly as a porpoise rolls. The porpoise, you will observe, is not a slender animal. Roll over as a puppy, tingling with the joy of life, rolls in the dust when at play. Roll quickly. Make at least eighty revolutions before stopping. Now you are very tired. The unaccustomed perspiration appears upon your face and body in drops. That is good. To reduce weight you must perspire. Most fat people have lost the art of perspiring.

“But you have not finished your exercise. Don’t think of breakfast. Don’t think of a nap after your strenuous half hour. Get a skipping rope and go out on the roof, on the fire escape, or into a vacant room and jump the rope twenty-five times. This the first morning. The second morning make it fifty and continue increasing the number until a flutter at your heart hints that you have taken enough of this exercise for the present.

“Then try some new dance steps. If you have done these thoroughly you will have spent an hour and a quarter at reduction. Go then to your bathroom and take a shower, first warm, then cool, then gradually becoming cold. With a big Turkish towel rub yourself thoroughly dry. Come back in a week and tell me how much you weigh.”

“One hundred sixty-one,” she said. “But that is not enough.”

“It is not,” I answered. “We must do better. This week, after you have finished your exercises indoors, you must dress at once and go for a long walk or ride.”

“But breakfast?” she asked faintly.

“It would be better if you ate no breakfast,” I answered sternly. “Or, if you take any, let it be a glassful or, if your stomach is clamorous, two glassfuls of buttermilk. Drink them slowly, taking at least five minutes for each glass.

“When you return from the walk or ride take another shower.”

“And rest?”

“There is no rest for the person who is reducing. It is an occupation in itself. After your luncheon, which should be of lean meat or fish, toast and coffee without cream or sugar and stewed or fresh fruit, go out again. Go shopping or calling. If calling, decline tea and sweetmeats that may be offered you. If shopping or calling don’t drive to your destination. Walk. For dinner you should have the same as at luncheon, with the addition, if you wish, of a small glass of white wine. White wine, being sour, is one of the agents for reducing flesh that all French dietitians prescribe. After dinner more exercise in the open. Driving is better than staying indoors, but walking is better. I have before pointed out that in walking you take in four times as much fresh air in a given time as you do in driving. And fresh air in the body is like a draught of air in a furnace, fanning a blaze that consumes all refuse and slag. Go back now,” I said, “and call again next week.”

Next week her step was lighter. Her eyes were brighter. She said: “You are a hard taskmistress, but I have done as you advised. My weight is now 154 pounds.”

“You have lost a pound a day,” I said. “That is enough. Some authorities would say it is too much. Now we will vary the treatment a little. I have told you about exercise and diet. Now as to abstinence.”

“It is dreadfully hard to do without sweets,” she sighed.

“Did you do without them?”

“Not wholly,” she admitted.

“If the hunger for sweets seizes you let fruit tablets dissolve in your mouth and swallow them slowly. This will satisfy for a time the craving for sweets that is as tormenting in its way as the craving for drink, and as hard to cure. The fruit tablets are a make-believe candy, and yet are so largely fruit and water that the sugar in them is hardly a calculable quantity.”

“But I am hungry nearly all the time; hungry for other than sweets. Hungry for substantials.”

“If you insist upon eating as much as you wish I can do nothing for you. You must leave the table with your appetite unappeased.

“Drink a great deal of water. That refreshes the body, but helps to destroy the appetite for food. Normally, you should drink ten glasses a day. Increase the amount to twelve or fourteen. With your buttermilk for breakfast, your lean meat, dry toast and coffee at luncheon and the same with white wine at night, your stomach will be satisfied.

“But do your water drinking discreetly. Begin in the morning as soon as you rise by sipping two glassfuls. Finish the day by the same quantity. The other should be drunk between meals or, at most, one glass should be drunk a day.

“Keep before your mind the word ‘Abstain.’ Remember that you must abstain from sweets, from pastries, from milk, from cauliflower, potatoes, lima beans, corn, all the vegetables and cereals that fatten.”

At the end of the third week she came back perceptibly lessened. “Eight pounds less this week,” she said triumphantly. “My weight is now one hundred and forty-six. Only eleven pounds of the thirty remain.”

“Do you perspire well?”

“Better than I did. But not freely.”

“Then the pores must be educated. Some pores must go to school to learn their function. When all else fails a course of Turkish or Russian baths will do this. Take them at home in a cabinet, or at public baths, as you prefer. I prefer the Russian baths because they are moist and they do not force the lungs to breathe hot air. The cabinet baths permit an opening for the head so that while the body is perspiring the lungs may be inhaling cool, pure air.

“Take one of these baths every morning. Keeping the feet in hot water facilitates the perspiration. At the end of a week you will find that the pores will have learned their office and perspiring will have become easy. While you are taking the course of baths you may relax somewhat from the exercise. Or you may take instead deep or kneading massage, the sort in which your masseuse’s knuckles seem to reach the bones.”

At the end of the week my patient wrote me: “I cannot call to-day, but rejoice with me. I have lost eight pounds this week. Only three more to spare. I am keeping tailors and dressmakers busy taking in my frocks.”

Three days later she appeared, looking radiant. It was as though a half dozen blankets that hid her beauty had been removed. Her charms had been hidden by too much flesh, as the flame of a lamp is obscured by a soiled chimney.

“One thing I forget,” I said, anxiously scrutinizing her face for sagging skin. “But you do not need the warning.”

“No, I had a facial massage every day to keep the skin of my face firm.”

“And there is no sign of a pendulous chin,” I said, admiringly.

“I kept the chin firm by freezing the muscles into hardness with cold water compresses and applications of ice.”

Here is how another young friend of mine lost nineteen pounds in five weeks without injury to her health.

Before she fairly realized that she was putting on flesh she found herself with all the symptoms of overweight. Her face was full and puffy. Her cheek muscles sagged, giving her face the jowl-like look that suggests the lower animals, transforming beauty’s face into a beastlike semblance, and that beast not the handsomest, nor most poetic, of the order. As she surveyed her figure in the mirror, particularly in the back, it looked broad and coarse. Moreover, she was conscious of her weight. Her movements had become clumsy. When we are at normal weight, that is, when we are only so heavy as nature intended, and nature abhors overfleshed women, we are not oppressed by our bodies. We feel so light and our minds are so capable of dominating our bodies that we scarcely realize that we have any weight. That birdlike lightness of body is a sure sign that we are at our best.

My friend, having a long social season before her, when she wished to look her best, resolved to train down. But how? She adopted none of the cure-alls prescribed by stout women we meet at Turkish baths. She did what is the wisest course when we are able to adopt it, went straight to her physician and asked his advice.

This was wise because her physician knew her constitution as she knew her alphabet. He knew which way lay peril. She must not take the beef and hot water cure, because she was predisposed to rheumatism, and authorities claimed, and this physician believed, that in beef there is at least seventeen per cent. of uric acid. The body is able to eliminate only a limited amount of the acid and the introduction into it of such excess over that amount would involve some remaining in the system. This should be avoided in cases of what the physicians call “uric acid diathesis.”

Also his patient was nervous, so he must not permit her that starvation system of diet which reduced her nervous force. Not being an especially vigorous woman, he was unwilling to run any risk of impairing her vitality.

Under his guidance, then, she began this regimen:

For breakfast, two slices of thin, dry toast. If her breakfast satisfied her cravings he insisted that the bread be dry. If not, she spread it very thinly with butter. With this she ate one medium-boiled or poached egg and drank one cup of coffee.

Being of those who say, and prove, if you watch them at the first meal of the day, “My breakfast is my best meal,” her physician knew that this light breakfast would at first be a hardship. He therefore urged her to eat very slowly, masticating her food until it turned into a thin liquid in her mouth. “If you do this,” he said, “one-half the food you formerly ate will just as fully satisfy your hunger.” “And that, which I didn’t at all believe at first I found to be quite true,” she said.

The only luncheon permitted her was a slight one of fruit. “Try to get on with one apple or orange,” he said. “If you are suffering from hunger eat two. But masticate, masticate, masticate.”

At night she was allowed to eat anything she chose, except the three fattening “ps”--potatoes, pudding or pie. But again she was charged to take twice as much time as usual for the meal. And at neither of her meals should she drink water. At breakfast and dinner one cup of black coffee was permitted.

For all the days that followed, for five weeks, she had the same breakfast and luncheon, but every other night she had no dinner save a large bowl of bread and milk. The milk contained no cream, but was skimmed.

Meanwhile she, who had always disliked exercise, discarded her carriage and took two walks a day, one in the morning and one in the afternoon. Her physician named no ground to be covered in these walks.

“Walk as long as you enjoy it, but not until you are tired,” he warned her. Her first unaccustomed walks were only three or four short city squares, but after two weeks, when nature had become accustomed to the new regimen, she was able to walk four miles a day, two before and two after noon.

If, as sometimes happened, she returned from her walk faint, she was allowed to drink a cup of hot but very weak tea, and if nature seemed to demand more sustenance, she drank two cups. But from these cream and sugar were sternly prohibited.

The results I have told you. And my friend never looked so lovely and she assures me she has never felt so well. There was no expensive journey nor stay at the baths; no daily massage. The loss of those nineteen pounds cost her only self-denial, the one fee for her physician and the tailor’s charges for taking in all her gowns four inches about the hips and two at the waist.

While ways to grow thin do not especially interest me, I cannot help hearing continually of them. Wherever I go the conversation of the women I meet tends to fat. All are interested because those who are fat wish to be thin, and those who are thin fear they may become fat. All womankind, it would seem, has organized into an army of fat fighters.

To the baths go women who weigh two hundred pounds, and when they return from Carlsbad, from Marienbad and elsewhere I pass them in the Bois without saluting them, because in those six weeks they have lost fifty pounds and are thin beyond recognition. It is marvelous. One of the great physicians who crossed the Atlantic recently to treat a New York society leader for obesity, received $2,000 for his services for two weeks. They will do much and pay greatly to reduce their flesh, these rich, but what of us who are not wealthy?

We can choose and follow some of their methods once we have learned them. This is one method which a friend of mine uses to keep her weight thirty-five pounds below what it formerly was. It is simple, being baths three times a week in hot salt water. Into an ordinary bath tub she empties two pounds of table salt. She pours water into the tub until it is two-thirds full, and remains in the tub for twenty minutes. After this she rubs her body briskly down with alcohol and retires.

Like most methods of quick reduction this may be criticised as temporarily weakening. Therefore while I am acquainting you with this treatment for obesity I do not recommend it to one who must keep her strength at its fullest. A vacation or a time when your tasks, whether they be business or professional or social, are light, would be the best time for this measure for reduction of weight.

From the harem of Constantinople, through an escaped inmate, comes the news that when a member of it becomes so fat that she is a formless sea of flesh, the overlord orders that she have bone-deep massage daily with this lotion:

Iodide of potassium, 2 ounces; camphor water, 2 ounces; alcohol, 2 ounces.

If while this deep massage and the hardship for a woman of the harem of eating no more of the delicious Turkish paste are continuing her face grows haggard and lines appear in it, it is bathed six times a day with:

Witch hazel, 1 ounce; rosewater, 1 ounce.

Specialists are always prepared to hear the complaint: “I don’t eat much.” All their patients tell them this and all of them believe it to be true, but in nearly every case it isn’t. A few admit that they are enormous feeders, but say “It is impossible for me to control my appetite.” A beauty specialist I know laughs at this.

“When you are hungry between the two meals I will permit you to drink water,” he orders. “Hot water or cold as you like, but drink it very slowly, and never take a glass of water unless there is the juice of a lemon in it. If you keep the stomach filled with water you will be less hungry. If you feel a ‘gnawing’ drink more water.”

This is the dietary permitted by an autocrat at one of the great European baths:

No liquor; all fish, except trout and salmon; chicken; beef (in very small and rare portions, preferably raw); eggs; nuts; all acid fruits such as cranberries, cherries, peaches and blackberries; rhubarb; beans; carrots; cabbage; cauliflower; asparagus; squash; tomatoes; onions; lettuce; celery; hominy; brown or rye bread; Dutch cheese.

These and nothing more composed the food. No servant could be bribed for a potato, and all turned round eyes of innocent wonder upon you if you asked for a sweet cake.

Because the change to this diet was so radical the doctor did not insist upon violent exercise, but he kept his reducing patients out of doors and encouraged them, as did the Paris physician, to keep moving.

While you are reducing depend upon a tape measure rather than the scales to determine your loss of weight. Measure your hips and waist and upper arm. Fat is bulk making, but it takes a large amount of it to weigh a pound. A woman, my neighbor at the baths I visited, had lost three inches about the hips and two about the waist, yet had lost only three-quarters of a pound in weight.

If I were ever encumbered by too much flesh I should first give the rice treatment a thorough trial. It is simple and cheap and has the merit of not reducing too rapidly, so that the facial muscles have time to adjust themselves to the new conditions and the skin of the face to also adjust itself, preventing the haggardness and aged look that follow too rapid reduction.

The rice cure can be explained in a paragraph, a short one, even in a line. It consists in an exclusive diet of rice and milk, or rice with a little butter and salt to make it palatable. It is a leisurely, and for that reason healthful, treatment. A young woman of my acquaintance rid herself of two pounds a week by this diet until she had diminished her weight by the desired ten pounds. I have no doubt, had she continued, she could have reduced indefinitely by that scale. She ate three large bowls of rice a day. Each bowl constituted one of her three daily meals. The rice was covered with skim milk. Had she chosen, she could have eaten it with a little butter and salt.

A fad in Ostend and at some of the German cures is to wrap the limbs and other fatty portions in white muslin or linen cloths that have been boiled in vinegar. They are wrapped around the fleshy portions of the body as hot as the cloths can be endured. When they cool they are replaced by others or they are dipped once more into the vinegar. This treatment is continued for at least twenty minutes and some of the faddists employ it three times a day. It has a certain value, for there is no question about the absorptive power of the skin. But its foes are sure that it makes the skin yellow.

In Germany is being attempted a method that would make for health and healthy thinness in America. German physicians advise the establishment in each town of fruit depots. If these depots or rooms were generally established and a man or woman could drop in at one of them for luncheon as easily as he or she now calls at a restaurant where fattening potatoes, puddings, pastry and liquors are served there would be a benefit to the general health.

Summer is the best season for reduction, for three reasons. First, one of the greatest agents for destroying excess flesh is pure air, and one may get all she wishes of it at this season. If circumstances permit you to leave the cities, the country air will aid in diminishing your girth.

A second reason why summer is the best season for reduction of weight is that we need and crave less food in this season, and, besides, the food is of a lighter nature and contains more acid than in winter.

One fashionable Parisienne betook herself to her château last month for her annual rebuilding and for the first three weeks lived exclusively on grapes and slept in an open air chamber on the roof of her country home. She grew clear of skin and lissome as a girl.

A third reason for utilizing summer in your reduction treatment is that it is the season which favors perspiration. And fat flows from our body on the streams of perspiration.

The latest word in the matter of obesity cures is that fat being composed chiefly of water must be squeezed as a sponge is to rid it of the liquid with which it is saturated.

Whenever there is need a supply soon follows. A school of masseuses have adopted this theory of fat and have gone to work heroically to prove their theory. One of these, who has gone to your country from Sweden, gives the new massage for three hours at one treatment. She beats and pounds and squeezes the flesh until it is soft as putty. The results are amazing. I know an actress who in order to play a vampire woman must needs reduce thirty pounds. This she did last summer, becoming slender and straight as a young pine tree, and with no lessening of her vitality or beauty.

In London they are “jumping the fat down.” Once a day, or oftener, the overweight clan jump up and down fifty times.

In Paris the so-called electric blanket has many advocates and friends. The person who desires to reduce her flesh wraps this blanket about her, attaches to its fastenings the electrical power from the lights in her room, and presently she is dripping with perspiration. Completely relaxed as in a Turkish bath, she lies in her own room, on her own bed, and loses undesired ounces and pounds. After twenty minutes or more she springs from her blanket, hurries to her bathroom and turns on the cold spray or shower, or takes a plunge in a tub of cold water. This, done twice a day, has been the secret of the vanishing flesh of many beauties at Ostend, who had the gratification of remaining in fashionable centers and enjoying life, instead of immuring themselves at stupid

baths.

These are effective new methods for general reduction. Often, however, there is need only of reducing certain portions of the body that are too redundant. Many women are annoyed, especially when they wear evening dress, by an unbecoming roll of fat lying between the shoulders. This has been removed by the simple means of patting it briskly with first one hand, then another, afterwards by stroking it, first with one hand, then the other, the strokes being firm and downward ones. It is better, still, to dip the palms in cold water before beginning this manipulation. “Ironing” the flesh roll with a lump of ice is another method successful in several instances of which I have personal knowledge.

If the chin has begun to multiply the ice ironing is useful, especially if the ironing be followed at night by tying up the chin by a muslin or rubber bandage that is fastened about the head.

Sometimes the excess of fat is in the face, giving the countenance a gross look, robbing it of much of its apparent intelligence, and muffling fine features in a blanket of superfluous flesh. Such a face has rid itself of this incubus, and emerged, youthful, rosy and well proportioned, because, as its owner whispered to me, she never retires without first passing a small lump of ice over her face, always with upward strokes. If the touch of the ice is unpleasant, or if there is in your composition a tendency to neuralgia, wrap the ice in a thin layer of absorbent cotton, or in a piece of gauze or cheesecloth.

Individual treatment for overweight can be treated according to individual needs. Study your needs and adapt your knowledge to them. Keep in mind these four principles of flesh reduction. All methods depend upon increased perspiration, lessened quantity or different quality of food, more vigorous exercise or that which reacts upon certain portions of the body, or greater freedom from clogging materials which are wastes of the body. Those bath powders which are advertised as reducing agents usually contain one of the salts which induce the latter results.

CHAPTER XVI

HOW TO GAIN FLESH

Every woman, while not desiring to be fat, wants to possess a figure that is pleasantly rounded. Curves, for women at least, are the lines of beauty. A man who is all straight lines may be handsome, but no woman who is all angles may be beautiful.

The young women, and the older women, too, who ask me, “What shall I do to become pleasingly plump?” are wise. For womanly lines, like a womanly voice, are wholly desirable.

How shall the thin woman become plump? It is a harder problem than that which I tried to solve last week. For a woman who is fat may become comparatively thin by self-denial, but the thin woman who would become plump must overcome many things, heredity, temperament, some of the most salient traits of her character. The thin woman must make herself over inside, so to speak, before she can make herself over outside.

To be pleasingly plump means that every angle is covered to an attractive roundness without any of the grossness of the figure that is too fat. As an example of such a figure, let me call your attention to Mary Garden. No one would dare say she is fat. She is not. She never will be, for she has the nervous temperament. But in all her figure there is no angle. Yet its lines are long, the curves graceful, and the ensemble is most individual.

For the thin woman who would become plump there must be a radical change in her manner of living. First she must learn a lesson from her fat sister. It is not to worry. Almost always the fat woman is care free. She is amiable. She never worries and never nags. Diane de Poiters, the great French beauty, had to struggle against the encroachment of a sea of fat. The reason may be found in her answer to the question: “Why are you so beautiful?” Her reply was: “I am beautiful because I never worry.” The thin woman must stop worrying.

The thin woman is a spendthrift of vitality. She is never still when there is a chance for activity. It was of such a woman that the sardonic bachelor says: “She cuts up quilt pieces just for the fun of sewing them together again.” By which the bachelor meant to convey that she did needless work. The thin woman must learn to rest.

The woman who is too slender to please herself or others must look to her diet. Those foods which her fat sister must eschew she must habitually eat.

She, too, must have her daily baths and her massage, but they must be radically different from those taken by the woman who would diminish her flesh.

Since her greatest hope of increased flesh lies in food I will first discuss that. Here is a list of those edibles which contain the starch or sugar, or both, that are needful for the taking on of flesh:

Thick soups, as bisque, cream of celery, cream of corn, puree of peas and puree of beans; fat beef, fat mutton, hot corn bread, hot biscuits, wheat, corn and buckwheat cakes, plenty of butter, honey; salad dressings in which there is more oil than vinegar; chocolate, pastries, puddings, bonbons, bananas, peaches, prunes, beans, peas, cauliflower, asparagus, potatoes, rice, gelatines.

She should drink cocoa or chocolate made with milk; red wines if wines be drunk at all; tea or coffee, if drunk at all, must be taken with cream and sugar. She should drink more hot water than cold.

Cold baths I do not recommend for any woman. Her organism is too delicate, I think, to successfully resist the shock of a cold plunge or shower, but if any woman can withstand it it is the stout woman. It has been claimed to be a considerable aid in reduction of flesh. By that token, if by no other, the thin woman should avoid them. Her baths must be at least tepid. I should advise them as warm as she can comfortably take them. For while hot baths are enervating a moderately warm bath is soothing to tired nerves, and so tends to those easeful habits which the thin woman needs to acquire. The fat woman should rise immediately from her bath, dress and go about her affairs. But it is admissible, even desirable, for the thin woman to lie down for a rest of twenty minutes or longer after her bath. The repose that follows a warm bath is one of the best aids to gaining flesh.

A Turkish bath once a week may be taken, but it should be taken prudently or it will lessen the flesh. The thin woman should not remain in the hot room for more than ten minutes. After the scrub which follows she should not lie in blankets, as I have advised fat women to do, to promote further perspiration. Instead she should go to a slightly cooler room and there take massage while her pores are gaping as open hungry mouths to receive it. Massage with olive oil is a fattener. For each bath I recommend:

Olive oil, 1 gill; oil of bergamot, ½ teaspoonful.

After massage with the oil she should rest for a half hour before dressing. To remove the odor and other unpleasant souvenirs of the oil rub she should powder her body freely with talcum before dressing.

For those to whom olive oil is distasteful there is this massage for the meager body, which is much used in France and Germany: Tannin, ½ gram; lanolin, 30 grams; oil of sweet almonds, 10 grams.

This, which I have before recommended for building the adipose tissues of the neck, is excellent for the body, especially for the sunken regions about the collarbones, for the thin layer of flesh over the ribs and for enlarging the hips:

Cocoa butter, 100 grams; alcohol, 95 per cent., 20 grams; essence of rosemary, 12 drops; essence of bergamot, 12 drops.

Some skins are irritated by cocoa butter. For these pure, fresh lard could be substituted. A recipe somewhat difficult to fill this side of Paris, but which has been invaluable to thin women who desired to be plump, is this for massage cream:

Salep of Persia, 15 grams; powdered cocoa, 60 grams; glan doux d'Asie, 60 grams; potato starch, 45 grams; rice starch, 60 grams; thin gelatine solution, 250 grams; vanilla, 5 centigrams.

Another simple, pleasant and efficacious massage cream is made from:

Olive oil, 2 ounces; pure starch, 1 ounce; lanolin, 1 ounce.

While I am aware that in America there is a prejudice against perfumes, I cannot share in it. Since the days of the early Romans well chosen perfumes have added elegance to a toilet. It is only their abuse which is to be deplored. A dainty woman need not be told that she must use the perfume sparingly, that there should be a hint, not a bald statement, of them about her. But there is no question that certain perfumes have also a tonic medicinal effect. Therefore for the thin woman whose nerves require soothing I recommend this toilet water, used by English and French women when tired. A half dozen drops in a bowl of water is deliciously soothing, and leaves a pleasantly pervasive yet elusive perfume in the room:

Jasmine water, 3 ounces; vanilla water, 1½ ounces; acacia water, 1½ ounces; tuberose water, ½ ounce; essence of ambergris, 5 drops; tincture of benzoin, ½ dram.

The thin woman may use all of these things and yet note but little improvement. For she has but little appetite as a rule, and it is hard to fatten one who will not eat. She should go to a physician, tell him of her loss of appetite, and ask for a prescription for a tonic which shall be, as are most tonics, an appetizer. In lieu of that I borrow from a famous French physician, who contributed much to the beauty of women, this formula for an appetizer:

Tincture of nux vomica, 3 grams; tincture of rhubarb, 60 grams; tincture of star anise, 3 grams.

The woman who would be plump must add to her daily allowance of sleep. If she sleeps eight hours and is still thin she should sleep nine hours, or even ten. And she should take a nap of a half hour to an hour after her midday meal. She should exercise before instead of after meals.

Briefly this is the regimen I should advise for thin women:

Begin the day with a light breakfast in bed. The breakfast may be a pot of cocoa or chocolate made with milk, and sweetened with three lumps of sugar in each cup, three slices buttered toast, two medium boiled eggs.

Rest for at least a half hour; better an hour. The time can be utilized in looking after your correspondence on one of the convenient writing pads, in bed, in reading the morning papers or in making your plans for the day.

Then a tepid bath, as I have directed, followed by a slightly cooler shower to prevent your catching cold.

Then a short walk or a drive.

Luncheon of roast beef or mutton with gravy, any green salad with mayonnaise dressing, a cup of cocoa or glass of milk, bananas or peaches or pastry.

Between luncheon and dinner sip two or three glasses of milk, remembering that milk is food rather than drink, and giving five minutes to each glass. Follow the luncheon by a nap. If you can’t sleep at least rest.

For dinner eat any food that appeals to you that is of starchy or sugary or fatty nature. Avoid pickles, oranges and all acids.

In this diet use saving common sense. Do not eat of rich foods so freely that your digestion will be impaired and your complexion become mottled. Drive away insomnia by drinking a glass of warmed milk, a cup of cocoa or chocolate and eating a biscuit or two before retiring.

For the thin woman the rule against eating between meals applied to the fat one does not hold. She may eat whenever hunger moves her, for hers is a normal hunger, indicating need of more nutriment.

I think it is not well to try to guide the natural growth of a young girl toward slenderness or plumpness. Nature should have its chance to indicate rather strongly which way it intends her to travel, whether the road of thinness or fat. When this has become apparent, which is not until after sixteen or eighteen, it is quite time to supplement nature.

But for those readers whose growth will not be interrupted by any radical changes in manner of living, I would advise special attention to diet. Give a great deal of intelligent attention to nourishing the body. Keep in mind always the class of foods that form flesh.

Of the cereals corn, wheat and oats belong in this class. The bread made from them has the same properties, especially if they are used in their natural, unadulterated state. Corn bread, made from rough yellow meal and spread plentifully with butter, is one of the best means of adding to the weight of the body. Potatoes, if used in connection with eggs, cheese and milk are important aids in that direction.

A French physician of unusual skill prepares to fatten his thin patients by requiring them first to fast for a short time. Sometimes he asks that this continue for three days, though in my opinion forty-eight hours are quite enough. This is to clear the body of all remnants of former manner of diet. This is followed in his system by an exclusive milk diet of three more days, he permitting the patient to drink as much as she likes, but insisting on at least two quarts a day, drunk very slowly, ten minutes for the consumption of each glass, almost literally eating, rather than drinking it.

Should the appetite rebel at the milk it may be varied by an occasional glass of orange juice or of lemon juice and water, half and half.

The third step in this rejuvenating of the body before beginning to take the flesh forming foods, is to eat nuts and fruit freely for a day or two or longer, unless your appetite becomes too rebellious.

When you have begun with the flesh forming foods, which I have given and which always include meats containing considerable fat, be careful to chew them so thoroughly that all turn to liquid form in your mouth before swallowing.

I knew a woman once, extremely thin, who always ate a half dozen dates for dessert, after a full meal. To this she ascribed her rapid gain in welcome flesh.

Exercise gently while building flesh, but do not exercise quickly nor long at a time.

Drink water freely, and during meals one glass slowly drunk of cold water will not interfere with, but rather aid, in the digestion. One of the first measures taken by those who wish to reduce their flesh is the opposite--to avoid drinking water at meals.

Rest often. Sleep as much as you can, taking a nap at midday if possible. Thin persons are nearly all worriers. Fat persons, as a rule, do not worry.

Massaging the body with olive oil or vaseline aids in flesh formation. Drinking olive oil has the same result.

My prescription for the increase of flesh is twofold. I counsel peace of mind and eating flesh-making foods.

Generally speaking, thin persons are of nervous temperament. They have a positive genius for worry. Stop worrying and control your nerves. This can be done through the practice of common sense and the exercise of your will. Train yourself along this line and it will amaze you to see what progress you have made in a few months. It is possible not to let things and persons get on your nerves. Try it, and keep on trying, until the avoidance becomes a habit.

You will be less nervous if you take more rest. Sleep; or if you can’t sleep, remain in bed an extra hour or two, if possible, every night. And if your circumstances permit, take a nap or a half-hour or more of relaxation at noon. Rest after meals.

Aside from this nerve control and banishment of worry, the greatest aid in flesh-making is in the greater quantity and different quality of food.

Science has lately contributed a valuable item to the flesh-making foods. The pine nut, known as pignolia, is one of the foods richest in fatty matter and in fat-making ingredients. Dr. Harvey W. Wiley, the great food expert and advocate of the pure food law, calls attention to the fact that these small, sleek, white nuts are composed of nearly 60 per cent. of fat, and that the sugar and starch, also fat-making ingredients, in them amount to 17 per cent. of their composition. They have heat-making properties equaling those of butter, containing nearly four times as much nourishment as lean beef. This discovery I repeat, hoping that those persons to whom the idea of eating pork or fatty beef will be obnoxious will find an excellent substitute in this.

Butter is a fattening agent. Spread bread thickly with this and eat foods cooked in it, if you would grow flesh. But because butter and cod liver oil are believed to interfere in some cases with digestion, I would advise the free use of cream and milk instead.

As a rule the person who is too thin is anæmic, and those foods which rebuild the system will tend to round the body. For such persons thick soups are desirable. Thick broths are strengthening and rebuilding. Vermicelli and macaroni, added to thick soups, tends to fatten. In Germany I came on an anæmic young woman taking the cure at one of the baths.

“What is that you are eating?” I inquired, looking dubiously at a thick sandwich she ate with evident relish.

“It is a chopped raw beef sandwich mixed with chocolate,” she said. “It is delicious. May I order you one?”

I declined, for it happens that I dislike both raw meats and chocolates. But I asked her about her regimen, and found that part of her prescribed daily diet was sandwiches made of chopped or scraped meat prepared like the meat for a Hamburger steak, and mixed with beef or mutton broth, butter or cod liver oil, or, as a special reward of merit she was granted the variety she most liked, raw beef with chocolate.

Raw oysters were also permitted, but there was almost no lemon juice sprinkled upon them and vinegar was not allowed upon the table. Eggs she was allowed without limit, and she was urged to take them beaten up in milk from which the cream had not been removed. All cereals were admissable, especially barley, hominy, tapioca and cracked wheat.

It is commonly supposed that thin people are thin for natural constitutional reasons, and that it is extremely difficult, if not altogether impossible, to increase weight. It is true that many people hold a certain weight year after year, neither gaining nor losing more than a pound or two. It is also true that many efforts to increase weight accomplish nothing. But thin people need not be discouraged or settle themselves into the belief that it is impossible to gain weight.

An eminent physician tells me he has known people of middle age who have never varied more than a few pounds in weight for twenty years, to add thirty-five pounds in one summer. But this was accomplished, not by any haphazard luck, but by a most careful, persistent and intelligent system of nourishment.

Most people are accustomed to eat about the same average amount of food every day, and they are guided in the amount they eat by their appetite. The result is that, with about the same daily habits of life and about the same daily appetite, and with about the same consumption of nourishment day after day, the bodily weight continues at a fixed amount. If one is working extra hard, the appetite may be a little stronger, and the additional weight which might be gained is consumed by the extra labor which is being performed. During a summer vacation it often happens that there is a gain of weight of five or eight or perhaps ten pounds, but this is lost again as soon as the old habits of life are resumed after the vacation is over.

In formulating a system for increasing weight it is necessary to consider all of the many factors which may be made to contribute to the gain. Of course it must be understood at the very outstart that it is necessary to increase the amount of food we are eating if we are to increase weight. It is not difficult to understand that a person's weight, which is maintained at an even level year after year on a given quantity of food, is not likely to increase unless the quantity of food or the quality of the food is increased. But it does not necessarily follow that weight will increase simply by increasing the amount of food consumed. Many other factors enter into the problem.

It is probably almost universally true that we eat many things every day which are of little or no value. Our stomachs are often filled with more or less worthless food instead of things of great food value.

The most important single factor in gaining weight is the kind of nourishment that is taken.

Bread, meat, cereals, thin soups, desserts, crackers, pastry and most vegetables are of very little value in increasing weight.

Thick pea or bean soup, baked beans, Boston brown bread, rice, Welsh rarebit, cheese, raw eggs, chocolate, milk and cream are the great producers of weight.

It is, of course, generally well known that rapid and considerable gains in weight may be made by drinking large quantities of milk. The flesh gained by abnormal consumption of milk is likely to disappear as rapidly as it was acquired; and it is the opinion of many of the best physicians that too much milk puts a dangerous strain upon the kidneys.

Flesh gained through a milk diet is of doubtful value, but flesh gained by eating the highly nourishing foods I have recommended is of permanent value.

If a person is eating all his appetite demands, it may be asked how any one is to eat any more. One way of creating a larger appetite is to move your meals further apart.

If, for any reason, you are not able to get dinner until an hour or more after your usual dinner time, you feel a considerably keener appetite and eat considerably more. If you will apply this to all the hours for your meals you will find that you are eating a considerably larger bulk of food each day. Get up earlier in the morning and have a longer interval between your breakfast and midday meal, and you will eat probably ten or fifteen per cent. more at noon. Put off your evening meal an hour later, if possible, and you will find that you eat a considerably heavier evening meal than you had been eating.

The older you grow the slower are your digestive processes. It takes fully an hour longer for a person of forty-five to digest the same meal eaten by a person of twenty.

Everybody knows how pate de foie gras, which is the fat and diseased liver of a goose, is produced. In Strasburg, where most of the pate de foie gras comes from, the unfortunate goose is taken into a dark cellar and one foot is nailed to the floor. The goose is then fed all he will eat, and when he has finished his meal more food is poked down his throat with a stick. The goose is, in this way, stuffed with food day after day, and is not allowed to have fresh air or exercise. The result is that his liver becomes degenerate, fat and enlarged; and this is the way pate de foie gras is produced.

The same sort of thing works in the same way with the human anatomy, and if you are to stuff yourself with extra food and acquire permanent and valuable flesh, you must thoroughly oxygenate your blood by fresh air and a reasonable amount of moderate exercise. Sleep with your window open at night and take a walk morning and evening. Do not run, hurry or take violent exercise of any kind.

The chief factor in gaining weight is to come to your meals with more appetite than ever before and eat more than ever before. Eat things of the highest nutritive value. If you are beginning your dinner with thick, rich pea soup, try to eat two or even three helpings of it. Whatever else you eat help yourself to double the usual amount and try to eat it all. And when you are all through and think you cannot eat any more, then eat a liberal helping of cheese, and after that drink a glass or two of milk.

If such a meal taxes your digestion you may need help. The chief digestive agent of the stomach is hydrochloric acid, and you may add power to your digestive machinery by taking a little. You may at the same time stimulate the other gastric secretions with a little nux vomica. Here is a prescription which will probably help you to take care of your extra quantity of food:

Diluted hydrochloric acid, 3 drams; tincture nux vomica, 2 drams; peppermint water and distilled water, each 2 ounces.

Take teaspoonful in wineglassful of water 3 times a day after meals.

Now, this is not all. You may still take a little more nourishment before you go to bed. Try drinking two glasses of milk--always sip milk slowly, taking five minutes for each glassful. Better yet, break and beat two raw eggs into the milk before you drink it. If you can get sweet cream, drink cream every day. Half a glass of cream is a rather rich drink, but it can be made easy to digest by diluting it with seltzer. Get a syphon of cold seltzer and squirt it into the half glass of cream, and it makes a delicious, nourishing and digestible drink.

Malt and cod liver oil are admirable fat producers. There are on the market one or two honest preparations of malt and cod liver oil which are not unpleasant to take. A tablespoonful in a glass of milk makes a valuable drink.

You should arrange to weigh yourself every day. If possible get a bathroom scale and always weigh in the morning as soon as you get out of bed. Whatever you weigh at night you will weigh from one and a half to two pounds less in the morning. If not convenient to weigh without your clothes on, then be sure you weigh always with the same clothes.

CHAPTER XVII

EXERCISES THAT HELP MAKE YOU BEAUTIFUL

There are exercises that reconstruct, build over, and there are exercises that destroy, chiefly by excess. I am going to tell you of the first sort. The second may be dismissed as violent exercises. Violence is always a destroyer of beauty. Excessive exercise with heavy dumbbells, whose weight exceeds the strength of the person wielding them, I mention as one of the worst of these destroyers.

I have before said, and I am glad to have an opportunity to repeat, that I disapprove of heavy exercise for women. Extreme physical effort taxes the strength and leaves its marks upon the countenance, writing the heavy, disfiguring characters of fatigue. It overdevelops the muscles, robbing the figure of its soft, delicate outline, making it bumpy, unseemly and masculine.

Exercise for women should have three aims. First, securing as much fresh air as is needed for health. Second, as much motion and adjustment of the internal organs as are needed for health. Third, for the correction of such habits as are threatening to the health and disfiguring to the beauty. A good eclectic system of exercises serves all these purposes.

A simple exercise that I have long used when I noticed a tendency of the shoulders to sag forward is to place my arms behind me, bend them at the elbows and thrust between the back and the elbows my brother’s cane. When he rebelled or when he and his precious cane were absent, I used my own umbrella or sunshade. The temporary support drew the shoulders far back and expanded the lungs so greatly that it became my favorite exercise. In this attitude I walk about the room many times, or, standing before the open window, tightly close my lips and breathe deeply. This I continue for fifteen minutes, unless my arms grow very weary, in which case I cease for the time, beginning again in a few minutes when I have rested. In all exercises I stop short of the point of fatigue.

For a sagging abdomen, slow, regular bending exercises are best. Stand with the arms raised above the head and the palms forward. Keep the elbows straight. With a slow, sweeping motion bend forward until the tips of the fingers reach the floor in front of you. This is difficult, especially for the stout and those with muscles stiffened from lack of use.

When you have mastered this exercise, by practise, thrust the hands clasped at the finger points as far back between the knees as you can. In this way a semicircle is described at one sweeping motion, and the abdominal muscles are strengthened at the same time and the abdominal organs stimulated.

For inactive, heavy back muscles the rotary trunk motion is best. Bend the body forward from the waist line, and swing the upper part of the body slowly around as though the waist were a pivot. Move the trunk slowly to the right as far as it will go, then to the left as far as possible. Sway slowly from the extreme right to left and back again, being careful not to wrench the body. These last two exercises are invaluable for setting sluggish intestines at work.

Hundreds of queries are sent me putting in various ways the one essential question: “What shall I do for a muddy complexion?” Let me answer all those questions now and briefly. Set your sluggish liver to work. The exercises I have just described will aid in that most necessary work. So will walks long enough for sufficient exercise, yet not long enough to exhaust you.

If all these, together with much water-drinking, fail to correct the liver-marked complexion, this will be assuredly helpful: Standing perfectly erect, raise the right arm as high as you can, stretching the left arm downward at the same time. Reverse this motion, and alternate the two. This air-sawing, done rapidly, will bestir the laziest liver.

For chronic indigestion I recommend walking, varied by rope-jumping. After a brisk walk, return to your room and, resting briefly, jump the rope from twenty to fifty times. Your strength must determine the number. It is better to begin with ten times and increase the number to fifty, or even seventy-five, as you become accustomed to the unusual exercise.

A favorite exercise of mine is the simple, easy one of sitting straight. Sitting straight develops the habit of poise. I sit every day before a mirror, and at sufficient distance from it so that I can see my reflection at full length. I note whether my chest is high or drooping. If high, I know that my figure is at normal. If drooping, I at once seek the cane or umbrella of which I have spoken and take the shoulder and chest raising exercise I first described, and which I call my “uplifting” exercise.

This I vary by clasping my hands behind and letting the head rest in them as a cup, while I inhale and exhale profoundly, moving the head slowly in its socket of clasped hands from one side to the other.

Swinging about on my revolving dressing stool, I note closely and critically my profile from brow to toe. If my chin tends to sag, seems by the slightest tendency to sag, I lift it as high as I can and, closing my teeth tightly, draw the backs of my hands alternately across it. I repeat this exercise fifty times, until the chin tingles and I know that the renewed circulation is doing its work of restoring the firmness of the muscles. My chin, I may explain, seldom displays the pendulous tendency, for I sleep with a very low pillow or no pillow at all. The high pillow I regard as one of the greatest enemies of beauty, for it causes curving shoulders and heavy chin.

Deep breathing is in itself a superb tonic, and certain exercises aid greatly in forming that habit and developing the power to breathe from the very extreme of the lungs, creating, so to speak, a continual draught in the lungs. Climbing is one of these. The well-known value of mountain-climbing is due to the fact that it necessitates deep breathing. If mountain-climbing is not open to you, there must be hills within your reach. And there are always staircases. This exercise, being somewhat taxing, should be moderately and gradually taken. Climbing develops the calves and thighs.

A horse is a splendid colleague in the work of upbuilding. A gallop sends the “reconstructive” fresh air, the true carpenter of the body, rushing through the body, doing his work quickly and well.

Young women who complain of dark circles under the eyes admit, by describing that symptom, depressed circulation. All of these exercises that develop the power and habit of deep breathing correct lowered circulation and impoverished blood and cure their unlovely symptoms.

From India, where the gospel of deep breathing as a spiritual as well as physical aid was born, comes a method of deep breathing that is wonderfully quieting to rebellious nerves. Close the eyes, and with the forefinger pressed closely against the left nostril, completely closing it, inhale and expel the air solely through the right nostril. Next, closing the right nostril by placing the forefinger upon it, breathe deeply through the left. Reverse these operations, and continue this alternate breathing for several minutes.

For clearing clogged lungs this, also derived from India, is useful: Inhale naturally and deeply, but expel the air slowly and thoroughly from between the lips, letting it escape with a whistling sound. Remember, however, to inhale through the nostrils alone, expelling only with the lips, for while germs cannot be drawn into the system through the nostrils, the fine hairs which line the nose being nature's sieve, they swarm from without into the open mouth at the slightest chance. That chance is afforded by the intake of air. This outrush, of course, bars their entrance.

It is really one of the simplest things in the world to have healthy lungs. Sit erect, stand erect, walk erect. And if you go through life sitting correctly, standing correctly and walking correctly, you will breathe correctly, and, breathing correctly, you will have healthy lungs.

And in order to have a good pair of lungs, a working machine that will serve you well all your life, begin at once--the younger you are, of course, the better--to build up the muscles between the shoulder blades, the muscles at the top of the shoulders and the muscles at the back of the neck.

Fresh air you must have, of course--plenty of it. But of what avail the purest oxygen if there are districts in that wonderful region inside your ribs where a breath of fresh air can never reach. And those are the very spots where pulmonary germs, like Jeshurun in the Bible, wax fat and kick. When one has little plague spots like these inside of his anatomy, fresh air and exercise, the usual prescriptions for sick lungs, are of no great value unless erect sitting, standing and walking are systematic and continuous habits. Then only are fresh air and dry sunshine of avail to affect radically the germs of tuberculosis.

Begin right off now. Straighten up. Whether you have well lungs or sick lungs, start exercising. The results obtained by even the simplest gymnastics are often magical, not only as a gain in health but as a distinct asset of physical beauty. One of your shoulders may hang a little lower than the other; that will work much harm to a depressed lung. Look to it always that your shoulders are well up in the air and well back. Lift up and throw back your shoulders so that your shoulder blades will lie flat on the back of your ribs, with the tops of the shoulders themselves pointing directly upward. Make this a habit.

I myself exercise but little. The reason is apparent. I am of slight physique, requiring rather a fostering of the vital spark than a lavish expenditure of it, in the direction of muscle making.

Light gymnastics after the bath in the morning, and a drive in the afternoon quite suffice for me. Since I never grow fat there is no need of training down. Therefore the exercise I take is quite enough for my needs.

But for American women, with their tendency to grow fat, this, I know, is not enough. While I believe there should be only enough exercise to properly tone the body, yet some require much more for this purpose than others, and there is not enough toning, when the body grows fat.

There is no one form of exercise so generally tonic to the system, I think, as walking. If a woman be of the bilious temperament, with an inclination to grow sallow and heavy-eyed, she needs longer walks than the woman of sanguine temperament, whose blood leaps through her veins and seems to seek escape by way of the mounting blushes in her cheeks.

A woman who needs walking, and she and her physician should be the best judges of whether she does, may begin by walking five city blocks and end by walking five or six miles. She should increase the distance gradually, for one long walk may be of brief benefit, but regular long walks are of inestimable value. It is never well to begin suddenly violent, unaccustomed exercise.

The chief value of walking is that it forces deep breathing, and deep breathing causes a cleansing of the intestines, as when a blast of cold air is introduced into a furnace it burns up all the refuse that while the fire was low clung to the sides and back of the grate. Here is a fact that should be kept hanging on a prominent peg in the memory. In ordinary instances, when a person rests he breathes four hundred and eighty cubic inches of air a minute. This is much less than is needed for cleansing the body. That is the reason why I oppose too much sleep. During the sleeping hours the amount of air we breathe is much reduced. That is the reason why many persons look at their worst when they rise in the morning. Lack of the amount of oxygen they take into the body when they are moving about, leaves their cheeks pale, their muscles sagging, and their eyes dim. Note how much handsomer you are an hour afterward than immediately upon rising.

On the other hand, while walking at the rate of four miles an hour, which is not the maximum rate, you will inhale five times as much air, that is 2,400 cubic inches, in the same time. Have you a room or suite of rooms, containing four windows? Have you opened one, and, finding that the air was not being freshened fast enough, have you opened the other three and noticed the instant

improvement? That then must be the best argument for walking as against driving.

If you form the daily walk habit see that it becomes a daily habit. Don't stay indoors, because it is too hot, or because it is raining. One should not take her daily walk in midsummer while the sun is highest. Rise earlier and take the walk in the dewy part of the day before breakfast.

If it is raining dress for the walk in the coquettish little rubber boots that are now fashionable, and the short serge or flannel walking skirt, and the little Tam o'Shanter or turban. Thus garbed, you don't care how wet you become. Leave your umbrella behind and let the rain pour upon your face. It will be the most grateful bath you ever had in your life. The rain bath for the face is delicious. Having had one you will lose no opportunity to take another. You will see in your glowing cheeks their first resemblance to the rose complexion of the Englishwoman, the finest complexion in the world.

The walk is cheaper and its effects a thousand times more lasting than any cosmetic. It throws off the enveloped cloak of lassitude that hides beauty. No woman is so attractive when she is listless as when she is thoroughly and happily alive. The walk awakens the sleeping or submerged self. It makes life under any circumstances seem worth while. And a woman, to keep her beauty, must always think life worth while.

I have seen a woman start on her walk pale, dull eyed, with the drooping lips that give the appearance of greater age, and have seen her return from that walk an hour later, her sallowness replaced by a clear pink skin, her eyes youthfully bright, her lips curling upward, the sign of content, her step springy. By the magic of the walk she seemed at least five years younger. Most of the famous pedestrians live to an old age. In a small town in America lives a man of seventy-five who recently took a two hundred mile walk in three days, stopping only for short rests of a few hours. He returned home, having rid himself of a bilious attack.

Another seventy-year-old youth walked off the rheumatism in a ramble from San Francisco to New York.

Therein lies one of the greatest values of the walk. It eliminates lingering, self-made poisons from the system.

An excess of uric acid is just now the fashionable affliction. No one suffers from it who is an habitual walker. Rheumatism and gout are caused by the settling of deposits about the joints. Those deposits of poisonous matter are not permitted to form if there is a thorough elimination by means of walking and much water drinking.

Indigestion in its various forms can be corrected, especially in the earlier stages, by walking, in connection with careful diet. Indigestion is a physical failing, especially peculiar to women. Walking, by bringing into play unused muscles and by making deep breathing necessary, as a walk always does, relieves this condition. Whatever clears the internal organs clears the complexion. Whatever naturally clears the internal organs brightens the eyes. Whatever promotes deep breathing lays in a new stock of vigor, as we fill our cellars with coal in the winter.

Riding is good exercise for women, if not taken in excess. Its drawback is that the side saddle forces one hip and shoulder higher than the other. If a woman rides she should by all means ride astride, so obviating this difficulty.

While I take my own morning exercise after the bath, with no aid whatever, dumbbells are valuable to those who "cannot become interested in freehand exercise." I should advise beginning with the smallest dumbbells made, those weighing one to half a pound.

Wrapped in a lightweight woolen bathrobe, and wearing tights or knickerbockers, hose and sandals or slippers, let her stand before the open window while she manipulates the dumbbells. With shoulders back and chest thrown out and head erect, let her curl the dumbbells twenty times, meanwhile breathing slowly and deeply in time with the exercise.

Start with the dumbbells at the shoulders and push them high over the head, counting and breathing deeply twenty times.

[Illustration: MADAME CAVALIERI IN HER MUSIC ROOM]

Rest for five minutes, the dumbbells standing on the floor in front of you. Bending your knees very little, but keeping your arms straight, rise to an erect position, with the dumbbells resting at your waist. Repeat this exercise, but raising the bells as high and as far behind your neck as possible.

Now start with the bells held by the arms in a horizontal position. Raise the bells until they are high above the head, then lower to the first position, keeping the elbows straight.

When this exercise has become easy, turn back the face until you are gazing at the ceiling. Breathe deeply. This is one of the best known exercises for chest expansion. The others develop the back, arms, chest, shoulders and waist.

This is valuable to correct a torpid liver. Stand erect. Raise the right arm, reaching as far as you can with it, at the same time pushing downward with the left hand. Reverse this movement, pushing upward with the left hand and downward with the right hand. Alternate until you are nearly breathless.

For a flat chest this exercise without apparatus is helpful. Shrug the shoulders as high and as fast as possible, ceasing only when you become dizzy. This, if the shoulders are even. If they are uneven, practice raising the defective one alone until in the course of weeks or months they are straightened, or carry a high cane on that side.

For the girl who has not learned to breathe correctly--that is, deeply, it is well to stand before the open window, and with her hands raised, the palms outward, inhale deeply, counting ten, hold, counting ten, exhale, counting ten.

Or this: Clasp the hands behind the head, the palms supporting it, and with the chest thrust forward, inhale, count and exhale as advised. If this at first causes giddiness count but four and gradually, as the body becomes accustomed to the new exercises, increase the counts to ten, and even to twenty-five.

For a stretching of all the muscles the best exercise I know is to clench the fists and, raising the arms, with elbows unbent, above the head, stretch the body to the greatest possible height.

Another to give suppleness to the body is to rise on the tiptoes, then lower the body until the weight rests upon the soles, then up and down again fifty times. I have known persons so infatuated with this exercise that they repeated it two hundred, and even five hundred times a day.

One warning: Never carry exercise beyond the point of slight fatigue. Never let it reach the point of exhaustion, for exhaustion, like illness, is a synonym for ugliness.

Women fancy that a weak back is the heritage of their sex. They fancy that aches and pains in that region are inevitable. In this they are mistaken. The back may be rebuilded and strengthened as can other weak spots. Discreet exercises are the best aid in that desirable direction.

For children who are growing round shouldered, shoulder braces are, for a time, beneficial, for they train the muscles to erectness. When this training has been accomplished the braces should be removed and the child required to practice the carriage the brace has taught him. But for a grown person I never advise braces except as a last resort in a desperate case, and particularly in cases of lung affections, to require the person to inhale fresh air.

We often receive the advice, “Rest your back to stop its aching.” This is sound advice in cases of extreme fatigue, but generally the best way to rest the back is to strengthen it, and the way to strengthen it is by well directed, but not violent, exercises.

Every muscle in the body is there for some use. Everyone should have enough exercise to keep it healthy. The muscles of the back are weak because they are so seldom used.

The best exercises for development of these neglected muscles are those which involve stooping. Spoiled, pampered beauties test themselves by stooping, and if they can touch the floor with their finger tips, without bending the knees, they pronounce themselves fit. Women less spoiled and pampered have far less anxiety about keeping fit. Their everyday work requires enough stooping to keep the muscles of the back flexible and the muscles of the abdomen firm, and of normal size.

Lifting moderate weights from the floor is a good exercise for strengthening the back. If the back be very weak it is well to begin with an empty bucket. As exercises strengthen it gradually fill the pail. A basket with a handle may serve the same purpose. Stoop slowly, and slowly lift the weight. Keep the leg muscles tense and make the muscles of the arms tense. Reach slowly forward and lift the weight with both hands. Lift it on a level with the waist line. Then lower it as slowly to the floor.

Next to stooping, twisting the muscles of the back is a good exercise for strengthening it. But let this twisting be slowly and gently done, or this will be one of the instances in which the remedy is worse than the disease. Violent exercise will only make the muscles weaker and cause a more severe ache, and possibly a severe injury, by wrenching them.

This is the best method for the twisting. Lift the arms slowly above the head, with the elbows unbent. Then slowly turn the body to the right, resting its weight on the left leg. Swing the body around, keeping the arms above the head but shifting the weight to the right leg. This is a most valuable exercise, for it contorts the muscles, causes a supply of blood to flow through them and by the unusual action they gain strength.

The same exercise as the foregoing can be advantageously done with the arms stretched out horizontally before you, and swinging them in a large half circle, being careful to shift the weight from one leg to the other and keeping tense the muscles of the legs on which the weight rests.

As a rule round shoulders are the sign of weakened muscles. Or the appearance of round shoulders may be given by a too great accumulation of fat across the shoulders.

A good exercise to correct this is a simple squaring of the shoulders, drawing in at the same time lungs full of air. Push back your arms so that the forearms are on a level with the waist and the elbows are pushed as far back as possible. By a gentle sawing motion move the elbows forward and back. This causes a rush of blood to the muscles surrounding the shoulders, and nourishes the muscles which you are exercising and banishes the fat cells.

To banish fat from the back draw the arms back as I have described. Thrust between the back and elbows a stout cane or a broomstick. Manipulate the cane by means of the elbows so that the muscles are not only strengthened but the cane is rolled over the flesh. The effect is to break the fat cells.

This is sometimes more easily done if you hold the cane in a diagonal position.

Useful to the same end is the exercise of sitting erect in a chair and exaggeratedly shrugging the shoulders, first one, then the other, then both together.

Work with light dumbbells will also in time reduce the fat of the back, but I counsel the use of light clubs and these in moderation. Standing erect, the feet resting flatly on the floor and the knees unbending, raise the dumbbells slowly above the head without bending the elbows. As slowly lower them until the arms hang loosely at the sides.

If you notice that one shoulder is higher than the other, give heed to your hips. The hip on the other side is probably thrust up and the shoulder on that side sinks, the shoulder on the opposite side rising to balance it. So if one shoulder is high, correct your way of standing. Stand with the weight evenly divided and rest on the balls of your feet. Your shoulders will drop naturally into place. Keep them in place.

Have you ever thought of the broomstick as an aid to beauty? Jesting? Not at all. I wish to convince you that that everyday tool for keeping your home clean is a means of making yourself handsomer. Indeed, yes.

Sweeping itself is an admirable exercise. It gives a variety of activity by causing several of the least used muscles to stretch and contract. Sweep vigorously and thoroughly and you will feel the rush of blood to the muscles of your forearm, to the muscles surrounding your shoulder blades and to those at the small of the back. And, more valuable than any of these, it causes you to bend the body at the waist, thus strengthening the muscles which are weak in nearly all women, those of the abdomen, muscles which, allowed to become weak and flaccid, cause that part of the body to sag, giving an unlovely prominence with the ugly bulge at the hips which caused a visiting artist from Europe to sneer:

“Ah, the great American figure is not, as I thought, the Almighty dollar. No, it is the unexercised forms of the women.”

The American woman has learned to develop and keep in control the upper half of her figure. Fine chests, with a graceful line from the shoulder to the bust, have grown common among American women. Many of them have mastered the not difficult art of deep breathing, so expanded the chest, developed the lung power and perfected what may be termed their upper halves.

But the glaring defect remains--the clumsy, conspicuous lower half of the body, which can only be made pliable and symmetrical with the rest of the body by exercises, among which note this simple one I have named, sweeping. Any household exercise that causes you to bend at the waist to the floor will keep the hips and abdomen in control, and in time diminish their size.

For this reason, if not for that of neatness, never lose an opportunity, if your figure has the defect I mention, to stoop to pick up a bit of paper or lint, or a scrap of cloth, from the floor.

Stoop from the waist. Don't resort to that trick of the indolent or the awkward, falling upon the knees when you pick up anything. Stooping is a graceful posture. Learn it.

If the defect in your figure is the other sort, the broomstick is still your friend. But use it in a different way. If you have a weak, narrow chest, if you are round shouldered, you should apply yourself to development in a different direction and your sweeping should not be the main object, but an incident, of your broom handle exercise. And if you are of this habit be sure to protect your not robust lungs from the dust raised, to some extent, by sweeping, even though the broom be swathed in a damp cloth, by keeping your lips firmly closed. Dust is nearly always disease laden. While the dry disease germs might continue their way through the air without causing breeding of disease, the darkness and moisture and the weakness of your lungs, to which they find their way through the open mouth, will stir them into new life and you will be the victim. Never, in any circumstances, inhale through the mouth. Occasionally to rid the body of an excess of carbonic acid gas you may safely exhale through the mouth to still further purify the body. Never, never, take in air through the mouth. Don't allow the nose to become lazy. To inhale air is its duty. Force it to perform it. And aid it by keeping the nostrils free from clogging substances.

The broom stick will serve its best purpose for you by being shortened, cut to a length of two or two and a half feet, according to the "reach" of your arms. Grasping the stick firmly, with a hand at either end, hold it high above the head and draw the air in deeply, filling the lungs to their capacity with full draughts of air. When you have filled every cell of the lungs with the fresh air hold the stick firmly above the head, count silently at least five. This done, drop your arms slowly, your hands still clenching the stick, in front of you, below the waist. While doing this expel the air gently until you feel that the lungs are almost empty of air.

It is not enough to say to most persons: "Shallow breathing is a bad habit. Correct it." The active human mind is an interrogation point and demands the courtesy and satisfaction of an answer.

Well, then, the results of shallow breathing are these: Sensitiveness to all the conditions that cause colds, and a disposition to allow colds to deepen into consumption or widen into pneumonia. Shallow breathing makes the liver lazy, and soon the body is bile flooded, the eyes becoming dull and the complexion yellow and lifeless. Clogged stomach and intestines are the marks of the shallow breather, for the body engine has not enough oxygen draught to burn up the fuel that has been thrown into it as food.

It is only the deep breather who enjoys life to its full and shows her enjoyment of it.

If you are not already an out-of-door woman become one at the earliest opportunity. Make a business of learning at least one of the outdoor sports.

Shall it be golf? Then you will have chosen well, for golf develops the muscles which are not strong in women, those of the back. By encouraging deep breathing it develops her chest. By causing her to bend considerably from the waist it strengthens her abdominal muscles. Because it causes her to walk a great deal it strengthens weak ankles and develops the muscles of the lower leg. These points, remembered and practiced, will make you a better golf player and will develop your health and strength in a corresponding ratio. Select your clubs with careful view to their length, and this will depend upon your own height and the length of your arms. To choose a club that is too long is as foolish and injurious as it is, if you are short, to sit upon a chair so high that your feet dangle.

Learn a good position for your strokes with wooden clubs at the very beginning. You should be erect. One leg should be straight under the body. Its heel should be on the ground, the toe a little pointed in. Slightly below the hips and not more than four inches from the body should be the level of the grip.

Because freedom of the wrists is so very important better practice when not on the links with a cane or closed umbrella. Place the hands together and hold them quite still in front of the hips, depending for the motion of the stick entirely upon the wrists. Remember that the golf stick swings on a pivot formed by the hands and wrists.

One of the benefits of golf playing to a woman is that it teaches concentration. The eye must be kept upon the ball, not before it is struck or while it is leaving the sward, but after it has left the ground.

If you take up lawn tennis play in moderation, especially at the beginning. I like tennis for women because it induces a fine flow of perspiration that will carry the clogging poisons out of the system. It stimulates the circulation and forces deep breathing. It has the further value of distributing the exercise rather generally throughout the muscles of the body. Many women play tennis, but few play it well. A reason is that they are careless in learning the first principles of the game. They are liable to grasp the racket loosely, and this spoils their play. Relax your grasp and the racket will turn in the hand while you make your stroke. Always hold it by the

extreme end, letting the leather binding on the handle rest against the palm.

For your preliminary practice before you play a game that is watched by critical friends practice strokes alone. Bat the ball against the kitchen door or the barn door or the neighbor's fence.

You will have spent your vacation well if during it you learn to swim.

Train yourself to the confidence and fearlessness that are necessary to master swimming. Make yourself realize that you need not fear deep water. It is no more dangerous to have two feet of water over your head than as many inches. This is especially true of salt water, for the deepest water has the greatest power to hold a body on its surface.

CHAPTER XVIII

POSTPONING THE DREAD SIGNS OF OLD AGE

Every woman is haunted by a specter, the dread ghost of old age. At sixteen girls begin to dread it. At thirty-six women set traps for it. At sixty they ward it off as best they may. I will tell you to-day what are the marks of old age and how to remove them.

Women search their faces in the mirror for the first faint lines that they fear may develop into wrinkles. The importance of these lines they greatly exaggerate. For example, there are even on a baby's neck two parallel lines known to experts as "lines of beauty." Others have named them "the collar of Venus." Women foolishly try to remove them, while the truth is that if a woman does not have them she lacks a recognized sign of beauty, and writes herself down to all beholders as so fat that her flesh has swallowed up her Venus's collar.

The infallible first sign of age is the sagging cheek muscles. These are more serious and more difficult to treat than wrinkles. When, at the merciless inspection of her face, which every wise woman gives herself in the morning, a woman detects signs of these sagging muscles, she must at once get to work upon them. The sagging muscles indicate that they have grown too weak to remain in place, and they must be assisted, strengthened. The way to strengthen them is to cause freer circulation in those parts that are affected. And the way to stimulate circulation is to massage the surfaces where circulation is desired.

But one must be very careful about the massage. Bad, that is, unintelligent massage, is worse than none.

Study the drooping cheek muscles and you will notice that they are apt to sag from the cheek over the edge of the lower jawbone, and try to melt in an ungraceful way into the neck. This is not to be permitted. The jawbone should keep its thin, fine edge to the end of life. The nearer it is like a razor edge in sharpness the nearer you are to keeping the facial line of youth. Some babes are born moon-faced and moon-faced remain. But it is true, nevertheless, in the large majority of cases, that if the lower edge of the jaw is of knife-like sharpness the woman who possesses it is young. If it be muffled by flesh the woman is old or is growing old.

Since the flesh is inclined to melt down into the chin, so forming the double or triple chin, it is necessary to massage that surplus flesh. Strengthen the muscles of the true or normal chin thus:

With a pure massage cream give one stroke to the muscles of the chin with the right hand, then with the left, and so alternate. Pass the hands from side to side, one under the other. When you have made twenty such strokes give your attention to the cheek muscles proper. With the tips of the first, second and third fingers rub slowly and gently, with a rotary motion upward and backward along the line of the jaw, and upward to the hair line. Repeat this operation again and again until the cheek muscles and the fingers are weary. When they have rested begin again, this time with the softer flesh above the jaw. Use the first three fingers again and let the motion be backward and upward again, but the pressure should be much lighter, for these muscles have not the bony support of the lower ones, and it is always hazardous to work other than skillfully on such muscles. For instance, the flesh just beneath the eye should never be touched.

Twice a day is often enough for ordinary cases. But in extreme cases ten minutes for massage four times a day is not too often.

Also let the woman whose cheek muscles are beginning to sag and who by the same token is acquiring a double chin, remember to keep up her head. Ordinarily a woman may turn to the flower for lessons in beauty. In this instance she must look to the horse. How much handsomer is the horse that carries his head high, and how much younger he looks!

Keep your head up while you are walking, while you are talking, even while you are resting. Did you ever see a beauty, even when in repose, allow her chin to sink upon her breast? Not while she is conscious. No, no. When she is exhausted from a long walk or a dance she rests the back of her head against the back of a lounging chair, but her chin is always up, always. And this not only while she is awake, but while she is asleep. Do not sleep upon a pillow if you can possibly rest without it. Or, if you must have a pillow, let it be very small. And try to lie on your back, with your chin up. That is the best position for health and beauty.

And now about another particular sign-post of age. There is a saying which persons always accompany by pointing to the delicate lines in front of and extending below the lower portion of a woman's ear: "That is where a woman first shows her age." In part that is true. There is one extenuating fact. Some ears are set much closer to the head than others. Those that are set well back and in draw the skin with a drum-like tightness at the base of the ear. Lines never form about ears so set. But if they grow well away from the head the skin about the ear is loose and the lines are sure to come between thirty and forty. I have seen them come about the ears of girls of nineteen. They too can be removed by massage. Use the third finger of each hand and massage with both hands at once, rubbing slowly, with gentle rotary motion upward.

I have known some women to pin back the ears. So they call it; but it consists merely in passing a band of white muslin around beneath the nose and sloping upward about the upper lobes of the ear, thus pinning, or pinioning them. This done for eight hours of every twenty-four, when the person is asleep, should do a great deal toward smoothing away the betraying little lines.

Another sign of age appears about the ears. There, as a rule, the hair first begins to grow gray. It would be well to cut rather than pull out these first gray hairs, for the hair pulled out usually means a mutilation and irritation of the scalp in that part of the head. But if they persist in growing I would recommend resignation--or dyeing. I do not advocate hair dyes. The only substance I know that I believe is not injurious is henna, which the Egyptians, who had wonderful hair, used. But henna gives the hair a reddish cast. If my hair were growing gray and thin about the ears and temples I would massage those parts often with lanolin.

Dull eyes and dark circles under the eyes are believed to be one sign of departing youth and vigor. Quite as often they are signs of impaired health, of anæmia.

If you are anæmic, you should go to a reliable physician and get a prescription for some good rebuilder. If this is not possible, give yourself the good home treatment of plenty of sleep, of more than the usual outdoor exercise, and of a diet of eggs, beets, spinach and string beans, all those things which contain much iron.

For the woman who is beginning to "show her age" I prescribe much rest, but never rest after a meal. She should rest before meals, say a siesta of an hour and a half before luncheon and dinner, but not immediately afterward. Rest after a meal induces flesh.

A sign of age is a dragging gait. The woman who wants to remain young should repair the waste by more rest. When she is in the privacy of her room she can completely relax. But for her in public there should be no relaxation. Let her remember the tendency to this dragging and in public be as truly on parade as a soldier at guard drill.

Also in the older woman we note bent shoulders. They should be straightened. Best of all by massage. A long, full stroke over the shoulders with the palms of the hands, meeting at a point between the shoulder blades. If massage did not cure I should try the shoulder and back braces sold at pharmacists'.

But massage with pure cold cream, tested and analyzed by a chemist, is the best friend of the older as well as the younger woman who wishes to be beautiful. This is excellent for oily skins:

One ounce tincture of benzoin; two drams tincture of musk; four drams tincture of ambergris; five ounces rectified spirits; one and one-half pints orange flower water.

This I recommend especially for delicate skins easily roughened by the wind:

Three ounces almond oil; five drams white wax; five drams of spermaceti; one dram oil of bitter almonds; three ounces elder flower water; one ounce witch hazel.

This, a simpler cream, is wholesome and efficacious:

Four ounces almond oil; four ounces rosewater; one ounce spermaceti; one ounce white wax.

This is an excellent preparation also for an oily skin:

Six ounces orange flower water, triple extract; one ounce deodorized alcohol; one ounce blanched bitter almonds; one dram white wax; one dram spermaceti; one dram oil of benne; twelve drops oil of bergamot; six drops oil of cloves; six drops oil of bigarade; one-quarter ounce borax.

This is an excellent massage cream, having cleansing properties:

Three ounces oil of sweet almonds; two drams balsam of tolu; ten drams oil of bitter almonds; two drams benzoin; two drops essence of lemon; two drops essence of cajeput.

An exquisite cream, much used by those who are fastidious, is this:

Four ounces oil of sweet almonds; six drams white wax; six drams spermaceti; two drams borax; one ounce glycerine; five drops oil of neroli; fifteen drops oil of bigarade (extracted from orange skin); fifteen drops oil of petit grain.

Some women of the old school prefer a liquid preparation to a cream. One of these was the beautiful Queen Elizabeth of Hungary. Her complexion was once the toast of Europe, and this when she had reached a very advanced age. I have used this modification of her favorite lotion for the face:

One-half ounce oil of rosemary; two drams oil of lavender; thirty grains oil of petit grain; three drams tincture of tolu; one-half pint orange flower water; five ounces rectified spirits.

Let us consider first the cause of wrinkles. The causes, rather, should I say, for the sources of wrinkles are five. They are: Age, worry, weariness, the bad habit of making faces, and the shrinking of the flesh away from the skin.

We cannot arrest age, the process of growing old, but we can conceal for a long time the fact of age. I believe it is quite possible for a woman to say, “From this moment I shall not appear to grow older,” and to achieve that end. I have known women who have seemed to stop short the revolutions in the wheels of time for twenty years. Others I have known who by a new regimen, or by changing their mental attitude toward life, accustoming themselves to that most wonderful of all rejuvenators, taking a more cheerful view, have seemed to grow five or ten years younger.

Age is not an inevitable creator of wrinkles. It merely deepens the tracks made by our thoughts, wearing them deeper and deeper with the years as the wheels of a wagon cut deeper and deeper into the clay of a country road. It is to be seen then that prevention is a large part of the treatment of wrinkles. To cure wrinkles first look to it that you do not acquire them.

Worry is another foe of the childlike smoothness of skin that is one of the most desirable states of beauty. The outward and visible signs of inward worry appear chiefly in two areas, in the diagonal lines extending from the nostrils to the lips, and in the forehead where they create what a precocious child, studying his mother’s face, called “gutters for the tears.” These lines are interesting as indicators of character. The woman with deep lines about her lips has greater determination and passion. She has a more intense emotional nature. The woman with the strongly marked horizontal lines in the forehead is more intellectual. Her anxieties are mental, while those of the woman with the parentheses are temperamental. To the woman with the ever growing deeper tracery on her forehead I should say, “Don’t fret.” The woman with the fast deepening parentheses I advise, “Don’t care.” Consider these bits of advice. The distinction is illuminative.

The accustomed eye sees readily the characters written by fatigue. They are rather creases than wrinkles, deep folds in the skin, as though the covering of the muscles had grown weary and limp, and was resting from its task of smoothly fitting over the muscles. They are perhaps the most disfiguring of the wrinkles and the hardest to remove.

[Illustration: KITTY GORDON Her arms, neck and shoulders furnish an ideal which every woman should try to attain.]

The bad habit of making faces--I shrink appalled from my task of preventing this, or of counseling how to remove its traces. Some women, especially American women, have yielded to the ugly habit thinking that the lines that follow it are the price one must pay for her vivacity. But they are mistaken, hopelessly, fatally mistaken. One of the most vivacious faces I have known is that of a beautiful French woman. Her face is like a mirror, but the eyes and mouth are the only reflectors. She does not draw the mouth down at one corner or the other while she talks. She does not raise her eyebrows until they threaten to become lost in her hair, puckering the skin at the corners of the eyes as though there were a drawing string beneath them. She does not prove her concentration upon a topic of conversation by creating deep horizontal lines in the forehead above and between the eyes. She does not laugh so violently that the flesh breaks up into ripples and eddies about the eyes. She makes her glowing eyes and her

smiling lips express all her thought and emotion. So did all the French beauties of old, which was the reason that Ninon L'Enclos and Mme. Recamier, in their extreme age, had lovers and no wrinkles.

The shrinking away of the muscles from the skin is a serious menace to beauty. Its causes are several. Perhaps a woman has reduced her flesh more suddenly than wisely. Perhaps the shrinkage has been caused by anæmia. The condition demands nourishment of the skin and of the muscles beneath the skin. But this is merely a local treatment. More than anything else it requires a rebuilding and rejuvenation of the entire system.

Knowing the causes we must avoid them. We must resolve to conceal if we cannot stop the ageing process. We must not, dare not, worry. We must never pass a certain point of fatigue, that point at which we are too tired to rest or sleep. Such a weariness is destructive. We must not make faces while we talk. Whatever our emotions we must try to keep our features serene as those of a mask. Leave to the mouth and eyes the task of expression. We must by nourishing both skin and muscles prevent their divorcing each other.

But granted that the wrinkles have appeared what shall we do to remove them? We must first remove the cause which has produced them. If two ugly parallel lines are discernible between the eyebrows we must correct that habit of scowling, whose footprints are ugliness. And we must avoid eye-strain. Often the lines in their beginning can be removed by giving up the habit of reading except by daylight, and then of not reading long continuously.

A young woman who, after much travel, noticed a light but ominous tracery of delicate lines on her face, said: "Heavens! I must take the rest cure, and buy cold cream by the pound!" She was right. Those first menacing wrinkles showed that she had not preserved the balance of vitality which assures perfect health. She had given out her strength faster than she renewed it. The outgo exceeded the inflow, which is merely over exertion, differently phrased. She went to bed and remained there for three days. In her darkened room sleep, the great ironer out of lines, aided by the generous and frequent applications of cold cream, removed her wrinkles. When she came forth from her rest cure her skin was smooth and as delicately flushed with pink as that of a healthy babe.

The cold cream which she had bought "by the pound" was one of the best to be obtained in the market or to be frugally made at home:

Spermaceti, ½ ounce; white wax, ½ ounce; oil of sweet almonds, 2 ounces; lanolin, 1 ounce; cocoanut oil, 1 ounce; tincture of benzoin, 12 drops; orange flower water, 1 ounce.

She might have used, as effectively, this which has an astringent quality, while the former is essentially a skin food:

Almond milk, 1½ ounces; rose water, 6 ounces; alum, 60 grains.

This relic of the customs of old France is another aid in the removal of crow's-feet or other paths of age:

Honey, 3 ounces; isinglass, 1½ ounces; pure vinegar, preferably that made from white wine, 1 pint; shredded red sandal wood, ½ dram.

A deliciously refreshing pomade classed with the wrinkle removers is composed of:

White wax, 30 grams; honey, 15 grams; juice of lily bulbs, 60 grams; rose water, 12 grams.

This is a liquid preparation which the beauties of the Austrian court named in their gratitude "The Water of Eternal Youth":

Pulverized sweet almonds, 48 grains; pulverized gum arabic, 32 grains; pulverized benzoin, 32 grains; pulverized olibanum incense, 32 grains; alcohol, 8 ounces; cloves finely ground, 16 grains.

The face should be washed with this as often as convenient, and the preparation can be applied by wetting freely bandages of cheese cloth or bolting cloth or old silk or muslin, tied about the chin or forehead.

Of course these must be applied by careful and skillful massage, the lines about the lips removed by a rotary motion of the second and third fingers of each hand, rubbing upward toward the nose. The lines about the eyes should be massaged in the same way, away from the corners of the eyes and toward the hair line. The lines between the brows should be ironed away by a pressure of the fingers between the brows and sweeping away above the eyebrows to the point where the eyebrows end. So for the horizontal lines of the brow the rotary motion of the first three fingers upward toward the hair. Afterward all this surface should be gone over carefully with the light, tapping motion which I have before described as being like the patter of rain.

The woman who has reduced her flesh rapidly may find the skin about the cheeks sagging into deep folds when she bends her head. These can be corrected by three methods, all of which I recommend to be used for that condition. First she must cultivate as a habit that poise of the head which is infinitely useful in removing a double chin. She must keep the chin and head tilted upward, the most graceful and becoming poise of the head for all women. She should massage the muscles with the first three fingers, following the muscles backward toward the lines of the ears. For the wee wrinkles that form in front of the ears massage with the second finger, in rotary motion, gently back toward the ear.

For obstinate wrinkles on the forehead adhesive plaster may be cut into strips and pasted across the wrinkled surface after the skin has been drawn taut into place by the thumb and forefinger.

A home remedy is a compress of old linen or muslin dipped into a mixture of the white of an egg and a gill of alcohol. Press the loose skin back into place as I have directed and apply the compress.

Dryness of the skin will cause wrinkles. To understand this study two rose leaves, one moist and full veined and nourished, the other drying and forming fine lines. The dry skin wrinkles sooner and deeper than the oily skin. Wrinkles are chiefly formed by the skin ceasing to fit well over the muscles which it protects. This may be because the muscles shrink or because the skin loses its firmness, or both.

Try to avoid wrinkles by keeping your face placid. The nervous person has more wrinkles and forms them earlier than the one of more self-controlled nature. Don't half close your eyes when you laugh. That habit causes wrinkles. Don't let your mouth droop when you are angry or troubled. That carves deep lines about your lips, making the dreaded parentheses. Don't wrinkle your brow when you talk or listen, to prove your veracity or interest. It is a habit that carves transverse lines on the brow.

When they begin to appear take more rest. Plenty of sleep is the greatest ironer out of wrinkles. Correct the bad habits that have caused them. Live simply. Nothing brings wrinkles sooner than dissipation and late hours.

When small, fine lines begin to appear, putting cold cream well into the affected area should help to drive them away. Ironing that portion of the face with small lumps of ice covered with cotton or gauze is a good remedy if you persist in it.

A method in general use in the beauty parlors of Paris, and that has been introduced recently in this country, is to spray the wrinkle area with cool or cold water. If you have not a wrinkle spray, a large perfume atomizer will serve the same end.

When your skin seems loose and inclined to form into folds use one of the following remedies:

Dip a bit of absorbent cotton into glycerine and pat it well into the wrinkle bed. Or apply cologne water in the same way. In a short time you can decide which is the better adapted to your skin. Glycerine, while a food and stimulant to some skins, is an irritant to others.

A nightly bath of the face in buttermilk sometimes tightens up the loosened skin.

This is a method much in use in Paris and Rome. Hundreds of years old, traced even to the time of Cleopatra, it is still effective, it is claimed, in keeping the countenance smooth and youthful. Heat a shovel red hot in the fire. Throw upon it when so heated a handful of powdered myrrh. Bend the face over it to receive the fumes, such fumes as can penetrate the napkin that has been spread over the face. Do this two or three times at the same treatment. Heating the shovel once more, pour white wine over it and, still through the moistened napkin which protects the face from the heat of the fire, receive the fumes in the face. A fortnight of two such treatments given daily is the recipe a woman whose face is smooth as a girl's, though this famous Parisienne is now sixty, gave me for my American readers.

A simpler remedy is to boil a small handful of pearl barley in half a pint of water until it is thoroughly cooked. Add a half dozen drops of mecca balsam. Place in a stone bottle and shake thoroughly before using. Bathe the face in this once a day.

These astringent lotions may also be applied with benefit:

Water, 1 quart; pearl barley, 2 handfuls. Boil until the barley grains are soft. Strain the liquor and add 50 drops of tincture of benzoin.

Wash the face, if possible, a dozen times a day with this:

Oil of rosemary, ½ ounce; oil of lavender, 2 drams; tincture of tolu, 4 drams; rosewater, 1 pint; rectified spirits of wine, 1½ pints; oil of petit grain, 30 drops.

Believe me, if the spirit remains young, the flesh will age but slowly. Contrive to keep interested in persons and conditions and circumstances. Don't let yourself be bored. Flee from bores or drive them from you.

When you are uninterested, your face grows heavy and opaque. It loses its reflective power, that mirror-like quality which is its chief charm. One of the wisest and most enchanting women I ever knew--truly a woman irresistible--told me she would never allow any one to see her in any but her sunniest mood.

"Meeting people is making pictures of one's self," she said. "Memory pictures that remain long, perhaps forever, in their minds. It is difficult, sometimes impossible, to remove that memory picture. They may see us in other moods and phases, but the ugly picture persists. If I am in an unbecoming mood, I hide until it is past, as I would hide did I suffer from an infectious disease."

That is true philosophy of charm. Be interested, be cheerful, be at your best when you are in public. If you cannot be these, hide from the sight of men and women until the eclipse of your charming self has passed. If you are a business and professional woman and cannot do so, at least hide the mood beneath an impassive face and behind the screen of a silent tongue.

Two extreme evidences of the approach of age are certain conditions of the head and feet. Don't let the lower part of your face grow heavy. That adds to the appearance of age. "Jowl-like" cheeks and a loose-hanging chin add years to apparent age. Prevent that defect, or, if it has appeared, correct it by great care.

Be vigilant as a worthy policeman. Be on the alert. Say to yourself, "Am I holding my head high? Am I giving the muscles of my chin exercise to keep them firm, or am I allowing the flesh to accumulate and form a bag about it?"

As many times a day as you can, and at least every morning and evening, give the neck and chin their stretching exercises. Raise the chin and let the head fall back upon the shoulders. Let it rest as far back as possible, and with the tips of the fingers press gently upward the muscles at the sides of the neck. Persuade those muscles. Train them. In time they will respond to the education you are giving them and grow firmer.

If, at the same time, you iron the falling muscles of the chin and neck with a piece of ice the process of rebuilding the lower part of the face will be quicker. But I have found very effective retiring with a piece of soft cloth, saturated in witch hazel, pressed about my neck. Witch hazel is an astringent and will draw the flaccid skin tighter.

No matter how tired you are, don't allow yourself to look tired. The tired lines and slipping downward muscles add greatly to your appearance of age. Control them. It can be done by an exercise of the will. Smile. Most women look better when smiling, and all, who have well kept teeth, look younger.

I said you must look to your feet. That is true. If you have worn shoes that give you a silly, mincing gait, buy larger ones and acquire a free, natural, springing walk. Don't drag your feet about as though they and your body had a weight you could scarcely bear. Lift your feet and walk with the fine spring and swing of youth. This, too, is a habit that can be formed even at an advanced age. Perhaps you have had the slow, heavy step of age from your childhood. Then it is high time to change it--if you would be young.

Study the faces about you and you will see that some of them are firm muscled, full and of even contour. In others you see that the muscles are sagging, slipping from place. The face is growing heavier about the chin and there is a drawn, strained look of the muscles about the eyes and temples. These are the fallen faces.

If you see that the muscles of your face are beginning to slip downward lose no time in counteracting this tendency to make the visage look older and heavier. Had I my choice between wrinkles and the regrettable fallen face I should choose the wrinkles as less ageing in appearance and more likely to be remedied.

First, reform your habits of sleeping. The posture in which we sleep determines into what lines the face and body fall for eight or nine hours of each twenty-four--a third or more of our time. If correct habits are formed for that time there is an admirable start on the road to better looks.

Notice how your head rests as you fall asleep. Perhaps it is bent far forward. In that case the facial muscles are relaxed and their tendency is to slip downward, tugging their weight, especially that of the large chin and cheek muscles, drawing them down throughout the night. All muscles relax while we are asleep. That is the reason why, on rising in the morning, the face looks heavy

and “pudgy.” The muscles do not recover their tone until the habits of the day reassert themselves.

With this knowledge you should be willing to make special effort and endure some inconvenience to prevent this slipping of the facial muscles at night. Toss away your pillow, or, if you are exceedingly uncomfortable without one, if the blood rushes to the head and causes you to be sleepless, use a small, flat pillow, or better still, slip such a pillow beneath the head of the mattress so that your body will rest at a slight incline, and the hair and scalp will be spared the heating of the pillow. Lie upon your back. In this posture your chin will be thrust upward and the muscles will be at tension. If you sleep thus the facial muscles will not sag during the night hours.

Study your habits during the day and correct such habits as cause a falling of the facial muscles. Perhaps you bend your head unnecessarily low over your work. If so avoid this. At any rate, give the chin muscles the opposite exercise by bending the head backward upon the shoulders many times a day.

Perhaps you have formed the habit picturesquely described as “talking into your chest.” This is an unbecoming mannerism of many women. Shyness or self-consciousness or listlessness may be the cause in some instances. In others it is sheer bodily laziness. Don’t let your chin sink upon your chest when you talk, nor at any other time. It makes a very unpleasant impression upon the hearer. It gives him the idea that you are secretive or deceitful. Lift your head when you talk, and look into the face of the person you are addressing. He or she will admire you more. Besides it is another means of preventing the slipping of the facial muscles, of keeping your face from falling.

We go back to nature for inspiration for beauty. Some of the most graceful of the modern dancers are self-taught and nature-taught, taking for models of grace the swaying of the tree boughs and the lilt of flowers in a wind. So we can go back to nature for models in the poise of the head. Take for an example, not some tired dray horse who lets his discouraged muscles sink beneath his forelegs, but the inquisitive bird, with head uplifted and upturned eyes seeking to solve the mystery of the trees.

Coax the muscles of the chin and neck into obedience. Beginning at the point where the muscles of the neck meet those of the shoulders, press firmly with the fingers of both hands, moving the hands upward to the muscles of the lower jaw and continuing the pressure on the muscles behind the ears.

Is your neck beginning to look old? Is the skin growing flabby? Are the muscles sagging? Is the skin looking yellow? Is it no longer a source of pride and pleasure to wear a V-shaped or low cut gown?

Do not despair, for the ageing neck is not an infallible sign of growing old. It is only one of them. And you have my assurance that you can make it look youthful again. For proof of this let me point you to the great singing teachers, yes, and the great singers who are their pupils. Almost every one of them--indeed, I can think of no exception--has a round, white, youthful-looking throat. One of the most beautiful necks I ever saw, white, strong, girlish, was that of the celebrated vocal teacher, Mme. Marchesi, when she was seventy.

But while this is true, it is also true that you should begin giving the neck special attention before you are thirty. It were better if you began when you were twenty-five.

First, look to its careful feeding. Give it at least one good meal a day by rubbing cold cream liberally into the front of the neck at night before retiring.

Look very carefully to the poise of the head. If the head be held proudly, the chin up, the muscles of the neck will also be held firm. But if you permit the head to droop the neck muscles share the sagging.

Never lie with the head high. One small pillow is enough for anyone, except the insomniac. If you can dispense with the small, flat pillow and lie with the head and feet on a level, so much the better for the neck.

The neck thus trained, and with the additional training of deep breathing, learned by vocal lessons, should never grow old. I advise every woman to take vocal culture for herself, even though she have no liking for music, simply for the sake of the beauty of her neck. The most beautiful necks in the world are those of singers.

But if these preventive measures have been neglected and the neck is losing its roundness and its firm aspect, have recourse to that great body builder, massage. There is special massage for the neck, and it must be intelligently given.

First strengthen the chin muscles by pressing firmly upon them with the backs of the hands. Turn the hands, with the backs upward, and letting the finger tips meet beneath the middle of the chin. Press with all your strength on the muscles of the chin, working backward and upward behind the ears to the hair line.

Second. With the tips of the fingers quite meeting at the point of the collar bone in front, draw the hands with long, slow strokes upward to a point beneath the ears. This is a good muscle building movement.

Third. Slap the neck smartly with the palms.

Fourth. “Lift” the tendons at the side of the neck that are inclined to grow more prominent and ropey each year. This lifting consists in seizing the tendons in a firm grasp and seeming to raise them to meet the head. This is painful, and may even cause a slight headache at first, but these are only Nature’s protests against the unaccustomed. Even Nature is an old fogey about innovations.

Fifth. Grasp the large muscles at the back of the neck and connecting the shoulders, and “lift” these also. Raise them as though it were your purpose to place them in the curve of the neck. This should be followed by a vigorous kneading of the muscles.

The aim of all these massage movements is to promote circulation in the neck. The yellowish, withered-looking skin denotes that the blood flows weakly in that part of the body. The flabby muscles indicate that the muscles have not been well exercised. A good developing exercise for the neck is to let the head lie back as far as possible on the shoulders, then roll slowly from one shoulder to the other.

The hands should be immersed in nourishing cold cream before “feeding” the throat muscles. This is a formula for a nutritious cream:

Almond oil, 1½ ounces; lanolin, ½ ounce; spermaceti, ½ ounce; witch hazel, ½ ounce; tincture of benzoin, ½ dram.

Ninon de L’Enclos, one of the greatest beauties of French history, had a beautiful neck, and to her is accredited the use of this neck food:

Rosewater, 8 ounces; almond oil, 8 ounces; tincture of benzoin, ¼ ounce; attar of rose, 5 drops.

This will be quite as efficacious and much less expensive without the attar of rose.

The following nourishes and whitens the skin of the neck:

Honey, 1 tablespoonful; lemon juice, 1 teaspoonful; whites of two eggs; enough bran or almond meal to make a fine paste.

This wash is also a good neck bleach, particularly useful in removing the dark stains or rings caused by wearing the prevalent gilt and silver trimmings about the throat:

Hydrochloric acid, ¼ ounce; water, 5 ounces.

Avoid high, tight collars. Wear soft white silk and muslin linings next the throat for colored collars. If it is necessary to wear costumes with high collars on the street, change them at once for collarless gowns when you are at home. If you wear chains or dog collars about the neck let them be loose.

A famous theatrical manager whose duty it had been to select thousands of beauties for the choruses of his productions, and who was a celebrated connoisseur of feminine beauty said that a neck to be beautiful must look as though it “belonged” to the body, that is, to use theatrical parlance, it must “be in the picture.” A long neck on a short woman is absurd, and a short neck on a tall woman makes her look like a freak of nature. If a girl is slender her neck should be slim, but she should take measures to prevent its being “scrawny.” If a neck is full and round, to correspond with the body of the owner, it is as nature designed it to be. A full, well rounded neck is not only beautiful in itself, but it is a sign of abundant vitality. The same theatrical manager I have before quoted said he cared not how thin a neck was if it matched the body and was well “covered.” He meant if the outlines of the bones and sinews were well hidden by a delicate covering of flesh. Usually if the neck is very thin the entire body is also, and measures should be taken to upbuild the constitution. Eating nourishing food, breathing deeply and giving the body plenty of rest, should fill out the hollows in the neck as well as the body.

This process can be hastened by patting into it nightly an emollient made of equal parts of almond oil and vaseline. Also the neck muscles can be strengthened by placing upon the head now and then a moderate weight, as a book, and walking slowly about the

room, balancing the book by so steadying the head that the book will not fall. If the neck be disproportionately fat gentle pinching between the thumb and first three fingers should reduce its bulk.

CHAPTER XIX

HOW TO TRAIN YOUR CHILDREN TO BE BEAUTIFUL

It is possible to train a child to beauty and this training consists of two means. One is to teach the little one habits of personal daintiness. The other is to impress upon him or her while very young, the principles of health.

A third is to correct any defects by early attention to them on your own part if you are parent, guardian or teacher.

For instance there is the child whose beauty may be marred by outstanding ears. The ears can be pressed back against the head by a compress made at home and worn at night. A bandage easily made in the house consists of a long, folded strip of strong muslin, twisted first around the head beneath the chin, then around the neck, then over the crown of the head, the ends of the strips of muslin being drawn rather tightly over the ears and fastened to one of the lengthwise strips by safety pins.

If you find the child often breathing with difficulty he probably suffers from that growth at the back of the nostrils called adenoids. Take him to a physician and have them removed, so preventing a long train of disasters, mental and physical, whose signs are that strained, drooping countenance we know as an adenoid face. Don't let any charlatan try to convince you that they can be cured in any other way. The single way to remove adenoids is by a surgical operation.

Look to the fact that the child's teeth have a good start. A little watchfulness will cause the first set to be drawn in good time for the second to come in straight and strong. Then teach the little one to take pride in their whiteness. Furnish a pure, fresh powder or paste, or let her use a powder for one cleansing and a paste for the next, and so on, alternating. Teach her to brush the teeth up and down, not across, and to brush them inside as well as out, and along the crowns. Help her to form the habit of always rinsing her mouth with warm water, or with warm salt water, if there be an acid tendency of the mouth, after each meal. Teach her that the mouth must always be rinsed with water into which a pinch of borax or of bicarbonate of soda has been dropped, after eating either fruits, which are acid, or candy, which soon resolves itself into acids.

Teach her that it is as necessary to be pure of mouth as of speech. Train her to be proud of clean nails and to be ashamed of gray or black rimmed ones. Teach her early to trim her nails and to keep them spotless, and keep the cuticle pressed back from them. Teach them that soiled hands are a disgrace to a little girl and offensive in a little boy.

Appealing to the pardonable vanity that is in little children, teach all that much of the expression of the face depends upon the arch and smoothness of the eyebrows, and show them how to train them by twice daily brushings.

Teach her to watch the dainty movements of her pet canary and her favorite kitten and emulate their table manners. Birds handle their food delicately, and kittens seldom fill their mouths overfull. The little girl will want to be as fine as her pets, and unconsciously will develop pretty table manners.

Teach him not to be afraid of fresh air. Teach him the contrary by telling him the story of "The Black Hole of Calcutta" and of the beautiful boy who was gilded to head a procession and who died after his brief glory because his pores had been closed by the gaudy stuff with which he was bedecked. Bogie stories are permissible if they frighten children into care of their health by leaving their windows open two or three inches at night and by wearing their clothes loose.

Don't let the children in your charge study to the point of eyestrain. Teach them to use the ears to save the eyes. Let them learn by listening. It was prophesied by a writer on health that in time the phonograph that now grinds out rag time airs to the lessening of the standard of popular taste will have records which tell the classic short stories of biography, fiction and history. Don't allow a child to overstudy. Better a well-developed, rosy-cheeked little one who knows no Latin nor higher mathematics than a squinty, anæmic who knows both, but who doesn't know the way in the woods to the woodchuck's hole nor how to defend himself in a schoolboy fight.

Teach them to love the life in the open. If you live all year in the crowded city, the roofs, at least, are available to you. And in some part of your home, even though small, you can put up a crude gymnasium. For instance, a horizontal bar, with a mattress drawn under it for precaution, will give the little ones great fun, besides being a developing agent.

Break the children’s unpleasant facial habits in the forming. Show a little girl how ugly and old she looks by flashing a mirror before her eyes while she is frowning. Show her that the frown of concentration is as ugly as the frown of anger and train her to solve a problem with smooth brows. If she twists her mouth unpleasantly when she talks, tell her of it, and if that doesn’t cure her, call the mirror to your aid.

CHAPTER XX

ADVICE TO BLONDES AND BRUNETTES

Six subjects are of special consideration to the blonde. She must remember that her type has the most delicate of complexions. To accentuate her blondness she should keep her hair as light as possible. She should eat such food as will enrich her golden coloring. She should avoid whatever tends to the accumulation of fat. She should guard against the faded appearance that comes early to most blondes. She should dress to emphasize her golden coloring.

While it is true that woman’s hair is her crowning glory, a blonde’s hair is her aureole, her halo of beauty.

Half the time and attention she gives to her toilet should be given to her hair. The blonde’s hair, as a rule, has a golden tint. This tint is the keynote of her beauty, and should be enhanced in every possible way.

She may wash her hair as often as she likes with no fear of its fading. The lighter it becomes the better. For her there need be no fear of using carefully those aids in cleansing the hair, ammonia, borax or washing soda. Each of these, if used often, tends to make the hair several shades lighter--but in too large quantities it will make the hair brittle.

Because it does not matter how light her hair becomes, the blonde may wash her hair oftener than the brunette does. A shampoo in borax water once or twice a week soon lightens the hair. One tablespoonful of borax in a gallon of water is sufficient.

Two shampoos a week in water in which ammonia has been sprinkled soon brings about a lightening of the hair. One gallon of water and half a wineglass of ammonia is a good proportion.

Two shampoos a week in a gallon of warm water with a heaping tablespoonful of washing soda in it is the speediest agent I know for lightening the hair, excepting peroxide, which some blondes who do not wish to actually bleach their hair use in small proportions in the shampoo. One tablespoonful of peroxide of hydrogen in a gallon of water is the usual proportion.

Every one expects light hair to be fluffy. Fluffiness is the accompaniment of goldenness in hair, and the observer of beauty is always disappointed if he sees fair hair smooth. Smoothness seems to belong rather to dark hair. The blonde should so comb and brush her hair that each hair is distinct and separate from the others. This gives an aureole-like effect to her face, and wonderfully softens her features.

The blonde knows that fair hair is expected to be fluffy. If it isn’t she can make it so by drawing it into a loose mass after a shampoo and tying it with a ribbon, letting it dry thus. If the hair is long it can be tied again by another ribbon close to the ends, making it curve or wave.

The blonde’s skin being finer and more delicate has a greater tendency to wrinkle. Wrinkles come early to her because her skin is so delicate. It is like rice paper, forming fine surface wrinkles as well as deeper ones. For this reason her motto should be “Oil, oil, oil.”

The blonde’s complexion is comparable to that of a rose. It has a superb bloom, but fades early. The withered rose petal is one of the most pathetic sights in nature. It is a danger signal to the blonde, saying sadly to her, “Guard well your complexion!”

The blonde should remember that the dry skin is the forerunner of wrinkles, and literally keep her skin well oiled. Occasionally a blonde, if stout, is troubled by a greasy skin. This old cosmetic has corrected that fault:

Sulphate of zinc, 2 grains; compound tincture of lavender, 8 minims; distilled water, 1 ounce.

This cream is of the soft sort that is especially adapted to a blonde’s delicate complexion:

Oil of sweet almonds, ½ ounce; olive oil, ½ ounce; oil of poppies, ½ ounce; white wax, ½ ounce; spermaceti, ½ ounce. First melt the white wax over a slow fire, pour in the other ingredients, and stir briskly until they cool and reach a cream-like consistency.

For a skin that is chronically dry, I recommend the use of almond meal instead of soap. It is not only cleansing, but injects into the pores the needed oil. I also advise frequent use of this:

Almond oil, 2 ounces; extract of Italian pink, 12 drops.

Many blondes when they are young are afflicted with unbecoming flushing of the skin. Sunburn and wind roughening are an affliction to the owners of such complexions. For these the compounds containing a generous amount of honey are healing and soothing. The following I have always heard recommended as efficacious by many blonde friends:

Honey, 1 ounce; almond oil, 1 ounce; white wax, 1 ounce; spermaceti, 1 ounce.

Now and then a complexion rebels against glycerine. This is more liable to be true of blondes, although I recall at this moment six at least who use the following to tone down the redness when their skin has been irritated:

Camphor water, 1 pint; glycerine, ½ ounce; powdered borax, ¼ ounce.

As her skin is more delicate, so the facial massage should be lighter than that given the brunette. It should indeed be the new massage, the patting, the raindrop sort of treatment, instead of the severe treatment of the old régime.

Always with a view to keeping and enhancing the golden tints in hair and skin, the blonde should be careful to eat such food as will feed the pigment that produces the wheat-like hair and apple blossom skin.

I have before spoken of Mme. de Crequy, the French beauty, who was in many respects a model to the other beauties of the court of France. Her biographers said that Mme. de Crequy had the loveliest complexion ever granted to woman. They said in the next line that she ate every day thirty oranges and almost nothing else.

The orange is the best friend of the complexion among the fruits. It clears the complexion marvelously, but it has besides the property of holding much of the golden shade in solution. A blonde whom I know tried the experiment of eating a half dozen oranges a day and increasing the number to a dozen daily for three months. In that time the change in her coloring was marvelously for the better. Her hair, which had been a shade too pale, took on the rich yellow of cornsilk.

When she had quite convinced herself of the fact that oranges are the food of beauty, and especially of blonde beauty, she was advised also to eat many carrots. This she did in connection with the oranges for six months. She ate carrots sliced and stewed in cream. She ate them in soup. She ate them mashed and seasoned slightly with salt and pepper. She even ate them baked. This she began doing in the early summer. By the same time the next year her hair had deepened three shades and was far richer. And her complexion was fresher, fairer and it harmonized more perfectly with the golden lights in her hair.

The blonde, as a rule, must fight the tendency to accumulate flesh. The man who first wrote “fair, fat and forty” was observant. He had registered the conclusion that the woman who is fair is at forty more than likely to be fat. And so she is. Recognizing this tendency of the placid nature, which is usually an accompaniment of fair face and hair, the blonde should begin to combat it at twenty. Better at eighteen.

She can prevent her waist and hips growing larger by deep massage. The Japanese women never grow fat. Ask them why and they show you how they pinch their hips to crush the tissues and keep the hips flat.

Your funny American dance, the cakewalk, is a great hip-reducer. That backward motion, with the face turned upward and the feet lifted prancingly, draws the tendons, solidifies the muscles and makes the limbs compact.

To reduce the hips, with hands on hips bend forward, swaying the upper body in a half-circle on a horizontal plane.

Stand erect and try to make the elbows meet in the back. This is an excellent exercise to remove the superfluous fat or to prevent superfluous fat forming upon the back.

To make the waist small and pliant stretch the arms high above the head and bend them forward, describing a quarter circle.

To reduce the abdomen, bend forward until the palms touch the floor.

To avoid growing stoutness lie upon the back and raise the body slowly to a sitting posture without bending the knees.

These exercises alone, begun early and persisted in, will keep back the tide of fat that comes with the years to most blondes.

She should guard, I have said, against the early fading that is the blighting tendency of her type. It is nature's compensation, a revenge nature seems to work at the behest of the jealous brunettes, that the blonde who was so exquisite in youth should early lose the delicacy of her skin and the brilliancy of her hair. But some blondes have prevented this early fading, and what some blondes have done other blondes may do. The cure in this instance is the preventive. The delicate skin that has been well fed will not grow dry and wrinkled early. The blonde who has made carrots and oranges her chief articles of diet for many years, supplying the iron needed to replenish the rich gold of her hair, will not early lose the luster of that hair.

The blonde's critics say that she should wear gown, hat, shoes and gloves to match, but that she should wear only one color. Perhaps this is untrue, but I have noticed that many of them are disposed to heap color upon color upon their costumes. Violet and green and mauve and black I have seen in one combination. The blonde who wore it looked cheap and common, and the glory of her hair was dulled by it. Had she worn any one of the colors alone, been a symphony in violet, in mauve, in green or in gold, she would have been ravishing. And the splendor of her hair would have been a glory in burnished gold. But she diffused her color effects by her strange costume. Blondes should always dress for their hair.

A rude bachelor said that "blonde" had come to be a term of contempt because there were so few natural ones. Scientists, too, say that her type is decadent and will in the course of a few hundred centuries disappear. But the blonde can enjoy herself for many generations before that happens. And she may remember that the blonde races have been the world rulers for many years.

The history of the evolution of the blonde shows that her origin was in the north, but that she emigrated to the south and ruled the brunette natives. Science gravely informs us that the blonde flourishes in the moistest climates. This great racial fact may be applied to individual cases. Certainly the blonde who wants to cherish her golden hair and fair skin should not turn inland, but to the seashore.

If you are a brunette your glory is your eyes, your menace is your liver, your besetting fault is a lack of cheerfulness.

As to your eyes first. Their color is in itself a guarantee of beauty. There is no shade of brown eyes that is not beautiful, beginning with the golden brown eyes, which the novelists delight to describe as tawny but which I have named tiger color, through the red brown shades--that to some imaginative ones suggest cruelty, to myself the brownish red shades of claret--to the so-called "black" eyes, which are indeed not black, for there are no genuinely black eyes. Place a bit of black velvet beside the darkest eyes you ever saw and note how brown the eyes look beside them.

They run the gamut of beauty. Brown eyes, the shade of the tobacco leaf, Fierenzuola, the Florentine authority on beauty, said are the loveliest eyes in the world. Certainly they are the eyes of sentiment, and sentiment is accepted even in America, though it has not here the importance in individual and national life that it has in Europe.

I have read somewhere that brown eyes ask for love and get it. The eyes of the brunette should shine starlike out of a creamy white face as stars peep through the breaks in a cloud.

The eyes being her glory, the wise brunette takes the best possible care of them. To care well for them she should care well for their surroundings. Eyes are of diminished loveliness indeed if the eyelashes and eyebrows be ill kept. The eyelashes should be thick and soft as silk. They should be long and their loveliness is still greater if they happen to be curly. To keep them in best condition there should be no eyestrain. Reading by a bad light, reading on a moving vehicle, reading in bed, looking at too great distances, or looking too continuously at too bright objects in the sun-light--as at an unshaded lake at high noon or a bit of glass in a high light, continuing at any task after the muscles of the eyes ache, cause eyestrain, and eyestrain causes inflammation of the eye itself, of the linings of the eyelids and of the rims of the eyelids.

Whatever inflames the lining of the eyes inflames the edges of the lids, and from inflamed eyelids the eyelashes fall with alarming swiftness.

Trimming the ends of the eyelashes once in six weeks I find makes them grow longer and thicker. I always have this done by a young person, because a young person's hand is firmer, and there must be no trembling of the hand that works in the region of the sensitive eye. Use one of the tiny brushes made for eyebrows and eyelashes. Use it every morning and evening. Brush the eyelashes lightly with a downward stroke to make them long, upward to make them curly. Both serve the chief purpose in the culture of eyelashes, which is to keep them clean. You are most careful to keep your velvet gown free from dust. Be careful also of your eyelashes, which are more vitally important to your beauty.

For bathing the eyes to relieve them of inflammation and so to strengthen the eyelashes use this preparation:

Distilled water, 1 pint; cornflowers, 30 grams. Crush the cornflowers in a mortar. Steep them in the water for a day--that is, for twenty-four hours. Strain the liquor through a piece of fine cloth, such as cheesecloth. Heat in a porcelain pan over a moderate fire. Cool and tightly cork. Bathe the eyes night and morning from an eyecup or with an eyedropper.

Spanish women whose eyelashes have faded often apply this mixture to make them darker:

Water, 300 grams; sulphate of iron, 10 grams; gall nuts, 50 grams.

Boil the nuts in the water for a half hour. Strain through cheesecloth or muslin. Add the sulphate of iron. Boil again until the quantity of the liquor is reduced one third. Apply at the root of the eyelashes, being careful not to let any of the mixture touch the eye. The best means of applying it is with a sable pencil. This formula may also be used for the eyebrows.

Brush the eyebrows night and morning, training them to a high arch. The expression of the face is more piquant if the eyebrows be high.

The brunette, even more than the blonde, should develop by every proper means the brilliancy of her eyes, for while the brunette's chief glory is her eyes, that of the blonde is her hair.

She should, besides taking all the rest she needs--even more than she needs so that she will be sure to have enough--use many cooling lotions. The boracic acid water which I have recommended for the blonde I forbid to the brunette, because it often leaves a sediment which clings to the eyelashes and shows white as hoar frost on the black lashes of the brunette. But for her there is the refreshing eyebath of cool, weak tea, or of this, applied fairly warm:

Rose water, 1 gill; witch hazel, 1 gill.

If the eyes ache persistently, retire to a dark room, lie down and place upon the eyes some cool tea leaves, secured there by the useful eye bandage or bandalette to which I have referred in a previous chapter.

If crow's-feet appear prematurely about her eyes she should apply lanolin, patting it in thoroughly. Lanolin is the base of most of the skin foods and has no equal, to my present knowledge, as a builder of flesh tissues.

The blonde's complexion fades early because her skin is extraordinarily thin and fine. The brunette's, as a rule, is the reverse. A fine almond meal is a good substitute for soap for the blonde's complexion.

The brunette, because her skin is thicker, and has a tendency to an oily appearance, could to her benefit use once a day a toilet soap made as follows:

White castile soap, 300 grams; spermaceti, 20 grams; oxgall, 10 grams; honey, 20 grams; essence of rosemary, 10 grams; essential oil of oranges, 15 grams; oil of lemon, 20 grams; alcohol, 15 grams; attar of roses, 2 drops.

Melt the spermaceti and the shaven soap in a bain marie. Add the other ingredients one by one, mixing thoroughly after each addition. Pour into molds.

If the brunette finds that the pure, cold creams contain so much oil and lanolin that they encourage the natural oil in her skin, she can feed her skin with slighter nourishment, as for instance some of the cucumber lotions that have from time to time appeared in the articles I have written. This can be prepared at home. Wash and wipe carefully six large cucumbers; leave the rind on and cut the cucumber into inch square cubes. Fill one saucepan with water, and into a small one place twelve ounces of almond oil. Drop the pieces of cucumber into the oil and heat until they reach the boiling point. When it has reached that point put it at the back of the stove and let it simmer for three or four hours. Strain through cheesecloth, crushing out of the cucumbers as much juice as possible. Stir in while it cools four ounces of benzoin. Keep the liquid in a jar in a cool place.

I had not thought there was a brunette who did not know that when she dabs powder on her face in the evening she should choose not white but Rachel, the brunette shade which has a tint of yellow in it. But I have seen brunettes go forth to conquest with their face so white as to make them seem ghastly and repulsive.

Some of my blonde friends in Paris were washing their hair every other week in light ale. They thought this was a tonic for the scalp, and that it made the hair light. My brunette friends, on the contrary, use diluted claret:

Claret, 1 pint; water, 1 pint.

They believe that this helps to keep their hair dark. Prof. Jocquet, my hair specialist in Paris--and by the way there is none better anywhere--cleansed my scalp last summer in lemon juice.

Juice of two lemons; almond oil, 5 drops.

It is Prof. Jocquet's interesting theory that oil applied directly to the scalp causes the pores to open and disgorge the hairs.

The brunette should look, for a model for her hair, to the luster of black satin. It seems to be the scheme of nature that the brunette should have straight, shiny hair, as it is that the blonde should have crisp, curling hair. Often individuals stray from this plan, but there is no doubt that the plan exists.

I have said that the menace to her brunette beauty is the liver. I repeat it. In the brunette there is always, as an accompaniment of dark pigment, a torpidly inclined liver. That lazy liver, if permitted, will make her complexion muddy, her eyes dull, her movements sluggish. She must stir up this languid organ, make it perform its functions. As the blonde must fear an excess of fat, so the brunette has reason to fear an excess of bile. She should eat such juicy, acid fruit, as cherries, strawberries and grapes, and in the water she drinks it is well to add the juice of half a lemon to every glass of water.

The brunette should regard the lemon as her friend. It is a tonic for her stomach and her scalp. Half a lemon rubbed well upon the scalp cleanses it.

Her temperamental tendency is toward "the blues." A blonde is more sanguine than a brunette. The brunette will correct her brown view of life by the same exercise and diet that goads the liver into activity.

CHAPTER XXI

SURE AIDS TO BEAUTY

To give all the beauty recipes I have tested and can personally recommend would require three or four volumes as large as this. There are many helpful ones which I have been unable to find room for in the chapters where they rightly belong. So I am going to group here in this last chapter a number of "Sure Aids to Beauty" which I feel confident every sensible woman will be glad to know.

Among the recipes and bits of advice which I can least afford to miss the opportunity of passing on to other women are many which have to do with the hair. The woman who wants to wear her hair parted, but finds this manner unbecoming because the roots of the hair are darker than the ends, will welcome this treatment:

Shampoo at least once a week. Use the juice of two lemons in a quart of water for the shampoo. Occasionally substitute for the lemon juice a tablespoonful of ammonia. Rub this well into the roots when washing the hair.

The best way to make dead brown hair rich and glossy is to upbuild one's general health. The hair and teeth are fairly safe barometers of the vitality. Abundant, glossy hair is usually the index of perfect health. Take the tonics of plenty of fresh air, of exercise out of doors, of simple, nourishing food, and your hair will share your vigor. Much brushing should make it more lustrous. To darken it some brunettes wash it in this:

Claret, 1 quart; sulphate of iron, ■ ounce.

No one could ask for a more satisfactory shampoo than the following: Water, one cupful; one egg; tincture of green soap, 1 teaspoonful; cologne, 1 teaspoonful. Mix thoroughly and rub well into the scalp.

A simple and harmless hair dye that has been vouched for by honest folk is the water in which potato parings have been boiled. Walnut stain, prepared in the same way, is uninjurious. Experiment until you have secured the right shade. But I would advise stimulating the hair by massaging the scalp every day and by vigorous brushing.

To get rid of dandruff without making your hair either oily or dry, first give the scalp frequent shampoos. Every other day, or even daily, is not too often, for a week or two, if the case be an obstinate one. After shampooing and on other nights rub carefully into the scalp a tablespoonful or more of the following:

Bay rum, 2½ ounces; olive oil, ½ ounce; tincture of cantharides, ½ ounce.

Sometimes after a serious illness like typhoid fever one's scalp becomes very dry. For such a condition massage well into the roots every morning and evening the following:

Oil of sweet almonds, 45 grams; essence of rosemary, 45 grams; oil of mace, 2 grams.

Brown hair that is becoming streaked with gray may be darkened with henna water. One handful of henna to a quart of water is the right proportion. Boil down until there is only a pint of liquid.

The best method of shampooing the hair is, in my opinion, to rub two or three handfuls, or as much as is needed, through the hair and upon the scalp. Draw the long ends of the hair together to the top of the scalp and lather well about the neck. Massage the hair well with the soap. Then pour upon the head pitcher after pitcher of warm water, or play upon it with the bath spray. Gradually reduce the temperature of the water until it is cool, though never cold. Cold water causes a shock to the scalp that is detrimental to the nerves.

I have told of the simplest shampoo I know. For brunettes who wish to preserve the glossy duskiness of their hair, this is beneficial:

Rum or red wine, 1 wineglassful; yolk of one egg.

There is no arbitrary usage in the matter of singeing the ends of the hair. When the ends are split singe them. There is no need at any other time. But I have noticed that the need is liable to occur in my hair about once in two months. The singeing should always precede the shampoo, for the odor of burnt hair is not a desirable fragrance.

One word more concerning the hair. Be scrupulous about your brushes. If necessary dip them into a bowlful of lather made of white castile soap every day after the morning brushing. A half dozen drops of ammonia in the water will help to cleanse them. Rinse them thoroughly, so that no particle of the soap remains.

I have said that the scalp must be kept cool. Brushing helps to preserve this condition. I have known girls, who came home tired after a day at business, to wrap a few bits of ice in a towel and place it upon the flushed and burning scalp, feverish from a day of intense mental activity. This soon cools the scalp, relieves the congestion in the head and sends the blood dashing back toward other centers. Massage also relieves the congestion.

Avoid a dry scalp as much as you do a hot one. Indeed, the dryness is the effect of the heat. This can be corrected by massage. Lotions containing oil are many. If the triweekly massage fails to release the oil from the sebaceous glands there may be a few applications of this:

Castor oil, 2 ounces; alcohol (95 per cent.), 1½ pints; oil of bergamot, 10 drops.

If you insist on using a dye to hide the approaching gray hairs, I recommend the time-honored walnut stain, made as follows:

Walnut bark, 1 ounce; alum, ½ ounce; water, 1 pint. Boil the bark in the water for an hour. Add the alum to "set" the color. Apply the liquid with a sponge or bit of cotton. Wrap an old veil about the head or wear a night cap after the application, on retiring, else the stain will perform its functions on the bed linen as well as your hair.

I would much rather recommend your massaging the scalp vigorously and using one of these applications to retard the appearance of gray hair, for I believe in tonics, but not in hair dyes:

Bay rum, 2 ounces; sulphur, ½, ounce. Wash the hair and the roots in the liquid. Sulphur is a well known agent in retarding grayness of hair.

Brown hair that is fading into gray is freshened by this wash:

Claret, 3 ounces; sulphate of iron, ½ dram. Let the iron dissolve thoroughly in the wine. Wash the hair as frequently as necessary in it.

Persian women who want black hair apply a paste of henna to the hair, leaving it on a half hour or more. They then wash this off and apply a paste of indigo, leaving it on at least three times as long. When this is washed off they oil the hair, usually with perfumed olive oil. A simpler method is to mix three parts of indigo with one part of henna, adding enough water to make a paste. The longer it is on the hair the darker it grows.

Camphorated chalk is cleansing for the teeth and tonic for the gums, but I do not advise using it too often. Once a day, and that at night, is often enough to use tooth powder, for there are few powders that do not more or less wear the surface of the enamel, as constant grinding wears away what is much harder than teeth, a stone. Powders are objectionable in one respect. If strong, they cause the lips to pucker and dry unbecomingly. Instead of using powder so often, rinse the mouth often with strong salt water, especially after a meal, and brush the teeth with a brush dipped into salt water, or with water in which a pinch of bicarbonate of soda has been dissolved.

When the teeth are in fairly good condition this simple powder is sufficient:

Precipitated chalk, 5 ounces; powdered orris root, 3 ounces; camphor gum, 1 ounce.

This is a tonic to teeth and gums:

Magnesia, 2 ounces; powdered orris root, 1 ounce; bicarbonate of soda, ½ ounce; ground cloves, 5 drams; green anise seed powder, 5 drams; powdered charcoal, 4 drams.

This is one of the strongest of tooth powders and should be used only occasionally and in extreme cases:

Precipitate of chalk, 3 ounces; crushed cuttle fish bone, 3 ounces; powdered orris root, 2 ounces; myrrh, 2 ounces; burnt hartshorn, 2 ounces.

This is a remedy for receding gums, and for those that are sensitive and addicted to bleeding:

Sugar of milk, 3 ounces; tannic acid, 3 drams; red lake, 1 dram; oil of anise seed, 8 drops; oil of mint, 8 drops; oil of neroli, 5 drops.

Salt water, strong and warm, is an excellent mouth bath. So is bicarbonate of soda in a one part to three solution. This is the famous Eau de Botot:

Alcohol, 1¾ quarts; anise seed, 100 grams; ground cinnamon, 35 grams; ground cloves, 32 grams; essence of mint, 20 grams; cochineal, 10 grams; quinquina, 10 grams.

This is a mouth wash easily prepared at home:

Water (filtered if possible), 1 quart; alcohol, 1 pint; salicylic acid, 7½ drams; oil of peppermint, 15 grains; orange flower water, 15 grains.

This myrrh lotion is one of the best for the mouth:

Orange flower water, 5 ounces; tincture of myrrh, 3 grams; pulverized gum arabic, 2½ drams; pulverized gum mastic, 2 drams; balsam of Peru, ½ dram.

A red spot on the white of the eye is a sign of inflammation and that indicates some strain of the eye. First remove the strain. Give the eyes all the rest possible. Sleep more than usual. Give up sewing and reading for a time. Take a midday nap if you can. If not close the eyes as often as circumstances will permit for a few seconds at a time. Keep them closed while on a train. Study how to get the best light you can on your task. Avoid the direct light upon the eye. Bathe the eyes with an eyecup in a mixture of boric acid, 1 ounce; rose water, 6 ounces.

Keep cool bandages as cold tea leaves or finely cracked ice on the eyes. Rest, rest, rest, the eyes. If a few weeks of this care does not clear the spot from the eye consult an oculist for the trouble may be a deepseated one.

You cannot change the color of your eyes, but you can accentuate their color by taking especial care of your eyebrows and eyelashes, so that they will grow longer and thicker and lend their shadows to the eyes. Brush them every night and morning with an eyebrow brush to keep them free from dust. The brush may be dipped into lanolin at night. There will be plenty of time for the lanolin to be absorbed by the skin during the night.

Since I advise against hair dyes I can not conscientiously advocate dyeing the eyebrows and eyelashes. To massage lanolin into the eyebrows and touch the edges of the eyelids with the same may in time cause the growth of new hair. As it comes in it may be a trifle darker. That is the only experiment I advise.

Eyebrows that look uneven and “scraggly” should be treated every night with an eyebrow brush dipped in this mixture:

Olive oil, 1 ounce; tincture of cantharides, ½ dram; oil of nutmeg, ¼ ounce; oil of rosemary, ¼ ounce.

If by any accident the lids have become granular, as may have chanced to be the result of excessive golf, or excessive automobiling, the wholesome girl does not permit the disorder to grow. She knows that rest is to some extent corrective of the evil. If this does not quickly remove it I advise seeing a physician at once. I cannot conscientiously recommend any lotion for a disorder so serious and disfiguring. A physician's advice is necessary.

For heavy, flabby, soft eyelids, which will wrinkle early into a prematurely aged appearance, the wholesome girl seeks first the extra sleep and rest that are the greatest tissue repairers. To gently assist nature in the work of rejuvenation she may resort to this ointment:

Fresh lard, 150 grains; sulphate of potash of aluminum, 25 grains; tannin, 10 grains; borax, 20 grains.

If her eyes be inflamed and extra amount of rest does not banish the unlovely condition she may supplement the rest with this applied--from three to five drops--by an eye-dropper:

Distilled water, 50 grams; quince seed mucilage, 5 grams; water of cherry laurel, 3 grams; borax, ½ gram. This is recommended to be used with three times the quantity of water by the famous Dr. Vaucaire.

Another French remedy is this compound:

Distilled water, 1 pint; sulphate of zinc, 10 centigrams; orris root powder, 1 gram.

If on awakening in the morning the wholesome girl, who is also an intelligent girl, finds that her eyelashes are encrusted by secretions from the eyes, she will first soften those encrustations by rosewater, if that be available. If not, by warm, strong salt water, or by equal parts of witch hazel and water. There are many ointments recommended for such purposes. This is by Dr. Vaucaire, an acknowledged authority on the care of beauty. It should be applied after the lids and lashes have been washed in warm water. Never attempt to remove the encrustations while dry or the lashes will come with them:

Oxide of zinc, 10 centigrams; oil of sweet almonds, 100 centigrams; subacetate of lead, 10 centigrams; vaseline, 10 grams; tincture of benzoin, 12 drops.

While Dr. Vaucaire prescribed this ointment he preferred to administer it himself, and he advised the greatest caution about the application of it lest some part of it get into the eyes. In this, as in other formulæ of this nature, I urge my readers to have the compounds prepared by the best pharmacists.

The eyebrows may be made thicker by massaging them every night with finger tips that have been dipped into lanolin. It promotes their growth to brush them daily with an eyebrow brush. This removes the dust that collects about and chokes the roots of the hair. The growth of eyelashes is stimulated by brushing them daily with an eyebrow brush dipped into lanolin. Keep the eyes cool and clean by washing them morning and evening in an eye-cup filled with a mild solution of boracic acid, a teaspoonful of the pulverized boracic acid to a pint of water. Pour the boiling water over the acid and strain it.

To make the eyelashes grow dip a soft brush or cloth into lanolin and touch the edges of the lids with it. Repeat this every night before retiring.

I am opposed to face steaming, except as a last resort, when the pores are deeply clogged with dust. The evils of face steaming are two. It causes the skin to relax, stretch and become flabby and eventually to form wrinkles. And it so relaxes the pores that some of them refuse to draw together again, leaving unsightly holes in the face. Apply with a piece of medicated gauze the following:

Camphor water, ½ pint; glycerine, ¼ ounce; borax, ■ ounce.

For a face that is beginning to look heavy I advise exercise out of doors and abstinence from rich foods. A chin band of rubber or of strong muslin worn at night will help to support the muscles, also prevent one of the habits which produce sagging cheek muscles. Form the habit of holding your head high, with chin a little uptilted. The application of cloths wet in cold water makes the muscles firmer. Many pat the face with ice. Others pass the ice over it with long upward strokes from chin to forehead. The ice should be wrapped in cotton or in a piece of muslin.

A red nose is caused usually by excessive use of alcohol or by some form of indigestion or imperfect circulation. Loosening your clothing wherever it is tight, whether it be in collars, garters, belts, gloves or shoes. Eat plain foods, little meat and many vegetables and salads and much fruit. Drink water very freely.

You can often improve the shape of an ugly nose by gently pulling it, beginning at the bridge, between the eyes, and pressing the cushions of the thumb and first finger against the sides of the nose and drawing them slowly, gently, but with firm pressure, to the tip. Dip a soft complexion brush into green soap, which you probably know is a liquid, and scrub the parts affected by blackheads. The more obstinate of them may have to be pressed gently out with the fingers or a comedone extractor. Afterward apply cold cream to heal the skin irritated by the treatment.

For an oily nose try dusting it with this powder:

Bicarbonate of soda, 2 ounces; pulverized orris root, 1 ounce; pulverized spermaceti, 1 dram. Mix thoroughly and keep in a dry place.

A sparing diet chiefly of fruit and liquids and copious water drinking should soon clear the complexion. Alternate applications of hot and cold cloths to the skin help to clear it. A pinch of iodide of lime in a glass of water, in daily doses, for a week, will aid in the body cleansing which is necessary to banish the tendency to boils. A few Turkish baths will aid the work.

For blackheads I sometimes recommend scrubbing the affected parts with green soap, using a complexion brush. When they have been softened, pressing out the blackheads with the side of a needle that has been sterilized by passing it through a flame or through boiling water, is the best and simplest means. After pressing out the blackheads place cold cream on the affected parts to heal the irritation.

I have known double chins to be removed by bandaging them persistently in cloths wet in witchhazel, which is an astringent. Also press the muscles upward from the side of the face, using all the strength you can coax into your hands.

Cocoa butter in itself does not cause the growth of hair, but friction of rubbing any cream into the skin may cause the growth of hair if one is inclined to such growth.

Lemon juice should remove tan. It is too strong to use undiluted on the face. Use an equal quantity of water or of rose water with it.

This is a good lotion for decreasing the size of open pores, also for checking the greasiness of the face:

Rose water, 3 ounces; elder flower water, 1 ounce; tincture of benzoin, ¼ ounce; tannic acid, 5 grains.

All save oily faces are improved by the use of cold cream. But I know no reason for using a cloth in applying it. The cloth wastes the cream, and using it will probably cause the face to wrinkle. Pat the cold cream into the face with your palms or the cushions of your fingers.

There is no unfailing remedy for superfluous hair on the face, for even electrolysis sometimes fails. Try various remedies until the hair is killed. Tweezers often remove the hair permanently. Try them first, pulling each hair out gently, being sure first to sterilize the tweezers by passing them through a flame or dipping them into boiling water. After removing the hairs bathe the skin with witchhazel or pat into it a soothing cold cream. Washing the skin repeatedly with equal parts of peroxide of hydrogen and water weakens the hairs, as well as bleaches them, so that they will be far less conspicuous than if dark.

I advise no woman to undertake increasing the size of the bust without first consulting her physician. If he thinks it wise apply with muslin cloths to the breast this lotion:

Lanolin, 50 grams; vaseline, 50 grams; tincture of benzoin, 20 drops; iodide of potassium, 3 grams.

Here is an excellent remedy for an oily skin, especially on the nose, where such a condition often enlarges the pores. It is a drying lotion which tends to draw the pores together and is made like this:

Rose water, 6 ounces; elderflower water, 2 ounces; tincture of benzoin, ½ ounce; tannic acid, 10 grains.

Only extreme measures will relieve an aggravated case of blackheads or acne. With a flesh brush dipped into a lather made of warm water and white castile soap, rub the afflicted part of the face vigorously. If the ugly black specks have not then become loosened it will be necessary to steam them. Fill a bowl with hot water, press the face into the bowl, just avoiding touching the face

with the water, and cover the head and bowl with a large thick towel, so that the steam will not escape. This should be done for from ten to twenty minutes. When this bath is finished the acne will be so loosened that it will be possible to press the blackheads out bit by bit, using a sterilized needle. Afterward massage the part of the face treated with pure cold cream.

A famous French skin specialist recommends for acne:

Salicylic acid, 50 grams; pure lard, 50 grams.

Women who fear to apply to their faces anything which might grow hair may safely use the following cold cream:

Almond oil, 2 ounces; rose water, 4 ounces; spermaceti, ½ ounce; white wax, ¼ ounce; tincture of benzoin, 2½ drams; elderflower water, 10 drops.

Cocoanut oil is a good substitute for the more expensive cold creams. It both cleanses and feeds the skin. But be sure the oil you buy is absolutely pure.

Unsightly, bristle-like hairs on the chin can often be removed by massaging the skin around them with cold cream or with olive oil. Then sterilize a pair of tweezers by holding them in boiling water or dipping them into peroxide of hydrogen, and pull out the hairs one by one with short, sharp jerks. Bathe the skin from which they have been removed with peroxide or some healing lotion and anoint it with cold cream to relieve the irritation.

If the flesh about your nails breaks and tears it is because you have permitted it to get too hard. Press it back from the nails after washing the hands. Meanwhile, rub cold cream into the skin at the base of the nails before retiring; or soak them in a bowl of olive oil daily until they become soft.

For a scalp wash for summer I know nothing better nor more grateful than this:

Steep a pound of rosemary twigs in boiling water. Let them remain in the water for twelve hours. Strain the liquor and add to it half an ounce of Jamaica rum.

This, my favorite hair tonic, has the approval of experts in this country and in Europe:

Sulphate of quinine, 30 grains; tincture of cantharides, 1 ounce; glycerine, 1 ounce; powdered borax, 15 grains; alcohol, 2 pints; water, 2 pints. Dissolve the quinine in alcohol and the borax in water. Add the other ingredients. Allow the mixture to stand for one week. Then filter through paper.

In summer when too ardent attention from the sun makes your skin coarse try wearing at night a face mask coated with this honey paste:

Ground barley, 3 ounces; honey, 1 ounce; white of one egg. Wash off in the morning with tepid rose water.

Disfiguring blotches sometimes appear on the forehead without any apparent cause. I have known them to be removed by applying the following mixture with a tiny camel's hair brush:

Glycerine, ½ ounce; rosemary water, 1¼ ounce; carbolic acid, 10 drops.

For a bust that is not firm, this preparation is sold in France:

Oil of sweet almonds, 100 grams; white wax, 50 grams; tincture of benzoin, 25 grains; rosewater, 25 grams; pulverized tannin, 15 grams.

For enlarging an undeveloped or atrophied bust, Dr. Vaucaire recommends a flesh-making diet. He forbids the application of any pastes or lotions to the meager breasts, but prescribes this internal remedy:

Liquid extract of galega (goat's rue), 10 grams; laco phosphate of lime, 10 grams; tincture of fennel, 10 grams; simple syrup, 400 grams.

He advises two soupspoonfuls in water before each meal.

The drinking of malt extracts is recommended by some specialists. Personally, I advise all exercises that develop the chest for this purpose. One of the best is called "ceiling gazing." With the head bent as far back as possible, stare steadily at the ceiling,

breathing deeply while counting for each inhalation ten, for each holding of the air in the lungs ten, and for each exhalation ten.

Bathing the face with a mild solution of borax and water will help dry any superfluous oil. Relief for this unpleasant condition will also be found in this lotion:

Sulphate of zinc, 2 grains; distilled water, 1 ounce; compound tincture of lavender, 8 minims.

This or the lotion which follows should be applied after bathing the face, and two or three times a day as convenient:

Camphor water, 1 pint; pure glycerine, ½ ounce; borax, ¼ ounce.

Either cologne, alcohol, glycerine and water or tincture of benzoin is a good astringent for aiding in the reduction of a double chin. Or you might try for the same trouble the following:

Vaseline, 100 grams; lanolin, 100 grams; iodide of potassium, 6 grams; tincture of benzoin, 1 ounce.

I advise feeding arms that are too thin with olive oil or cocoa butter. Both of these are fattening agents. Patience and thorough daily applications of one of these will greatly improve the thin arms. But the patient should try exercise also. Holding the arms straight out at the sides and moving them round and round in a circle is a good arm developer.

Any of the following creams are excellent for massage purposes:

Oil of sweet almonds, 500 grams; spermaceti, 500 grams; white wax, 100 grams; rosewater, 50 grams.

This is especially good for the neck, hands and arms which are to be uncovered that night:

Glycerine, 1 ounce; rosewater, 1 ounce; oxide of zinc, 1 ounce.

The old-fashioned Nadine cream has a strong claim upon many beauties of many nations. It is made this way:

Lanolin, 4 ounces; cocoa butter, 4 ounces; glycerine, 4 ounces; elderflower water, 3 ounces; rosewater, 5 ounces.

This, valuable for its whitening as well as softening effect, is of English origin:

Milk of white almonds, 3 ounces; strained honey, 2 ounces; cold cream, 4 ounces; orange flower water, 5 ounces.

From England, too, comes this recipe, which has been adopted in slightly modified form by France:

Essence of cucumber, 2 ounces; juice of cucumbers, 2 ounces; spermaceti, 1 ounce; white wax, 1 ounce; olive oil, 1 ounce; almond oil, 1 ounce.

This is a well-known and valuable massage cream:

Expressed oil of almonds, 9 fluid ounces; rose water, 3 fluid ounces; fine sodium borate, 33 grains; spermaceti, 1 ounce avoirdupois, 400 grains; white wax, 1 ounce avoirdupois, 370 grains.

For making the limbs plump enough to correspond with a well developed body two methods are practicable. One is to rub olive oil into the skin every night before retiring. Or, if you prefer, a cold cream. Developing exercises that will enlarge the muscles are, for the arms, twirling them in large circles at the sides and holding them straight from the shoulders. For enlarging the muscles of the legs a similar exercise from the hips, swinging the leg in large, free circles, is valuable.

I am often asked if powder injures the skin. Pure rice powder can do no harm if removed at night with cold cream. Washing the face with water does not so effectually remove powder. Take the powder off with cold cream, which mixes better with it. Then cleanse the face with warm water and almond meal or oatmeal, or if you prefer it, with soap.

Paris physicians, also those of the Russian court, have withdrawn their objections to perfumes, and luxurious women are using them more than ever. They are more discreet and discriminating than formerly, relying more upon perfumes used after the bath, when they can be well absorbed into the skin, and causing them to remain longer than by a hit-or-miss application of them upon the hair or clothing. This, borrowed from England, is a delightful tonic applied to the skin after the bath:

Rosemary, 6 ounces; orange peel ground into fine powder, ½ ounce; thyme, ½ ounce; rosewater, 1 pint; spirit of wine, 1 quart.

Bath bags filled with equal parts of orris root powder and almond meal and bran are tossed into the baths instead of soap, and are more refreshing and quite as whitening.

An anæmic friend finds her tepid bath much more refreshing by adding to it a wine glass of this:

Eau de cologne, 1 ounce; spirits of camphor, ½ ounce; tincture of benzoin, ¼ ounce.

This is a new compound for the bath which I have used for my refreshment when fatigued from travel:

Bromide of potassium, 1 gram; carbonate of calcium, 1 gram; carbonate of soda, 300 grams; sulphate of soda, 5 grams; sulphate of iron, 3 grams; sulphate of aluminum, 1 gram; perfume to taste, either oil of lavender, oil of thyme, oil of rosemary, 1 gram; tincture of stavisacre, 50 grams.

An anæmic condition is not always the cause of the lips having a blue, parched appearance. Sometimes the cold weather will make them look so. Anoint them morning and night and before going out of doors with this solution:

Honey, 1 ounce; eau de cologne, ½ ounce.

Or with this salve:

Olive oil, 1 ounce; white wax, 1 ounce; spermaceti, 1 dram.

A good salve for freshening chapped lips is:

Spermaceti, ½ ounce; oil of sweet almonds, 1 ounce; white wax, ¼ ounce; cochineal, 1 drop; oil of roses, 6 drops.

Good for the same purpose is this:

Olive oil, 5 drams; white wax, 5 drams; alkanet chips, ½ dram.

Habits that mar beauty are as the little foxes that destroy the vines. They are many and small and mischievous. I mention some of them warningly for careless beauties, as signposts point the way on country roads:

Don’t eat too much.

Don’t chew the lips.

Don’t bite the nails.

Don’t sit on your foot.

Don’t eat many sweets.

Don’t read in a dim light.

Don’t bathe in a cold room.

Don’t neglect a daily outing.

Don’t read or write facing a light.

Don’t sleep in ill-ventilated rooms.

Don’t read when the eyes are tired.

Don’t read or write on a moving train.

Don’t open the eyes upon a bright light.

Don’t stand with the shoulders forward.

Don’t stand with the abdomen thrust out.

Don’t let your hands or feet remain cold.

Don’t make faces when you talk or listen.

Don’t drink much wine. The less the better.

Don’t neglect to bathe your feet every night.

Don’t sit on the last three bones of your spine.

Don’t be afraid to yawn or stretch when alone.

Don’t thrust the hips far backward as you walk.

Don’t sit with one shoulder higher than the other.

Don’t stand with one hip higher than the other.

Don’t fail to sleep as many hours as you require.

Don’t wear too light weight clothing in winter.

Don’t sleep in a room crowded with draperies and rugs.

Don’t forget to visit your dentist once every three months.

Don’t let the chin bury itself in the neck. Keep it high.

Don’t wear tight shoes or tight gloves or tight corsets.

Don’t brush or comb the hair roughly. The scalp is tender.

Don’t go into the outer air directly after washing the face.

Don’t be afraid of rain or snow. They are tonics and beautifiers.

Don’t be discontented. Discontent engraves ugly lines in the face.

Don’t fall asleep with the features drawn in anger, worry or fatigue.

Don’t forget that the warm bath is a sedative; the cool bath a stimulant.

Don’t use every new cosmetic you see advertised or hear recommended.

Don’t wear clothing so heavy that its weight drags upon the vital organs.

Don’t dwell upon unpleasant things. Dismiss them if you value your beauty.

Don’t allow the skin to grow dry. A dry skin is the parent of many wrinkles.

Don’t rest upon large pillows. They cause round shoulders and double chins.

Don’t lie down for rest with your nerves and muscles tied in small, hard knots.

Don’t forget that the reclining posture is a storehouse of strength and beauty.

Don’t let the muscles grow flabby. Firm muscles give the appearance of youth.

Don’t lead a too regular life. A varied programme is better than an unvarying one.

Don’t keep your rooms either too hot or cold, but at an even, moderate temperature.

Don’t be afraid to work, and to work hard. It is only worry mingled with work that kills.

Don’t allow yourself to become ill. Every illness subtracts from vitality and adds to apparent age.

Don’t think that when you have brushed your hair your duty to your head is done. The scalp must be massaged.

Don’t wriggle the feet or fingers or hunch the shoulders. Find other and less ugly outlets for your nervous energy.

Don’t moisten the lips with the tongue to make them red. It will only cause them to roughen and chap.

Don’t forget that the eye bath, the nasal douche and the mouth bath are part of the daily ceremonial of cleanliness.

Don’t forget for one moment that health is the basis of beauty. And build your beauty upon that only sure foundation.

Don’t neglect the protection for your skin when you go out or the care for it when you come in from out of doors.

Don’t think that to keep the teeth beautiful they must be continually brushed. After the daily brushing remember the mouth bath.

Don’t think you are ever too tired for the night toilet. The face must always be washed and cold creamed at night if you value your complexion.

Don’t, especially if you are slenderly built, permit the shoulders and chest to sink. If you are too tired to hold them up take a nap, or at least recline for a time.

CHAPTER XXII

THE BEAUTY’S PERSONALITY AND HER CLOTHES

Have you ever seen a jeweler at work making a gem as fine and handsome as he can or as the nature of the jewel will permit? That is what you must do for yourself. Polish your personality.

The jeweler makes the jewel shine with all its possible luster. That is what every woman should do for the gem which is herself. The jeweler holds the gem to the light to see what is its best angle and sets it so that that angle is prominent. So should a woman do with her best feature.

Study yourself in silhouette. Place yourself before a mirror so that you can see yourself as one would see you who hurriedly brushed past you in the street. See yourself sidewise. If you see that you have a good profile and that the lines of your figure are graceful, keep your side to the world, so to speak. Remember that this is your best line and live up to it. Dress your hair so it will enhance the profile, making it cameo like. If you discover a style of dressing your hair that is becoming to you, and that makes that profile stand out in finer relief, never mind whether it is the fashion of to-day or of ten years ago. Its beauty will be its excuse and will make it the fashion for you. So in your gowning. If your figure has a better silhouette when draped in full gathered and shirred effects follow them. If, as is liable to be true if you have a full figure, flat folds and tucks and bands are more becoming, make abundant use of them.

Learn dressmaking yourself, if your means are limited, and learn to apply your own principles of dressing. Make yourself individual. It costs but little to dress well if you can make your own clothes. If you find that your front view is better, face the world, as it were, instead of turning your side to it.

I have heard of some women, “Her hair grows prettily.” When I have scrutinized their faces I have found that what was meant by the phrase was that it grew in odd, attractive little ripples or scallops about the face. Yet I have seen the same women brushing their hair flat and pressing it back in a hard, straight line from their faces. These human jewelers were neglecting one of the best angles of their personality. I have seen women whose rich, thick hair was their greatest charm draw back the hair from their faces and twist it up in a hard little knot. I wanted to cry out against this thoughtlessness.

I once overheard a pair talking while in the first stages of love-making on board a transatlantic steamer. The man said, “You have beautiful eyes, but you don’t know how to use them.” The next day as I saw her while on a deck promenade I saw that he was right. She half covered them with heavy, lazy looking lids. When she looked at any one with them she looked with a slow, steady regard and without a smile in them. If I had had eyes like that I should have been most industrious with them. I would have opened them very wide, very often every day. It would have illuminated conversation, and promoted mutual understanding. And I would have taught them the pleasant trick of smiling.

I know a woman of whom it has often been said: “She is handsome when she smiles, but she hardly ever smiles,” and this should have been enough of a tip, as you say in America. Yet it wasn’t. Whenever I saw her her lips drooped. Her cheeks muscles relaxed. If anything startled her out of herself she smiled, quickly, roguishly, with a flash of intelligence and good humor that was entrancing.

Her smile transformed her from a plain, dejected looking woman to a radiant, attractive one ten years younger in appearance than she had looked a second before. If she had polished her personality she would be always living up to that smile.

I know another woman, more intelligent, though younger. She has lovely, red-gold hair. At a time when it was fashionable to wear hats that come low upon the face, completely hiding the hair, I said to her: “And do you hide your beautiful hair beneath the foolish fashions?”

“No,” she answered. “Somehow, I always manage to show some of it. Perhaps I draw it back from the forehead a little more than the fashion requires. Or, I may tilt it a little more to the side than is necessary. But I always show my hair.” Polishing her personality, you see.

If a woman has a beautiful mouth she should be at more pains than another to massage the lips to keep them full and moist. She should massage the gums to keep them strong and red. And of her teeth she should take infinite care. Such a woman should smile and smile again, for fine teeth and a fresh, sweet mouth are always attractive.

If she has a classic chin and a fine throat she should keep the chin well up to reveal the line from chin to chest.

If her hands are pretty she should wear her sleeves short enough to display them. If her hands are shapely and tapering she should wear her sleeves still shorter.

If the lines of her throat and shoulder are good she should form the Dutch collar and low necked habit. If her figure is good she should emphasize that within the limits of modesty.

In short make radiant your personality. Discover your best points and keep, preserve and accent them. To use your plain Americanism: “Keep your best foot forward.”

Fashions change, but taste endures. Fashions come and go, but becomingness is a fixed quantity.

The woman who is wise in her own beauty will make this her creed. She will determine after much observation of herself what is becoming to her and what is not, never to cross the danger line between.

She will not aggressively defy fashion. She will adopt its becoming modes, and adapt its unbecoming ones to the point only of becomingness. But she will resolutely determine that she will wear nothing that will detract from her beauty.

In the matter of dress, I have the courage of my convictions. I will not wear that which I believe to be unbecoming to me. Sometimes I may fancy I look well in what another may not admire as a part of Cavalieri. In that I may be mistaken. But I never consciously wear what makes me look less well than I would otherwise.

For instance, you will observe from my photographs that I almost never change the style of wearing my hair. Long ago I found that flat waves drawn low upon my brow and cheeks were becoming to me. In itself the style is a trying one, but it happens to be becoming to my type of face. The Italian women are almost the only nation that can wear it to advantage. It seems to belong to the large, soft eyes, straight nose and delicate chin of the race. And so through the succeeding years I have worn them, and because I looked well in them have worn them in the morning, in the afternoon and in the evening, have worn them to early musicales, to luncheons, to teas, for drives and the opera. I have varied the style only when the times or character I was playing in opera demanded that they be changed.

It is my opinion that the woman who discovers the style of hair dressing that is adapted to her individual style and with some possible slight modifications, which are concessions to the mode, preserves that general style until the chiselling of the years has so changed her face that she requires a different coiffure, is the clever woman. Such a woman is Alexandra of England. The court hair dresser, a great artist in his way, gave weeks to studying the coiffure that should best frame the facial charms of the Princess of Wales.

He determined upon the present style. Queen Alexandra dressed her hair in the same style for thirty years. It is admirable for her long, patrician features, setting off their mingled delicacy and strength, and her fine English coloring. In time she will doubtless change the style to one softer and looser, calculated to lessen the effect of aging features. But that time, happily, is far off for her gracious Majesty. In general, it is true that preserving the same outlines of a coiffure for most of a lifetime makes a woman seem younger.

In general, too, these rules may be followed in choosing the coiffure that shall be yours. Do not accentuate that which nature has already accentuated too much.

If nature has given you a round, chubby face counteract this too decided tendency by building the hair high. Give the coiffure the effect of a pyramid. The one high point at the top of the head will materially lengthen the face and lessen the roundness which tends to insipidity. The high coiffure will thus give distinction to a face that had lacked it.

If the forehead is too low comb the hair loosely back from it. This will add to the alertness and intelligence of the expression. If, on the other hand, nature has given you the knobby, by which I mean what you call the intellectual, forehead, the brow which is full and high and broad, with projecting bumps, modify nature's extreme by training the hair to fall in loose tendrils upon it. Also comb the rest of the hair, but loosely, from about it. Never tightly, for that will give the drawn, frightened look which nature has already carelessly bestowed.

If your face be broad, the high coiffure increases its apparent length.

If yours be a slender countenance, then affect the low coiffure, for its tendency is toward breadth.

If the face be broad, do not build the hair out loosely about the ears. Instead comb it upward above the ears.

If the face be slender, its apparent breadth is added to by the "fluffing" out of the hair about the ears.

If the face is angular, its hardness is reduced by a soft arrangement of the hair.

In arrangement of the hair remember that balance is the law of beauty, as it is of wisdom. For instance, balance the heavy jaw by drawing the hair in a loose mass well forward above the brow. Balance the snub nose by a loose coiffure with no jutting protuberance at the back to suggest that it is the corresponding pole of the nose.

As to color of the hair, it is my judgment that we would better leave it as nature painted it. Nature is the greatest colorist. She matches complexion, eyes and eyebrows perfectly with the hair. Transform your hair, and you will be at the trouble of transforming your entire person.

We are not to blame for our hair, but we are to blame for our hats. They must look as though they belonged to us as our faces, our eyes, our teeth belong to us.

I always trim my own hats. First I began to trim them because I had not the money to buy them or to pay for trimming them. Now I trim them because no one can do so to suit me.

I prefer simple hats, for the sufficient reason that they are more becoming to me. But an overtrimmed hat is inartistic. It is ugly. It is vulgar. The hat should serve its function of being a becoming frame for the face. The head should not be a mere pedestal or milliner's dummy for a monstrous hat. Women answer criticisms of the terrible travesties now worn, "But they are the fashion." Yes, but who made them the fashion? You and you and you. A fashion can be killed at its birth, in the shops of Paris, if women will but determinedly say: "No, no, no. I do not like it. I shall not wear it. Show me others."

Remember the law of balance. A woman with a tapering chin should wear a hat built to a corresponding peak at the top. The effect of these two peaks should be to form an agreeable oval.

The round-faced woman's safety of becomingness lies in the hat in which angles predominate. It should have stiff ribbon bows and sharp aigrettes, or pointed wings and dagger-like ornaments. This woman will always be improved, too, by wearing V effects in coats and wraps and gowns.

The hornlike effects should be avoided by the woman with sharp features. Her task of lending a semblance of softness and roundness to her face is made easier by a hat with a soft brim trimmed with a fall of lace or a shirring of silk or velvet. Also the sharp-featured woman should never wear a sailor hat. Neither should any woman over twenty-five.

Here are some rules about dressing, so fundamental that I would hesitate to give them were it not that every day I drive down Fifth Avenue I see them flagrantly transgressed.

For instance, I see the short, stout woman wearing a short, stout coat. The long, thin woman wears a long, thin coat. That is, each woman, forgetting the law of balance, has chosen that which accentuates what nature has already overaccentuated. The short coat

should have been worn by the tall woman. It would have made her seem shorter. The long coat should have been worn by the short woman to disguise her brevity.

I see short women wearing horizontal trimming, when they should have had lengthwise trimming, pointed trimming or no trimming at all.

I see a tall, slender woman wearing a long cape, when she could have divided her superabundant height in two by wearing a short one.

I see a short woman wearing a flounce about her already absurdly short skirt. By some perversity the short woman tries to emulate the barrel and the tall woman the telegraph pole.

The woman with a crane-like neck bares its funny length to a grinning world, and the woman with a mere line where a neck should be muffles that up with ruches that make her look like a frightened setting hen.

If only they would have ever before them the thought, “What is becoming to me?” and put far behind them the other question, “What is the fashion?” then would women dress artistically, not ridiculously.

I do not preach that which I am not willing to practice. It happens that I do not like white. To me it is a dead, trying color. Therefore I never wear it. I am told this is to be a white season. I answer, “It will not be for me.” And I continue to wear blue or black on the street, and pale shades of rose or blue or green or yellow at night. And merely because it happens to be “a white season” people do not forget to look at La Cavalieri in rose or yellow or blue or green.

Let me recall to you the most beautiful of American women, Maxine Elliott. One winter the coat covering the hips, forming a second thickness of cloth upon them, was fashionable. Did Miss Elliott wear it? Not at all. I saw her wearing a very pronounced cutaway coat, one in which the frock part of the coat was cut at the very middle of her hips, so taking from instead of adding to the width of her figure. And the Maxine Elliott hats! Have you noticed how like they are, no matter what the fashion?

Always beautiful, because of elegant, yet simple lines, but more particularly beautiful because they are becoming to their wearer. They are very little trimmed; usually with large, flat bows or low curving feathers. Almost always they are black, or black with a touch of white, but always they look as though they were designed for or by Miss Elliott, as I doubt not they are.

The lank woman must shun the V-shaped corsage as His Satanic Majesty is said to avoid the bowl of Holy Water. The broad corsage, draped with full flounces of lace or tulle, will be most becoming.

In the same degree the stout woman must avoid the corsage with round effects. She should seek the pointed effects to counteract her redundancy of curves.

I will not go further into details on this subject. The intelligent woman to whom this law of balance in dress has been presented will work out successfully her own problems.

It applies as well to colors as to form. The high-colored woman needs pale tinted colors to reduce her own exuberance of color, while the neutral tinted woman, she with light gray or blue eyes and ash-brown hair, requires in her youth at least brilliant shades.

When buying your wardrobe I beg of you to think less of the fashion plates displayed by your tailor and dressmaker than of your own style.

Everyone has a style of her own, and that is good style for her. One authority on woman’s dress even goes so far as to urge women to know themselves so well as to decide whether in their composition mind or soul or body dominates. “For,” according to this lecturer on womanly beauty, “each of these three parts of your composition is represented by a color. If you are a woman of intense spirituality you should wear much yellow, for that represents the soul. Should you lean more to the material side of life you are best represented by red. If you are one of the growing army of the intellectuals, this authority advises wearing much of the mental color, which is blue.”

It occurs to me to inquire whether that is the reason why women of strong mentality are often referred to as “blue stockings.” I do not wholly agree with this woman lecturer.

If, for instance, you are a red woman, why not wear considerable yellow? It will give you a more soulful aspect, and, if our manners react upon our characters, why should not colors? Wearing the soul color may develop latent soul qualities. Or the red woman, by

wearing much blue, might, to use a term of the stage, “convey an illusion” of greater mentality than she has, and perhaps stir that part of her self to greater activity.

It is an interesting theory, but may, perhaps, be pursued to the point of attenuation. One quality I like so greatly in you Americans is that you are practical, and theories so tenuous as this I have quoted move you to laughter. I recall that when one of your authors wrote of the color of individual auras and talked of a “pink personality,” she greatly interested the humorists. I leave with you this theory to smile at or to adopt as you like.

But in what I shall say next I am most gravely serious. That is that in selecting your wardrobe I would have you think far more about your individuality than about the passing fashion. I do not know what will be the next caprice in furs. I do not care. Being tall and slight I shall choose long-haired furs, as the silver fox, because, to use an Americanism, I can “carry them well.” But if you who read this are short, and especially if you are short and stout, wear short-skinned furs, as mink and seal and sable, if you can afford them, for long-haired furs will render you out of drawing, absurdly costumed.

While choosing your hats and wraps, your gowns and gloves, be for once self-centered. Self-centeredness is excusable when one is shopping. It is in the direction of economy, for if we think steadily of ourselves we will not purchase a fur coat in which our sister looks adorable but ourself ridiculous, and we will not order a gown that will prove so unbecoming that we will give it away after once or twice wearing it.

Keep in mind, after your own individuality, certain art principles that apply to dress. This is a good one as to color. “Dress up to your eyes, your hair or your complexion.” Permit me to explain. If a girl has brown eyes she may not always wear brown gowns. But she can be exceedingly careful to wear no tint that will make her creamy skin look sallow. For her creamy shades are becoming, because they harmonize with her complexion.

If a girl has red hair she will be wise if she wears shades, regardless of the tint of the moment, that will throw the hair into relief--as blue, or green, or black. If a woman has Irish eyes--that fascinating mixture of blue and gray, that holds in its depths much of infant innocence yet much of worldly wisdom, deep eyes that fascinate because they are inscrutable--she will look her best in gowns that match her eyes, the same indeterminate blue and gray.

Think of yourself steadily and not tenderly in the selection of stuffs. If you are thin and active, soft materials, as chiffons, crêpe de chines, light weight silks, will be becoming. If you are of heavier habit, heavier silks and broadcloths are more expressive and so more becoming.

The dividing line between the skirt and bodice is ugly. If you cannot have a one part dress, then hide the dividing line by a girdle. If you are stout, let the girdle be of the same shade and material as the gown. If not slender, you may safely wear a girdle of different shade than your gown.

Artists know the beauty of the straight line, and for a few seasons coutourieres have groped their way toward it. Parallel lines running lengthwise are the lines of beauty in dress because they consistently follow those of the figure. For this reason a gown whose pronounced lines are from the shoulder, the drapery curving slightly at the waist, give grace and beauty to the figure. Trimmings that run around the figure always lack beauty, and if of contrasting material they have a ludicrous effect. The high girdle gives an appearance of greater length to the limbs. The girdle, if not of the same color and material, should not be of too glaringly the opposite.

Remember that stiff effects are always inartistic, so avoid the appearance of being trussed up, as a fowl in the oven or soldier on parade. For this reason shun tight sleeves, tight gloves, or skirts, so heavy or narrow that they make your gait an awkward one. I am glad that fashion permits the wearing of loose gloves. They give ease to the hands and are far more graceful than the tight ones that gave the hand the appearance of being stuffed into it.

When selecting your hat, a bit of brilliant color may be introduced; but let it not be directly above the face, for it will give to the face the illusion of being pale, whether it is or not.

CHAPTER XXIII

ODDS AND ENDS OF BEAUTY CULTURE

Three months recently in Russia and six months in Paris taught me some new fads in the cultivation of beauty. While you Americans are so clever, as well as beautiful, you may not have heard of some of these. I will, therefore, call the roll of those devices for the improvement of beauty which are finding present favor in Europe, some of which seem to me to have considerable scientific value.

But I ought to say that I have not myself personally used or tested all of these rather heroic new methods. Not all medical men are agreed on all things, especially on new things, and I advise my readers to ask the advice of their doctors on some of these matters.

There is, for instance, what is known as the vaccination cure for pimples. Pimples I have called “spots on the sun of beauty.” Spots, whether on a frock or a face, are disfiguring, and it is desirable to remove them as soon as possible. Inoculation by a special form of vaccine is the latest method adopted by the medical profession. It has been in many cases very successful. The only objection is that it is still comparatively expensive.

The new theory is that pimples are caused by the presence of malefic germs. A culture is made of these germs in beef broth. The fluid is then rendered sterile by heating it to the boiling point. A small vialful of this broth contains hundreds of millions of the germs. While the germs themselves are dead, the peculiar poison generated by them remains. The treatment is given by a hypodermic injection. This poison is destructive to the living organisms, and in a few weeks’ treatment obstinate cases of pimples have been completely cured by the welcome new process.

For obstinate cases of acne some advanced physicians are utilizing the X-ray. Blackheads are always disfiguring. Certain physicians have adopted the principle that these micro-organisms lodge in the follicles from which spring the small hairs that form a down on the cheeks. These micro-organisms spread fast and cause inflammation. The X-ray is summoned to check the spread of the inflammation. This they do without danger to the skin. After three or four treatments the face looks as though it were badly sunburned. This appearance remains, it seems to the patient, discouragingly long, but the results are most gratifying in every case I have studied. The acne has been permanently removed and the complexion left beautifully clear.

A third scientific treatment of great aid to beauty is the removal of scars by an injection, locally, of a healing serum, beneath the skin. Its function is to loosen the structure, relax the drawn tissues and smooth the surface that had been, to use an Americanism, “puckered.” There is in this last remedy the element of risk that always obtains when a foreign substance is injected into the circulation.

Because of this element the method has not the entire endorsement of the medical profession.

A method that has great vogue just now is the new or modified massage called patting. This is accepted by those who have always been consistent enemies of massage as it is generally given. Their theory is that massage, as many have known it, merely moves the wrinkles from one part of the face to another. Patting, they declare, does not drag the skin, but builds up the muscles and promotes the circulation. The name is a well-fitting one. Patting is done very lightly with the tips of the fingers.

The nose clamp is a new and amusing device adopted by beauties and would-be beauties to prevent the spreading of the nostrils and to give the nose, that would otherwise be too round, a delicate point. I have called on my friends in the morning and have been received in their bedrooms. They looked very charming in their night robes of delicate batiste, embroidered and further ornamented with pink and blue bows, not pink and blue bows on different gowns, but combined in the same gown. Their hair carefully parted from the point of the forehead to the back of the neck, and braided in two loose braids, either hangs becomingly over their shoulders, one braid tied with a blue bow, the other with a pink, to match the ribbon garniture of the night robe, or is twisted loosely around the head. Their complexions looked fresh and cool from their bath of cold cream, but they all looked odd, and I shrieked with laughter at them because they wore nose clamps. One who disliked the touch of the cold metal substituted the homely domestic article, the clothespin. Both the clamp and the clothespin are well protected by a lining of white silk or velvet. Absurd as these things look, I was assured by all who wore them that they served admirably their purpose.

Ice has come to be one of the first aids of beauty. It is used after massage of the face and neck to harden the muscles. I find women using it to drive away wrinkles and this seems to me scientific, for while the shock of the first application will drive the blood from the surface, it causes it to rebound, bringing a fine flush to the skin and feeding the neglected and shrunken tissues.

Whatever renews the tissues eradicates wrinkles.

Many physicians are endorsing sulphur facial baths to cure acne. This lotion is applied several times a day, they told me, with good results:

Rose water, 4 ounces; precipitate of sulphur, 1 dram; tincture of camphor, 1 dram.

Women are beginning to realize that sagging muscles, rather than a superabundance of flesh, are the cause of the double chin. They are preventing, as far as possible, the falling cheek muscles and the pendulousness of the chin muscles by hardening them with lumps of ice held in the hand and pressed against those muscles as long as the pressure can be endured; also by wearing chin bandages.

First the fancy, then the fad, then the flitting. This is the history of most announced discoveries of the means to heighten beauty. They have their little hour of discipleship; their impulsive following; their period of vanishing. Yet beneath nearly all the beauty fads there is a more or less well applied principle of science.

For instance, there is the rubber chin band. The band to control the usurping flesh of the double chin was first of muslin. Then it was improved by the use of elastic. Now it has evolved to its best state, that of strong yet light rubber, made with a throat latch resembling the lower part of a horse's halter. Attached by a clasp on either side are straps that fasten at the top of the head. The original idea of compressing the flesh so that it would form in a smaller and becoming mold was sound, but the later idea of using rubber appeals still more to common knowledge. The wearing of rubber next to the skin causes perspiration.

Therefore, the rubber band will not only hold the flesh of the pendulous chin in place, but by causing free perspiration it will gradually reduce its size. The rubber band, worn at night, and frequently during the day, for a half hour or more at a time, is the best cure for the double chin the new year has offered us.

The aged hand has been a source of much mortification and anxiety to the woman who has left her thirties and her forties behind her. Yet electricity, that prime aid in the rejuvenation of beauty, has come to her aid, and now the woman who has a good many years to her credit, but who does not care to admit that balance, goes to the beauty parlors, settles back comfortably in a reclining chair, and renews the youth of her hands by electrical treatment.

The operator traces over the hand again and again, round and round, focussing most on the base of the back near the wrist a small electrical machine attached to a light battery. The skin of Madame's hands begins to tingle. The blood rushes in a flood to the surface. In a few days she notices that the ugly furrows, trenches dug by the cruel spade of time, are being filled up. After a little longer time they are entirely filled and present an even surface. The hand has been plumpened.

The work of rejuvenation has been done. With occasional renewals of this treatment, combined with much nightly feeding of the hands with a plumpening oil or cold cream, they will keep their renewed youthfulness.

Either of the following creams I recommend for that purpose:

Spermaceti, 6 ounces; white wax, 2 ounces; oil of almonds, 16 ounces; glycerine, 4 ounces; rosewater, 4 ounces; borax, 1 ounce; oil of rose, 20 minims; extract of jasmine, 1 ounce.

This whitens as well as plumpens the hands:

Alcohol, 3 ounces; glycerine, 2 ounces; cologne, 2 drams; boric acid, 4 grains; quince seed, 1½ drams; carbolic acid, 10 grains; glycerine of starch, 2 ounces; oil of lavender, 20 drops; distilled water, 2 pints.

A soothing and whitening, as well as feeding, cream is this:

Cucumber essence, 1 pint; cucumber juice, 2 ounces; oil of almonds, 1 pint; olive oil, 1 ounce; white wax, 1 ounce; spermaceti, 1 ounce.

Transcriber's Notes:

Italics are shown thus: _sloping_.

Variations in spelling and hyphenation are retained.

Perceived typographical errors have been changed.

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Practical vegetarian cookery

Unknown

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PRACTICAL

VEGETARIAN COOKERY

EDITORS

THE COUNTESS CONSTANCE WACHTMEISTER KATE BUFFINGTON DAVIS

“Thus the King’s will is: There hath been slaughter for the sacrifice And slaying for the meat, but henceforth none Shall spill the blood of life nor taste of flesh, Seeing that knowledge grows, and life is one, And mercy cometh to the merciful.”

--_Light of Asia._

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PREFACE.

The aim of this book is to demonstrate the nutritious and appetising possibilities of vegetable foods. Cattle are becoming so diseased that apart from a humane revulsion against the consumption of meats in daily food, man is being driven for his own welfare to seek purer food substance. Any physical habit indulged in for generations is difficult to overcome, and the transition period between daily meat eating, and pure vegetarianism is a difficult one. We have endeavored to suggest such a variety of tasty and nutritious foods as will materially aid in making the change.

We do not claim this to be an exhaustive treatise on Vegetarian Cookery; only a clear and practical aid in the better preparations of some of the delicious products of the Vegetable Kingdom. Many children show a natural dislike to meats, and Mothers are at a loss how to supply them with proper nourishment when they reject the meat. Requests have come to us for aid through this very fact; and was one of the incentives to the bringing out of this book.

Mothers will have no difficulty in finding a plentiful variety of relishable and nutritious foods for the children if they will study the following pages. Equally easy will the formal dinner appear when one wishes to entertain Vegetarian friends.

INTRODUCTORY.

Vegetarianism from a Theosophical standpoint involves a whole philosophy of life. The short quotation on our title page well expresses the theosophic concept of the Unity of life, and the law of cause and effect which we call Karma. Life is fundamentally a unit, and aught that works ill to any manifestation thereof has effect on all. Through occult science we are taught a very practical lesson of direct benefit to the individual, by a diet free from blood. As clearly stated in Annie Besant's manual on "Man and his Bodies," man molds these instruments of his will, or true self. These bodies are but instruments; in no sense the man himself; and these instruments or bodies are finely responsive to the operator, or true self, only as they are purified and harmonized. Gross foods, and gluttony make gross bodies, not only physical, but astral as well. For the astral bodies feed on the subtle emanations of the foods supplying nutriment to the physical encasement. If, through the consumption of meats we feed the astral on the emanations of blood or animal life, we intensify the gross desire-nature of the astral man, intensify the passional-nature, and at death, when the physical body is cast aside as a discarded garment, the dense, gross, astral body is held to corresponding planes in the realm of the astral; thus the purgatory of the Roman church becomes a very real and uncomfortable experience. If, on the contrary, clean habits of life have purified the astral body, when it is liberated at the hour of death from the prison house of flesh it is not of the same degree of density as the lower astral planes, and it passes on to the sunlit meadows of that world and away from its slums.

Alcohol has also a most pernicious effect on the astral vehicle, and for that reason is eliminated from the food of the occultist. It is a great mistake to give to the perishing, alcohol, or narcotics, as it has really a more serious effect on the out-going astral than on the physical encasement. When man learns to live on clean food, to have clean habits and to think clean, generous thoughts, there is naught in all this wonderful universe that he need fear.

PRACTICAL

VEGETARIAN COOKERY.

SOUPS.

SOUP STOCK.

Any nuts with herbs dried and ground will nicely flavor and enrich stock.

STOCK FOR CLEAR SOUPS.

Place four onions in large kettle with a gallon of water, let boil steadily two hours, then add one carrot, two small turnips, two parsnips, three bay leaves, one head of celery (if celery leaves cannot be had a saltspoonful of celery seeds may be used), one-eighth head of cabbage. Let boil four hours; strain. This should make a gallon of strong stock.

TOMATO BOUILLON.

Put one quart of tomatoes, with one and a half quarts of water, in kettle over the fire; add one tablespoonful of chopped onion, two bay leaves, four whole cloves, one level teaspoonful of celery seed and a half teaspoonful of pepper. Cover and cook twenty minutes. Strain through a sieve. Beat the whites of two eggs until partly light, add them to the tomato, and boil rapidly for five minutes. Strain through two thicknesses of cheese cloth. Reheat, season with two teaspoonfuls of salt and serve with croutons.

JULIENNE SOUP.

Boil tender, not soft, one small potato, one small carrot, one half cupful of green peas (canned peas can be used), and one small head of celery, if in season; if in summer, asparagus heads will do. Cut the large vegetables into small dice, and add one quart of the clear stock. Take the yolks of two eggs, whipping them up with one tablespoonful of milk with salt to taste, put in a crockery cup and set in steamer; let cook until solid; set away to chill, then cut in small dice or fancy shapes and add to the soup.

MACARONI SOUP.

One-third package of Macaroni, or Spaghetti; cook in boiling water, salted to taste, until tender, then drain quickly and add one quart of clear stock. Bring to a boiling point and serve.

TORONTO BISQUE.

Place a sauce pan, with half a cupful of fine chopped onion, the same of carrot and celery, over the fire; cover with boiling water; cook five minutes; drain off the water. Melt one tablespoonful of butter in a saucepan, add the parboiled vegetables; cover and cook ten minutes, stirring often; then add one heaping teaspoonful of flour, stir and cook two minutes, add one cupful of canned tomatoes, and one quart of boiling water, cook fifteen minutes. Shortly before serving rub the bisque through a sieve; mix the yolk of two eggs with half a cupful of cream; add it to the bisque, and stir for a few minutes over the fire. In the meantime cook two ounces of macaroni in salted water thirty-five minutes; drain and rinse it off with cold water; cut the macaroni into small pieces the size of a white bean; add one cupful of this macaroni to the bisque and serve.

TOMATO SOUP.

To one can of tomatoes add one pint of water, four peppercorns, one half bay leaf, four cloves, and a bit of mace; cook until the tomatoes are soft enough to strain. After straining add two teaspoonfuls of sugar, one teaspoonful of salt, one fourth teaspoonful of soda; thicken with two tablespoonfuls of butter and three tablespoonfuls of flour blended together.

CREAM OF TOMATO.

To one half can of tomatoes, add one scant tablespoonful of finely chopped onion, and three spikes of celery, cook until tender, then strain through a wire sieve; season to taste, add soda the size of a pea. Scald one quart of milk, mix one teaspoonful of butter with heaping teaspoonful of flour, dissolve in warm milk and stir into the scalding milk; add to the strained tomato stock just before serving; don’t let it stand after milk is added. Serve with crackers.

DUTCH SOUP.

Take one bay leaf, one half can of tomatoes, one half can of corn, one medium sized onion, chopped; two heads of celery, cut fine (or one half teaspoonful of celery seed); one half cupful of rice, one half cupful of oatmeal, one carrot, cut in dice, one eighth head of cabbage, cut fine, one small turnip, cut fine, gallon, or more, of cold water, with salt to taste. Cook gently until all vegetables are thoroughly tender. Very nice served plain, or with dumplings. This soup is a hearty luncheon in itself.

CREAM OF POTATO.

To one head of celery, cut fine, add one teaspoonful of chopped onion, one large, or two medium sized potatoes, sliced; cook until you can mash through a wire sieve; then add one quart of scalding milk, one half cupful of cream, and thicken to a cream with buttered flour. Serve with oyster crackers.

POTATO SOUP WITH DUMPLINGS.

Pare, wash, and cut into dice, six good sized potatoes, chop fine one onion, place in kettle with water to cover, salt to taste, and cook until tender; then add one quart of cream or rich milk, add one tablespoonful of butter, a dash of pepper, and let come to a boil.

Have ready dumplings made as follows: To four heaping tablespoonfuls of flour, add pinch of salt, one even teaspoonful baking powder, one tablespoonful cream, and water enough to make soft dough; do not knead, mould into small lumps, size of walnuts, and drop into soup as soon as the soup comes to a boil. The dumplings take about eight minutes to cook, and the kettle should be kept covered all the time. The soup needs to be carefully watched that it does not boil over or burn; it is well to lift the kettle free from the stove every three or four minutes, giving it a little twirl, but do not lift the cover until the eight minutes are passed, for

sudden reduction of temperature may make the dumplings heavy.

RICE POTATO SOUP.

To two tablespoonfuls of rice, thoroughly washed, add one potato cut in large dice, one tablespoonful of finely chopped onion, and one-third of a teaspoonful of celery seed; cook until tender, salt to taste, add one quart of hot milk and one half cupful of cream. Serve with crackers.

SOUP WITH NOUILLES.

Nouilles--Beat two eggs, mix to a stiff paste with flour and a pinch of salt, roll out very thin on well floured board, let dry a few minutes, then roll snugly, cut from end of roll in strips as thin as possible, and shake out thoroughly. Have one quart clear stock hot and shake nouilles in gently. Let it simmer until nouilles are tender.

BEAN PURÉE WITH NOUILLES.

Take one pint of cold Boston baked beans; place in kettle with two quarts of water, one small onion, chopped fine, one small bay leaf; let boil until onion is tender, put through a wire strainer (if too thick, more water can be added); season to taste, add nouilles and let simmer until they are tender.

BEAN PURÉE WITH TOMATO.

To one bowl of cold Boston baked beans, add one half onion, chopped; one half teaspoonful of celery seed, one pint of tomatoes, one bay leaf, and one quart of water. Let boil one half hour, then mash through a colander, if too thick add more water, have ready one heaping teaspoonful of flour blended smooth with water, stir into the strained mixture, and put soup back on the fire, letting it come to a good boil. The flour is added to keep the soup an even creamy thickness. Serve with croutons.

RED KIDNEY BEAN SOUP.

To one can of red kidney beans, cooked in their own juice and then mashed through a sieve to remove skins, add one quart of rich fresh milk, one tablespoonful of butter, salt and pepper to taste. Let come to a boil and serve with croutons, or wafers.

BLACK BEAN SOUP.

Soak a pint of black beans in two quarts of cold water over night; boil them four hours or more; mash them thoroughly, strain them through a colander into a saucepan, cover, and let boil. Mix a tablespoonful of flour smoothly with cold milk or cream, stir into the boiling soup until it thickens; add a cupful of butter; if it is too thick, thin with boiling water; add a tablespoonful of lemon juice. Season and spice to taste.

SPLIT PEA SOUP.

Put a pint of split peas, and one bay leaf, with two quarts of cold water in a covered saucepan to boil for four hours; mash the peas thoroughly, strain them through a colander into a saucepan; set it, covered, over the fire to boil; mix one tablespoonful of flour with a cupful of soft butter, stir it into the boiling soup until it thickens; cover and boil five minutes or more. If the soup is too thick it may be thinned with boiling water. Season to taste. One pint of strained tomato added to this makes a very nice soup, of different flavor.

CREAM OF CELERY.

Cut the tops of one stalk of celery; simmer gently until tender in sufficient water to cover, with one teaspoonful salt. Cut up celery stocks in one inch pieces and boil in one pint of water until tender. Boil two tablespoonfuls rice in water until nearly done; then add to the celery soup to boil a few minutes; strain celery tops and add the liquor to the soup pot. Boil one quart of milk in double boiler; thicken with one scant tablespoonful of flour blended with one tablespoonful of butter; add another teaspoonful of salt; add this to soup and let boil but a second. Have ready one half cupful of whipped cream; place in the bottom of the tureen, pour on the hot soup, and serve with crackers.

WHITE SOUP.

Put in a saucepan one and one half pint of water; when boiling throw in the white part of a cauliflower separated into sprays, let boil twenty minutes; then add bread balls made thus:--to one pint of bread crumbs, add powdered marjoram, thyme, sweet savory and chopped parsley, to taste; one tablespoonful of melted butter, pinch of salt, a little whole wheat flour and beaten egg to bind; form into little balls, size of walnuts, and drop into the soup and boil ten minutes; then add one pint of rich milk or cream to soup, and let come to a boil. Grate in a bit of cheese, just enough to flavor delicately. Serve with croutons.

CREAM OF CORN.

To one can of corn add three pints of milk; boil for half an hour. To one tablespoonful of chopped onion, add two tablespoonfuls of butter and cook in frying pan until delicate brown, then add to onion and butter two tablespoonfuls of flour; blend. Stir this mixture into the corn and milk; add salt and pepper to taste; cook five minutes; then run through coarse sieve to strain, and stir in the well beaten yolks of two eggs and one quarter of a cupful of cream; return to double boiler and cook until it thickens; do not let it boil.

CORN CHOWDER.

Pare and slice one large potato and one onion; place in agate kettle a layer of onion; cover that with one cupful of corn; then add the sliced potatoes; add just enough water to cover, and let simmer gently until onion and potatoes are tender. Add one quart of rich milk, one third cupful of cream and let come to a boil. Remove from fire and stir in the whipped yolk of one egg, and add a tablespoonful of chopped parsley.

GREEN PEA SOUP.

Put a quart of freshly shelled, unwashed peas into a double boiler, steam until the peas can be thoroughly mashed, pour in a quart of boiling milk, let boil for one minute and strain it through a colander into a saucepan; mix two tablespoonfuls of flour smoothly with cold milk; stir it into the boiling soup until it thickens; add two tablespoonfuls of butter, set it covered on the range, to boil five minutes or more,--until the flour is cooked. Season to taste. A sprig of mint cooked with the peas gives a flavor liked by many.

CABBAGE SOUP.

Steam a whole cabbage with the stem end down, for two hours or more, set it off, covered, to cool; take off the coarse outer leaves, chop the cabbage very fine, put it into a saucepan with a cupful of butter, and season to taste. Set it over the fire for the butter to melt; then dredge in gradually four tablespoonfuls of flour; stir, to mix it with the butter and cabbage, pour in a quart or more of boiling milk, or water, stir until it thickens; cover it and boil five minutes or more, to cook the flour.

CAULIFLOWER SOUP.

May be made the same as cabbage soup; only substituting cauliflower for cabbage.

CREAM OF ASPARAGUS.

Cut off half inch tips from two bunches asparagus stalks. Cook the stalks until tender in boiling water. Rub through a colander, salt to taste; add three pints of boiling milk; smooth one teaspoonful of butter with one of flour and stir into the soup. Cook fifteen minutes; while this is in course of preparation boil the tips till tender, drain and put in tureen. When soup is done take from stove, add one half cupful of cream and pour over the tips. Serve with croutons.

SUMMER VEGETABLE SOUP.

Pare two medium sized onions and one turnip, place these with one cupful of finely chopped cabbage to cook in three quarts of boiling water. Season to taste with salt and cook till tender, then add one cupful of green corn, cut from cob, bring to a quick boil and cook five minutes, add one half cupful of cream just before serving.

BLACK BEAN SOUP.

Soak one quart of black beans over night; put them in a kettle with a gallon of cold water and two bay leaves; boil slowly until well done, rub through a colander, and return to the kettle; season with salt, white pepper, and, if liked, a little thyme; blend one tablespoonful of butter with one tablespoonful of flour and dissolve in one half cupful of warm water; stir into the soup. Serve with croutons.

CARROT SOUP.

Boil six carrots in water; when thoroughly done drain them and pass them through a fine sieve. Mix the pulp thus obtained with as much clear stock (water will answer, but the soup will not be so good) as will make it of the desired consistency. Add pepper, salt, and a pinch of sugar. Melt one ounce of butter and mix with it a tablespoonful of flour; then gradually add to the carrot purée; let it come to a boil, add a small piece of butter; serve with croutons.

MOCK TURTLE SOUP.

Boil a bay leaf and a scant cupful of lentils in salted water until tender. Mash through colander to remove husks. Put back in kettle and add water enough to make one quart of soup; blend one tablespoonful of butter with scant tablespoonful of flour and stir into the soup; let come to a boil. Just before serving add fine slices of lemon, and two sliced, hard boiled, eggs.

SCOTS BROTH.

Wash two ounces of barley; soak it for three hours; chop one half of a medium sized head of cabbage, and one onion, put over to boil with the soaked barley, in one quart of water; salt to taste. Let boil for two hours; adding more water if it becomes too thick, be careful not to add too much water; season with savory herbs, or soup powder; add a tablespoonful of butter, and serve with croutons.

WHITE TURNIP SOUP.

Peel and prepare turnips according to quantity of soup desired, put them over to cook in boiling water; when half done add one fifth as much of onions, chopped very fine, with pepper and salt to taste. When turnips are tender pour the liquid through a sieve and rub the turnips through with a spoon. Return to kettle and add as much milk as is required to bring soup to the proper consistency; add a little parsley, chopped fine; one cupful of cream, and one tablespoonful of butter blended with one teaspoonful of flour. Serve with croutons.

CREAM OF LIMA BEANS.

Soak one cupful of dried lima beans over night; in the morning drain and add three pints of cold water. Cook until tender and rub through a sieve. Cut two slices of onion and four slices of carrot into small cubes; cook in two tablespoonfuls of butter until yellow, add one cupful of cream or milk, two tablespoonfuls of butter, two tablespoonfuls of flour, one teaspoonful of salt, and one saltspoonful of pepper; and stir into the boiling soup. Strain and serve.

BEAN PURÉE WITH TOMATO.

To one pint of cold Boston baked beans, add one chopped, small, onion, one bay leaf, and one cupful of tomato; boil in one quart of water until tender, then mash through a colander, put back in kettle over the fire and add one tablespoonful of butter blended with one teaspoonful of flour; season to taste, let come to a boil, and serve with croutons.

SAVORIES AND RELISHES.

SAVORY HASH.

Take one third of brown lentils (which have been cooked tender and rubbed through colander) to two thirds of chopped cold boiled potatoes, add one cupful of bread crumbs over which has been poured one tablespoonful of melted butter. Season, adding savory, soup powder or sage and chopped onion, as preferred; put tablespoonful of butter in frying pan, add the hash, cover until thoroughly heated, then remove cover and let brown, turn out on platter garnished with parsley.

NUT LOAF.

Grind or chop very fine one half pound of nuts--any kind you prefer; add one pound of broken bread, one fourth pound of butter; turn on one pint of boiling water and one egg, well beaten, salt, pepper, and sage to taste; chop very fine. Butter a pudding dish, cover the buttered surface with bread crumbs, pour in the mixture, and bake one hour or until well done. Turn out on a platter, garnish with parsley or celery tops. Serve with cranberry sauce.

VEGETABLE SWEET BREADS.

To six tablespoonfuls of lentils, previously boiled in salted water until tender and mashed through a colander, add three tablespoonfuls of bread crumbs and two beaten eggs, mix well together and fry by tablespoonfuls in plenty of hot butter. Serve hot, with green peas.

STUFFED SQUASH.

Boil or steam, a good sized summer squash, it needs to be of tender skin, leave on the skin and cut it once across before putting on to cook; let it cook until tender, be careful not to break in taking up; scoop out the seeds with a spoon, have ready some bread crumbs in which have been mixed one tablespoonful of melted butter and tablespoonful of finely minced onion and an equal quantity of chopped parsley or mint, as you prefer, with salt and pepper to taste; fill the cavity in squash with this stuffing and fasten together. Place in the oven and bake one half hour, basting frequently with butter and hot water.

STUFFED CUCUMBERS.

Take three medium sized cucumbers, pare, remove the seed centers and fill with stuffing. Bind the halves together with tape and steam until tender; remove all tapes, but one, that through the middle, lay them in a baking dish and brush them over with egg; then scatter fine bread crumbs and brown. Serve in long dish, with brown gravy.

The stuffing is made as follows: Put one tablespoonful of melted butter in stew pan, fry in the butter until brown one onion and two medium sized apples chopped fine. Drain from the fat and make into stuffing with bread crumbs flavored with a little mint, savory, or sage, as one prefers; whip one egg and stir in, with seasoning to taste.

VEGETABLE CUTLETS.

Use as a basis the vegetables from which the clear soup stock is made; after they have been thoroughly drained, set away, and chilled they will chop nicely without mushing. To the quantity of vegetables used for one gallon of soup stock, add one half can of peas, and one quart of chopped, cold, boiled potatoes; pepper and salt to taste. Mould in flat cutlet shapes, dip in fine bread crumbs, then in egg, again in bread crumbs, and fry in hot oil or butter. Serve hot. This will make about four dozen cutlets. If the chopped vegetables are placed in a cool place they will keep nicely several days.

CELERY ON TOAST.

After washing and removing green leaves, cut celery stocks into pieces about four inches long and cook in boiling, salted, water; when tender, lay on buttered toast, moistened with the water the celery was cooked in; add a brown sauce, and serve.

TURNIP SOUFFLÉ.

Make a white sauce of three tablespoonfuls of butter, three of flour, and enough milk to make a thick, white sauce; use three cupfuls of strained cooked turnip, whites of three well beaten eggs, a teaspoonful finely chopped onion; salt, and a dash of cayenne; mix all together, adding the whites of eggs last folding them carefully in, bake in a well buttered pan in slow oven until a delicate brown.

FARINA CROUSTADES.

Put one quart of water in double boiler and add one teaspoonful of salt; when scalding hot stir in gradually one and one half cupful of farina; let it cook till very thick; then spread out on a flat buttered dish about one and one half inches thick; when perfectly cold cut with a round cutter and scoop out some of the center so as to make a sort of cup; brush over with the yolk of egg and set in oven till a delicate brown.

For filling, cut into dice, three hard boiled eggs, season with salt, cayenne, and chopped parsley; add two tablespoonfuls of mushrooms cut in half; mix with enough well seasoned brown sauce to moisten well; fill the little croustades and serve; pass more of the filling or sauce in a gravy boat.

RICE CROQUETTES.

One cupful of rice, boiled in one pint of milk and one of water until tender. While boiling, add butter the size of an egg, two teaspoonfuls of sugar, three eggs, and the juice and grated peel of one lemon. Mix well, make into rolls a finger long, and dip first into yolks of two eggs, well beaten, then into cracker crumbs, and fry in hot cocoanut butter.

ITALIAN MACARONI.

Boil one third of a package of macaroni in salted water until tender, drain and rinse in cold water; heat and cover with tomato sauce (see sauces and gravies).

MACARONI PIE.

Boil a quarter of a pound of macaroni in water until quite soft; pour off the water; add half a pint of milk, a quarter of a pound of grated cheese, a piece of butter, a very little mustard, salt, a pinch of cayenne, and a dust of white pepper. Let it boil for a minute, then bake in a dish lined with rich crust. The crust should be brushed with the white of egg to keep it dry.

MACARONI CHEESE.

Take the quantity of macaroni required to fill a baking dish two thirds full, and boil until tender in salted water, drain through a colander and rinse in cold water, place in baking dish with half a cupful of milk if quantity used is small, a whole cupful if two quart dish is to be filled, add cupful of grated cheese, pinch of soda and dash of cayenne; bake a delicate brown.

VEGETABLE HOT-POT.

Use one turnip, one Spanish onion, one cupful of stewed tomato, one and one half pound of potatoes; one half cupful of tapioca previously soaked, butter, pepper, and salt to taste. Cut turnip into dice and boil until tender, at the same time let tapioca cook clear. Cut potatoes up fine, and chop onion fine and scald. Place a layer of onion at bottom of buttered baking dish, then tapioca, on top of this, potatoes, chopped turnip, and tomato,--with a little butter on each layer; repeat this until the dish is full, and have a layer of potatoes at the top. Bake in hot oven for one hour, the last quarter remove cover; add layer of bread crumbs and brown.

WINTER VEGETABLE PIE.

Place in baking dish, slices of cold boiled potatoes, onions, celery, and carrot, then add one scant cupful of stewed tomatoes and one half can of peas. Cover with stock, thickened to a gravy with butter and flour, cover with plain crust, and bake. A pie of this nature can be made with a great variety of ingredients; apples, boiled chestnuts, onions, and potatoes make a good combination. Rice, with a grating of cheese, celery, onion, and tomato, another variety.

VEGETABLE HASH.

Of cooked and chopped vegetables, use one carrot, one blood beet, two turnips, two quarts of finely sliced potatoes, one onion, and a stalk of celery; one sprig of parsley; put them in a stew pan, cover tight, and set in the oven. When thoroughly heated pour over a gravy of drawn butter and cream. Stir together and serve.

NUT CROQUETTES.

Shell and grind one pound of English walnuts, add one teaspoonful of salt, and the juice of half a lemon, one tablespoonful of chopped parsley, a dash of cayenne pepper; mix thoroughly. Place one cupful of milk in double boiler; rub one tablespoonful of softened butter with two tablespoonfuls of flour; when the cream is hot, stir in the flour and butter; cook until it thickens; season lightly.

Then turn the thickened cream into the nut mixture; have ready a well beaten egg and whip in; mix all together thoroughly. Set away to cool; when cold form into shapely rolls, dip in bread crumbs, then in beaten egg, again in bread crumbs, and fry quickly in hot fat. Be sure the fat is at right temperature,--see “Important Notes.”

BISCUIT PATES.

Make a nice light baking powder biscuit. Have ready, when the biscuits are done, one cupful of small mushrooms cooked tender and cut fine, dressed with one half cupful of cream, mixed with juice of mushrooms, and thickened with one teaspoonful of flour,

blended with teaspoonful of butter; season to taste with salt and pepper. Take a thin slice off of the bottom of the biscuit, dig out the center, leaving reasonably thick walls, put little piece of butter in the shell and fill with mushrooms dressing; serve at once. Stale biscuit may be used by toasting them a few minutes in a hot oven after they have been hollowed out. These are crisp and some prefer them to fresh biscuit.

YORKSHIRE PUDDING.

To six large tablespoonfuls of flour, add one teaspoonful of baking powder and one half teaspoonful of salt; sift thoroughly; beat the yolks of three eggs, and add milk enough to mix with flour and make the consistency of soft custard; whip whites of eggs to stiff froth and fold into mixture lightly. Melt a heaping tablespoonful of butter in dripping pan, letting it brown slightly; pour in the mixture and place in oven; then pour over the top a half cupful of melted butter; brown another spoonful of butter, and when pudding is almost done baste with browned butter. When done cut in squares and serve with melted butter.

FRIED APPLES.

Wash apples and dry them, cut in circular slices through the core of the apples. Sprinkle liberally with sugar and fry in butter until well cooked. Serve on a platter.

VEGETABLE SAUSAGES NO. 1.

Take three cupfuls of grated bread crumbs and moisten with hot water; add salt, pepper, and mixed herbs. Beat till light, one egg and add to bind. Shape in small cakes, or rolls, and fry in hot grease.

SAUSAGES NO. 2.

Take one cupful of boiled, or Boston baked, beans; heat, and mash through sieve; chop two onions and boil very tender, mash, and add to beans. Place in oven one cupful of bread crumbs and let them dry and brown, then roll to powder; add to the mixture, bind with an egg, and use savory or sage to flavor, with salt and pepper to season. Roll in shape, dip in wheat meal, and brown in hot butter or oil.

CHINESE RICE.

Wash rice thoroughly, have agate kettle half filled with boiling salted water. Sprinkle rice in the boiling water; let cook until rice is thoroughly tender; then drain through a sieve.

CURRIED RICE WITH EGGS.

Prepare Chinese rice and serve with curried gravy made as follows: Put one teaspoonful of chopped onion in frying pan, with one heaping tablespoonful of butter; thicken with browned flour and add sufficient water to make gravy of right consistency. Season with salt, pepper, and curry powder enough to delicately flavor. Heap rice in center of shallow dish or platter, pour the gravy around the edge of rice, garnish with slices of hard boiled eggs, and lemon.

BANANA FRITTERS.

Slice bananas one half inch thick; squeeze over the slices some orange juice; stand for fifteen minutes; drain each piece, dip in fritter batter and fry.

CURRIED RICE.

Thoroughly wash one cupful of rice; let soak several hours in cold water; put two tablespoonfuls of butter in saucepan; add one teaspoonful finely chopped onion; when the onion begins to color drain the rice and add to onion and butter; stir a few minutes; add two teaspoonfuls curry powder, salt and pepper; then add two and one half cupfuls of boiling water; cover and cook rapidly for ten minutes; then move where it will cook very slowly three quarters of an hour.

IRISH STEW.

Chop fine a small onion, put over to stew in one pint of water; add a bay leaf and half a teaspoonful of salt; let simmer until onion is tender, take out the bay leaf; add pint of milk and one large potato, pared and sliced thickly; let simmer until potato is tender, then add one spoonful of flour blended with half a teacupful of butter; add chopped three hard boiled eggs, pour over split baking powder biscuit and serve on a platter, garnished with parsley.

CHESTNUT CROQUETTES.

Boil one quart of the large French chestnuts; remove the shells and thin brown skin; mash and run through a sieve; put into a double boiler, add enough sugar to sweeten, about two tablespoonfuls, the grated peel of one orange and juice of one half of a lemon, one tablespoonful of finely chopped citron; beat the yolk of one egg with one tablespoonful of cream; add to the chestnuts; turn out and when perfectly cold, form into croquettes; dip in egg, then in bread crumbs or fine cake crumbs may be used; fry in deep hot fat.

For the sauce, put into a double boiler one half cupful of thick cream, three fourths cupful of strong coffee, three tablespoonfuls of sugar and the yolks of four eggs well beaten; stir till it begins to thicken, remove from the fire; add juice of one half an orange, one tablespoonful of lemon juice, three teaspoonfuls Maraschino; serve with the croquettes.

MUSHROOMS.

GRILLED MUSHROOMS.

Prepared in this way the mushrooms must be large. After washing and peeling, score the tops with a knife and lay them for one hour in a pickle of oil, salt, pepper and lemon juice. Place them, tops down, on a close-barred gridiron and broil over a clear, slow fire. Serve on toast with a sauce made as follows:

Chop the stalks and pieces of mushrooms that have broken in the washing and stew in broth for ten minutes with a little minced parsley and onion. Beat the yolk of one egg with a gill of cream and add slowly to the sauce. Stir the whole until hot without boiling and pour it over the toast.

ESCALOPED MUSHROOMS.

Put the mushrooms in a buttered baking-dish with alternate layers of crumbs, seasoning each layer plentifully with butter; add salt, pepper and a gill of cream or gravy. Bake twenty minutes, keeping covered while in the oven.

MUSHROOM PIE.

Line a baking dish with rich crust. Drain the liquor from a can of small mushrooms, slice the mushrooms, add one cupful of cream, or rich milk, and tablespoonful of butter, to juice of mushrooms. Season to taste and thicken with tablespoonful of flour blended with butter; add the mushrooms, fill in the baking dish, cover with top crust and bake a rich brown. Brown sauce may be used if preferred.

AUNT SUSAN’S MUSHROOM PIE.

Line a deep pudding pan with rich paste; fill two thirds full of mushrooms (if raw they must be stewed a few minutes first), make a gravy of flour rubbed very smooth with thick cream, or with butter and milk, thin with boiling water, season with salt, pepper and soup powder, pour over the mushrooms, cover with paste and bake.

BAKED MUSHROOMS.

Toast for each person a large slice of bread and spread over with rich sweet cream; lay on each slice, head downward, a mushroom, or if small, more than one; season and fill each with as much cream as it will hold. Place over each a custard cup, pressing well down to the toast; set in a moderate oven and cook fifteen minutes. Do not remove the cups for five minutes after they come from the oven, as thereby the flavor of the mushroom is preserved in its entirety.

STEWED MUSHROOMS.

Drain off the juice from a can of small mushrooms; put a heaping tablespoonful of butter into a frying pan; add two tablespoonfuls of flour and brown well, stirring all the time; then pour in the juice of mushrooms with water enough to make a thin gravy; season with salt, pepper, and soup powder; add mushrooms and stew a few minutes, then serve.

MUSHROOMS IN WHITE SAUCE.

For stewing, the smaller mushrooms are preferable. Carefully peel the tops, cut the ends of the stalks level, wash and drain in colander. They should be stewed, till tender, in as little water as possible. When thoroughly cooked, add a pint of cream, or new milk, and thicken in usual way with flour blended in melted butter.

MUSHROOMS WITH LEMON.

Use the small canned mushrooms, separate the mushrooms from the liquor, put them, with one tablespoonful of butter in saucepan; add one tablespoonful of lemon juice, a pinch of white pepper, and one quarter of a teaspoonful of salt; place the saucepan over a slow fire and cook gently fifteen minutes, then serve.

EGGS.

CURRIED EGGS, NO. 1.

Put into saucepan two tablespoonfuls of butter, add one half teaspoonful onion juice; cook slowly till the onion begins to color; then add one tablespoonful flour and one teaspoonful curry powder; when perfectly smooth add three fourths of a cupful of clear stock and one half cupful of cream; cook for five minutes, stirring constantly; season with salt and pepper. Cut six hard boiled eggs into halves lengthwise; strain the sauce over them and let stand on the stove a few minutes till thoroughly heated. Serve on thin squares of toast.

CURRIED EGGS, NO. 2.

Boil half a dozen eggs hard and let them get cold. Fry in butter two large onions cut in thin slices, and let them get quite brown, season these with pepper and salt, and add a pint of boiling water; when the onions have stewed for a little while, put in a cupful of milk thickened with arrowroot, or flour, and flavor with curry powder, let it simmer, then put in the eggs cut in halves, making them hot, but do not let them boil. The amount of curry powder used is a matter of taste; garnish the dish with boiled rice, and serve very hot.

BAKED EGGS.

Butter gem pans and line with fine, buttered, bread crumbs. Break one egg carefully into each pan, season with bits of pepper, salt and butter, cover lightly with buttered bread crumbs, and bake in oven until delicate brown.

SCRAMBLED EGGS.

Break the eggs into a bowl and beat moderately light; add cream in proportion of one tablespoonful to every two eggs; season to taste. Have one tablespoonful of butter melted in hot frying pan and pour into the mixture. Stir until cooked solid, turn on hot platter and serve at once with toast.

SHIRRED EGGS.

Set a saucer on the stove--the heavy japanese ware stands the heat best--and put in it a teaspoonful of butter, when hot break two eggs into the dish, let cook until they bubble, and begin to set. Serve in the dish in which they are cooked, slipping the saucer on to a small plate. Serve at once.

HARD BOILED EGGS.

The eggs should be placed in boiling water, then set where they will simmer, rather than boil, and be left for fifteen minutes; the yolks will be dry and fine. To make them peel easily slip at once into cold water on removing from the fire.

LYONAISE EGGS.

Put one half tablespoonful butter in sauce pan, add one teaspoonful onion juice, cook slowly five minutes. Add one tablespoonful flour and, when well mixed, add one and one half cupfuls milk, stir till it thickens, season with salt and pepper, pour the sauce in a bake-dish, and break six eggs onto the sauce. Sprinkle quite thickly with bread crumbs, put bits of butter over all, and set in the oven for three or four minutes.

EGGS WITH MUSHROOMS.

Trim and peel the mushrooms; put them in stew-pan with butter, and cook until tender, season to taste. Place in shallow dish pouring the butter over them, then break over them eggs enough to cover, sprinkle thickly with bread crumbs and add bits of butter, place in hot oven long enough to set the eggs. Do not let the eggs harden; four or five minutes is the time usually required. Serve at once.

SAVORY EGGS.

Fry slices of Spanish onions until a delicate brown; add a tablespoonful of chopped parsley, pepper and salt, blend fat with tablespoonful of flour; add a pint of hot milk. Have ready some hard boiled eggs, quarter, and heat in the prepared sauce. Serve on toast.

FRICASSEED EGGS.

Boil the eggs till hard, take them out of the shells and arrange on a platter either in halves, or the yolks whole and whites cut in dice; make a rich white sauce and pour over them, garnish the dish with parsley.

EGGS FORCED.

Boil the number of eggs required; throw into cold water to chill; peel, and cut crosswise, take out the yolks, being careful not to break the whites. Rub the yolks with tablespoonful of butter (if six eggs are used), add two tablespoonfuls of cooked, chopped, mushrooms, pepper, salt, and one tablespoonful of chopped parsley; heat this mixture and beat it to a paste. Stuff with it the whites of the eggs and serve cold on bed of cress.

EGG CUTLETS.

For each cutlet allow one hard boiled egg, chopped fine, a tablespoonful of bread crumbs, the same quantity of grated cheese, a pinch of curry powder, pepper and salt; mix the whole with the beaten yolk of a raw egg and shape like cutlet; dip in white of egg and bread crumbs and fry brown; serve very hot.

ROASTED EGGS.

Fresh eggs well roasted are considered by some to be much richer than boiled eggs. Eggs may be roasted in the oven or in hot ashes. Care should be taken to turn them, where the heat is unequal.

EGGS IN CREAM.

Put half a cupful, or more, of cream into a shallow earthen dish, and place the dish in pan of boiling water. When the cream is hot, break in as many eggs as the bottom of the dish will hold, and cook until well set, basting them occasionally over the top with the hot cream, season to taste, and serve promptly.

ESCALOPED EGGS.

Boil six eggs fifteen minutes, the water should simmer, rather than boil; then slip the eggs into cold water for a moment, to make them peel easily, remove the shells and set aside to cool. Make a white sauce of rich milk thickened with butter and flour, seasoned to taste. Remove the whites of eggs and chop; cream the yolks with one half cupful of cream and add to white sauce. Stir in the chopped up whites, and add a teaspoonful of chopped parsley; place in baking dish, sprinkle bread crumbs and bits of butter over the top and set in hot oven just long enough to brown delicately.

POACHED EGGS, SPANISH STYLE.

Heat an earthen pan slowly and melt in it a tablespoonful of butter; add a teaspoonful of salt, a smaller quantity of pepper and a small onion minced very fine; or in place of the onion, use parsley, and sweet herbs, or a combination of all together as you prefer. Drop in the eggs one at a time; do not stir, but let them brown a little; turn carefully and brown on the other side. In Spain and Mexico they are served in the dish in which they are cooked, and as hot as possible.

SWISS EGGS.

Cover the bottom of a dish with two ounces of fresh butter and on this scatter grated cheese; drop the eggs upon the cheese without breaking the yolks, season to taste. Pour over the eggs a little cream and sprinkle with about two ounces of grated cheese; set in a moderate oven for ten or fifteen minutes.

FRENCH OMELET (PLAIN).

Beat the yolks of six eggs to a cream, and beat whites to a stiff froth, add two tablespoonfuls of cream, or rich milk, to the yolks, season to taste, whip in the beaten whites lightly. Have omelet pan well oiled with butter and moderately hot; cook slowly until browned slightly on the bottom, then set pan in upper grate in hot oven. Serve on a platter garnished with parsley.

DRESSED OMELETS.

A nice variety can be given omelets by filling supplied just before folding.

TOMATO DRESSING.

Five tomatoes stewed down, and seasoned with salt, pepper and butter. Spread on omelet just before folding.

OMELET, WITH FRENCH PEAS.

Heat and drain one can of peas, season with salt, pepper and butter. Cover the platter and serve omelet on peas.

MUSHROOM FILLING.

If fresh mushrooms are used, select the small variety; peel and slice them, stew until tender in butter; season to taste and spread on omelet before folding.

FOAMY OMELET (SWEET).

Beat the yolks of six eggs to a cream, add one half cupful of cream, one tablespoonful of sugar. Whip the whites to a stiff froth, and add one half to the mixture; have frying pan moderately hot, melt one teaspoonful of butter in pan; be careful not to brown, and pour in the mixture. Cook carefully, lifting pan from fire frequently so it will not scorch on the bottom; when nearly set, pour over the rest of whites of eggs, and sprinkle with powdered sugar, then set in oven until whites of eggs set; have ready a hot platter, slip omelet on to platter, lay spoonfuls of jelly on omelet and double quickly. Serve at once. This omelet without sweetening is very nice with savory dressing, such as minced herbs heated in butter.

BREAD OMELET.

Crumble a cupful of stale bread and soak in half a teacupful of milk. Then beat quite smooth, and add half a teaspoonful of salt and five beaten eggs. Butter a shallow pudding dish well, pour in the mixture, and bake in an oven about ten minutes, serving at once in the same dish, as it falls quickly.

VEGETABLE OMELET.

Chop an onion finely, together with two crisp heads of lettuce, season with salt and pepper, and stir in six well beaten eggs, add three tablespoonfuls of cream. Pour into hot, buttered spider, and when thickened, but not hardened, fold over and serve on hot platter. Parsley may be used, if preferred, in place of lettuce.

CHEESE OMELET, NO. 1.

Break three eggs into a basin; whip them till well mixed; add pepper and salt, and two ounces of grated cheese; melt one tablespoonful of butter in frying pan; when the butter is quite hot pour the mixture into the pan; as soon as it begins to set, draw the thickening portion from the bottom of pan with a silver fork, letting the liquid substance cover the pan, do not stir; repeat this operation until it is all sufficiently cooked; then turn onto a heated platter, garnished with parsley, or cress.

CHEESE OMELET, NO. 2.

Mix to a smooth batter three tablespoonfuls of flour with half a pint of milk. Beat together four eggs, a little salt and one fourth of a pound of old cheese grated. Add these to the flour and milk and mix all, beating briskly for several minutes. Put three ounces of butter on a frying pan, and when it is boiling hot pour in the mixture and cook to a nice brown on both sides, turning carefully. Serve on a hot dish.

EGG AND ASPARAGUS.

Cut about two dozen stalks of asparagus into inch lengths and boil tender. Drain, pour over a cupful of drawn butter; stir until hot, turn into a baking dish. Break about six eggs on top, put a bit of butter on each, with salt, and pepper; put into a quick oven until the eggs are “set.”

DEVILLED EGGS.

Boil the eggs for twenty minutes, remove the shells, cut each egg in half without breaking the whites; take out the yolks and pound them in a mortar, adding cayenne, salt and curry powder. Stuff the whites with this paste and join the eggs to their original shape. Cut off just sufficient of each broad end to enable them to stand, and arrange them thus on a dish in a bed of cress or parsley.

EGGS ON TOAST.

Put one tablespoonful of butter in a chaffing dish, and when bubbling add one tablespoonful of flour, one half teaspoonful of salt, one half saltspoonful of pepper, and, gradually, one cupful of milk. Add the whites of three hard boiled eggs, chopped fine. When hot, pour over three slices of toast. Rub the yolks through a strainer over all and garnish with parsley.

SAVORY SAUCES AND GRAVIES.

Nut butter is an excellent substitute for meat essence in gravies, stocks, and sauces. It should be used in the proportion of one tablespoonful to one quart of water.

BROWN SAUCE.

Heat a pint of thin cream; when boiling add a tablespoonful of flour, browned in the oven and rubbed to a smooth paste with a little cold milk; salt to taste; cook thoroughly for ten minutes; then add one cupful of hot, stewed, strained tomato. Beat thoroughly.

TOMATO SAUCE, NO. 1.

Melt one tablespoonful butter, add one tablespoonful of chopped onion, fry until delicate brown; then add one tablespoonful of flour; gradually pour in one cupful of clear soup stock and one half cupful of strained juice of tomato. Season to taste, and cook until it thickens. Nut or dairy butter may be used.

TOMATO SAUCE, NO. 2.

Put one half can of tomatoes, one cupful of water, two cloves, two allspice berries, two pepper corns, two sprigs of parsley, one teaspoonful of mixed herbs, over to boil in granite saucepan; fry one tablespoonful of chopped onion in one tablespoonful of butter till a delicate brown; then add tomato mixture and one heaping tablespoonful of corn starch that has been dissolved in cold water. Simmer ten minutes, add one half teaspoonful of salt, and one half saltspoonful of pepper, add a dash of cayenne, if liked. Strain.

WHITE SAUCE.

To one pint of milk add one heaping tablespoonful of flour blended with one tablespoonful of melted butter; boil until it thickens, salt to taste, add one half cupful of cream. If too thick, thin with hot milk.

CHEESE SAUCE.

Flavor white sauce by adding grated cheese, and stir until the cheese is quite melted.

DUTCH SAUCE.

To four ounces of butter add the well beaten yolks of three eggs, a teaspoonful of flour, a dessertspoonful of lemon juice and salt to taste; put in double boiler and stir gently until it thickens; do not let it boil or it will curdle. This sauce is very nice with asparagus or cauliflower.

DRAWN BUTTER.

One half cupful of butter, rubbed well with two tablespoonfuls of flour; put into saucepan with about one pint of boiling water, stir constantly until well melted. Add one tablespoonful of chopped parsley.

BUTTER SAUCE.

Season a cupful of flour with pepper, nutmeg, and cloves. Mix it with water into a thin paste, and work in a piece of butter about the size of an egg. Put the paste into a pan over the fire, and boil it for a quarter of an hour, then take it off, and add some fresh butter in small portions at a time, continually stirring the contents, to prevent the butter from rising to the surface. Afterwards add lemon juice to flavor, and mix thoroughly. This sauce may be used with almost any vegetable. Another way of making butter sauce sometimes called oiled butter, which is generally liked, is to take as much fresh butter as will be wanted, and melt it, but do not let it brown. Skim it, pour it out, let it rest a minute, then drain it from the curd at the bottom, and serve.

BROWN BUTTER GRAVY.

Take one bay leaf, and a teaspoonful of chopped onion and simmer fifteen minutes in one pint of water. Brown two tablespoonfuls of flour. Put one heaping tablespoonful of butter in frying-pan, melt, browning slightly, add flour, then the strained water that is flavored with onion and bay leaf; let boil, if too thick add more hot water. Salt and pepper to taste.

CHEESE DISHES.

AN ENGLISH MONKEY.

Soak one cupful of bread crumbs in one cupful of milk about ten or fifteen minutes. Melt one tablespoonful of butter, add one cupful of cheese broken into small pieces; stir until melted; add the crumbs and one beaten egg, one half teaspoonful of salt, a few grains of cayenne, and a piece of bicarbonate of soda as large as a pea. Cook for five minutes; serve on wafers.

RICE AND CHEESE.

Take one pint of boiled rice and one cupful of grated cheese; add to the cheese a dash of cayenne pepper and soda the size of a small pea; mix thoroughly. Place the rice and cheese in alternate layers in buttered baking dish. Sprinkle bits of butter over the top and bake in hot oven until brown.

WELSH RAREBIT.

Take one fourth pound of good rich cheese, grate it, add one half cupful of milk; put in a double boiler. Mix one half teaspoonful mustard, one saltspoonful of salt, a sprinkle of cayenne pepper and soda the size of a small pea, to a smooth paste with a little milk; add the yolks of two eggs, and beat well. When the cheese is melted stir in mixture of egg and seasoning, add two teaspoonfuls of butter, and cook until it thickens, stirring constantly. Pour over toast, or heated square crackers and serve at once.

CHEESE PUDDING.

Grate one half pound of cheese and add a dash of cayenne, and soda the size of a pea; add six ounces of grated bread, using crust and all; mix with pepper and salt to taste, melt two ounces of butter in one gill of boiling milk and pour over the mixture (cook in double boiler and stir until cheese is melted), then beat in the yolks of three eggs, beat whites of eggs stiff and add them to the mixture (after it is set off of the stove), then pour into a greased pudding dish and bake in moderately hot oven.

CHEESE STRAWS.

Sift one cupful of flour, one half teaspoonful of baking powder, a dash of cayenne pepper, and salt thoroughly. Then work in two tablespoonfuls butter, add three fourths of a cupful of grated cheese and mix to a soft dough with milk. Roll out lightly on a floured board, cut in strips the length of a pencil, also make some small rings. Bake in a hot oven until delicate brown. Put sticks through one or two of the rings. Nice to serve with salads, or for lunch boxes.

ESCALOPED POTATOES, WITH CHEESE.

Slice cold boiled potatoes and sprinkle with salt and pepper; prepare a good cream sauce; put a layer of sauce, then one of potato into a shallow bake dish, having the last layer of sauce; cut some thin strips of cheese about two and one half inches long, lay them on top of the potatoes, sprinkle with bread crumbs, put into a good oven till slightly browned and the cheese is somewhat melted.

CHEESE PATÉS, NO. 1.

Make a good short crust, roll it out very thin and line as many patty pans as will be required; fill them with stale bread crumbs, or dry rice. Cover with crust and bake in a quick oven. When cooked, remove the lid and take out the bread, or rice; fill up the case with cheese mixture; brush round the edge with egg and cover with the lid. Serve very hot.

Cheese Mixture.--Grate one half pound of good rich cheese, add a dash of cayenne pepper and a tiny speck of soda, mix with white sauce to the consistency of cream, stir over the fire until the mixture is thick, remove from stove, and add one well beaten yolk of egg. Fill the cases while hot and serve at once.

CHEESE PATÉS, NO. 2.

Cut rounds of bread two and one half inches thick and with a sharp knife or smaller cutter cut the center nearly through; spread all over with soft butter, put into a quick oven till a delicate brown, grate enough dry cheese to make one large cupful; season with salt, cayenne and a very little dry mustard; moisten with cream and stock till you have a smooth paste, adding a few drops of onion juice; fill the centers of the bread rounds; the cheese must not be too soft; put in a quick oven till cheese is melted, then draw to the edge of the oven; put a spoonful of beaten white of egg on top of each center, let color for a moment and serve.

CHEESE RELISH.

Fill a baking dish with alternate layers of grated cheese, in which you have mixed a tiny speck of soda, a dash of cayenne pepper, and bread crumbs, placing crumbs in bottom of dish. When filled, pour over it rich milk, or cream, in proportion of one half pint to each cupful of crumbs. Salt to taste and bake for twenty minutes in a reasonably hot oven.

CHEESE PUFF.

Butter liberally two slices of bread and place one in bottom of baking dish; grate one fourth pound of cheese and sprinkle half of it over the buttered bread with a little salt, a dash of cayenne pepper, and soda the size of a pea; then add another slice of buttered bread and the rest of the grated cheese; season as before; whip two eggs to a froth and beat into one pint of milk; pour it over the bread and cheese mixture and bake a delicate brown; serve hot.

CHEESE WAFERS.

Take a quarter of a pound each of flour, butter, and grated cheese; mix them thoroughly with one quarter of a saltspoonful of cayenne pepper. Mix with yolk of egg and water to a smooth stiff paste; roll this out to the thickness of half an inch, then cut into pieces about three inches long and one inch wide. Bake these until they are lightly browned, and serve them as hot as possible.

CHEESE CUSTARDS.

Six tablespoonfuls of grated cheese, two of butter, four eggs, one cupful of milk with a teaspoonful of corn starch stirred into it, salt and pepper to taste. Beat the eggs very light and pour upon them the heated milk (with a pinch of soda), having thickened with the corn starch. While warm add butter, pepper, salt and cheese. Beat well and pour into greased custard-cups. Bake in a quick oven about fifteen minutes, or until high and brown. Serve at once, as a separate course, with bread and butter, after soup, or before serving dessert.

SALAD DRESSINGS, AND SALADS.

CREAM DRESSING.

To one pint of boiling cream, add two ounces of flour, stirred to a smooth paste with two ounces of butter; cook two minutes. Remove from sauce pan and add one ounce more of butter, stirring until cool and perfectly mixed; then season to taste with lemon juice, salt, pepper, and mustard (blending the mustard first in a little lemon juice). Add sliced olives; or, if preferred, use one tablespoonful of chopped parsley and one half teaspoonful of finely chopped onion; the olives are best with cabbage, and onion and parsley with mixed salads.

PLAIN DRESSING.

Beat one egg very light; add one tablespoonful of vinegar and cook in double boiler until thick; place one tablespoonful of butter in a bowl and pour the hot custard over it; beat until smooth, then add mustard and salt to taste--one half teaspoonful of mustard, and saltspoonful of salt is the usual proportion,--with half a teaspoonful of sugar to blend. Set away to cool. Just before using, add sufficient sweet cream to thin to the consistency of rich cream.

MAYONAISE DRESSING.

To the yolks of two eggs add a scant teaspoonful of mustard, equal quantity of salt, and a dash of cayenne pepper, stir, then add, very slowly almost drop by drop, one teacupful of olive oil. The mixture should be as thick as butter, then add one tablespoonful of lemon juice, if too thick, thin with sweet cream. For cabbage or potato salads it is well to add one half cup of sweet cream, while for tomato, aspic or plain, no cream should be used.

FRENCH DRESSING.

Mix one half teaspoonful of salt, with one half saltspoonful of pepper and two tablespoonfuls of lemon juice; then add slowly, stirring briskly, one half cupful of oil. Very nice for plain salads.

COOKED SALAD DRESSING.

Mix one tablespoonful of sugar, one teaspoonful of mustard, one teaspoonful of salt, a speck of cayenne and the yolk of one egg; add two tablespoonfuls of melted butter and one half cupful of milk. Stir over boiling water until it thickens. Take from the fire and add the beaten white of the egg and two tablespoonfuls of lemon juice.

AUNT SUSAN'S SALAD DRESSING.

Beat together one level teaspoonful of mustard, one heaping teaspoonful of sugar, one dessertspoonful of melted butter, one half teaspoonful of salt and the yolk of one egg; add one cupful of milk and cook in double boiler until it thickens; stirring all the while. When thick add lemon juice or vinegar to taste. This dressing can be kept any length of time by bottling, not necessary to seal.

SALAD CREAM.

Heat one half cupful of vinegar and one half cupful of sugar. When very hot add one half cupful of sour cream into which the yolks of two eggs have been beaten. Stir well, remove from the fire and then chill before using.

Very nice on cabbage salad.

SPRING SALAD.

In a salad bowl put a layer of fresh watercress, then a layer of thinly sliced cucumbers, then a layer of tomatoes with a teaspoonful of chopped chives. Repeat the process and put a border of watercress round the bowl. When ready to serve pour on a French dressing and toss until well mingled.

STUFFED TOMATO SALAD.

Select good sized, smooth, solid tomatoes, scald and skin quickly, slip into ice-water to chill, then carefully remove center without breaking under part; remove seed pulp with your finger, then fill with a chopped mixture of onion, cucumber, parsley, and cress; cover with mayonaise dressing and serve on platter garnished with lettuce leaves, or parsley. One should use judgment in regard to any mixture given in receipt of this nature, and omit any article not pleasing to individual tastes, for instance some prefer to omit parsley, others do not like onion, etc.

PLAIN TOMATO SALAD.

Choose smooth round medium sized tomatoes, scald, and skin quickly. Set away to chill, serve on lettuce leaves with thick mayonaise dressing.

TOMATO ASPIC.

To one quart of strained tomato juice, add one bay leaf, one teaspoonful of chopped onion, and one teaspoonful of salt; let boil ten minutes, strain through fine sieve, or cheese cloth. Set back on stove and thicken with two or more tablespoonfuls of cornstarch, previously dissolved in one third cup of cold water; let boil until clear, turn into wet mould, and set away to chill. Serve on lettuce leaves with thick mayonaise dressing.

SUMMER SALAD.

Take two small heads of nice tender lettuce; tear, do not cut, add one pint of wax or string beans, that have been cooked till tender. Add one medium sized cucumber, sliced thin, and one young onion, two hard boiled eggs, sliced, add a dash of cayenne pepper, cover with mayonaise or French dressing.

ITALIAN SALAD.

Select two small heads of crisp tender lettuce, wash carefully; pare and slice one medium sized cucumber; cut fine one third cupful of parsley; wash one bunch of water cress; clean six crisp round radishes but do not pare, slice thin; slice very thin as much onion as suits your taste, mix all together and dress with oil, lemon juice, salt and cayenne pepper, mixed thoroughly until the lemon cuts the oil; this result is obtained more quickly if your oil is thoroughly chilled and is added slowly to the lemon juice and salt; add pepper last. This is a delicate and delicious summer salad.

STRING BEAN SALAD.

String, wash and break into inch lengths one quart of tender beans, boil in salted water until tender; drain thoroughly, then mix with one cupful of French dressing, and let stand until cold. Serve on lettuce leaves, and just before sending to the table add a little more dressing.

LIMA BEAN SALAD.

If fresh beans are used boil until tender in salted water; in winter use the California dried beans and soak over night, then boil gently till tender; drain, and when cold sprinkle with salt and pepper; add one tablespoonful of chopped parsley and a few drops of onion juice; pour over a French dressing, or, if you prefer, a mayonaise; arrange on crisp lettuce leaves, garnish with hard boiled eggs.

NUT AND CELERY SALAD.

To three cupfuls of finely cut celery, add one cupful of chopped English walnuts; dress liberally with mayonaise dressing, thinned with cream. Garnish with celery leaves and slices of lemon.

PLAIN CELERY SALAD.

Wash and finely cut the celery, and cover with mayonaise creamed dressing. Serve with slices of lemon.

POTATO AND CELERY SALAD.

Cut in dice one pint of cold, boiled, potatoes, add two cupfuls of finely cut celery. Pour over one half cupful of French dressing; let stand twenty minutes. Then cover with mayonaise and garnish with celery leaves and sliced lemon.

POTATO SALAD NO. 1.

Cut cold boiled potatoes into small dice, add one tablespoonful of onion juice, or tablespoonful of chopped onion (if onion flavor is liked). Sprinkle with celery seed and dress with oil, salt, cayenne, and lemon juice, the same as Italian salad.

POTATO SALAD NO. 2.

Arrange a parsley border and lay on slices of boiled potato, add a few drops of onion juice, or bits of finely chopped onion, or celery; then add finely chopped whites of hard boiled eggs; ornament the top with chopped parsley and yolks of boiled eggs, and dress liberally with French dressing. Chill before serving.

POTATO SALAD NO. 3.

Slice five or six cold boiled potatoes, one cucumber, a dozen olives, and three small onions, into a bowl; add half a teacupful of capers, a few chopped meats of English walnuts, and cover with mayonaise dressing.

BEET SALAD.

Boil small sized beets till tender in salted water; remove the skin, scoop out the center--leaving the sides one quarter of an inch thick; pour over them a French dressing to which has been added a few drops of onion juice; stand aside for an hour. Chop up four stalks of crisp celery and one cucumber; add one tablespoonful of chopped parsley, one half teaspoonful of onion juice and the chopped pieces of the beet taken from the centers; mix all together, drain the beets, and fill with the mixture; arrange on water cress, pour over it a French dressing.

CABBAGE SALAD.

Select a solid, white, head of cabbage, cut in half; then slice as finely as possible, with sharp knife or cabbage cutter the quantity desired; let stand in cold salted water for half an hour, drain thoroughly, and dress freely with cream dressing, to which has been added a dozen sliced olives, and a teaspoonful of chopped parsley.

SALAD OF GRAPE FRUIT AND WALNUTS.

Remove the pulp carefully from the grape fruit and add walnut meats in proportion of one half to the quantity of pulp; make a dressing of three tablespoonfuls of oil, with salt to taste, a dash of cayenne pepper, and one tablespoonful of lemon juice; pour this over the grape fruit and walnuts, and serve very cold.

A SWEET SALAD.

Slice bananas, and place in pudding, or salad dish, alternate layers of banana and strawberries, covering each layer liberally with sugar. Cover with whipped cream. Instead of strawberries, oranges may be used.

ORANGE SALAD.

Beat the yolks of four eggs until very thick and light colored, then beat into them, gradually, one cupful of sifted, powdered sugar and half a level teaspoonful of salt; beat until the sugar is dissolved. Next add the juice of two lemons and beat again. Peel and slice thin, six bananas. Peel four oranges, cutting close to the pulp, pick out the seeds, and slice oranges across in thin slices. Put into a deep glass dish a layer of bananas, then of the dressing, then of the orange, then again a layer of each in the same order with banana on the top, and pour the remainder of the dressing over it. Set on ice and serve very cold.

SALMAGUNDI.

Cut into neat strips three cold boiled potatoes, one carrot, one large beet, one half of a small cauliflower--all boiled and cold. Pile in attractive order on a flat dish; chop a cucumber pickle fine and strew over the pile, cover with raw tomatoes, pared and sliced; surround with crisp lettuce leaves as an outer bordering and pour mayonaise dressing over all. Pass a boat of dressing with the salad, also toasted crackers and cheese.

LETTUCE AND GRAPE FRUIT SALAD.

Tear a head of washed lettuce into pieces. Pare and divide into carpels one grape fruit. With a pen-knife slit the white skin that envelops each carpel; take hold of the two ends, bend it back, and the fruit will fall out in little pieces, remove the seeds. Pour fruit and juice over the lettuce, and serve with a French dressing.

VEGETABLES.

CREAMED VEGETABLES.

Take equal quantities of carrots, turnips, asparagus, peas and cauliflowers. With a vegetable scoop cut the carrots and turnips into pieces a quarter of an inch square, or turn them into the shapes of olives, filberts, &c. Divide the cauliflowers and asparagus into small, neat pieces. Cook the vegetables separately in plenty of water; when tender drain and dry them; cover with white sauce and serve.

ESCALOPED ONIONS, CAULIFLOWER, OR ASPARAGUS.

Boil until tender, then put in baking dish and pour over sauce made of one tablespoonful of butter rubbed into one and one half tablespoonfuls of flour, pour over it one pint of hot milk, and cook until it is like a custard. Sprinkle thick with bread crumbs and bake one half hour. Cut the vegetables into small pieces before pouring over the sauce.

ASPARAGUS.

BAKED ASPARAGUS.

Place the asparagus with the root ends together in a baking dish; sprinkle in salt and black pepper; mix two tablespoonfuls of flour smoothly with soft butter to make a thin paste; spread it over the asparagus; cover the dish with a plate; lay a weight on it; cook it until the asparagus is very tender. It may be served in the dish in which it is baked.

ASPARAGUS ON TOAST.

Cut away the hard ends; wash, then tie lightly together in a large bunch with the heads all one way; set in deep kettle with the heads up, fill with salted water to within two inches of the top of the asparagus; cover and let boil until the stems are tender; the steam will have cooked the tops. Have ready bread toasted a delicate brown in the oven. Cut toast in strips about two inches wide, lay it on hot shallow dish or platter, butter liberally, drain the asparagus and pile it on the toast; sprinkle liberally with butter, pepper, and salt, and serve with cut lemon.

ASPARAGUS WITH WHITE SAUCE.

Make a good crust and line a baking dish, fill with cooked asparagus, dress with the white sauce; cover with top crust; and bake in hot oven.

ASPARAGUS PIE.

Make a good crust and line a baking dish filled with cooked asparagus, dressed with the white sauce; cover with top crust; and bake in hot oven.

ASPARAGUS PUDDING.

Beat together four eggs, a tablespoonful of butter, pepper and salt. Add three tablespoonfuls of flour mixed with one third teaspoonful of baking powder, then a scant cupful of milk, and finally the boiled, chopped tender tops of two bunches of asparagus. Put into a well greased mould with a top, cook in a pot of boiling water two hours; turn out and pour over it a cupful of drawn butter.

BEANS.

CREAMED STRING BEANS.

Cut the ends and string them. Put them in a covered saucepan with water, and cook till tender, drain, and remove any strings that may have adhered, then place again in the pan, add one cupful of cold milk, and salt to taste; thicken with flour mixed smoothly with

soft butter to the consistency of thick cream; let them cook until the sauce is thoroughly done, add a dash of pepper, and serve in hot covered dish.

WAX BEANS.

The yellow wax bean is very nice when young, prepare as you do any string bean, stew until tender, letting liquor boil away and seasoning with salt, pepper, and butter.

BOSTON BAKED BEANS.

Small navy beans are the best. Carefully pick over and wash one pint, soak over night in enough water to cover; in the morning place in a kettle with fresh water and boil for fifteen minutes; skim out of this water, and put into an earthen crock, add one large spoonful of molasses; one teaspoonful of mustard, salt to taste, and a large heaping tablespoonful of butter with water enough to cover; place a cover on the crock and set in the oven, cook them all day. They need to be watched at intervals of half an hour to see that the water is visible at the top of the beans; the last hour, if the oven is moderate, no more water should be added.

DRIED LIMA BEANS.

One cupful is sufficient for a family of five. Wash and put to soak over night. Steam in double boiler, with just water enough to float, until thoroughly tender. Salt to taste and add one tablespoonful of butter and a dash of pepper.

Dried beans can be freshened in an hour by soaking in hot water, and renewing the water as soon as it cools.

FRESH LIMA BEANS.

Boil until tender in just water enough to float, when nearly done, uncover and let water simmer away, add one cupful of sweet cream, and salt to taste just before serving. If you do not have cream, use milk, thickened with one teaspoonful of flour mixed with one tablespoonful of soft butter.

SUCCOTASH.

Take one cupful of cold cooked lima beans; add one half can of sweet corn, or equal quantity cut from cob; season to taste and add one teaspoonful of butter and one cupful of milk; cook until the corn is tender. Serve in hot, covered dish.

CORN.

ROASTED CORN.

Steam the ears until tender, then strip them, turn each ear in a flat plate in which there is a sufficiency of melted butter; then place them on a gridiron over a clean coal fire, and turn them until they are well toasted.

CUT CORN.

Steam the ears until tender, then strip them and cut the corn from the cob; add butter and seasoning to taste; place in hot covered dish; set in steamer until thoroughly heated through and serve very hot.

GREEN CORN--STEAMED.

Select nice full ears; and place in steamer with the husks on. Steam an hour or more until tender then strip the ears; cutting off both ends; heap the corn on a hot shallow dish and set in the oven a minute or two to dry.

CORN FRITTERS.

In the summer when fresh corn can be had, grate the corn from the cob and mix in proportion of one cupful of grated corn to three well beaten eggs; salt to taste and fry in hot butter by spoonfuls; serve hot. They are much more delicate and delicious than where flour and milk are used. The corn supplies both the milk and flour in its own substance. Grated, or very tender, canned corn can be used in the same way in the winter season.

BAKED CORN.

Chop as fine as possible the contents of one can of corn; add a heaping tablespoonful of butter; season to taste; add one pint of milk; put in baking dish; place in oven and bake until a nice brown.

CORN PUDDING.

Cut enough uncooked corn from the cob to fill a pint measure; place in covered sauce pan with a pint of cold milk; let cook until tender; then add two tablespoonfuls of flour smoothly mixed with cold milk. Stir until the mixture thickens; add two tablespoonfuls of butter; set it off to cool.

Beat the yolks of four eggs in a large bowl; beat whites separately to a stiff froth; then mix well with the yolks, add to the warm corn and milk mixture, put into a hot buttered baking dish and brown in quick oven.

CORN ON TOAST.

Take pieces of bread four inches square and fry a delicate brown in butter; then heap on the bread a large tablespoonful of stewed or canned corn and heat through thoroughly; serve very hot.

CORN PATÊS.

Chop finely half a can of corn; stir in bread crumbs until stiff; season with salt and pepper; fill patê shells two thirds full and lay piece of butter size of hickory nut on top of each filling; then pour over each one a tablespoonful of cream; place in oven and bake till delicate brown; serve hot. Very much like oysters.

If creamy dressing is preferred, omit the bread crumbs, and thicken the cream with a little flour and butter before pouring over the corn, use a little more cream to each shell.

CABBAGE.

TO BOIL CABBAGE.

Wash in cold water, and pick over very carefully. Put whole in a covered boiler, with the stem end down, sprinkle well with salt, pour over it a cupful of cold water, boil until it is very tender, then uncover it for the water to boil away; set it on the back of range to dry, take off the coarse outer leaves, serve it in a hot, deep, dish. Cut the cabbage into halves or quarters and lay butter on each piece.

CABBAGE IN WHITE SAUCE.

Cut a head of white cabbage in pieces two or three inches large, put them into a covered saucepan with salt, one cupful of cold water, and flour mixed to a smooth thin paste with soft butter; boil until the cabbage is very tender.

CABBAGE IN MILK.

Chop coarsely one-fourth large or one-half small head of cabbage; put over in saucepan with enough salted water to float; let cook until nearly done, then drain; add one quart of rich milk and cook until tender; add salt, pepper, and butter to taste.

HOT SLAW.

Chop one half large, or one small head of cabbage; put over in saucepan with salted water; cook till tender, but not soft; drain, add one-half cupful of vinegar, salt and pepper to taste, with one tablespoonful of butter.

BAKED CABBAGE.

Boil a firm, white, head of cabbage until tender, drain, and set aside until cold. Then chop fine; add two well beaten eggs; one ounce of butter; salt, and pepper, with three tablespoonfuls of cream; bake in moderate oven.

EGG PLANT.

ESCALOPED EGG PLANT.

Steam a whole egg plant until it is soft throughout; cut it in half, lengthwise; put each half into a vegetable dish; cut it in squares; sprinkle them with salt and moisten with Worcestershire Sauce; spread butter over them; dredge with powdered crackers; strew with pieces of butter and brown in a quick oven.

BAKED EGG PLANT.

Peel and cut in pieces enough egg plant to fill a quart bowl; steam until it can be mashed smooth; stir in two tablespoonfuls of butter, one tablespoonful of salt, and one half teaspoonful of black pepper; put it into a baking dish; smooth it over, dredge it with powdered cracker; strew it with pieces of butter; and brown it in a quick oven.

FRIED EGG PLANT.

Cut it crosswise into thin slices; fry them immediately in boiling cocoanut butter or vegetable oil; sprinkle both sides with salt and black pepper; cover the frying pan with a tin cover; set it on the back of range to steam until the egg plant is very tender; serve on a hot shallow dish.

EGG PLANT IN EGG AND CRACKER.

Cut it in thin slices across; fry it immediately in hot cocoanut butter or vegetable oil; lay the slices on a cold dish; sprinkle both sides with salt and black pepper; pour beaten egg over to moisten both sides; turn each slice in powdered cracker; fry them a second time in the boiling fat; lay them on a hot dish; serve them brown and crisp.

EGG PLANT BALLS.

Prepare as for baked egg plant; roll a tablespoonful into round balls in the palms of the hands, flatten them, pour beaten egg over them to moisten both sides, turn each in a plate of powdered crackers, fry them brown in boiling fat, and serve them on a hot shallow dish.

PEAS.

GREEN PEAS.

Do not wash peas, as it spoils their flavor and makes them less nutritious. Peas should not be shelled until immediately before using.

TO BOIL PEAS.

Put them into a covered saucepan, with cold water enough to float them; boil them until the peas are tender; then uncover them for the water to boil away; set them at the back of range to dry; serve them in a hot, covered, vegetable dish, with a tablespoonful of butter laid on them; or, if liked, one cupful of cream may be added just before removing from saucepan.

PEAS IN WHITE SAUCE.

Put the peas into a saucepan, with one cupful of cold water, and one teaspoonful of flour, mixed smoothly with soft butter to make a thin paste. Cover the saucepan, and boil the peas until they are very tender; add one-half cupful of cream and serve in a hot, covered dish.

PATÊS WITH PEAS.

Make little shells of puff paste and dress with peas stewed tender, to which has been added cream, thickened slightly with flour and butter.

PASTRY WITH PEAS.

Make little shells of pie crust and fill with young peas cooked tender and seasoned with pepper, salt, and butter; the peas should be carefully drained before filling the shells.

POTATOES.

BOILED POTATOES.

Boiled potatoes are more nutritious when boiled in the skin. They should be placed in a kettle with a sufficient amount of cold water to cover them, salted to taste, cooked in an uncovered kettle, and the water permitted to boil away; then let kettle remain on the back of range where they will keep hot, until the potatoes are dry and mealy. Peel before serving.

NEW POTATOES.

Small new potatoes with white skins need not be peeled, but should be buttered liberally and served in a hot dish.

MASHED POTATOES.

Boil until tender and place in colander, have ready a large bowl with tablespoonful of butter and half a cupful of cream; mash through the colander into a bowl, then whip potatoes and seasoning thoroughly with a fork, as a spoon destroys the delicacy; place in dish and set uncovered over steam to heat thoroughly. Serve quickly.

POTATO CROQUETTES.

To one pint of hot mashed potatoes add one tablespoonful of butter, one half saltspoonful of pepper, one half teaspoonful of salt, one dash of cayenne, one half teaspoonful celery salt, and a few drops of onion juice. Beat until very light. When slightly cooled, mix in yolk of one egg; add one teaspoonful of chopped parsley. Shape into croquettes, roll in fine bread crumbs, then in a mixture of egg and milk, roll again in bread crumbs, let stand about fifteen minutes in a cold place, then fry by plunging in very hot fat for a moment. Do not fry more than three at a time, in order not to chill the fat. Drain carefully.

POTATO PATÊS.

Take a tablespoonful of warm mashed potato in the palm of your hand, shaping it like a ball; then with a teaspoon take out a good part of the center. Fill this potato patê shell with minced onion and celery cooked tender in butter, and add a grating of cheese; season to taste, then cover it over with potato; dip into melted butter and egg; place in a shallow baking pan and place in a hot oven, let come to a nice brown; serve on platter garnished with parsley.

SARATOGA CHIPS.

Select medium sized potatoes, pare, wash, and slice them very thin; dry with a napkin. Have kettle of cocoa butter, or oil, heated to right temperature (see “Important Notes”) and sprinkle potatoes in kettle; do not crowd; when a delicate brown, skim out, and place in sieve in a warm place to drain; sprinkle lightly with salt.

PRINCESS POTATOES.

Boil and mash the desired quantity; while the potatoes are still warm spread them half an inch thick on a plate and set away to cool. When ready to use them, cut the potato into strips an inch wide and two inches long; dip the strips into melted butter, and then into well beaten egg, finally placing them in a baking pan and browning them in a hot oven.

WACHTMEISTER POTATOES.

Select potatoes of medium size and perfect shape; scour the skins, and steam until tender, then place in oven until skin is slightly toughened; remove from oven and open at one end, carefully removing contents, do not break the skins. Have ready a bowl of whipped cream; mash the potatoes and mix freely with whipped cream. Stuff back in potato skins and set in shallow dish, open ends up; place back in oven and let them get thoroughly hot, then serve. One who has been a strict vegetarian for years finds salt a poison; and it is omitted intentionally in the “Wachtmeister” receipt. It can of course be added to potato in mixing for those who desire it.

POTATOES IN WHITE SAUCE.

Peel and quarter potatoes, put them into saucepan (with salt, if desired) add flour and butter, mixed to a smooth paste, in the proportion of one tablespoonful of flour to two of soft butter, a teaspoonful of chopped parsley and just water enough to float potatoes; cover the saucepan and cook until potatoes are very tender.

LYONAISE POTATOES.

To one tablespoonful of finely chopped onion, add seasoning to taste; place in frying pan with two tablespoonfuls of butter and let fry a light brown, being careful not to burn. Have ready one quart of cold boiled potato cut in small dice, add and turn delicately with fork until potatoes have absorbed the butter; just before removing from fire add one tablespoonful of chopped parsley. Serve very hot.

ESCALOPED POTATOES.

Pare, wash and slice enough potatoes to nearly fill a baking dish; season to taste, fill the dish with cold milk and add one large tablespoonful of butter distributed over the top, bake in moderate oven, keeping dish covered until potatoes are nearly done. Then remove cover and brown.

FRENCH FRIED POTATOES.

Peel and cut in strips medium or small potatoes, wash, then dry with a clean towel. Have ready a kettle of cocoa butter thoroughly hot, drop in potatoes and cook until a delicate brown; if salt is used sprinkle slightly when taken from the fat, let drain in wire dish in the oven one minute, then serve in hot dish.

FRIED POTATOES.

A nice way to fry potatoes is to dip them in egg and then in bread crumbs; then fry until brown.

POTATO SCONES.

Boil potatoes in salted water; three good-sized potatoes making a sufficient supply for moderate family; drain and mash; mix with just enough flour to enable you to roll out the mixture, cut with biscuit cutter and bake on an ungreased griddle, turning frequently. The scones should have the thickness and consistency of wheat pancakes.

POTATO PEARS.

Cook five potatoes and rub through a strainer. While hot add two tablespoonfuls of butter, one half teaspoonful of salt, one fourth teaspoonful of celery salt, one fourth teaspoonful of pepper, a few grains of cayenne, and one teaspoonful of chopped parsley. Beat thoroughly and add yolk of one egg. Shape in the form of pears. Beat one egg, slightly diluting with two tablespoonfuls of milk. Roll the pears in the egg, then in crumbs, and fry in deep fat; dry on brown paper. Insert a clove at the blossom and stem of each pear. Garnish with parsley.

POTATO PANCAKES.

Grate six large potatoes; drain, and add pint of cream or milk, two well beaten eggs, one tablespoonful of flour, and beat well. Melt one teaspoonful of butter in frying pan, pour in a thin layer of batter; as it cooks loosen it from the pan, when a delicate brown, turn, and brown. Serve hot.

SWEET POTATOES.

BAKED SWEET POTATOES.

Wash carefully, cutting out any bruised spots; place in steamer. When they are tender put them in a quick oven to roast to a delicate crust.

ESCALOPED SWEET POTATOES.

Pare medium sized potatoes; cut into halves or into three slices, according to size; place a layer in a baking pan, add bits of butter, pepper, and a generous sprinkling of sugar; then add another layer of potatoes and seasoning. When all have been used, add enough boiling water to show through them, but not quite enough to cover them. Cover the pan and bake one hour in a moderate oven; then remove cover and bake one half hour longer until the potatoes are nicely browned on top. Serve in the dish in which they are baked.

SWEET POTATO CURRY.

Pare potatoes and cut into dice, about an inch in size; sprinkle with curry powder and brown in two tablespoonfuls of butter. When they are half cooked salt, pepper and cover with soup stock; boil until tender.

SWEET POTATO CROQUETTES.

Boil, peel, and mash six large sweet potatoes; season with salt, a tablespoonful of butter, one of sugar and a little pepper. When cold, mold into croquettes, dip into beaten egg, then into finely rolled bread crumbs, and fry brown in hot fat.

GLACED SWEET POTATOES.

Cut cold boiled, or steamed potatoes, into slices about an inch thick and season to taste. For one pint of potatoes, melt one fourth cupful of butter and add one tablespoonful of sugar. Dip the slices into this liquid and lay them on a large pan. Cook for twelve minutes in a very hot oven, or until they become a rich glossy brown. Serve hot.

FRIED SWEET POTATOES.

Peel and slice sweet potatoes about one fourth inch thick; fry in deep fat for about ten minutes, drain on a brown paper in warm oven for a few minutes, sprinkle with salt; serve hot.

BROWNED SWEET POTATO.

After potatoes are steamed until tender, peel and cut them in lengthwise strips; brown in hot cocoanut butter or vegetable oil.

WARMED UP SWEET POTATOES.

Any left over cold steamed potatoes can be made into a relish by peeling, slicing and frying a delicate brown in butter.

ONIONS.

Steam old onions; stew young onions.

TO STEAM ONIONS.

Put them whole into a baking dish, covered with a plate; set it in a hot oven to steam for three or more hours; take off the coarse outer skin and serve the onions in a hot, covered, vegetable dish, with butter, salt, and black pepper.

STEWED ONIONS.

Peel young onions and put them into a covered saucepan; add salt, one cupful of cold water, flour mixed smoothly with soft butter to make a thin paste, and one tablespoonful of chopped parsley; stew them until they are thoroughly tender; serve them in a hot covered dish.

YOUNG ONIONS IN WHITE SAUCE.

Select the young onions with green tops, cutting off the coarse part of the top; boil until tender; drain; place in vegetable dish and sprinkle with pepper and salt; add teaspoonful of butter; have ready one pint of milk, scalded and thickened with heaping teaspoonful of flour blended with melted butter, boiled sufficiently to thoroughly cook flour. Pour over the onions and serve.

BAKED ONIONS.

Bermuda, or large Spanish, onions are the best for baking, although the ordinary white onion will do; set them without peeling in a large pan of salted water, to which add one cupful of milk; boil until tender; drain and remove skins, put in baking pan; sprinkle with salt and pepper; add a very little of the water they were boiled in, and set in oven to brown. Pour melted butter over them and serve.

FRIED ONIONS.

Peel large onions; slice them very thin in rounds; sprinkle them with salt and red pepper; brown them in boiling cocoa butter, or vegetable oil; cover the frying pan with a tin cover; set it on the range to steam until the onions are very tender; serve them heaped on a hot, shallow dish; garnish them thickly with sprigs of fresh parsley to neutralize the odor after they are eaten.

ONIONS IN MILK.

Peel small white onions; nearly fill a quart bottle; put in two tablespoonfuls of soft butter mixed to a paste with a tablespoonful of flour, one teaspoonful of salt, and one half teaspoonful of white pepper; pour in a pint of cold milk; cork the bottle; set it in a saucepan of cold water over the fire to boil an hour or more; serve it turned into a hot covered dish.

Wash the leaves in cold water; shake out each leaf, and heap them on a colander to drain.

SPINACH.

TO BOIL SPINACH.

Put the leaves into a kettle to boil twenty minutes; then uncover the saucepan so as to boil the juice nearly away; turn the spinach into a colander; drain them into a hot vegetable dish, in which is butter, salt, and black pepper; turn it into the butter and salt; serve it with poached eggs on the top.

CHOPPED SPINACH WITH EGGS.

After spinach is boiled and dried, chop it in the saucepan very fine with a knife; set it over the fire again to dry; stir in butter, salt, and black pepper; break in two or more eggs; stir them with the spinach and let them cook until it looks quite dry; serve it in a hot vegetable dish.

SPINACH SOUFFLE.

Boil and dry spinach; chop it very fine in the saucepan and let it dry; stir in two tablespoonfuls of butter, one teaspoonful of salt, and one half teaspoonful of black pepper; let the butter be absorbed. Beat the yolks of two eggs in a large bowl, beat the whites to a stiff froth, mix them well into the yolks, stir in the hot seasoned spinach with a fork, and bake it in a hot buttered dish in a quick oven until the top is well browned.

TOMATOES.

TOMATO ON TOAST.

Use stale bread, cut in reasonably thick slices; dip in sweet milk, then in beaten egg, seasoned with salt and pepper; fry in butter till a nice brown. Have ready a quart of tomatoes that have stewed gently until reduced one fourth; season to taste; add one tablespoonful of butter and pour over fried toast. Just before serving place a poached egg on each slice.

STUFFED BAKED TOMATOES.

Select good-sized, smooth, solid fruit; wash, do not pare; cut out the hard center and remove seed pulp with finger. Fill in with mixture made of two cupfuls of bread crumbs, wet with one tablespoonful of melted butter; add two tablespoonfuls of chopped onion, one cupful of chopped celery, season to taste; heap the filling in tomatoes and put a piece of butter on top; place in earthen pie dish to bake. They should be in the oven until well browned on top; serve on squares of bread that have been fried a nice brown, in butter.

FRIED TOMATOES.

Wash and slice the tomatoes, without paring; sprinkle with seasoning, dip in flour, cook in frying pan with butter, a liberal supply of grease is required. Cover for a few minutes, so the tomatoes may steam through, and not brown too quickly, as they need to be well cooked; turn and brown on both sides. Serve on toast.

FRICASSEED TOMATOES.

Select large smooth tomatoes; cut them in half, do not peel. Take a broad agate, or enameled pan and melt in it two ounces of butter; cover the pan with the halved tomatoes that have been sprinkled with salt, and pepper, and dipped in meal; whole wheat flour is best. Put cover on pan and let cook until tomatoes are cooked through, but not broken. The fire should be moderate, and it is well to lift the tomatoes occasionally so they will not burn or stick to pan. When cooked, pour in one half cupful sweet cream, let come to a scald, and serve.

ESCALOPED TOMATOES.

Fill baking dish with alternate layers of bread crumbs and cold stewed tomatoes, well seasoned, finishing with bread crumbs on top, and break in bits over the top one heaping tablespoonful of butter, and bake until brown.

TOMATO AND RICE FRITTERS.

Add one teacupful of cold stewed tomatoes to two cupfuls of cold boiled rice; season to taste; bind with one egg well whipped; mould into smooth little shapes, and fry in butter.

DEVILLED TOMATOES.

Take two or three large firm tomatoes, not over ripe, cut them in slices half an inch thick and lay on a sieve. Make a dressing of one tablespoonful of butter and one of vinegar rubbed smooth with the yolk of one hard boiled egg; add a very little sugar, salt, mustard and cayenne pepper; beat until smooth and heat to a boil. Take from the fire and pour upon a well beaten egg whipping to a smooth cream. Put the vessel containing this dressing in hot water while the tomatoes are being broiled over a clear fire. Put the tomatoes on a hot dish and pour the dressing over them.

BREAD STUFFS.

HOME MADE YEAST.

Wash, pare, and soak one large potato. Steep one tablespoonful of hops (loose) in one pint of boiling water; mix one heaping tablespoonful of flour, one teaspoonful of sugar, one teaspoonful of salt, one teaspoonful of ginger; grate the potato into the flour mixture; let the hot water boil briskly for one minute, strain it over the flour and potato mixture, and mix thoroughly; if it does not thicken like starch, place it over the fire for a few minutes, stirring briskly. If too thick, add boiling water till thin as cream. When lukewarm or at 70 degrees, add one half cake of yeast. Raise in a warm place till frothy, beat it down every half hour. Bottle and keep in a cool place.

THREE HOUR BREAD.

Pour one cupful of boiling water over two tablespoonfuls of flour and beat well; when this becomes lukewarm add two teaspoonfuls of sugar and one yeast cake that has been dissolved in one half cupful of lukewarm water. Beat thoroughly, add flour enough to make a thick batter, beat until light and set in a warm place, about 90 degrees F. Keep covered and let rise until light and frothy, with this proportion of yeast it should rise in thirty minutes. When light add one cupful of scalded milk, cooled to lukewarm, and flour enough to make a stiff dough; stir in the flour with a spoon, beating it thoroughly; when the dough begins to stiffen, cut in the flour with a bread knife; add flour until the dough slips easily from the board, and does not stick to the hands. Then knead the dough on a slightly floured board until smooth, elastic, and full of air bubbles. Knead it firmly, but lightly, using only the wrist movements, put back in bowl, cover, and let rise in warm place until it doubles in bulk; shape into loaves, or biscuit; brush lightly with melted butter, and place in warm buttered pan. Let rise, closely covered, until loaves have doubled in bulk. Bake in an oven hot enough to brown one teaspoonful of flour placed on a piece of paper, in five minutes. If biscuits are to be baked, the oven should be hot enough to brown flour in two minutes. Let the bread bake from forty-five minutes to one hour. The first quarter of the time the bread should rise, but not form a crust; the second quarter the crust should form; the third the crust should become golden brown; the fourth

should complete the baking. Place the loaf to cool uncovered, and in such a position that the air can circulate freely around it, bottom and all.

WHOLE WHEAT BREAD.

Make a sponge of one half cupful lukewarm water, one half yeast cake dissolved in one fourth cupful lukewarm water, and one cupful of white flour; cover; and set in warm place,--about 90 degrees F.--until light and foamy; add one half cupful scalded milk, cooled to lukewarm, one half teaspoonful of salt and whole wheat flour to make a stiff dough; knead thoroughly, put into warm place, let rise until it doubles in bulk; mould into a loaf, put into a warm buttered pan, and keep closely covered in warm place until it rises sufficiently to double in size; put into a hot oven; at the end of fifteen minutes lower the temperature of oven and bake at least forty-five minutes longer. This makes one loaf.

ENGLISH UNFERMENTED GRIDDLE BREAD.

This bread is usually made from whole wheat flour. It is cooked on a griddle, hence its name “Griddle Bread.” The griddle should be made thoroughly hot before placing the dough on it, and sprinkled with a little fine white flour. Measure the meal, and for every two level measures of meal allow one measure of boiling water; have the meal in a mixing bowl, and use a wooden spoon for stirring. Make a hole in the center of the meal and pour the boiling water into it, stirring all the time till it forms a mass or lump. No kneading is required. Sprinkle the paste-board with fine white flour and turn the mass onto it. Roll out into cakes, making the cake about half an inch thick. The edge should not be ragged, but dredged with fine flour and pressed with the knuckles to an even thickness. Dredge fine flour on each piece, rub it well in with the fingers, then turn it on the other side with the knife and do the same, so that the surface has a fine smooth appearance. As each piece is prepared, place it on the hot griddle plate. Two or three minutes is sufficient time to prepare the bread from the moment the water boils. The time for the cooking necessarily varies according to the heat of the fire, which should be kept at an even temperature; twenty to thirty minutes will be found the average.

TEA ROLLS.

Make a sponge of one cupful of lukewarm water, one cake of yeast, one fourth cupful sugar, and flour enough to make a soft dough. When sufficiently raised add a little over a cupful of softened butter, and three fourths of a cupful of luke warm milk and enough flour to keep it a sponge. Beat well and let rise; then add beaten white of one egg and enough flour to knead. Knead thoroughly and let it rise again; work down; place in a buttered bowl; let it rise again, turn onto a board, roll, and cut. Shape to suit fancy, in finger rolls, bread sticks, or cleft rolls; place in pans and let rise; bake in hot oven. For Cinnamon Rolls, make as above only roll out one fourth inch in thickness and spread with softened butter, sugar, cinnamon, and currants. All bread stuffs brown better if brushed over with melted butter.

WHOLE WHEAT MUFFINS.

Take one and one half cupfuls of whole wheat flour, one cupful of common flour, two teaspoonfuls of baking powder, mix, and sift together; beat up one egg and add one cupful of milk; add one tablespoonful of melted butter and stir into the dry mixture; bake in gem pans in a hot oven for about twenty minutes.

CORN MUFFINS.

Mix thoroughly one cupful of white flour, one half cupful of fine yellow corn meal, one eighth cupful of sugar, two tablespoonfuls of baking powder; then beat one egg and stir in one cupful of sweet milk; stir into dry mixture; then add one tablespoonful of melted butter; beat well, and bake in muffin tins.

GRAHAM OR RYE GEMS.

To one and one half cupfuls of graham, or rye flour, measured after sifting, add one eighth cupful of sugar, two teaspoonfuls of baking powder, one half cupful of white flour and mix thoroughly; then add one cupful of sweet milk and two tablespoonfuls of melted butter, and stir quickly. Put in hot gem pans, bake for twenty-five minutes in hot oven.

BAKING POWDER BISCUITS.

To one pint of sifted flour add two teaspoonfuls of baking powder; sift together twice; then rub in one tablespoonful of shortening until fine, like meal. Mix in gradually enough milk to make a soft dough, cutting it in with bread knife; when stiff enough to be handled it should look spongy in the cuts, and seem full of air; turn it out on a well floured board, toss with knife until well floured, pat with rolling pin, and when dough is about half an inch thick, cut it into rounds and bake at once in hot oven.

PUFFS.

Sift one teaspoonful of baking powder into two cupfuls of flour; with one half teaspoonful of salt; add two cupfuls of milk and two eggs, beat the yolks and the whites of the eggs separately. Bake in gem pans in quick oven.

POP-OVERS.

With one cupful of flour, mix one saltspoonful of salt; add slowly one cupful of milk; when a smooth paste is formed add one cupful more of milk and one egg beaten thoroughly; beat well; cook in hot buttered gem pans or earthen cups in a quick oven for half an hour, or until the puffs are brown and well popped over. The more the milk and flour are beaten the lighter the puffs will be.

WAFFLES.

Sift together one pint of flour, one teaspoonful of baking powder, one teaspoonful of salt; add one and one fourth cupfuls of milk to smooth the batter; then add the well beaten yolks of three eggs; beat well; then whip in one tablespoonful of melted butter; and add the stiffly beaten whites of the eggs, cutting and folding these in. Have waffle-iron hot and well greased; butter as soon as taken from the iron. Sugar can be added at the same time, if relished.

BOSTON BROWN BREAD.

Take one pint each of whole wheat flour and Indian meal, one cupful of molasses, three fourths cupful of sour milk, and one half teaspoonful of soda, one and one half pints of cold water, mix; put in steamer on stove over cold water, which is afterwards brought to the boiling point and kept constantly boiling until bread is done; steam for four hours, and brown in the oven. Just before putting in the steamer add one cupful of seeded raisins.

BANNOCKS.

Two teacupfuls of oatmeal, or barley meal, sifted with two teaspoonfuls of baking powder; add two beaten eggs, one tablespoonful of sugar and one pint of milk with a little salt, sifting in the meal. Mix and bake on a griddle.

GRIDDLE CAKES.

To one cupful of flour, add one saltspoonful of salt, one tablespoonful of baking powder; sift thoroughly; add milk enough to make a batter like a thick cream; then whip in one teaspoonful of melted butter. One egg may be well beaten and added, though it is not necessary.

This receipt can be varied by using graham, corn, or whole wheat flour, in proportions of two thirds graham or wheat to one third white flour. Corn should only be one third corn to two thirds white flour.

HOMINY GRIDDLE CAKES.

To one cupful of sweet milk, add one cupful of warm, fine, boiled hominy; add one half teaspoonful of salt, two eggs,--whites and yolks beaten separately,--one teaspoonful of melted butter. In mixing add well beaten whites of eggs last. Use flour enough to make thin batter. Can be cooked either as griddle cakes or waffles.

RAISED GRAHAM GRIDDLE CAKES.

One cupful of graham meal, one cupful of flour, one half yeast cake dissolved in one quarter of a cupful of lukewarm water, mix with this one pint of milk scalded and cooled, and let it rise over night. In the morning add one tablespoonful of molasses, and one saltspoonful of soda. If the batter is too thick add a little warm water.

INDIAN MEAL GRIDDLE CAKES.

One pint of Indian meal, one teaspoonful of sugar, one teaspoonful of butter, add gradually to this sufficient boiling milk to wet the meal; when cool add two well beaten eggs, and sufficient cold milk to make a thin batter.

BREAD GRIDDLE CAKES.

One pint of stale bread crumbs; pour over them one pint of hot milk; add one tablespoonful of butter; when the crumbs are soft rub through a strainer and add the beaten yolks of two eggs, one cupful of flour, and two teaspoonfuls of baking powder. If the batter is not thin enough add a little cold milk.

RICE GRIDDLE CAKES.

Take one cupful of sweet milk, one cupful of warm boiled rice, the yolks of two eggs beaten until light, one tablespoonful of melted butter, and flour enough to make a thin batter; stir in lastly the whites of the eggs beaten stiff and dry. Bake on a hot griddle.

SOUR MILK GRIDDLE CAKES.

Sift one half teaspoonful of salt and one teaspoonful of soda into one pint of flour; add one scant pint of sour milk or cream, the beaten yolks of two eggs, and lastly the whites beaten very stiff. Bake on a hot, well greased griddle.

BREAKFAST FOODS.

WHOLE WHEAT.

Sift one cupful of whole wheat meal into one pint of boiling water; add salt to taste. Cook in double boiler and steam from one to two hours, until meal is thoroughly cooked. Very nice when cold fried in delicate slices and served with maple syrup.

Graham, rye, oat meal, or corn meal can be cooked in same way, only they require longer cooking. Corn requires the most time. Corn and oat meals need a larger quantity of water.

SANDWICHES.

CHEESE AND EGG SANDWICHES.

Beat two eggs in a bowl for two minutes, add two tablespoonfuls of milk, one eighth tablespoonful of salt, a sprinkle of white pepper; melt one half tablespoonful of butter in a small frying pan, pour in the eggs, stir until they begin to thicken, then sprinkle over one tablespoonful of freshly grated bread crumbs and two tablespoonfuls of cheese, stir for a few minutes longer, remove and put one tablespoonful of this preparation between two thin slices of bread.

EGG SANDWICH.

Break two eggs in a small bowl and beat until they foam; add a sprinkle of salt. Place a small frying pan over the fire with one tablespoonful of butter; as soon as butter is melted pour in the eggs, stir until they thicken, then remove. Butter four thin slices of bread, cover two with the eggs; lay over the remaining two slices; trim them neatly and cut them slantingly in half.

NUT SANDWICHES. No. 1.

Mix equal parts of grated Swiss cheese and chopped English walnut meat. Season with salt and cayenne. Spread between thin slices of bread slightly buttered, and cut in fancy shapes.

NUT SANDWICHES. No. 2.

Shell one half pint of peanuts and roll them fine with the rolling pin. Stir the yolk of one hard boiled egg to a cream with one half tablespoonful of butter, add one teaspoonful of French mixed mustard, one quarter teaspoonful of salt, one tablespoonful of lemon juice, one half tablespoonful of unsweetened condensed milk, one half cupful of finely chopped red apple, the finely chopped white of an egg, and the nuts. Put one tablespoonful of this mixture between two thin slices of bread; trim them evenly all around, and cut them slantingly into two pieces.

PLAIN CHEESE SANDWICH.

Butter the bread; lay thin slices of cream cheese to cover, add a lettuce leaf, and cover with another piece of buttered bread.

COTTAGE CHEESE SANDWICH.

Use crisp, square crackers, wet the cottage cheese with sweet cream, season to taste, and spread on crackers.

OLIVE AND CAPER SANDWICHES.

Chop olives very fine, add one third as much of finely chopped capers; mix thoroughly with a little soft butter; season with celery salt, cayenne, a very few drops of lemon juice, and a little of the grated lemon peel. Spread on thin squares of buttered graham bread.

CHEESE AND MUSTARD SANDWICH.

Grate one fourth pound of cheese and mix one half teaspoonful of salt and mustard, with a dash of cayenne pepper; melt one tablespoonful of butter and blend with seasoning; then stir thoroughly into the cheese; if liked, a teaspoonful of lemon juice may be added. Spread on thin slices of whole wheat, or white, bread.

BOILED EGG SANDWICHES.

Chop the whites of hard boiled eggs very fine; blend the yolks with a little cream or melted butter, season to taste, and spread on buttered white bread.

TOMATO SANDWICH.

Cut thin slices of brown bread; spread with French mustard; then a layer of cream cheese; sprinkle lightly with salt; peel and slice some small, solid, ripe tomatoes. Cover the prepared bread with the slices; form into sandwiches and cut in broad strips. Serve with water cress.

TOMATO AND EGG SANDWICH.

Chop the whites of four hard boiled eggs very fine. Mash the yolks and blend with a little thick cream, some tomato pulp, salt, pepper, and a tiny pinch of sugar. Spread on thin slices of brown, buttered, bread.

CHOCOLATE SANDWICH.

Melt one ounce of grated chocolate; whip in a little hot cream; add one half teaspoonful of vanilla flavoring, a little confectioner’s sugar, and the yolk of one egg. Stir until it begins to thicken, then whip in the whites of the egg beaten to a stiff froth.

Spread on thin slices of sponge cake, or white bread and butter.

MUSHROOM SANDWICHES.

Stew a few large mushrooms in one ounce of butter; cover closely and cook slowly so that they shall not burn; mash them with pepper, salt, and a dash of nutmeg; cut thin slices of whole wheat bread, butter and spread with the mushroom paste. Cut into finger sandwiches.

PINEAPPLE SANDWICH.

Cut small sweet sponge buns in slices; spread them with grated pineapple; sift with fine sugar; press two slices together and spread soft icing on top and sides.

ITALIAN SANDWICHES.

Make a mixture of chopped olives, grated cheese and chopped English walnuts in the proportion of two fifths each of cheese and olives to one fifth of nuts; then make a dressing of five tablespoonfuls of malt vinegar (or six, if ordinary vinegar is used) bring to a scald and stir into the well beaten yolks of five eggs; set the egg mixture back on the stove and stir constantly until it becomes as

thick as cream; then remove from the stove and beat in one tablespoonful of butter, whipping until the butter is dissolved and thoroughly blended. Season to taste with salt, pepper and mustard; if liked add a dash of cayenne. Stir in the chopped olives, nuts, and cheese. Spread between crisp square crackers, or thin slices of whole wheat bread.

FRUIT SANDWICHES.

Slice whole wheat or graham bread very thin, butter, then spread with a layer of chopped raisins, or candied cherries wet with orange juice.

GRAHAM SANDWICHES.

Chop olives; add a little chopped parsley and a little finely chopped celery; mix with mayonaise dressing to which has been added a few drops of onion juice and a very little French mustard; spread thin slices of graham bread very lightly with butter; then put a layer of the mixture; cover with another slice of buttered bread and cut into strips or squares.

RUSSIAN SANDWICHES.

Spread zephyrettes (crackers) with thin slices of cream cheese; cover with chopped olives mixed with mayonaise. Place a zephyrette over each and press together.

CAKES AND ICINGS.

CAKES.

Thin cakes require a hotter oven than those baked in thick loaves. Cakes with molasses in them burn more quickly than others. Thin cakes should bake from fifteen to twenty minutes, thicker cakes from thirty to forty minutes, and very thick loaves about one hour. If only the yolks of the eggs are used the cake is richer, if only the whites it is lighter. Have all ingredients ready, then see that fire and oven are right, and mix carefully. The secret of fine grained cake is in the mixing. First always cream the butter by beating, then add sugar slowly, creaming carefully, then add the well beaten yolks of eggs. Sift the flour and baking powder together three times, at least, then add alternately in small quantities the flour and milk, and last of all the stiffly beaten whites of eggs, working them in as lightly as possible.

ONE EGG CAKE.

Cream one half cupful of butter in a warm bowl adding slowly one cupful of sugar, whip the yolk of one egg and add to butter and sugar. Have ready two cupfuls of flour into which has been sifted two teaspoonfuls of baking powder; put flour and baking powder through sifter three times. Add flour and one cupful of milk slowly and alternately to butter mixture, adding last of all the whites of egg beaten stiff and one teaspoonful of flavoring. Bake in loaf in moderate oven for thirty minutes.

ORANGE CAKE.

Cream one third cupful of butter with one and one half cupfuls of sugar; add the well beaten yolks of three eggs and one teaspoonful of flavoring, beat well; add alternately, in small quantities, two heaping cupfuls of flour, into which two rounded teaspoonfuls of baking powder has been sifted, and one cupful of milk; last of all add the whites of the three eggs, beaten to a stiff froth, folding them into the dough lightly. Bake in shallow pans for about twenty minutes, or until cake shrinks from the pan. Put together with orange icing.

IDA’S CAKE.

Beat the whites of four eggs very stiff and set in refrigerator to chill; cream the yolks; add one cupful of sugar and a teaspoonful of lemon extract; sift flour until very light, and sprinkle in one cupful slowly, stirring lightly; then fold in the whites of the eggs as delicately as possible. Bake in moderate oven.

ANGEL FOOD.

Sift one cupful of flour and one half teaspoonful of cream of tartar together, sifting at least six times; add one cupful of sugar, sift again; beat the whites of seven eggs stiff; chill; then whip in the flour and sugar; flavor with one teaspoonful of vanilla extract. Bake

in moderate oven.

WATER SPONGE CAKE.

Beat the yolk of one egg, add one half cupful of sugar and beat again, add one half teaspoonful of lemon juice and three tablespoonfuls of cold water, then two thirds of a cupful of flour into which one half even teaspoonful of baking powder has been sifted, and lastly the whites of the egg beaten stiff. Bake in shallow pan or in small tins.

TEA CAKES.

Tea cakes that are much esteemed in southern households are made from the yolks of six eggs, half a pound of butter, one pound of sugar, one pound of flour and one teaspoonful of baking powder mixed with the flour. They should be rolled thin and baked in a quick oven. Frost with a thin icing or sprinkle while hot with granulated sugar.

POOR MAN'S CAKE.

Take three good-sized apples, pare, chop them fine, put them into a saucepan with two cupfuls of molasses, and boil until the apples are soft--say for three minutes--remove, and add one cupful of sugar, one egg, and one half teaspoonful of ginger, cinnamon allspice, clove and nutmeg, one cupful of strong coffee in which one and one half teaspoonfuls of soda are dissolved; two and one half cupfuls of flour.

This cake will keep all winter. These proportions make three large cakes.

COFFEE CAKE.

One cupful of brown sugar, one cupful of molasses, one half a cupful of butter, one beaten egg, one half a cupful of strong coffee, one tablespoonful of ground cinnamon, one teaspoonful of ground cloves, four cupfuls of seeded raisins, one cupful of thinly sliced citron, four cupfuls of flour into which has been sifted one teaspoonful of soda. Bake in moderate oven.

CREAM CAKE.

Dissolve one half teaspoonful of soda and mix with one scant cupful of sour cream, beat one egg and stir in, add a scant cupful of sugar and one and one half cupfuls of flour. This can be baked as a loaf, or in gem pans, or used for layer cake.

FRIED CAKES.

Two cupfuls of sugar, four eggs, one cupful of sour cream, and one cupful of buttermilk, one teaspoonful of soda, nutmeg to taste, flour enough to make a soft dough; roll until one half inch thick, cut in rounds, cutting out small ring in center; fry in hot cocoanut butter. The fat should be deep enough to float the cakes and hot enough to cook quickly; when nicely browned, drain, then powder with confectioner's sugar.

SUGAR COOKIES.

Mix one half cupful of creamed butter with one cupful of sugar, beat to a smooth cream. Whip one egg light and add to sugar and butter; add one teaspoonful of flavoring and one fourth cupful of milk with flour enough to make sufficiently stiff to roll thin, having previously sifted through the flour one half teaspoonful of baking powder. Roll a little at a time, cut out and bake about ten minutes in hot oven.

JUMBLES.

Two eggs, six tablespoonfuls of butter, six tablespoonfuls of sugar, one teaspoonful of lemon extract, a pinch of soda sifted in flour enough to make a dough stiff enough to roll. Roll very thin, cut and bake in quick oven.

GINGER SNAPS.

To one cupful of molasses add one half a cupful of water, in which has been dissolved one teaspoonful of soda; one cupful of sugar, one teaspoonful of ginger, one teaspoonful of cinnamon, one cupful of butter with flour enough to roll. Cut and bake in quick oven.

SOFT GINGERBREAD.

Dissolve one teaspoonful of soda in four tablespoonfuls of hot water, mix with three fourths of a cupful of molasses; add four tablespoonfuls of melted butter and one and three fourths cupfuls of flour with ginger enough to flavor; bake in gem tins.

MACAROONS.

One pound of sweet almonds blanched and beaten to a paste; mix with them one and a quarter pounds of powdered sugar, the grated rind of two lemons and the whites of six eggs. Drop on buttered paper and bake a light brown in a moderate oven.

LADY FINGERS, NO. 1.

Beat two eggs until light; add one teacupful of sugar, a little salt, and flavoring to taste. Use one teacupful of flour sifted with one teaspoonful of baking powder, making the dough of a consistency that can be rolled. Cut into strips the size of the finger and bake.

LADY FINGERS, No. 2.

One half pint whites of eggs, beaten very stiff; add gradually one half pound sugar, beating well all the time, add the yolks of the eggs and mix together lightly; then stir in very lightly one half pound of flour. Transfer the mixture into fingers on sheets of paper. Dust with powdered sugar, and put on pans and bake in hot oven. Watch them very carefully, as it only takes a few minutes to bake them. When cold they may be removed from the paper by placing them on the table face down, and washing the bottom of the paper with a wet sponge. Now turn back to their proper position and they can be easily removed. Join them in pairs and keep them covered until used.

ÊCLAIRS.

Put into an enameled saucepan one quarter pound of butter, one quarter pint of water, and a few drops of lemon juice; bring all to a boil; while boiling mix in smoothly one quarter pound of flour, draw back the saucepan from the fire and add to the mixture three well beaten eggs. Bake on greased tins in hot oven about twenty minutes. When done make a slit in side of each and quickly fill with either thick custard, or stiff whipped cream that has been sweetened and flavored; then as quickly as possible pour some chocolate frosting over the top. Serve when cold.

CREAM PUFFS.

Boil with a large cupful of hot water half a teacupful of butter, stirring in one teacupful of flour during the boiling; set aside to cool and when cold stir in four eggs, one at a time without beating; drop on tins quickly and bake in a fairly hot oven. When baked fill in with a cream made by beating together three tablespoonfuls of flour, one egg, and half a teacupful or more of sugar, according to taste; stirred into half a pint of milk while boiling, and flavored to liking.

FRUIT JUMBLES.

Beat to a cream one cupful of butter; add gradually one and one half cupfuls of sugar, the yolks of three eggs beaten, one teaspoonful of ground cinnamon, one half teaspoonful of ground cloves, one half a nutmeg, grated, the juice and rind of one lemon, three tablespoonfuls of sour milk, in which has been mixed three fourths teaspoonful of soda; one cupful of seeded and chopped raisins, the beaten whites of three eggs, and about three and one half cupfuls of flour; either roll and cut out, or drop by the spoonful on a buttered sheet.

CHOCOLATE STRIPS.

Cream three tablespoonfuls of butter, add gradually one cupful of sugar, add three tablespoonfuls of melted chocolate, one teaspoonful of vanilla and one cupful of flour, beat thoroughly, spread very thin on well buttered pans, bake in a quick oven, brush with the white of egg as soon as you take from the oven, cut into strips one inch wide while hot.

MISS FARMER’S SPONGE CAKE.

Beat the yolks of four eggs until thick, add gradually one cupful of sugar, and beat for two minutes; add three tablespoonfuls of cold water, mix and sift thoroughly one and one half tablespoonfuls of corn starch, one scant cupful of flour, one level teaspoonful of

baking powder, one fourth teaspoonful of salt; add to the first mixture the whites of four eggs beaten stiff, and one teaspoonful extract of lemon. Bake in a buttered angel cake pan for forty-five minutes, or in a shallow cake-pan for thirty-five minutes in a moderate oven.

VELVET CAKE.

Cream one half cupful of butter, add gradually one and one half cupfuls of sugar, add three egg yolks well beaten and one half cupful of cold water, mix and sift thoroughly one and one half cupfuls of flour, one half cupful of corn starch, two level teaspoonfuls of baking powder; add with the beaten whites of four eggs; cover with opera caramel frosting.

ICINGS.

SOFT FROSTING.

Boil one cupful of sugar and one third cupful of water until it will string, pour slowly on the beaten white of one egg, beating constantly until cool; flavor to taste.

CREAM ICING.

Two tablespoonfuls of cream and one half teaspoonful of flavoring, add sufficient confectioners' sugar to make stiff enough to spread. Any kind of fruit juice may be used instead of cream. Orange is very nice.

ORANGE ICING.

Yolk of one egg, grated rind and juice of one orange; confectioners' sugar to make thick enough to spread.

OPERA CARAMEL FROSTING.

Cook one and one half cupfuls of brown sugar, three fourths cupful of thin cream and one half tablespoonful of butter until a ball is formed, when the mixture is tried in cold water. Beat until ready to spread.

DESSERTS.

PASTRY.

Sift one cupful of flour and one saltspoonful of baking powder together. Rub in two tablespoonfuls of shortening, mix quite stiff with ice water, using about one fourth cupful. Turn out on a floured board, pat, and roll till one fourth inch thick, then distribute one teaspoonful of butter over the surface. Sprinkle with flour and fold over and over, roll out again into a long strip, then roll like a jelly roll, and cut from end as needed, and roll out from end. The secret of good pastry is to thoroughly chill material.

For all fruit and custard pies brush bottom crust with white of egg before putting in filling. The crust will then remain dry and delicate.

A RICH PUFF PASTE.

One quart of flour and one pound of butter; sift the flour and work in the yolk of an egg well beaten; mix with ice water and roll out to the thickness of an inch or less. After the butter has been worked in cold water to extract the salt, place it on one half of the dough, folding the other half over it, set away for fifteen minutes in an ice chest, or other equally cold place, and then roll out into a long strip, which fold into three parts by turning over each end and rolling each fold; repeat this operation six or seven times. The colder the dough can be kept while being worked in this way, the better will be the results.

MINCE PIES.

To one cupful of water add one cupful of molasses, one cupful of sugar, one beaten egg, one cupful of vinegar, two and one half Boston crackers, rolled fine, one cupful of stoned raisins, butter the size of an egg, one quarter of a teaspoonful of cloves; two thirds of a teaspoonful of cinnamon; two thirds of a teaspoonful of allspice.

This will make three pies. The pies should bake slowly, taking about three quarters of an hour. A grating of nutmeg should be added to each pie before putting on upper crust. The egg, cracker, and slow baking thickens this apparently thin mixture.

FRUIT PIE.

Carefully wash two thirds of a cupful of dried currants, add equal quantity of seeded raisins; with one cupful of sugar and one cupful of water; place in saucepan and boil gently for one half hour; remove from the fire and add two tablespoonfuls of vinegar, with cinnamon, cloves, allspice, and nutmeg to taste; two chopped apples, one tablespoonful of rolled crackers, half a cupful of chopped, sweet pickled peaches, or any preserved or spiced fruit; bake with two crusts. This will make two pies.

CREAM PIE.

Make a boiled custard, with one pint of milk, yolks of two eggs well beaten, and three tablespoonfuls of sugar, place in double boiler and thicken with one tablespoonful of flour that has been blended with melted butter, add one half teaspoonful of vanilla, let cook until flour is thoroughly done (if too thick a little more milk can be added). Have ready a baked pastry, fill with the mixture; then whip the whites of the two eggs to a very stiff froth and add one half cupful sugar and a few drops of flavoring, spread over the pie; set in oven just long enough to set the frosting and touch it with delicate brown. Serve cold. A chocolate pie can be made after the same method by omitting the yolks of the eggs and beating into hot milk one-fourth cake of chocolate.

CUSTARD PIE.

Beat three eggs until light, add three tablespoonfuls of sugar and beat again. Then grate sufficient nutmeg to flavor, and add three cupfuls of scalded milk. Bake slowly in single crust; as soon as the custard puffs and a knife blade can be dipped in and comes out clean, it is done.

LEMON PIE.

Beat the yolks of three eggs until thick, add one cupful of sugar and the grated yellow rind of one large lemon (be very careful not to grate any of the white of the lemon skin or it will make pie bitter), also the juice; beat until thick and light colored, then add one tablespoonful of corn starch, dissolved in a little water. Pour into a pie shell and bake slowly until it puffs. Beat the whites of the eggs until light, then gradually add three tablespoonfuls of sugar and beat until stiff. When the pie is slightly cooled, cover with this frosting, return to oven, and let it get a very delicate brown. Serve cold.

SQUASH PIE.

To one and one half cupfuls of prepared squash, add one cupful of scalded milk, one half cupful of sugar, one saltspoonful of cinnamon, a dash of nutmeg and cloves, and one egg well beaten, pour in egged crust, and bake thirty minutes, or until it puffs up all over. Sweet potato may be used in place of squash. To prepare squash or sweet potato, steam and mash.

RIPE CURRANT PIE.

To one cupful of the fruit, washed and removed from stems, add one cupful of sugar; one cupful of cream, and one tablespoonful of flour; bake with only an under crust.

NEUFCHATEL CHEESE PIE.

One Neufchatel cheese, one teacupful of sugar, grate the rind of one lemon and use with it one half of the juice, half a teacupful each of rolled cracker crumbs, and currants, four eggs, one tablespoonful melted butter, half a teacupful of cream, or rich milk, half a nutmeg grated and one saltspoonful of salt. Crumble the cheese and cracker crumbs well together, beat the eggs with the sugar and add to cracker mixture, following with the butter and cream. If the cream is very rich the butter may be omitted. Lastly, add lemon, nutmeg and currants. The currants should previously be washed, dried and dusted with flour. Mix all well together and put into well buttered patty-pans that have been lined with puff-paste. Bake fifteen or twenty minutes in a quick oven. They will puff up, but must not be permitted to get too brown.

PINE-APPLE TART.

Line a pie plate with pastry, and fill with mixture made of one ounce of butter, and one half cupful of sugar beaten to a cream; the well beaten yolks of five eggs, a grated pineapple, one teacupful of cream and add last of all the whites of the eggs beaten stiff and folded in lightly, with a little more sugar.

ALMOND PEACH PIE.

Line a pie dish with puff or good plain paste, lay halves of canned peaches, with the stone side up all over the bottom of the crust; fill the cavity where the pit was with a spoonful of chopped almonds; sprinkle with sugar and pour over a very little of the peach juice; cover with a crust, and bake till a nice brown; serve with, or without cream.

PUDDINGS.

IRISH MOSS JELLY.

Pick over and wash carefully one half cupful of Irish Moss. Put it into one pint of boiling water, add the thin yellow rind cut from one lemon, and one cupful of sugar; simmer until the moss is dissolved, add the juice of lemon and a grating of nutmeg, and strain into a cold, wet, mould. Set away to harden; serve plain, or with cream. Orange may be used in place of lemon, though a dessert spoonful of lemon juice used with the orange improves the flavor. This Irish Moss may be substituted in place of gelatine in all delicate puddings calling for that animal product; it is to be had at any druggist's.

SAGO MILK.

Soak a cupful of sago in a quart of cold milk; put in a double boiler with one cupful of sugar; cook until the sago is dissolved; pour it into a dish, and stir in ten drops of the essence of lemon or vanilla. Serve it hot or cold.

SAGO JELLY.

Soak a cupful of sago in a quart of cold water over night; boil in double boiler for an hour; then uncover it for the water to boil away. Add two cupfuls of sugar and the strained juice of a lemon; pour it into a dish in which it may be served. Serve it cold, with smooth fresh cream, sweetened and flavored.

ORANGE FOAM (FOR TWELVE PERSONS).

To the juice of twelve oranges (the small, tart ones are best) add the juice of one lemon, the grated yellow rind of two oranges, and three cupfuls of sugar. Whip till very light the yolks of twelve eggs; then whip in the prepared juice. Whip the whites of eggs as stiff as possible (keep them well chilled while whipping) and beat in lightly, yet thoroughly, the prepared mixture. Serve in punch glasses with lady fingers. Place half of a lady finger in bottom of each glass. The amount of sugar used may vary according to the flavor of the oranges. If the foam is not stiff, then add more whites of eggs. It is difficult to give exact quantities because the flavor and juiciness of the fruit varies so. This should be prepared just before serving.

NEAPOLITAN PUDDING.

Dissolve a cupful of currant jelly in a cupful of hot water; thicken with dissolved corn starch (be careful not to use too much corn starch, only just enough to make it stiff when chilled). Have ready a chilled mold, pour in the mixture as soon as the starch is thoroughly cooked, and the white of one egg, whipped till very stiff, is added to the mixture. Then make an equal quantity of strong sweet lemonade, bringing this to a scald, thicken the same way, adding egg in same manner; pour this as second layer in mold. Then take two cupfuls of milk, bring to a scald, sweeten, and thicken as before, then add the yolks of two eggs, well beaten, whipping in one half teaspoonful of vanilla flavoring, add to previous layers in mould (the layers can be placed in order to suit fancy), set away to chill thoroughly, and serve with whipped or plain cream. Other fruit flavors can be used in same way--pineapple or apricot syrups are very nice.

FRUIT MANGE.

To one pint of boiling water, add the juice of two nice, though any sauce may be used--brought to a scald, add one tablespoonful dissolved corn starch with sugar to taste; let boil until starch is well cooked, remove from stove and add the whites of two eggs, beaten stiff; pour into wet mould, and chill. Serve with cream and sugar.

LEMON SNOW.

To one pint of boiling water, add the juice of two lemons, and two tablespoonfuls of corn starch, well mixed with one and one fourth cupfuls of sugar; strain, and cook until thick. When partly cooled, beat vigorously with a wire egg beater or spoon, add the whites of three eggs, beaten to a stiff froth, whip in thoroughly, and pour into a chilled, wet mould; when firm and cold, turn out and serve with cold boiled custard and jelly, or cream and sugar.

ORANGE SOUFFLÉ.

Make a boiled custard with the yolks of five eggs, a quart of milk, and sugar to taste. When cool pour it over four sliced oranges, from which all seeds and tough fibre have been removed, and to which has been added one cupful of sugar, and grated rind of one orange. Place this in baking dish, cover with a meringue made of the whites of four eggs; then place the dish in a shallow pan of cold water and put in oven until the meringue is a golden brown. Serve cold.

ORANGE CUSTARDS.

Beat the yolks of six eggs with one and one half cupfuls granulated sugar till light; add to this two cupfuls of orange juice, the juice of one lemon, and the grated peel of one orange; fill in small cupfuls and place in steamer, when solid set away to chill; serve on boiled rice, over which pour a pint of rich cream, sweetened and flavored with a little grated peel of orange.

CHESTNUT CREAM.

Roast the chestnuts, then grate to powdered flakes, heaping lightly in middle of pudding dish, surround with apricot jam, and serve with whipped cream.

PEACH CAKE.

Have sponge or plain cake baked in two layers; cut or slice canned peaches; cover a layer of the cake with the cut peaches; put on another layer of cake and more peaches and turn over all well sweetened and flavored whipped cream.

STEAMED CABINET PUDDING.

Use one tablespoonful of butter to grease a three pint pudding mould. Take one cupful of fruit; raisins, candied cherries, or preserved fruits, as you prefer; sprinkle one half the fruit in the buttered mould, then break in stale cake or bread crumbs, mixing with it the rest of the fruit, filling the mould lightly. Then whip up three eggs, add to them three tablespoonfuls of sugar and three cupfuls of milk, pour over the cake and fruit mixture. Let stand one hour, then steam for one and one fourth hours. Serve hot with creamy sauce.

COLD CABINET PUDDING.

Make a custard of one pint hot milk, yolks of three eggs, three tablespoonfuls of sugar; thicken with corn starch. Flavor with teaspoonful of vanilla. Decorate a mould with candied fruit; cover fruit with custard; cool, add a layer of lady fingers or stale cake, then a layer of fruit and more custard, and chill; continue until the mould is full. Serve with whipped cream and candied cherries.

PRUNE WHIP.

Wash thoroughly one half pound of prunes and soak three hours in enough water to cover; cook in same water until the consistency of marmalade. Rub through a sieve, sweeten. Whip the whites of four eggs, and add the prunes (which should be thoroughly chilled); beat until well mixed; pile lightly on a buttered platter, and bake until a delicate brown. Serve with whipped cream or soft custard.

WASHINGTON PIE, CHOCOLATE FILLING.

Make a plain cup cake, and bake in two layers. For the filling, beat the yolks of two eggs till light, and add one half cupful of sugar; stir this into one half cupful of milk; melt two ounces of chocolate and stir into the milk; put on stove, and cook till it thickens; beat till cool, flavor with vanilla and spread on the cake between layers and sprinkle confectioners' sugar on top. Plain Washington pie has simply a dressing of whipped cream, sweetened, and flavored with vanilla, between the layers.

STRAWBERRY CREAM CAKE.

Make cake the same as for any good layer cake. For the filling take one cupful of thick sweet cream, whip until stiff, add four tablespoonfuls of fine grained granulated sugar and one pint of strawberries, crushed slightly, and sweetened. When cake is perfectly cold spread between layers. This should not stand long before serving.

CHARLOTTE RUSSE PIE.

Three eggs, one and one half cupfuls of sugar, two cupfuls of flour, one teaspoonful of pure cream of tartar, one half cupful of cold water, one half teaspoonful of soda. Beat the eggs thoroughly with the sugar, add one cupful of flour with even teaspoonful of pure cream of tartar, then water, and another cupful of flour. Enough for two pies.

Filling--Pure, sweet cream, beaten until stiff; sweetened to taste; flavored with vanilla. Cut open pie, fill, and pile some cream on top. Two cupfuls of cream will fill two pies.

STEAMED FRUIT PUDDING.

Make a dough of six heaping tablespoonfuls of flour; pinch of salt, one heaping teaspoonful of baking powder, two tablespoonfuls of cream, and water enough to make a soft dough; mix as lightly as possible. Then add one pint of any preserved or stewed fruit that is desired, the fruit should be well sweetened; steam for forty minutes. Be particular to keep the steam at regular heat, not letting it die down. Serve with syrup, made of the fruit juice, or hard sauce.

CHARLOTTE RUSSE.

One quart of rich, sweet, cream; whipped to a stiff foam; sweeten, after whipping, with two tablespoonfuls of sugar, and flavor with scant teaspoonful of vanilla extract. Line a glass bowl with separated lady fingers, and heap the whipped cream lightly in the bowl. Chill, and serve within an hour.

CONNECTICUT INDIAN PUDDING.

Add to three tablespoonfuls of cornmeal, three fourths of a cupful of molasses and a little salt; mix well; put one generous quart of milk in double boiler; when scalding hot add the meal and molasses; stir till free from lumps; let cook for five minutes; then butter well a baking dish, grate the rind of two or three oranges; put a layer on the bottom of the dish; pour in the liquid and put the rest of the grated peel on top; add one tablespoonful of butter to one fourth cupful hot milk; pour over pudding; bake three hours in a moderate oven; eat with rich cream, or hard sauce.

CHINESE PUDDING.

Whip one pint of cream and set it in a pan of cracked ice; add one half cupful of chopped preserved ginger, one half cupful powdered sugar; one half cupful of cold boiled rice.

Dissolve one half cupful of Irish moss in boiling water, using as little water as possible; strain, and stir into the cream mixture; stir until it thickens. Set away to harden, and serve with ginger sauce.

BANANA PUDDING.

Make one quart of strong sweet lemonade, bring to a scalding point, add juice of one orange. Thicken with dissolved cornstarch, the same as any cornstarch pudding; being careful not to make too stiff. Have ready the whites of two eggs, beaten very stiff. When the corn starch is thoroughly cooked, set the dish off the stove and whip in the eggs. Then slice in two bananas, pour in moulds, set away to chill thoroughly, serve with cream and sugar. This is quite as delicious as any gelatine pudding.

CREAM RICE PUDDING.

Two cupfuls of milk, two tablespoonfuls of rice, two tablespoonfuls of sugar, one half saltspoonful grated nutmeg, one half cupful stoned raisins. Stir frequently. When it begins to thicken add more milk, sweetened and spiced; when rice is tender add one half cupful cream and remove from oven. Serve cold.

SWEET POTATO PUDDING.

Peel and grate the potatoes. To one quart of them add two eggs, two tablespoonfuls of butter, three fourths of a cupful of sugar and one cupful of sweet milk. Cream the butter and sugar, add the eggs, stir well, then add the other ingredients, stirring briskly. Bake one hour. Serve hot without sauce.

OAT MEAL PUDDING.

To one cupful of cold boiled oatmeal, add one cupful of sugar, three cupfuls of milk, two well beaten eggs, one tablespoonful of vanilla and one half cupful of seeded raisins; bake in moderate oven about three quarters of an hour.

SNOW BALLS.

Cook one cupful of rice until tender. Wring small pudding cloths (one third yard square) out of hot water and lay over a small bowl. Spread rice one third of an inch thick over cloth. Put an apricot in the center, filling in each half of apricot with rice. Tie tightly and steam ten minutes. Remove the cloth carefully and turn the balls out on a platter, and serve with apricot sauce. Canned apricots may be used. If fresh fruit is preferred steam the apricots tender before removing stones.

CREAM PUDDING.

Stir together one pint of cream, three ounces of sugar, the well beaten yolks of three eggs, with scant teaspoonful of vanilla flavoring. Whip the whites of the eggs very light and add last, stirring lightly. Pour into baking dish that has been well buttered and upon which has been sprinkled bread crumbs to the thickness of ordinary pie crust. Sprinkle bread crumbs over the top of pudding, set dish in shallow pan half filled with water, and bake the same as any custard.

FRENCH BREAD PUDDING.

Butter small thin squares of bread and spread with jam, or tart jelly; place them in a buttered pudding dish; have the dish about one half full; pour over a boiled custard (using the yolks only for the custard); beat the whites of two eggs, adding gradually two tablespoonfuls of powdered sugar; beat one large tablespoonful of the jam or jelly used; heap on top of the custard and brown slightly in the oven.

SAUCES FOR PUDDINGS.

APRICOT SAUCE.

Take one cupful of apricot juice, thicken with one teaspoonful of corn starch and sweeten with one half cupful of sugar; let boil until clear.

HARD SAUCE.

Beat together one half cupful of butter and one cupful of sugar until it is creamy and white; flavor with one teaspoonful of vanilla extract.

CREAMY SAUCE.

Cream one half cupful of butter, then stir in one cupful of powdered sugar, a little at a time, and beat until very light. Then add one fourth cupful of cream or milk and one scant teaspoonful of vanilla flavoring. Just before serving set the bowl in a pan of hot water, and as soon as the sauce is smooth and creamy remove from fire. It should not be heated enough to melt the sugar.

GINGER SAUCE.

Chop finely one fourth cupful of preserved ginger; add one cupful of water and a quarter cupful of sugar, and boil for five minutes. Pour it over the well beaten whites of two eggs, add two tablespoonfuls of lemon juice, and chill.

CURRANT JELLY SAUCE.

Put four tablespoonfuls currant jelly in a saucepan with one teaspoonful of butter; let it heat and melt slowly; pour over one half cupful of boiling water, moisten one teaspoonful of cornstarch with a little cold water; add to the other ingredients and cook five

minutes; add the juice of one orange, grated peel of one half orange and one and one half tablespoonfuls blanched almonds finely chopped.

EGG SAUCE.

One cupful of sugar, a tablespoonful of butter, two eggs, a little salt, and a teaspoonful of vanilla, or any flavoring preferred. Mix the butter and sugar to a cream, add the yolks of the eggs, and beat until very light. Beat the whites to a stiff froth and stir in, add flavoring and beat well together. This is especially good for apple or berry dumplings. Lemon is nice to flavor it when used for apple puddings, but should not be used for other fruits. When a plainer sauce is desired, leave out the butter.

APPLE DESSERTS.

STEAMED APPLES.

Wash, pare, and remove cores of six tart apples; place in earthen dish and put in steamer, over boiling water. Steam until soft. Serve with steamed oatmeal or boiled rice, and cream and sugar.

BAKED APPLES.

Wash, and core sour apples. Place them in earthen or granite dish and fill the center of each apple with sugar. Measure one tablespoonful of water for each apple and pour around the apples (not over, as you should not disturb the sugar in apple centers). Bake until tender, remove apples to the dish in which they will be served at table. Strain the juice, add one third cupful of sugar. Cook five minutes, and pour it over the apples, let cool, and serve with cream.

APPLE FRITTERS.

Core, pare, and cut apple into slices one fourth inch thick, sprinkle with sugar and cinnamon or nutmeg, and set them aside while making batter.

Beat the yolks of two eggs, add one tablespoonful sugar, one half cupful of sweet milk, and enough flour to make it almost a drop batter. Melt one tablespoonful of butter and add to mixture. Beat in the well whipped whites of two eggs. Dip each slice of apple into the batter, see that it is well covered and quickly drop into a kettle in which is sufficient hot cocoa butter or vegetable oil to float it; fry until the apple is soft, and the fritter a light brown on both sides. Drain, trim, and sprinkle with pulverized sugar. Serve hot.

APPLE DUMPLINGS BAKED.

Select moderate sized, tart apples; pare, core, and steam until tender, not soft; have ready a plain pie crust rolled thin in pieces size of small pie plate. Place one apple on each piece of crust, fill the core with sugar, spice to taste and add teaspoonful of hot water to sugar. Wrap crust about the apple pinching it together, place in hot oven and bake until crust is well cooked; serve hot with hard sauce.

APPLE SLUMP.

Cut apples as for pies and fill a rich undercrust of a good thickness; cover with a thick topcrust and bake in a slow oven for about an hour; when baked remove the top crust, add sugar and spice, and butter half the size of an egg, mix with the apple; then remove part of the apple. Place the top crust in an inverted way upon what remains, and the apple that has been taken out on top of that. Should be eaten hot.

APPLE RICE.

Fill a pudding dish half full with tart apples, pared, quartered, and sprinkled thickly with sugar, and a grating of nutmeg. Wash thoroughly half a cupful of rice and sprinkle over apples in pudding dish. Steam until rice is tender. Serve with cream and sugar.

APPLE CREAM.

Place in an enamelled pan with a wineglassful of water, one pound and a half of minced apple, half a pound of pulverized sugar, the finely minced rind of half a lemon, and a quarter of an ounce of ginger powder; simmer gently till soft enough to pass through a

sieve. When cold, beat in thoroughly one pint of cold fresh cream, or new milk which has previously been brought to a boil, and sweetened.

APPLE FLUMMERY.

To two pounds of peeled and cored apples add one pound of sugar, and the minced rind of a fresh lemon; place in an enamelled pan, cover with water and steam till quite soft, strain and beat the fruit to a pulp. Boil in the strained liquor one ounce of Irish moss for fifteen minutes, strain the liquor again, and add the crushed fruit, simmer for three minutes, turn into a chilled and wet mould. Let stand until solid and well chilled. Serve with cream.

SHORT CAKES.

Take one quart of flour, one teaspoonful of salt, one pint of rich sour cream; dissolve one teaspoonful of soda in a little boiling water and stir into the cream; dissolve one tablespoonful of butter and add to cream; then stir in flour, roll out as you would for biscuit; bake in round pan in two layers, spreading butter between the layers; when baked, take apart and spread with any prepared fruits.

If preferred, sweet milk and baking powder may be used in place of the sour cream and soda. And the following is an excellent receipt:

RACHEL'S SHORT-CAKE.

Two cupfuls of flour, one third cupful of butter, two well rounded teaspoonfuls of baking powder, one cupful of milk, one half teaspoonful of salt. Roll in two layers one half inch thick, butter well between layers and on the top and bake.

STRAWBERRY FILLING.

Mash one quart of strawberries in an earthen dish, add sufficient sugar to make a rich sweetness, set the dish in the oven until the dish is heated through, butter each half of the short-cake, covering with the crushed fruit, and putting a liberal supply on top, sprinkle with pulverized sugar, and serve with cream.

ORANGE FILLING.

Get small, tart, juicy oranges, pare half dozen or more, carefully remove all the white, and slice; take out all the seeds and tough fibre; then crush with enough sugar to make very sweet.

Place in agate saucepan and set on back of range to get thoroughly hot; butter the short cake liberally and apply filling between layers and on top; serve with whipped cream.

CRANBERRY FILLING.

Wash the berries and pick them over carefully; cook in agate saucepan with water enough to float over a moderate fire; mash through a colander; then add sufficient sugar to make very rich and sweet; set back on range until sugar is thoroughly dissolved; butter short-cake liberally and apply filling between layers and on top.

PINEAPPLE FILLING.

Get a ripe pineapple; pare and slice; then shred with a silver fork; cover thickly with sugar, and set away for three or four hours; then set on range in an agate kettle to heat thoroughly; butter short-cake liberally, and apply filling between layers and on top; serve with whipped cream. Canned pineapple may be used, though the fresh fruit is best.

BANANA FILLING.

Slice three bananas and one orange, grate the outside rind of the orange and mix with one cupful of sugar, and juice of orange; pour on the sliced bananas. Butter the short-cake and fill with the fruit thus prepared. Serve plain, or with whipped cream.

ICES.

WATER ICES.

The simplest way of making fruit ices is much the best. Take one pint of water to one quart of fruit juice, sweetened to taste; and it should be remembered the sugar is less apparent in the frozen mixture than in the liquid. This proportion holds for all fruit ices; except the lemon. The lemon prepare as you would a rich lemonade, adding the well beaten whites of two eggs to each quart of the mixture. Be careful to freeze smoothly and the ices will be delicious. I especially recommend strawberry, pineapple, apricot, orange and lemon.

UNCOOKED CREAM.

To one quart of cream, add one teaspoonful of vanilla flavoring, and one cupful of sugar. If you have a freezer that stirs with the triple movement in freezing, it is unnecessary to whip the cream. Otherwise it should be partially whipped before being placed in freezer.

FRENCH CREAM.

Scald one pint of milk in double boiler; beat two eggs with one cupful of sugar until light; then whip in two tablespoonfuls of flour; turn into hot milk and stir until it thickens, cook fifteen minutes and set away to cool. When cold add one quart of whipped cream, and one cupful more of sugar with one tablespoonful of vanilla flavoring; freeze.

CHOCOLATE CREAM.

To make chocolate cream add to the above, when the custard is being prepared, one ounce of dissolved sweet chocolate that has been cooked to a gloss with one tablespoonful of boiling water and two tablespoonfuls of sugar. Omit the second cupful of sugar usually added with cream.

WACHTMEISTER PUDDING.

Fill a mould with alternate layers of sponge cake and jam,--strawberry or apricot, are preferable,--then saturate with rich cream flavored with vanilla and sweetened. Freeze in moulds. Custard may be used in place of cream.

FROZEN FRUITS.

To one pound of mashed fruit, add whites of three eggs, and one pint each of sugar and water. Make a syrup of the sugar and water; when cool, add the fruit and freeze.

With sweet fruits like oranges or raspberries, add juice of one lemon and one half cupful more of sugar. The fruit is very nice, without the addition of the eggs.

PINEAPPLE SHERBET.

To one quart of grated pineapple pulp, add juice of two lemons; dissolve one and one half pounds of sugar in one pint of water, and bring to a boil, skim and cool; when cold, add the fruit pulp, and the well whipped whites of two eggs; freeze soft.

STRAWBERRY SHERBET.

Crush a pound of picked strawberries in a basin and add a quart of water with a sliced lemon, let stand for three hours; put one and one quarter pounds of sugar into another basin, cover the basin with a cheese cloth and pour the berry juice through it. When the sugar is fully dissolved strain again. Freeze soft.

CONFECTIONS.

CANDY DOUGH.

To the white of one egg placed in a glass add equal quantity of cold water, or better yet, rich, sweet cream, and one teaspoonful of vanilla extract. Beat thoroughly; then stir in gradually enough confectioner’s XXXX sugar to make stiff. Cover with damp napkin and use as needed for the following varieties:

CHOCOLATE CREAMS.

Mould small pieces of candy dough into the shape of thimbles, put them on a buttered pan or paraffine paper in a cool place to harden. Melt two squares of sweet chocolate in a saucer over a tea kettle. When the cream balls are sufficiently hard, dip them in the melted chocolate. Use two forks. Let the candies drain on the forks, then put them on the tins again to dry.

CREAM WALNUTS.

Break pieces of candy dough to the size of a nutmeg, roll them in the palm of the hand until smooth and round. Press halved walnut meats on each side, letting cream show between.

CREAM ALMONDS.

Mould almond nut into center of a small ball of candy dough. Roll in granulated sugar and set away to dry.

CREAM NUT CAKE.

May be made by stirring chopped nuts into candy dough, then rolling into sheets about three fourths of an inch thick and cutting into squares.

CREAM DATES.

Wash and dry dates, remove the stones, and fill with candy dough, then roll in confectioner's sugar.

ORANGE CREAMS.

Take the white of one egg and an equal quantity of orange juice, and grated yellow rind of one orange, mix with confectioner's sugar until a stiff dough. Mould in shapely lumps and roll in granulated sugar. This also serves for orange flavored filling for chocolate drops. Any fruit juice can be used in this same way. Any flavor desired that cannot be obtained readily from fresh fruit can be had by using extract with white of egg and cream base.

CHOCOLATE ANNAS.

To three cupfuls of white sugar, add one cupful of milk and one fourth teaspoonful of cream of tartar, boil about nine minutes, or until it will form a soft ball when dropped into cold water; then add two squares of melted chocolate and one tablespoonful of butter. Cook one minute longer. Remove from fire, add one teaspoonful vanilla extract, beat vigorously for one minute, then pour into buttered pans. When cool mark in squares.

MOLASSES CANDY.

Two cupfuls of molasses, one cupful of sugar, one teaspoonful of vinegar, one tablespoonful of butter. Boil until it is brittle when tried in cold water. Pour in a buttered tin; when cool pull until white.

BROWN BETTIES.

Two cupfuls of brown sugar, half a cupful of milk, boil about four minutes, stirring constantly; when almost done stir in three quarters of a cupful of chopped walnuts or chopped blanched almonds; remove from the fire and stir till it grains, and looks sugary, then pour into a well oiled tin to the depth of half an inch; when it cools mark off in squares with a knife.

LEMON MINTS.

Sift a quantity of confectioner's sugar into a bowl and work into it lemon juice until all sugar is absorbed, then add water, a very little at a time, until a smooth, stiff paste is formed. A bit of the lemon peel may be grated into it. Roll into balls and flatten, placing them in the oven a moment to harden.

SOFT CARAMELS.

One quart of brown sugar, half a pint of milk, one third cupful of butter, and half a cake of chocolate. Boil about nine minutes, but not so long that you cannot pour them into the pan. Mark into squares.

BUTTER SCOTCH.

Two cupfuls of light brown sugar, one cupful of butter, one tablespoonful of lemon juice and one of water. Mix all together and boil twenty minutes, add one fourth teaspoonful of baking soda, drop a little in water and if it is crisp it is ready to take off. If not, cook longer; when done, pour into a flat buttered tin.

MARSHMALLOWS.

Three ounces of gum-arabic, half a pint of hot water, half a pint of powdered sugar, the white of one egg, flavoring. Dissolve the gum-arabic in the water, strain, and add the sugar. Boil ten minutes or until the syrup has the consistency of honey, stirring all the time. Add the egg, beaten stiff, and as soon as thoroughly mixed remove from the fire; add flavoring to taste, orange flower or rose is generally used. Pour the paste into a pan dusted with corn starch. The paste should be spread one inch thick. Cut into squares when cold, and roll in powdered sugar.

CHOC-O-POP.

Have ready a mixture made of one cupful of sugar, one half cupful of molasses and one cake of chocolate, cooked until it nearly crisps in cold water, keep warm. Pop corn enough to fill a three quart bowl, turn into a big pan and mix with the candy.

CRACKER-JACK.

Is made in the same way, only use one third sugar to two thirds molasses and omit the chocolate.

FROSTED FRUITS.

Carefully pick over and wash the fruit, such as cherries, plums or strawberries. Whip the whites of two or three eggs, according to quantity of fruit; dip the fruit in beaten egg, drain (keep the eggs well beaten) then dip fruit into powdered sugar. Cover a pan with a sheet of white paper, place the fruit on glass dish; dry, chill, and serve.

STUFFED DATES.

Wash and carefully dry the dates by placing them in a colander and letting stand in warm place; remove the stones and insert half a pecan, or one fourth of an English walnut; roll in confectioner’s sugar.

SALTED ALMONDS.

Blanch half a pound of almonds by pouring over them one pint boiling water; let stand three minutes. Drain and cover with cold water. Remove the skins and dry the almonds on a towel. Fry in hot butter. Drain on brown paper, and sprinkle with salt.

BUTTER SCOTCH.

One cupful of sugar, one cupful of molasses, half a cupful of butter, nearly one tablespoonful of vinegar, a pinch of soda; boil until done; when cold, cut into squares and wrap in paraffine paper.

CARAMELS.

One cupful of molasses, one half cupful of milk, one cupful of sugar, one teaspoonful of flour, one tablespoonful of butter, one fourth pound of chocolate; boil until it will harden when dropped in cold water, then add a few drops of glycerine and one teaspoonful of vanilla; turn into a buttered pan, when partly cool, mark in squares.

COFFEE CREAM CARAMELS.

Melt two pounds of sugar with as little water as possible; when the sugar begins to bubble, pour in slowly one teacupful of rich cream and stir carefully; add two ounces of fresh butter and the extract from two ounces of coffee, stirring gently and continuously while adding. As soon as cooked sufficiently to be brittle when dropped in cold water, pour into buttered tin dish, and when nearly cooled, mark off with a buttered knife into squares.

CHOCOLATE CARAMELS.

Cream together one teacupful of sugar with half the quantity of butter; add one fourth of a pound of grated chocolate and one teacupful each of molasses and milk. Beat well together and boil until a portion of it dropped in ice-water sets and cracks. Pour into well buttered tin pans to the thickness of half an inch. When nearly cold mark into squares with a buttered knife.

LEMON CANDY.

Put one pound of sugar into a pan or kettle with half a pint of water and a third of a teaspoonful of cream of tartar; let it boil, and when a little of it dropped in cold water becomes brittle it is done; pour into a shallow buttered dish. When cooled sufficiently to be handled add one third of a teaspoonful of tartaric acid with the same quantity of extract of lemon, and work thoroughly into the candy until the acid has been evenly distributed. If worked too much the transparency of the candy may be destroyed.

COCOANUT DROPS.

Grate one cocoanut and add to it one half its weight in sugar and the white of an egg whipped to a stiff froth. Mix all together thoroughly and drop on buttered white paper in a pan. Bake for fifteen minutes.

KISSES.

Beat the whites of four eggs to a stiff froth and stir in half a pound of confectioner's sugar, flavor with one half teaspoonful of vanilla. Whip thoroughly and then drop in quantities about half the size of an egg on buttered paper, well separated; lay the paper on a half inch board and place in moderate oven. Watch carefully and when they begin to color take them out, remove from paper and join them in pairs by their flat surfaces.

BEVERAGES.

TEA.

Tea should be made with the little filagree silver balls that come especially for that purpose. Fill ball with best quality Oolong, or English Breakfast, tea that you can obtain (cheap teas are injurious and tasteless). Have a pot of boiling water, fill your cup and then immerse the tea ball in cup until the strength desired is obtained. Serve with sugar and sliced lemon, after the Russian fashion; it is more wholesome than with cream.

COCOA.

Allow one teaspoonful of cocoa and sugar to one cupful of milk and water, in equal proportions. Heat the milk in double boiler. Put the water in the cocoa pot, when it boils stir in the dry cocoa, mix well. After boiling three minutes, add the hot milk. Serve when it begins to rise in the pot.

FRENCH COFFEE.

Three pints of water to one cupful of ground coffee. Put coffee in bowl; pour over it about half pint cold water and let stand for fifteen minutes; bring remaining water to a boil. Take coffee in bowl, strain through fine sieve, then take French coffee pot, put coffee grounds in strainer at top of French pot, leaving water in bowl. Then take boiling water and pour over coffee very slowly. Then set coffee-pot on stove for five minutes; do not let boil. Take off and pour in cold water from bowl that coffee was first soaked in, to settle. Serve in another pot. The French, who have the reputation of making the best coffee, use three parts Java to one part of Mocha.

AMERICAN COFFEE.

Allow one tablespoonful of ground coffee to each cupful of water used; mix coffee with half the white of one egg; add one cupful of cold water and shake well, then add as many more cupfuls of cold water as you have allowed for. Place on back of range and steep ten minutes, then bring forward. Let come to a boil. Settle with one half cupful of cold water.

CARAMEL COFFEE.

To prepare, take three and one half quarts of bran, add one and one half quarts of corn meal, one pint of molasses, one half pint of boiling water, mix well, and bake, stirring often. Make the same as "American Coffee," only let boil a little longer.

CHOCOLATE.

Melt dry, over steam, one half cake of sweet chocolate; bring to a scald one quart of rich milk, add one cupful of sugar, turn into a heated bowl, then add the melted chocolate and whip with egg beater until chocolate is thoroughly dissolved in the milk. The longer it is whipped the better it will be. Serve with whipped cream.

APRICOT WATER.

Skin twelve apricots, take out the stones, pour on one quart of boiling water; allow them to stew for one hour, then strain off the clear liquid and sweeten with three ounces of sugar.

GINGERADE.

Gingerade is made of any fruit, stewed with pulverized ginger, flavored with lemon juice, and carefully strained.

GRAPE JUICE.

Wash and remove from stems ten pounds of grapes, put over to boil with two quarts of water. Let boil until seeds and pulp separate. Strain through cheese cloth bag, let it drain slowly, do not squeeze. Put juice back in kettle, let come to a boil, and add one and one fourth pounds of sugar; boil two or three minutes. Seal boiling hot. The secret of success in bottling grape juice is to have everything boiling hot, jars, juice, rubbers, and tops. The best way is to have jars in kettle of boiling water right on the stove and tops in boiling water, likewise, and fill right from kettle of boiling juice on the stove. Then if your cans are air-tight the juice will surely keep.

FRUIT JUICES.

The following rules hold good for any kind of fruit: Crush the small fruits raw, strain, add one half pound of sugar to each quart of juice, let boil one minute, and bottle, using same precautions as those specified in receipt for grape juice.

PINEAPPLE FRAPPÉ.

Boil one quart of water, one pint of sugar, and one pint of chopped pineapple for twenty minutes; add one cupful of orange juice and one half cupful of lemon juice. Freeze soft.

ORANGE FRAPPÉ.

Make a syrup by boiling one quart of water and one pint of sugar for twenty minutes; add one pint of orange juice and the juice of two lemons; one cupful of candied cherries should be added just before freezing. Freeze soft.

ENGLISH MARMALADES.

RHUBARB MARMALADE.

Peel and cut into inch pieces tender young rhubarb, to every pint allow one pound of loaf sugar and three oranges. Spread the cut rhubarb on a shallow dish and cover with the sugar; leave it for twelve hours; then put it into the preserving kettle with the grated yellow rind of the oranges (be careful not to use any of the white pulp or it will make the preserve bitter), add the tender, juicy pulp of the oranges and boil slowly for about one hour, or until jam sets when tested on a cold plate.

ORANGE MARMALADE.

To every pound of sliced oranges (one half Seville and one half sweet) add three pints of cold water; let stand in a cool place for forty-eight hours; then boil all together until tender, generally about two hours; set away for twenty-four hours. Then weigh the fruit and to every pound of the boiled fruit add three fourths of a pound of sugar. Boil until it will “set” when tried on a chilled plate.

LEMON MARMALADE.

Pour a scant quart of boiling water over two pounds of sugar and let it stand until dissolved. Put in agate preserving kettle and peel some very thin, thread-like strips of the delicate yellow rind of the lemons; add to the liquid; carefully peel and remove all fibrous parts from six large lemons, collect the seeds, tying them in a thin cloth; add the pulp and the little bag of seeds to syrup, keep kettle uncovered and let preserve boil gently. When it “sets” on a chilled plate it is done. The seeds used in this way make it jell much more quickly and the marmalade is more delicate in flavor.

APRICOT MARMALADE.

Choose deep yellow apricots, not too ripe; take off the skin, take out the stones, and extract the kernel. To each twelve pounds of fruit add eight pounds of sugar, put in agate kettle, and boil until it will “set” by dropping into a chilled plate. It needs to be stirred frequently and carefully watched to prevent burning.

INVALID COOKERY.

PEA SOUP.

One pint of fresh, or one can of marrowfat peas; boil until thoroughly soft so they will mash easily; then strain through a sieve to remove skins. To pulp and liquor add one pint of cream, one teaspoonful of sugar, salt and pepper to taste, and one tablespoonful of butter. Serve with wafers. This is a very nutritious and relishable soup for a convalescent.

MILK TOAST.

Brown delicately a thin slice of stale bread, cut in strips and place in bowl; to one cupful of rich milk, brought to a scald, add a teaspoonful of butter, have ready one heaping teaspoonful of flour blended with water, strain into scalding milk and stir until it thickens, set back and let cook gently while you whip the white of one egg to a stiff froth, add a pinch of salt, then take the simmering milk from the stove and whip the beaten white of egg in quickly. Pour over toast in bowl and serve at once.

CUP CUSTARD.

Allow one egg and three fourths of a cupful of rich milk for each cup, sweeten to taste and flavor with grated nutmeg, or vanilla extract, as you prefer, pour in cups, set cup in shallow tin half filled with water, and place in oven; bake until solid, and knife blade can be drawn out clean. Cooking in the pan of water prevents custards from separating and becoming watery.

RICE FOAM.

Wash one heaping teaspoonful of rice and cook until thoroughly tender in milk; mash through a sieve; add pinch of salt; heat a half cupful of cream to a scald, and stir in the rice. Whip the white of one egg to a stiff froth, and add immediately on removing from the stove. A bit of chopped parsley may be added, if liked. Serve with wafers. This is a pleasant change from sweet gruels, and is very nutritious.

CREAMED GRUEL.

Cook one tablespoonful of rolled oats in scant pint of water; when soft strain through a sieve; add one half cupful of cream; salt to taste, and let come to a scald. Have ready the whites of two eggs beaten to a stiff froth, take gruel from the fire and whip in the eggs, sweeten to taste and flavor with a dash of nutmeg or a few drops of vanilla extract.

EGG GRUEL.

Heat a cupful of milk to 180 F., and stir into it one well beaten egg mixed with one fourth cupful of cold water. Stir constantly for a few minutes until thickened, but do not allow it to boil again. Season with salt, or if preferred, a little loaf sugar.

BARLEY GRUEL.

Wash three tablespoonfuls of pearl barley, drop it into a pint of boiling water and parboil five minutes. Pour the water off and add one quart of fresh boiling water, let it simmer gently from one to three hours, strain, season, and serve. A small piece of lemon rind added to the gruel one half hour before it is done will give an agreeable flavor. Equal quantities of barley gruel and milk make a very nourishing drink; a little lemon juice with sugar to taste is sometimes liked as the flavor for the gruel.

ARROWROOT.

Mix two tablespoonfuls of arrowroot with four tablespoonfuls of cold water; add half a pint of boiling water and boil until it thickens; sweeten to taste and add a little grated nutmeg.

GRAHAM GRUEL.

Mix one tablespoonful of graham meal in four tablespoonfuls of cold water, stir it into a pint of boiling water, cook twenty minutes, salt to taste, and boil ten minutes longer, put a gill of thin gruel into a cup with one half gill of milk or cream, and serve hot.

EGG NOGG.

Beat the yolk of a freshly laid egg with a tablespoonful of sugar until it is light and creamy, add to this one half cupful of milk (hot or cold, as you wish the drink, warm, or chilled), whip in, lightly, the white of the egg, beaten stiff, a light grating of nutmeg, and if mixed cold, a tablespoonful of cracked ice. Serve at once.

EGG AND LIME WATER.

To a wineglass full of lime water, add the stiffly beaten white of one egg. Give this often, in small quantities, to patient. It is excellent in cases of obstinate vomiting and bowel trouble.

APPLE WATER.

Wash and wipe a large sour apple and, without paring, cut it into thin slices. Put them in a bowl with one strip of lemon peel, add one cupful of boiling water, cover and set away to cool, strain when cold, sweeten and serve with cracked ice. Cranberries or rhubarb may be used in the same way.

EGG LEMONADE.

Beat the white of an egg to a stiff froth, mix with it the juice of a small lemon and one tablespoonful of sugar. Add one cupful of ice water and shake thoroughly.

ARROWROOT WATER.

Boil the thin rind of a fresh lemon in one quart of water. When boiling, pour over one tablespoonful of arrowroot previously mixed with a little cold water, stir well, sweeten to taste, and let it boil for five minutes; squeeze in the juice of one lemon.

BARLEY WATER.

One teaspoonful of pearl barley, one half lemon, one quart boiling water, sugar to taste. Wash the barley in cold water, add boiling water, juice of lemon, a bit of rind, let stand, covered, and warm for three hours.

EGG TEA.

Take the white of one egg and beat it to a stiff froth, beat the yolk into it with a scant tablespoonful of sugar, then pour in slowly (beating the mixture all the time) half a cupful of hot milk; flavor with grated nutmeg or vanilla to taste.

TOAST WATER.

Brown nicely in the oven slices of bread, and pour upon them sufficient boiling water to cover. Let them steep until cold, keeping the bowl or dish containing the toast closely covered. Strain off the water and sweeten to taste. Chill by setting dish in bowl of chopped ice.

BARLEY WATER.

Put two ounces of pearl barley into half a pint of boiling water and let it simmer a few minutes. Drain off and add two quarts of boiling water with a few figs and stoned raisins cut fine. Boil slowly until reduced about one half and strain. Sweeten to taste, adding the juice of a lemon and nutmeg if desired.

BAKED MILK.

Put the milk in a jar, covering the opening with white paper, and bake in a moderate oven until thick as cream. May be taken by the most delicate stomach.

FLAXSEED LEMONADE.

Pour on four tablespoonfuls of whole flaxseed one quart of boiling water and add the juice of two lemons. Let it steep for three hours, keeping it closely covered. Strain and sweeten to taste.

IMPORTANT NOTES.

THE WAY TO TEST HOT FAT.

If a bit of dry bread will brown in one minute fat is hot enough for a raw mixture. If cooked mixtures are to be browned the fat should be hot enough to brown a piece of bread in forty seconds. This method however, is only a makeshift and is not absolutely accurate. A thermometer should be used; 380 to 390 degrees is the right temperature for frying vegetable substances. Heat fat slowly.

CELERY FLAVORING.

Clean the green stalks and leaves of celery and dry, place in paper bags to be used for soups and savories when celery is out of season. This can be used in place of the celery seed called for in some receipts.

NUT BUTTER.

Peanuts shelled and well roasted with the skins rubbed off will, when ground, dissolve into a buttery substance which can be spread on bread and made into sandwiches. All kinds of nuts reduced to flour can be readily digested and can be placed on the table to be eaten with bread or spread on sandwiches.

BAY LEAVES.

Bay leaves contribute a most delicate and pungent flavor to soups, savories and gravies. They can be obtained at any druggist’s, and five cents worth will last a long time.

SUBSTITUTES FOR INGREDIENTS IN NON-VEGETARIAN RECEIPTS.

SUET.

In place of suet use bread crumbs soaked in oil or butter.

MEATS.

Use nuts as substitute for meats. To prepare the nuts for cooking, pick from the shell carefully and chop very fine, or better yet, grind in nut mill.

GELATINE.

In place of gelatine, use Irish Moss or corn starch.

MEAT FATS.

Nut butter takes the place of meat extract and fats in gravies and sauces. Where plain butter is preferred with a savory flavoring of herbs, always brown the flour used for thickening.

PASTRY.

Cocoanut or cow’s butter is the substitute for lard or cotoline in vegetarian pastry.

HERBS.

The value of herbs for savories and soups is too little understood by American cooks. Here is “Aunt Susan’s” receipt for a “soup powder” that will flavor any soup, gravy, or savory dish with a fine flavor:

SOUP POWDER.

Sweet Marjoram--Powdered, two ounces. Parsley--Powdered, two ounces. Summer Savory--Powdered, two ounces. Thyme--Powdered, two ounces. Bay Leaf--Powdered, two ounces. Lemon Peel--Powdered, one ounce. Sweet Basil--Powdered, one ounce. Rosemary--Powdered, one ounce.

TO PREPARE ONIONS FOR SALADS OR FILLINGS.

Peel and slice, or chop, cover the onions with boiling water, and let stand three or four minutes, drain and put in ice water, let stand ten or fifteen minutes, or, until crisp. The onions are just as crisp as before, and much more delicate.

THE WAY TO DRY CORN.

Just scald, then cut from the cob, put in a pan and set over kettle of boiling water; stir frequently, and in a couple of hours the corn will be almost dry, if the water in kettle has been constantly kept at boiling. Set in warm oven half an hour and the corn is ready to put in bags; dry and clean.

WEIGHTS AND MEASURES FOR COOKS.

1 pound of wheat flour is equal to 1 quart 1 pound and two ounces of Indian meal make 1 quart 1 pound of soft butter is equal to 1 quart 1 pound and 2 ounces of best brown sugar make 1 quart 1 pound and 1 ounce of powdered white sugar make 1 quart 1 pound of broken loaf sugar is equal to 1 quart 4 large tablespoonfuls make ½■ gill 1 common-sized tumbler holds ½■ pint 1 common-sized wine glass is equal to ½■ gill 1 tea-cup holds 1 gill 1 large wine glass holds 2 ounces 1 tablespoonful is equal to ½■ ounce

COLORING FOR SAUCES AND SOUPS.

Crush a quarter of a pound of loaf sugar to powder, put it into a sauce pan with a tablespoonful of water, and stir it unceasingly over a gentle fire until it begins to acquire a little color. Draw it back and bake it very slowly, still stirring it, until it is almost black, without being in the least burnt. It will take about half an hour. Pour a quart of water over it, let it boil for a few minutes until the sugar is quite dissolved, pour it out, and when cold, strain it into a bottle and store it for use. A tablespoonful of this browning will color half a pint of liquid.

BOILING VEGETABLES.

It is very essential for health that all the properties of food should be retained in the cooking, therefore the habit of boiling the various vegetables, in an unnecessary quantity of water, and then draining this down the sink, is a means of defrauding the organism of the nourishment originally contained in the article.

Potatoes, carrots, parsnips, and other articles requiring their skins to be removed for serving or mincing, should, when possible, be steamed “in their jackets” and peeled as much as necessary afterwards.

Cauliflowers, cabbage, &c., are excellent when steamed. Green peas, beans, and such, should be put in a covered vessel, with a little butter, and, when necessary, a spoonful or two of water, and gently stewed, standing inside a saucepan of water without the water touching them; or they can be stewed in the oven in an earthenware jar, with a little butter and a spoonful or two of water. This method of cooking takes very little longer time than the ordinary boiling in water. The oven should be moderately heated.

STEWING FRUITS.

Fruits are better stewed in a double enamelled saucepan, or baked in a tightly covered earthen jar in the oven with as little water as possible.

Dried fruits, such as raisins, figs, dates, &c., should be washed and picked over carefully, then soaked for several hours in cold water till they are soft and swollen to their fullest extent, when they should be stewed in the same water.

USE OF SALT.

As little salt as is palatable should be used, and an effort made to daily lessen its use. When once the system is freed from the use of this mineral in its daily food, a small dose shows it to be an active poison. There is enough of natural salts in our vegetable foods without our making use of the mineral deposit. Knowing that many will use this book who are just turning from the meat diet, we give, as a rule, the usual quantity of salt in the receipts used in ordinary cookery. For the same reason we give the ordinary beverages in daily use, in the menus.

BEVERAGES.

Fruit juices are far more conductive to good health than tea or coffee, and we especially recommend lemon juice diluted with boiling water as a breakfast beverage, though we have not ventured to place it on the regular bill of fare. It is a most appetising morning drink, and should be taken a short time before eating.

MENUS FOR ONE WEEK.

BREAKFAST--MONDAY.

Chinese Rice with Cream. Fruit. Boiled Eggs. Creamed Potatoes. Whole Wheat Muffins. Lemon Marmalade. Coffee.

LUNCHEON--MONDAY.

Bean Soup with Nouilles. Toast. Boiled Egg Sandwiches. Jelly. Gingerade.

DINNER--MONDAY.

Cream of Tomato. Steamed Sweet Potato. Celery on Toast. Macaroni and Cheese. Lettuce with Mayonaise. Whole Wheat Bread. Fruit Pie. Stuffed Dates. Grape Juice.

BREAKFAST--TUESDAY.

Fruit. Whole Wheat with Cream. Savory Hash. Warmed Sweet Potatoes. Griddle Cakes. Syrup. Coffee.

LUNCHEON--TUESDAY.

Cabbage Soup. Baked Potatoes. Fried Apples. Corn Muffins. Preserves. Oolong Tea.

DINNER--TUESDAY.

Soup. Cream of Celery. Mashed Potatoes. Omelet with Peas. Wax Beans. Tomato Aspic on Lettuce with Mayonaise Dressing. Cabinet Pudding. Coffee.

BREAKFAST--WEDNESDAY.

Breakfast Food with Cream. Stewed Raisins. Creamed Potatoes. Shirred Eggs. Toast. Tea or Coffee.

LUNCHEON--WEDNESDAY.

Dutch Soup. Wachtmeister Potatoes. Hot Biscuit. Apricot Sauce. Tea.

DINNER--WEDNESDAY.

Soup. Cream of Carrot. Escaloped Tomatoes. Rice and Cheese. Parsnip Balls. Potato Salad. Apricot Tapioca. Cake. Coffee.

BREAKFAST--THURSDAY.

Oat Meal with Cream. Corn Fritters. French Fried Potatoes. Stewed Prunes. Whole Wheat Muffins. Tea.

LUNCHEON--THURSDAY.

Corn on Toast. Lyonaise Potatoes. Cheese Puffs. Whole Wheat Bread and Butter. Cake. Peaches. Cocoa.

DINNER--THURSDAY.

Clear Soup with Nouilles. Escaloped Potatoes. Vegetable Cutlets. Lima Beans. Celery Salad. Apple Dumplings. Hard Sauce. Nuts and Raisins. French Coffee.

BREAKFAST--FRIDAY.

Fruit. Breakfast Food with Cream. Potato Balls. Fried Tomatoes. Corn Cakes with Syrup. Caramel Coffee.

LUNCHEON--FRIDAY.

Welsh Rarebit. Baked Potatoes. Stewed Tomatoes. Oat Meal Pudding. Tea.

DINNER--FRIDAY.

Corn Chowder. Escaloped Potatoes. Devilled Tomatoes. Mushroom Pie. Cheese Relish. Banana Short Cake. Fruit Juice.

BREAKFAST--SATURDAY.

Fruit. Oat Meal with Cream. Milk Toast. Baked Potatoes. Bread Griddle Cakes. Jam. English Breakfast Tea.

LUNCHEON--SATURDAY.

Rice Soup. Creamed Potatoes. Escaloped Eggs. Honey and Waffles. Chocolate.

DINNER--SATURDAY.

Split Pea Soup. Lyonaise Potatoes. Nut Loaf. Wax Beans. Salad of Lettuce and Grape Fruit. Apple Pie. Cheese. Coffee.

BREAKFAST--SUNDAY.

Fresh Fruit. Porridge with Cream. French Fried Potatoes. Boston Baked Beans. Brown Bread. Coffee.

DINNER--SUNDAY.

Julienne Soup. Welsh Rarebit. Corn on Toast. Baked Sweet Potatoes. Mushroom Pie. Nut Salad. Orange Foam. Lady Fingers. Coffee.

SUNDAY NIGHT LUNCH.

Russian Sandwiches. Celery Salad. Cake and Fruit. Grape Juice.

MENUS FOR PLAIN LIVING.

BREAKFASTS.

Breakfast Food. Marmalade. Creamed Potatoes. Whole Wheat Griddle Cakes. Syrup. Coffee.

Breakfast Food with Cream. Spanish Eggs. Rice Fritters. Graham Gems. Apricot Marmalade. Tea.

Fruit. Graham Porridge with Cream. Corn Muffins. Vegetable Sausages. Lyonaise Potatoes. Chocolate.

Grapes. Rye Porridge with Cream. Boiled Potatoes. Vegetable Cutlets. Whole Wheat Muffins. Coffee.

Apples. Whole Wheat Porridge with Cream. Baked Potatoes. Fried Corn Mush. Lemon Marmalade. Pop Overs. English Breakfast Tea.

Bananas. Oat Meal with Cream. Potato Pancakes. Toast. Scrambled Eggs. English Breakfast Tea.

Oranges. Chinese Rice. Shirred Eggs. Creamed Potatoes. Pop Overs. Coffee.

Porridge with Cream. Savory Hash. Orange Marmalade. Muffins. Chocolate.

Fruit. Oat Meal Porridge with Cream. Rice Griddle Cakes. Maple Syrup. Coffee.

DINNERS.

Soup. Cream of Asparagus. Omelet with Peas. Lima Beans. Creamed Potatoes. Pop Overs. Rice Pudding. Coffee.

Rice Soup. Vegetable Hash. Escaloped Potatoes. Cabbage Salad. Squash Pie with Cheese. Coffee.

Lentil Soup. Italian Macaroni. Corn Fritters. Lyonaise Potatoes. Apple Tapioca. Coffee.

Baked Beans. Stewed Tomatoes. Baked Sweet Potatoes. Rolls. Apple Dumplings. Coffee.

Escaloped Eggs. Mashed Potatoes. Corn on Toast. Snow Pudding. Coffee.

Sweet Breads with Peas. Mashed Potatoes. Biscuit. Oat Meal Pudding. Coffee.

Tomatoes on Toast. Baked Potatoes. Macaroni and Cheese. Orange Custard on Rice. Coffee.

Bean Puree with Nouilles. Creamed Vegetables. Stewed Tomatoes. Macaroni Pie. Cheese Puff. Fruit. Coffee.

Potato Soup with Dumplings. Cheese Custard. Wafers. Farina Croustades. Potatoes in White Sauce. Sliced Cucumbers. Pineapple Tart. Coffee.

COLD SUPPERS.

Egg Sandwiches. Celery Salad with Cheese Sticks. Coffee Cake. Orange Foam. Iced Tea.

Tomato Salad. Whole Wheat Bread. Nut Sandwiches. Angel Food. Strawberries and Cream. Lemonade.

Boston Baked Beans Cold, Serve with cut lemons. Whole Wheat Bread. Butter. Olives. Cheese. Wafers. Sliced Peaches. Sponge Cake. Chocolate Sandwiches. Grape Juice.

HOT SUPPERS.

Bean Salad. Wachtmeister Potatoes. Waffles with Syrup. Celery. Cheese. Crackers. Coffee.

Tomato Fritters. Baked Potatoes. Cake. Sauce. Chocolate.

Rice Croquettes. Lyonaise Potatoes. Jelly. Pop Overs. Tea.

Savory Hash. Baked Potatoes. Tomato Salad. Honey. Whole Wheat Muffins. Chocolate.

FORMAL LUNCHEONS.

Cherries. New Potatoes. Nut Croquettes. Steamed Corn. Italian Salad. Wafers. Macaroons. Orange Ice. Kisses. Chocolate with Whipped Cream.

Tomato Bouillon. Sweet Breads Served on Green Peas. Wachtmeister Potatoes. Grilled Mushrooms. Lettuce Salad. Wafers. Cheese. Lady Fingers. Eclairs. Chocolate Stripes. Pine-Apple Sherbet.

Soup. Cream of Green Peas. Eggs and Asparagus. Farina Croustades. Potato Pears. Salad of Grape Fruit and Walnut. Graham Sandwiches. Wafers. Chocolate Cream. Velvet Cake. Chocolate.

Corn Soup. An English Monkey. Bread. Savory Eggs. Boiled Potatoes. Turnip Soufflé. Snow Balls. Orange Cake. Gingerade.

Oranges.[1] Welsh Rarebit. Potato Croquettes. Fricasseed Tomatoes. Baked Eggs. Baked Mushrooms. Bread. Butter. Nut Salad. Wachtmeister Pudding. Grape Juice.

[1] Peel and pierce with a fruit fork, leaving fork in the fruit; lay on a bed of cracked ice in shallow dish; serve from the platter.

Macaroni Soup. Curried Rice. Fried Tomatoes. Yorkshire Pudding. Princess Potatoes. Olives. Salmagundi. Wafers. Frozen Fruits. Coffee.

FORMAL DINNERS.

Mock Turtle Soup. Mashed Potato. Biscuit Patês. Lima Beans. Cabbage Salad. Bread. Butter. Olives. Pine-apple Short Cake. Celery. Cheese. Crackers. Coffee.

Julienne Soup. Vegetable Omelet. Escaloped Potatoes. Italian Salad. Stuffed Tomatoes. Wafers. Ripe Currant Pie. Coffee.

Soup. Cream of Asparagus. Mashed Potatoes. Nut Croquettes. Peas. Baked Mushrooms. Cheese Wafers. Tomato Salad. Orange Short Cake. Coffee.

Soup. Cream of Potato. Baked Egg Plant. Eggs with Mushrooms. Pastry with Peas. Lettuce Salad. Cheese Wafers. Charlotte Russe. Coffee.

Tomato Bouillon. Welsh Rarebit. New Potatoes. Asparagus Pie. Peas. Tomato Salad. Bread. Butter. Frozen Sherbet. Macaroons. Stuffed Dates. Lady Fingers. Coffee.

Soup. Cream of Celery. Potato Patês. Mushroom Pie. French Peas. Stuffed Tomato Salad with Mayonaise. Bread. Butter. Olives. Banana Pudding. Cakes. Nuts. Raisins. Coffee.

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C. F. Langworthy

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U. S. DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN 487.

CHEESE AND ITS ECONOMICAL USES IN THE DIET.

BY

C. F. LANGWORTHY, PH. D., _Chief of Office of Home Economics, States Relations Service_,

AND

CAROLINE L. HUNT, A. B., _Expert in Nutrition, Office of Home Economics_.

[Illustration: UNITED STATES DEPARTMENT OF AGRICULTURE]

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE, STATES RELATIONS SERVICE,

Washington, D. C., June 10, 1916.

SIR: Since cheese is one of the important agricultural products of the United States and a foodstuff used in a larger or smaller quantity in nearly every American home, it seemed desirable to study its relative nutritive value and the ways in which it may be prepared for the table.

Although it is so generally liked, there seems to be a widespread belief that it is not well digested and that it is a cause of physiological disturbances. Neither of these beliefs is substantiated by the results of the extended series of digestion experiments undertaken as part of the nutrition investigations of the Office of Home Economics. Indeed, cheese was found to be very thoroughly digested, ranking with other staple foods in this respect. Moreover, experiments made with the respiration calorimeter did not indicate that it was less easy of digestion than a comparable amount of meat.

In the studies of the digestibility of cheese the Bureau of Animal Industry cooperated with the States Relations Service and was also of great assistance in securing, for experimental purposes, cheese made and cured under controlled conditions. Supplementing the experiments as to the nutritive value of cheese, many tests were made of methods of preparing cheese for the table, the main purpose being to suggest dishes and combinations of such a character that the cheese might replace other nitrogenous material and fat when this seemed desirable.

The bulletin was prepared by C. F. Langworthy, chief of the Office of Home Economics of the States Relations Service, and Miss Caroline L. Hunt, who has had wide experience in the study of both scientific and practical problems in nutrition. The recipes were collected from many sources and in the majority of cases were studied experimentally by Miss Hunt.

Acknowledgement should be made to teachers of home economics in agricultural colleges and other educational institutions, to housekeepers, and others who have supplied data of great value in preparing the bulletin.

Respectfully, A. C. TRUE, _Director_.

Hon. D. F. HOUSTON, _Secretary of Agriculture_.

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CHEESE AND ITS ECONOMICAL USES IN THE DIET.

INTRODUCTION.

Cheese is believed to be the oldest of the dairy products and the first form in which milk was preserved for future use. One may conjecture that it owes its origin to the accidental storing and ripening of sour milk curd. Although it has been a staple food with many races for uncounted years, there is a widespread belief that it is suitable for use chiefly in small quantities as an accessory to the diet, and that in large quantities it is likely to produce physiological disturbances. We are inclined, therefore, to think of those who make cheese one of the chief articles of their diet as being driven to this course by necessity rather than being led to it by choice.

Because of these opinions extensive studies have been carried on as a part of the Department Work in Home Economics, of the food value, thoroughness of digestibility, ease of digestion, physiological effect, and special character of cheese as food as well as of methods which are followed in preparing it for the table. The conclusion drawn from this extended study is, in brief, that cheese properly prepared and used is not generally a cause of physiological disturbances, and that it may easily be introduced into the bill

of fare in such quantities as to serve as the chief source of nitrogenous food and may be made a substitute for other nitrogenous foods when such substitution is desired.[1] The results of these studies have been brought together in this bulletin with a view to making them helpful to all interested in the subject, but particularly to housekeepers.

From the standpoint of the housekeeper, cheese is of importance because of its high nutritive value, particularly its high percentage of protein or muscle-forming materials, because of the ease with which it can be kept and prepared for the table, and because of its appetizing flavor and of the great variety of ways in which it can be served.

From the point of view of agriculture cheese is an important commodity. The latest census figures available show that considerably over 300,000,000 pounds are made yearly in the United States, the value of the product being nearly $29,000,000, and the amount of money invested being over $6,000,000. The figures quoted are from the census report which first separated the details of the cheese industry from those of the butter and condensed-milk industries. From earlier statistics available, however, it is fair to judge in a general way of the development of any one of these industries from the figures given for the three industries combined. In general, these figures show that there was a great leap forward in the three industries in the decade between the years 1880 and 1890, and that since that time there has been a continuous, steady, healthy growth in the business of cheese making.

As might be expected, the amount of the product and the amount of money invested have increased more rapidly than the number of men employed, indicating that, as in most manufacturing industries, labor-saving devices and other improvements have reduced the proportion of physical labor required.

As regards the kind of cheese made in the United States, the figures show that of the amount produced in 1905 approximately three-fourths was what is known to the trade as standard factory cheese, or what is usually known to the retail purchaser as American cheese. A very small per cent—1.1 per cent—was skim-milk cheese, the remainder being American modifications of certain important foreign brands, Neufchâtel, Camembert, and others.

From the standpoint of the retail dealer, cheese is important because it is a convenient article to handle. Its percentage of nutrients being high and its percentage of water low, it is not bulky. It is comparatively easy, too, to preserve in good condition. The difficulty of cutting exact amounts called for by customers may be considered the chief inconvenience. Efforts have been made to obviate this difficulty by making small cheeses. Experiments have been reported from the Oregon Experiment Station[2] on the canning of cheese in pound lots; and from the Wisconsin Experiment Station[3] in making cheese prints like those in which butter is commonly sold. In some of the factories cheeses weighing about 5 pounds and having the same shape as the larger cheeses are made. These are convenient for use in families where a large amount of cheese is eaten, and furthermore cheese in such form dries out and spoils less quickly and easily than cheese cut in wedge-shaped slices, as it usually is when sold by the pound. A convenient way of keeping and using such cheese is given on page 11.

The sale of cheese in pots is another way of overcoming the difficulty of cutting exact amounts. Cheese thus prepared is, as a rule, softened by the addition of butter fat or other fat, with the idea of making it of such consistency that it can be used like soft cheeses.

There is something to be said also of the value of cheese to that not inconsiderable number of individuals who must occasionally cater for themselves—those men and women in business life, for example, who find it convenient neither to carry lunches nor to go to restaurants. For these, cheese offers a convenient way of supplying the necessary protein, for it can usually be obtained in good condition in any neighborhood. Combined with crackers, some of the ready-cooked cereals, or bread, and with fruit, it makes a fairly well-balanced meal.

FOOTNOTES:

[1] U. S. Dept. Agr., Yearbook 1910, p. 359.

[2] Oregon Sta. Bul. 78.

[3] Wisconsin Sta. Rpt. 1901, p. 132; U. S. Dept. Agr., Farmers' Bul. 156.

CHEESE MAKING.

Though the chief points in the manufacture of cheese are well known, and are discussed in detail in other publications[4] of this department, it may not be out of place to review them here. Cheese is made ordinarily from whole milk, and most of the kinds best

known in the United States from cows' milk. In every 8 parts of milk by weight there is approximately 1 part of solid nutrients, the remainder being water. For our present purpose we may think of the nutrients as being equally divided into three groups—protein substances (casein and albumin principally), fat, and milk sugar. In the process of cheese making the casein, which constitutes more than three-fourths of the proteids of the milk, is precipitated by rennet, forming a curd. Most of the fat attaches itself to this curd. The curd is broken up, and the whole is heated to a temperature between 96° and 108° F. The whey is drained off and carries with it most of the milk sugar and the albumin. The curd is salted and pressed. It is kept for several weeks or longer in a cool place, where it "ripens," developing flavors through the action of bacteria or other microorganisms, and also undergoing certain other marked changes.

The average cheese while fresh and moist contains proteids and fat in much the same ratio as that in which they are found in the milk. More than one-fourth its weight is proteid, about one-third fats, and one-third water. There are always present small amounts of albumin and sugar which have clung to the curd. Owing to the addition of salt, the percentage of mineral matter is high compared with that of most other foods.

In ripening, cheese changes in texture and its original pastiness gives away to a somewhat granular consistency in some types, or to a waxy or a buttery consistency in others.

The above brief outline refers only to the essentials of cheese making. In practice, there are many variations with respect to the kind of milk used, the proportion of butter fat or cream retained in or added to the milk, with respect to the methods followed in separating, preparing, seasoning, and handling the curd, and to the handling and ripening of the cheese. It follows that there is an almost endless number of cheeses with different names and of different appearance and flavor.

Cheese making was formerly a home or farm industry, but is now, in the United States at least, very largely a commercial enterprise carried on in factories. It differs from many industries in that the factories are almost always located in the country or in the smaller towns rather than in large cities, this being more true of cheese making than of the manufacture of potted cheeses or other special articles, which has become a large industry. It is worthy of mention in this connection that the making of cheese crackers and other bakers' goods in which cheese is an ingredient has developed into an important part of the baking trade.

FOOTNOTES:

[4] U. S. Dept. Agr., Farmers' Buls. 166, 225, 244; Bur. Anim. Indus. Buls. 105, 146.

KINDS OF CHEESE USED IN AMERICAN HOMES.

The American factory cheese—the so-called American cream cheese—is of the English Cheddar type, and as it is the most commonly used of all the commercial varieties in the United States, may be taken as a standard. Other types are, however, well known, particularly in cities and large towns where there are well-stocked markets and stores, and it is interesting to note also, at least briefly, the characteristics of some of them. Full descriptions of a very large number of cheeses (about 250 in all) may be found in an earlier bulletin of this department.[5]

CHEDDAR AND AMERICAN FULL-CREAM CHEESE.

Cheddar cheese—named from the English village where it originated—is a comparatively old type of cheese, very popular in England and also in the United States. The name is now more fitly applied to a process than to any particular shape.

Cheddar cheese is made from sweet cows' milk, which may be skimmed, partly skimmed, or unskimmed. If made from unskimmed milk the cheese is called "full cream." If cream is removed the cheese is designated "part-skim" or "skim," as the case may be.

Cheese of Cheddar type as made in the United States is perhaps most often marketed in large, flat, round forms, 13 to 16 inches in diameter, about 5 or 6 inches in height, and weighing 26 to 32 pounds each, though other shapes and sizes are also fairly common. It is usually pale to darker yellow in color, though it may be white when uncolored. When fresh it is mild in flavor, but when well ripened has a characteristic and sharp taste. The new cheese is soft, though not waxy, in texture, and may be easily shaved or broken into small pieces. When well ripened it may be finely grated.

These characteristics, together with its distinctive and peculiar flavor and its wide distribution in the markets, are qualities which help to make it the variety most commonly used in the United States.

Sage cheese is a variety of Cheddar cheese, which is flavored with sage and is further characterized by the green mottled appearance formerly due to bits of sage leaf but now generally obtained in another way.

ENGLISH DAIRY CHEESE.

From the standpoint of the cook who frequently wishes to use grated cheese this variety is important. Though made in much the same way as Cheddar, it differs from it, in that the curd is heated to a somewhat higher temperature, and the cheese is therefore harder. It commonly sells for somewhat more per pound than the standard or American factory variety and is likely to be found only in the larger markets.

SOFT CREAM CHEESES.

Cream cheese true to name is made from rich cream thickened by souring or from sweet cream thickened with rennet. The whey is removed by draining. It is then covered, salted, and turned occasionally, being ready for market in 5 to 10 days. A variety is also made with rennet from cream of low fat content, as well as a number of other special sorts much more common in France than in the United States.

The term “cream cheese,” however, is an elastic one and includes many varieties which are sold under special trade names. Such cheese is common in most markets.

Soft cream cheese differs from standard cheese, so far as composition is concerned, in having more water and fat and less protein, water usually making up about one-half of the total weight. It differs also in being much more perishable. These cheeses commonly sell for 10 or 15 cents each, which is about 40 to 50 cents a pound.

Of late there have been on the market varieties of such cheese or of Neufchâtel, made by combining the cheese with chopped pimiento. These bring a relatively high price in market and may be easily prepared at home if this seems more convenient. (See p. 34.)

NEUFCHÂTEL CHEESE.

This very popular variety—named from a town in northeastern France—is similar in appearance and in the way it is marketed to soft cream cheese. It is made either from whole or skim milk curdled with rennet. After draining and pressing, it is kneaded thoroughly, formed into small rolls or blocks, and then ripened until special molds develop, which requires about four weeks. It is then wrapped in tinfoil and marketed.

PARMESAN CHEESE.

This is a name given outside of Italy to a very hard cheese which in that country is said to be known as Grana, a name given because of the granular appearance which it has after it has been broken. It is sometimes sold in grated form and brings a relatively high price, but is more commonly sold ungrated. When well made it will keep for years and may be easily broken and grated. It is very generally used in Europe for serving with soups, for seasoning macaroni, and for other similar purposes, and is quite common in American markets.

SAP SAGO.

This is a skim-milk cheese made in Switzerland, which is suitable for grating. It contains, for every 4 pounds of cheese, 1 pound of a clover (_Melilotus cæruleus_) grown in Switzerland. It is greenish in color and has an unusual flavor. It is not high-priced.

GORGONZOLA AND ROQUEFORT.

These are highly flavored cheeses characterized by the presence of molds through their entire mass. Roquefort is made from the milk of sheep; Gorgonzola, from cows’ milk.

POTTED OR SANDWICH CHEESES.

Ordinary cheese is often mixed with butter or oil in the proportion of 5 parts of cheese to 1 of butter or oil, by weight. The mixture is sometimes seasoned with mustard or with curry powder. Such cheeses, unseasoned or seasoned, are on the market in great

variety. Potted cheese may be easily prepared at home if the housekeeper wishes to take the trouble.

SWISS CHEESE (EMMENTALER, GRUYÈRE, ETC.).

This term as used in America is somewhat vague. Different names are given to the varieties according to the districts of Switzerland in which they are made, but they are all similar and characterized by a mild, sweetish flavor and the presence of large holes or “eyes.” Foreign and domestic brands are to be found in most markets. They are suitable for cooking purposes, as well as for use without being cooked, and are much used in this way in Europe and well known and liked in the United States.

EDAM CHEESE.

This is a cheese made in Holland. It is molded in spherical form, and the outside is usually dyed red. It is usual in this country to cut off a section of the top, which serves as a lid, and to scoop out the inside as needed. In Holland it is frequently served in slices, particularly when it is fresh. Edam cheese is seldom used in cookery in American homes, though thrifty housewives, after the greater part of the cheese has been removed, often stuff the hollow shell with cooked and seasoned macaroni, rice, or something similar and bake.

BRIE AND CAMEMBERT CHEESE.

These are very soft rennet cheeses of foreign origin and of somewhat smaller nutritive value than standard cheese, and of strong flavor and odor. They are not often used in cookery, but are used as an accompaniment to other foods. The Bureau of Animal Industry and the Connecticut Storrs Experiment Station in cooperation have experimented with the making of Camembert cheese with marked success, and have published a full account of the work.[6]

COTTAGE CHEESE.

Cottage cheese and other sour milk and cream cheeses, junket, Devonshire cream, and a number of other cheese-like products are described in the section which deals with homemade cheese.

FOOTNOTES:

[5] U. S. Dept. Agr., Bur. Anim. Indus. Bul. 146.

[6] U. S. Dept. Agr., Bur. Anim. Indus. Buls. 71, 98, 109, 115, 120, Circ. 145; Conn. Storrs Sta. Buls. 35, 46, and 58.

THE CARE OF CHEESE IN THE HOME.

One of the best ways of keeping cheese which has been cut is to wrap it in a slightly damp cloth and then in paper, and to keep it in a cool place. To dampen the cloth, sprinkle it and then wring it. It should seem hardly damp to the touch. Paraffin paper may be used in place of the cloth. When cheese is put in a covered dish, the air should never be wholly excluded, for if this is done, it molds more readily.

In some markets it is possible to buy the small whole cheeses mentioned on page 6. These may be satisfactorily kept by cutting a slice from the top, to serve as a cover, and removing the cheese as needed with a knife, a strong spoon, or a cheese scoop. It is possible to buy at the hardware stores knobs which inserted in the layer cut from the top make it easy to handle. The cheese below the cover should be kept wrapped in a cloth.

CHEESE AS A FOOD.

Cheese is used in general in two ways—in small quantities chiefly for its flavor and in large quantities for its nutritive value as well as for its flavor. Some varieties of cheese are used chiefly for the first purpose, others chiefly for the second. Those which are used chiefly for their flavor, many of which are high priced, contribute little to the food value of the diet, because of the small quantity used at a time. They have an important part to play, however, in making the diet attractive and palatable. The intelligent housekeeper thinks of them not as necessities, but as lying within what has been called “the region of choice.” Having first satisfied herself that her family is receiving sufficient nourishment, she then, according to her means and ideas of an attractive diet, chooses among these foods and others which are to be considered luxuries.

Those cheeses, on the other hand, which are suitable to be eaten in large quantities and which are comparatively low priced are important not only from the point of view of flavor, but also from the point of view of their nutritive value. Among such cheeses the one which, as noted above, is known to the trade as standard factory cheese and to the housewife as American cheese stands out pre-eminently. Therefore when the word “cheese” is used without specification in the following pages it may be taken to refer to this particular variety.

THE FLAVOR OF CHEESE.

Cheese owes its flavor to the fatty acids and their compounds which it contains and to ammonia-like bodies formed during ripening from the cleavage of the casein, to salt added to the curd, and in some varieties, like Roquefort, to bodies elaborated by molds which develop in the cheese. In the highly flavored sorts some of the fatty acids of a very marked odor are present in abundance, as are also the ammonia-like bodies. Indeed, in eating such cheese as Camembert a trace of ammonia flavor may often be plainly detected.

The cleavage of the nitrogenous material of the cheese and other changes are brought about chiefly by the action of enzymes originally present in cheese or by microorganisms and are to be regarded as fermentative and not as putrefactive changes.

The liking for highly flavored cheeses of strong odor is a matter of individual preference, but from the chemist’s standpoint there is no reason for the statement often made that such cheeses have undergone putrefactive decomposition.

COMPOSITION OF CHEESE AND SOME OTHER FOODS COMPARED.

In the present state of our knowledge concerning dietetics it seems best to give the housekeeper general rather than absolute rules with respect to the kind and amount of food which should be eaten at any meal or at any given time by persons in normal health living under usual conditions. It is not necessary, therefore, for the housekeeper to know the exact composition of food materials in order to cater well for her family, a rough approximation being sufficient for the purpose. In the case of cheese she will be near enough to the fact if she thinks of it as composed approximately of equal parts by weight of proteids, fats, and water. This rough conception is sufficient to associate it in her mind with the foods of high proteid value, a point which is important in connection with the making of bills of fare. It should lead her to class it also with the foods which are rich in fat and prevent her from combining it unnecessarily with other fatty foods.

In order, however, that the question of the use of cheese in the diet may be adequately discussed, knowledge of its composition in comparison with other foods is desirable, and there is an abundance of data available on this subject, since the composition of cheese and other foods has often been investigated at the Department of Agriculture, in experiment station laboratories, and in many other places where nutrition problems are studied. An extended summary of analyses of cheese of different sorts is included in an earlier publication of this department.[7]

Data regarding the composition of cheese and a few other common foods are summarized in the following table:

Average composition of cheese and some other common foods as purchased, and also on the basis of edible portion.

Food materials.	Refuse.	Water.	Protein.	Fat.
	Per cent.	_Per cent._	_Per cent._	_Per cent._
Cheese		34.2	25.2	33.7
Beef of average composition as purchased	18.6	50.5	15.2	15.5
Edible portion		62.2	18.8	18.8
Porterhouse steak as purchased	12.7	52.4	19.1	17.9
Edible portion		60.0	21.9	20.4
Loin steak, broiled, edible portion		54.8	23.5	20.4
Dried beef		53.7	26.4	6.9
Eggs as purchased	11.2	65.5	13.1	9.3
Edible portion		73.7	13.4	10.5
Milk		87.0	3.3	4.0
Bread		35.3	9.2	1.3
Potatoes as purchased	20.0	62.6	1.8	.1
Edible portion		78.3	2.2	.1
Apples as purchased	25.0	63.6	.3	.3
Edible portion		84.6	.4	.5

Food materials.	Carbohydrates.	Ash.	Fuel value per pound.
	Per cent.	_Per cent._	_Calories._
Cheese	2.4	3.8	1,950
Beef of average composition as purchased		.7	935
Edible portion		.9	1,145
Porterhouse steak as purchased		.8	1,110
Edible portion		1.0	1,270
Loin steak, broiled, edible portion		1.2	1,300
Dried beef		8.9	790
Eggs as purchased		.9	635
Edible portion		1.0	720
Milk	5.0	.7	310
Bread	53.1	1.1	1,215
Potatoes as purchased	14.7	.8	295
Edible portion	18.4	1.0	385
Apples as purchased	10.8	.3	190
Edible portion	14.2	.3	290

It will be seen from the above table that cheese has nearly twice as much protein, weight for weight, as beef of average composition as purchased and that its fuel value is more than twice as great. It contains over 25 per cent more protein than the same weight of porterhouse steak as purchased, and nearly twice as much fat.

As shown by the figures in the above table, cheese contains 3.8 per cent ash. Of this a considerable part may be salt added in cheese making. Like the milk from which it is made, cheese ash is characterized chiefly by the presence of calcium (lime), magnesium, phosphorus, and iron, the average values as given in earlier bulletins of the department[8] being 1.24 per cent calcium oxid, 0.049 per cent magnesium oxid, 1.49 per cent phosphorus pentoxid, and 0.0015 per cent iron.

The total amount of the mineral matter needed per day by the body is relatively small, yet mineral matter is very important. It is commonly assumed and is probably true, that a mixed diet reasonably varied and reasonably generous will supply all the ash constituent which the body requires. If for any reason calcium and phosphorus are lacking in the diet, the amounts may be readily increased (as pointed out in one of the publications just cited) by a free use of milk and such milk products as cheese and junket, without decreasing the palatability of the diet or materially increasing its cost.

FOOTNOTES:

[7] U. S. Dept. Agr., Bur. Anim. Indus. Bul. 146.

[8] U. S. Dept. Agr., Office Expt. Stas. Buls. 185 and 227.

NUTRITIVE VALUE AND COST OF CHEESE AND SOME OTHER FOOD MATERIALS.

Since the market prices of foods vary, it is difficult to compare the amounts of nourishment secured for a given sum, 10 cents say, in buying different food materials. We may, however, suppose that foods have certain prices and make the comparison on this basis. In the following table the amount of cheese obtained for 10 cents when cheese costs 22 cents a pound is shown, together with the protein and energy value of this quantity, this value being compared with similar values for a number of other common foods at certain assumed prices per pound.

Amounts of protein and energy obtained for 10 cents expended for cheese and other foods at certain assumed prices per pound.

---------- | | | 10 cents' worth will | | 10 cents | contain— Food | Price. | will |---------- materials. | | buy— | | A fuel | | | Proteid. | value of— ----------+----------+----------+----------+---------- | |_Ounces._ |_Ounces._ |_Calories._ Cheese | 22 cents per pound | 7.3 | 1.9 | 886 Beef, average | 20 cents per pound | 8.0 | 1.2 | 467 Porterhouse | | | | steak | 25 cents per pound | 6.4 | 1.3 | 444 Dried beef | do | 6.4 | 1.6 | 315 Eggs | 24 cents per dozen | 10.0 | 1.3 | 198 Milk | 9 cents per quart | 38.3 | 1.2 | 736 Wheat bread | 5 cents per pound | 32.0 | 2.9 | 2,400 Potatoes | 60 cents per bushel | 160.0 | | 2,950 Apples | 1½ cents per pound | 106.7 | | 1,270 ----------+----------+----------+----------+----------

Since cheese is ready to be eaten when it comes from the market, it may be more interesting for some purposes to compare its composition with that of cooked beef, freed from bone and from superfluous fat, such a piece as would be served to a person at the table. Weight for weight, cheese has appreciably more protein than such cooked beef, and 50 per cent more fat.

So far as its composition is concerned, then, cheese is entitled to be considered as directly comparable with meat. The possibilities of using cheese and some other food materials in the same way as meat is discussed in some detail in an earlier publication of this department.[9] It is so used by the peasants of some parts of Europe, and was formerly so used among many other groups of people. The fact that it is not more commonly so used in this country is probably due to several causes. One cause is habit, which makes the meal seem incomplete unless it includes meat; another is the fact that since cheese has a more pronounced flavor than meat, it is not so likely to be generally acceptable as the chief food of a meal. There is always likely to be at least one member of the family who does not relish it in quantity. Another cause is the fact that it is commonly believed to be indigestible, and still another is the fact that housekeepers, through lack of experience, are much less skillful in the arrangement of bills of fare in which cheese is the central food than they are in arranging bills of fare in which meat is thus used. These last two causes will be considered in sections which follow.

FOOTNOTES:

[9] U. S. Dept. Agr., Yearbook 1907, p. 367.

THE DIGESTIBILITY OF CHEESE.

As was stated above, cheese has been thought a cause of digestive disturbances, but work recently done by the Office of Experiment Stations, in cooperation with the Bureau of Animal Industry, and briefly summed up in a recent publication tends to disprove this.[10]

In the large number of experiments which were conducted, young men in good health were fed on a diet consisting of bread and fruit combined with American factory cheese which was made with different amounts of rennet and in different stages of ripening. The results showed that over 90 per cent of the nitrogenous material of the cheese was digested—that is, retained in the body—and nearly 90 per cent of the energy it supplied was available. In other words, cheese compares favorably with other foods in thoroughness of digestion—that is, in the percentage finally digested. Furthermore, it did not cause constipation or other physiological disturbances.

The above statement refers to full-cream cheese. Experiments made at the same time gave practically the same values for the digestibility of skim-milk cheese, of Swiss cheese, of Roquefort and Camembert cheese, and of cottage cheese.

Artificial digestion experiments made at the Minnesota Agricultural Experiment Station[11] indicate that cheese protein is digested by the ferments of the intestines rather than by those of the stomach, and this is suggested as a reason for its reputation as a "hearty" food, the belief being that some foods which remain in the stomach longer than the average time, or are not digested by the stomach, are "hearty." Cheese protein (casein) is intimately associated with fat, and there is experimental evidence to show that this condition has an effect upon the progress of digestion in the stomach.

The burning sensation or similar sensations sometimes experienced after eating certain sorts of cheese has been attributed to the presence of small amounts of free fatty acids.[12] It is commonly said that cheese is difficult to digest, the idea being that the body expends more labor in assimilating it than is required for other comparable foods. Experiments recently carried on by the Office of Experiment Stations in which the respiration calorimeter was used to study the energy expenditure during the period of active digestion, do not indicate that cheese differs materially in ease of digestion from a comparable amount of meat.[13] Uncooked full-cream cheese was used in these experiments. Another series recently begun by the Office of Experiment Stations with cooked cheese, though not yet sufficiently advanced to be conclusive, indicates that cheese thus eaten does not differ materially from raw cheese in this respect.

In connection with the use of cooked cheese in the diet, one fact should always be kept in mind. This is that, in common with all other fatty foods, cheese which has been overheated in cooking is likely to contain burned—that is, decomposed—fats. Disturbances from this cause, however, should be laid to poor cooking and not to the composition of this special food.

The use of potassium bicarbonate has often been recommended for increasing the digestibility of cheese, the amount suggested being a level teaspoonful to a pound of cheese. That the bicarbonate renders the cheese soluble in any appreciable degree, as has been claimed, is not apparent from a number of experiments which have been made. It does, however, neutralize some of the free fatty acids of the cheese, thus destroying some of the characteristic flavor. To some people this may be an advantage, but to others it would be counted a disadvantage.

FOOTNOTES:

[10] U. S. Dept. Agr., Bur. Anim. Indus. Circ. 166.

[11] Minnesota Sta. Bul. 74.

[12] Hutchison's "Food and the Principles of Dietetics," London, 1901, p. 145.

[13] U. S. Dept. Agr., An. Rpt. Sec. 1910, p. 149; Rpt. Office Expt. Stas. 1910, p. 35; Yearbook 1910, p. 359.

THE USE OF CHEESE IN THE DIET.

It has been the purpose, in preparing this discussion of cheese, to consider ways in which mild-flavored sorts may serve as staple articles of diet, rather than the use of highly flavored varieties as appetizers and as accompaniments of other foods. The use of highly flavored cheese as a condiment is customary and may profitably be extended, since it offers a simple way of adding to the

attractiveness of the diet. The variety of the cheese selected is a matter of choice, some persons preferring such kinds as well-ripened American full-cream cheese or the potted cheeses, and others such sorts as Roquefort, Camembert, and other varieties. From the physiologist's standpoint, cheese used in this way for its flavor should really form a part of a well-balanced meal rather than be added to a meal which already supplies an abundance of nutritive material. In other words, condimental cheeses may better accompany a moderate than a very generous menu.

In considering the use of cheese in quantity as an integral part of the diet there are many possibilities from simple combinations like bread and cheese to elaborate dishes in which cheese is used as a flavor and as a principal constituent.

As has been pointed out, cheese, being rich in both protein and fat, would logically replace such foods as meat, fish, and eggs when taken in quantity, rather than cereal foods characterized by a large amount of starch, or succulent foods, such as vegetables and fruits. In planning menus of which cheese forms a large part the housekeeper should bear these facts in mind.

BILL-OF-FARE MAKING WITH CHEESE AS THE CENTRAL FOOD.

Since meat has so generally been the chief protein food of a meal, and the kind selected usually has determined the choice of vegetables and condiments, it is not strange that very many housekeepers should be inexperienced and consequently unskillful in planning meals in which cheese is substituted for meat when for any reason they may desire to make such a change. In seeking skill they might take a suggestion from the experiments to which reference has been made, and also from a case investigated and reported by the Office of Experiment Stations, of a man who lived for months upon a diet of bread, fruit, and cheese, and who remained in good health and active, and did not weary of the monotony of the diet.

The first two articles of the diet mentioned, namely, the bread and the cheese, could have been taken in such amounts as to constitute what is usually considered a balanced ration, i.e., in such amounts as to supply the right quantity of muscle-forming foods in comparison with the energy value. The bread and cheese taken with the fruit, however, make a ration which is well balanced not only in the older and more widely accepted sense, but also in the more modern sense that it makes an attractive and palatable combination of foods, as well as a balanced ration, and thus favors digestion. The watery and refreshing fruits or succulent vegetables with their large supply of cellulose are a pleasant contrast to the concentrated and fatty cheese.

Housekeepers would probably find that if in planning menus of which a cheese dish is the chief feature they were to take pains to supply also crisp, watery vegetables, water cress, celery, lettuce served with a dressing or with salt alone, or simple fruit salads, and would give preference to refreshing fruits, either fresh or cooked, rather than to what are known as heavy desserts, they would in general be more successful in pleasing those who are served.

There is another point also to be considered in combining cheese with other foods. Whether it is raw or cooked it is likely to be somewhat soft, and so seems to call for the harder kinds of bread—crusty rolls or biscuit, zweiback, toast, pulled bread, rye bread, the harder brown breads, or crackers, and some of the numerous crisp ready-to-eat cereal breakfast foods. Brittle cookies, too, seem more suitable than rich soft cakes or puddings for the dessert in such meals.

A few bills of fare are given below which experience has shown to represent combinations of dishes which are palatable and which, if eaten in usual amounts, will supply protein and energy in proportions which accord with usual dietary standards. Menus such as these are more commonly served at lunch or at supper, but they might equally well be served for dinner, the selection of dishes for any meal being of course chiefly a matter of custom and convenience for those who have any range of choice.

Suggested bills of fare in which cheese dishes are the chief source of protein and fat.

MENU NO. 1.

Macaroni and cheese (p. 26 or p. 27). Raisin bread or date bread. Orange and water-cress salad. Baked apples. Sugar cookies. Cocoa.

MENU NO. 2.

Cheese fondue (p. 24 or p. 25). Toast, zwieback, or thin and crisp baking-powder biscuit. Celery. Potatoes, baked, boiled, or fried in deep fat. Peas, or some other fresh vegetables. Coffee. Fruit salad with crisp cookies or meringues.

MENU NO. 3.

Clear soup. Baked eggs with cheese (p. 29) or Boston roast (p. 28). Baked potatoes. Lettuce salad. A sweet jelly, crab apple or quince for example, or a preserve. Rye bread. Orange or banana shortcake. Tea.

These bills of fare should be taken as suggestive merely and not as a solution of the problem. In fact, the whole art of making bills of fare needs developing. There is abundant evidence that overeating, where it exists, is frequently due to the fact that meals are not skillfully planned. People often continue eating after they have taken enough in total bulk because they have not had all they want of some particular kind of food. The meal has contained too large a percentage of proteid or too much starch; has been too moist or too dry; too highly flavored or not sufficiently flavored. Bill-of-fare making calls not only for knowledge of food values but also for skill in combining flavors and textures.

In this discussion of menu making, and of the use of cheese as an integral part of the diet, the aim has been to suggest ways of using cheese to add to the palatability of meals made up of usual dishes, and to suggest dishes containing cheese which could serve as substitutes for meat dishes when so desired, and also for dishes of many sorts to be used as taste suggests and in which the nutritive value as well as the flavor is increased by the addition of cheese. If cheese is used and in quantity, it is obvious that some other proteid and fat foods should be diminished, in order that the meal or day's menu may not be unduly hearty.

For the convenience of the housekeeper, a number of recipes for cheese dishes are given in later pages, these being preceded by directions for making cottage cheese and other similar cheeses which are usually made in the home.

HOMEMADE CHEESE.

Even as late as a generation or two ago cheese of different kinds was made at home for family use, as sour-milk or cottage cheese still is, and cheese making was very generally a farm industry, cheese, like butter, being sold by the farmer who made it. Cottage cheese is very commonly homemade. Most types of cheese, however, are now as a rule made on a large scale in factories where advantage may be taken of labor-saving devices. The general topic of farm cheese making has been considered in an earlier bulletin of this series,[14] prepared by the Dairy Division of the Bureau of Animal Industry.

Curds and Whey.

Cheese curds and whey, an old-fashioned dish, which is often spoken of in accounts of life in earlier times, sometimes refers to sour-milk curd and sometimes to curd separated with rennet. This dish when made with rennet is much like junket and though far less common to-day than was once the case is wholesome and palatable.

Cottage Cheese.

This cheese is very commonly prepared in the home, and the process of making it is very simple. It consists merely of curdling the milk, separating the curd from the whey, seasoning, and pressing it.

The curd is formed by the souring of the milk, and the process is hastened if the milk is kept warm, the best temperature being about blood heat, 96° F. A temperature much above this should be avoided, as the curd is likely to become hard and tough if much heated. The danger is usually not that the whole will be overheated but that the portion nearest the fire will be. In the old-fashioned kitchen there was usually a place where the milk could stand till it was uniformly warm throughout. With our present cooking arrangements it is often desirable to hasten the process. This may be done by setting the milk into a pan of warm water or by pouring hot water directly into the milk itself. The effect of the latter method is to remove much more of the acid than when the whey is left undiluted. Some consider this a great advantage.

If, for any reason, the curd is overheated, it should be put through a meat chopper. This will insure cottage cheese of excellent texture.

If the milk is thoroughly chilled before the whey is drained off it retains more of the fat than if this is done when warm. Under no circumstances, however, is much of the fat retained in cottage cheese. It is therefore more economical to make it out of skim milk and to add the fat to the curd in the form of butter or cream.

Chopped parsley, caraway seeds, chopped olives, and pimiento may all be used for flavoring if such flavored cheese is preferred to plain cottage cheese.

Cottage cheese[15] is most commonly consumed immediately, but if made in quantity for commercial purposes, it may be packed in tubs and placed in cold storage. Sometimes it is formed into rolls or blocks and wrapped in tinfoil when marketed. Such cheese is used without ripening.

Though cottage cheese is usually made by allowing the milk to sour naturally, it is sometimes more convenient to curdle the milk by adding rennet, and some housekeepers have a preference for cottage cheese thus made, since the flavor is milder and the acid taste which it possesses when made from sour milk is lacking.

Sour-Cream Cheese.

When cream is to be made into cheese similar to cottage cheese, it should be drained without having previously been heated. The drainage is facilitated by moistening the cloth in salt water before the cream is poured in. The curd is formed either by souring or by the addition of rennet.

Uncooked Curd, or French Cottage Cheese.

The French make cheese from sour milk without heating it. They pour the milk into earthen molds which have holes in the bottom. A very fine sieve may be used instead of the molds. The whey drips out and the curd assumes a custard-like consistency and takes the shape of the mold. When sufficiently stiff, the cheese is chilled, and is eaten with sweet cream and sugar. It is a staple dessert in many French families, especially in hot weather, and is delicious served with acid fruit, such as currants, or with strawberries.

Junket.

If cottage cheese is made from sweet milk and rennet and served without breaking and separating the curd and whey, the dish is called junket. It is customary to season it a little, as with grated nutmeg or with cinnamon and sugar.

Buttermilk Cheese.

At the Wisconsin Experiment Station[16] a method has been devised for making a soft moist cheese out of buttermilk. When made on a large scale, as it might be in creameries, there are various precautions to be taken which are pointed out in the publication cited. In making it in small quantities, these precautions are unnecessary, and the method is even simpler than that of making cottage cheese, because the quality does not depend so much on the temperature.

To make the buttermilk cheese, heat buttermilk gradually to about 130° or 140° F. Allow it to cool and strain it. As the curd will settle to the bottom, most of the whey may be poured off before the draining is begun.

This cheese is, of course, almost wholly without fat and yet, probably because the particles of curd are very finely divided, it has a smooth consistency, which suggests the presence of fat. It may be served seasoned with salt only or it may be mixed with butter or cream and seasonings. It is suitable for combining with olives and pimientos, as recommended on page 34, or for any use to which the ordinary cream cheeses are put.

Buttermilk Cream.

This product also was devised by the Wisconsin Experiment Station.[17] By controlling the temperature in heating the buttermilk and not allowing it to go above 100° F., a compound is made which after draining has the consistency of a very thick cream. It is claimed by the station investigators that this “cream” is suitable for eating on bread in place of butter.

The recipes on pages 34 and 35 suggest ways of making a salad dressing out of buttermilk cream.

Devonshire Cream.

Devonshire cream somewhat resembles sweet cream in flavor and consistency. It is very much liked in England, where it is commonly eaten with fresh or preserved fruit, but is not so well known in America.

To make Devonshire cream, allow a pan of whole milk to stand for 24 hours in a cool place or for 12 hours in a warmer place. Place the pan on the cooler part of the stove and heat until the milk is very hot, but not to the boiling point. If heated too much a thick skin will form on the surface. The more slowly the milk is heated the better. Having been heated, the milk should be kept in a cool place for 24 hours and then skimmed. The thick cream obtained has a characteristic flavor and texture.

FOOTNOTES:

[14] U. S. Dept. Agr., Farmer's Bul. 166.

[15] North Carolina Sta. Bul. 210.

[16] Wisconsin Sta. Bul. 195.

[17] Loc. cit.

CHEESE DISHES AND THEIR PREPARATION.

The list of cheese dishes in the culinary literature of this and other countries is a long one, but most of them are variations of a comparatively small number of general types. Those which have been selected and studied experimentally represent the principal types and in many cases have been adapted to American methods of preparations and tastes. In some instances, this has resulted in new and perhaps more rational combinations than those which served as models.

For convenience, the cheese dishes included in this bulletin have been grouped under the following heads:

(1) Cheese dishes which may serve as meat substitutes. (2) Cheese soups and vegetables cooked with cheese. (3) Cheese salads, sandwiches, and similar dishes. (4) Cheese pastry, cheese sweets, and similar dishes.

Variety may be obtained in the recipes by varying the flavorings. Among the best flavorings for cheese dishes are onion, chives, and the ordinary green sweet pepper. Since the cheese needs very little cooking, however, and onion or the pepper needs a great deal, they should always be previously cooked, either by stewing in a very little water, or by cooking in butter. The seeds of the pepper, of course, should be removed before cooking. Where chopped celery is used, as it may be in most of these dishes, it, too, should be cooked beforehand until tender. Other good flavors are mustard, curry powder, onion juice, chopped olives, pimiento, and, according to European recipes, nutmeg or mace.

In preparing the cheese it often has been found convenient to use a very coarse grater having slits instead of the usual rounded holes. Such a grater, in spite of its name, shaves the cheese instead of grating it. When the cheese is soft this is an advantage, since the grater does not become clogged.

CHEESE DISHES WHICH MAY BE USED IN THE SAME WAY AS MEAT.

Meat is wholesome and relished by most persons, yet it is not essential to a well-balanced meal and there are many housekeepers who for one reason or another are interested in lessening the amount of meat which they provide or to substitute some other foods for it. The problem with the average family is undoubtedly more often the occasional substitution of other palatable dishes for the sake of variety, for reasons of economy, or for some other reason than the general replacement of meat dishes by other things.

Foods which are to be served in place of meat should be rich in protein and fat and should also be savory. Cheese naturally suggests itself as a substitute for meat, since it is rich in the same kinds of nutrients which meat supplies, is a staple food with which everyone is familiar, and is one which can be used in a great variety of ways. In substituting cheese for meat, especial pains should be taken to serve dishes which are relished by the members of the family. A number of recipes for dishes which contain cheese are given below. They are preceded by several recipes for cheese sauces which, as will appear, are called for in the preparation of some of the more substantial dishes.

Cheese Sauce No. 1.

1 cupful of milk. 2 tablespoonfuls of flour. 1 ounce of cheese (¼ cupful of grated cheese). Salt and pepper.

Thicken the milk with the flour and just before serving add the cheese, stirring until it is melted.

This sauce is suitable to use in preparing creamed eggs, or to pour over toast, making a dish corresponding to ordinary milk toast, except for the presence of cheese. It may be seasoned with a little curry powder and poured over hard-boiled eggs.

Cheese Sauce No. 2.

Same as cheese sauce No. 1, except that the cheese is increased from 1 to 2 ounces.

This sauce is suitable for using with macaroni or rice, or for baking with crackers soaked in milk. (See p. 27.)

Cheese Sauce No. 3.

Same as cheese sauce No. 1, except that two cupfuls of grated cheese or 8 ounces are used. This may be used upon toast as a substitute for Welsh rabbit.

Cheese Sauce No. 4.

Same as cheese sauce No. 2, save that 2 tablespoonfuls of melted butter are mixed with the flour before the latter is put into the milk. This sauce is therefore very rich in fat and has only a mild flavor of cheese.

Among the recipes for dishes which may be used like meat, the first 30 are such that, eaten in usual quantities, they will provide much the same kind and amount of nutritive material as the ordinary servings of meat dishes used at dinner. In several cases there is a resemblance in appearance and flavor to common meat dishes, which would doubtless be a point in their favor with many families.

While, chiefly owing to custom, it may not accord with the taste of the family to serve cheese dishes at dinner in place of meat, it is much more in accord with usual dietary habits in American homes to serve such dishes at least occasionally for lunch, for supper, or for breakfast; that is, for a less formal meal than dinner. The last group of recipes in this section, beginning with “breakfast cereals with cheese,” supply rather smaller proportions of nutritive materials than those in the first group and so may be more suitable for use at the less hearty meals. There is no hard and fast line to be drawn between the two groups, however, and many of the recipes may be used interchangeably.

In the recipes calling for large amounts of cheese the food value is given, not in figures, but in comparison with beef of average composition and average percentage of waste. This comparison is necessarily rough owing to the varying composition of the foods and the varying weights of such ingredients as a cupful of grated cheese or bread crumbs. In making the comparisons, beef of average composition has been considered to have 15.2 per cent of protein, and a fuel value of 935 calories per pound; ordinary American cheese has been considered to have 26 per cent of protein and a fuel value of 1,965 calories per pound. After many weighings, 4 ounces was decided to be the average weight of a cupful of cheese and 2½ ounces the average weight of a cupful of bread crumbs. These weights have been taken, therefore, in calculating the food value of dishes. When cheese is very soft, however, it may be pressed into a cup and measured like butter. Under these circumstances, the weight of a cupful of cheese may be considered one-half a pound. The price of cheese is taken as 22 cents a pound, of butter 25 cents a pound, of eggs 25 cents a dozen, in this and all similar calculations in this bulletin. Prices vary with time, place, and season. Those mentioned above are such as were paid for materials at the time the experiments here summarized were made and are not extreme values in either direction. Like all such estimates, the calculations are only relative, and the housekeeper who wishes to estimate the comparative cost of the cheese dishes and other foods can readily do so by taking into account the amount of materials used and the prices paid for ingredients at any particular time.

Cheese Fondue No. 1.

1■ cupfuls of soft, stale bread crumbs. 6 ounces of cheese (1½ cupfuls of grated cheese or 1■ cupfuls of cheese grated fine or cut into small pieces.) 4 eggs. 1 cupful of hot water. ½ teaspoonful of salt.

Mix the water, bread crumbs, salt, and cheese; add the yolks thoroughly beaten; into this mixture cut and fold the whites of eggs beaten until stiff. Pour into a buttered baking dish and cook 30 minutes in a moderate oven. Serve at once.

The food value of this dish, made with the above quantities, is almost exactly the same as that of a pound of beef of average composition and a pound of potatoes combined. It contains about 80 grams of proteids and has a fuel value of about 1,300 calories. Estimated cost, 18 cents, calculated as explained on p. 23.

Cheese Fondue No. 2.

1■ cupfuls of hot milk. 1■ cupfuls of soft, stale bread crumbs. 1 tablespoonful of butter. 4 eggs. ■ of a pound of cheese (1■ cupfuls of grated cheese or 1 cupful of cheese cut into small pieces). ½ teaspoonful of salt.

Prepare as in previous recipe.

The protein value of this dish is equal to that of 1■ pounds of potato and beef, the fuel value, however, being much in excess of these. Calculated cost (see p. 23), 22 cents.

In making either of these fondues, rice or other cereals may be substituted for bread crumbs. One-fourth cupful of rice measured before cooking, or one cupful of cooked rice or other cereals, should be used.

A comparison of the recipes for the two fondues may indicate the general principle on which the recipes in this bulletin have been worked out. The second recipe is one commonly found in cookbooks. In the first one, the butter has been omitted and water substituted for milk and the amount of cheese is slightly increased. This makes a somewhat cheaper dish and one which is less rich because its percentage of fat is not so great. For this reason it is easier to adjust to the ordinary bill of fare. A dish in which there is combined cheese with its large percentage of fat, butter with its 85 per cent of fat, and eggs with their 10 per cent of fat, is too rich to admit of being combined rationally with other fatty dishes. It therefore limits the number of dishes that may be served with it, making milk soup, for example, or dishes containing white sauce or those containing much butter or oil seem out of place. The omission of butter from the ordinary recipes and the substitution of water or skimmed milk for whole milk may perhaps be the means of making cheese dishes more wholesome and more generally acceptable.

Another advantage of omitting butter from cheese dishes and of substituting water or skimmed milk for whole milk is that it makes it possible to increase the amount of cheese without making the dish too rich. This is of advantage to those who like the flavor of cheese, and also, because it tends to increase the tissue-forming value of the dish, particularly if skimmed milk is used rather than water.

Boiled Fondue.

1½ cupfuls of bread crumbs. 1½ cupfuls of milk. 1½ cupfuls of cheese cut into small pieces. 1 egg. 2 tablespoonfuls of butter. 6 ounces of crackers.

Soak the bread in the milk. Melt the butter and add the cheese. When the cheese has melted add the soaked crumbs, the eggs slightly beaten, and the seasoning. Cook a short time and serve on toasted crackers.

Since it consists of essentially the same ingredients, the food value of this dish is obviously much the same as that of fondue made in other ways.

Rice Fondue.

1 cupful of boiled rice. 2 tablespoonfuls of milk. 4 eggs. 1 cupful of grated cheese. ½ teaspoonful of salt. 1 teaspoonful of some commercial meat sauce, or similar flavoring.

Heat the rice in the milk, add the other ingredients, and cook slowly until the cheese is melted. Serve on crackers or toast.

The food value is not far from that of a pound of beef of average composition, and the calculated cost (see p. 23) is 15 cents.

Corn and Cheese Soufflé.

1 tablespoonful of butter. 1 tablespoonful of chopped green pepper. ¼ cupful of flour. 2 cupfuls of milk. 1 cupful of chopped corn. 1 cupful of grated cheese. 3 eggs. ½ teaspoonful of salt.

Melt the butter and cook the pepper thoroughly in it. Make a sauce out of the flour, milk, and cheese (see p. 23); add the corn, cheese, yolks, and seasoning; cut and fold in the whites beaten stiffly; turn into a buttered baking dish and bake in a moderate oven 30 minutes.

Made with skimmed milk and without butter, this dish has a food value slightly in excess of a pound of beef and a pound of potatoes. Calculated cost (see p. 23), about 20 cents.

Welsh Rabbit.

1 tablespoonful of butter. 1 teaspoonful of cornstarch. ½ cupful of milk. ½ pound of cheese, cut into small pieces. ¼ teaspoonful each of salt and mustard. A speck of cayenne pepper.

Cook the cornstarch in the butter; then add the milk gradually and cook two minutes; add the cheese and stir until it is melted. Season and serve on crackers or bread toasted on one side, the rabbit being poured over the untoasted side. Food value is that of about three-fourths of a pound of beef. Calculated cost (see p. 23), 13 cents.

Tomato Rabbit.

2 tablespoonfuls of butter. 2 tablespoonfuls of flour. ¾ cupful of milk. ¾ cupful of stewed and strained tomatoes. ■ teaspoonful of soda. 1 pound of cheese. 2 eggs, slightly beaten. Salt, mustard, cayenne pepper.

Cook the butter and the flour together, add the milk, and as soon as the mixture thickens add tomatoes and soda. Then add cheese, eggs, and seasoning. Serve on toasted whole wheat or Graham bread.

Green Corn, Tomato, and Cheese.

1 tablespoonful of butter. 2 cups of grated cheese. ¾ cup of canned or grated fresh corn. 1 ripe pimiento. ½ cup of tomato purée. 2 egg yolks. 1 teaspoonful of salt. ½ teaspoonful of paprika. 1 clove of garlic. 4 slices of bread.

Into the melted butter stir the cheese until it, too, is melted. Then add the corn and pimiento, stir for a moment and add the egg yolks beaten and mixed with the tomato juice and the salt and paprika. Have ready the bread toasted on one side and very lightly rubbed on its untoasted side with the garlic cut in two. Pour the mixture over the untoasted side of the bread and serve at once. A poached egg is sometimes placed on top of each portion, making a very nutritious combination.

Macaroni and Cheese No. 1.

1 cupful of macaroni, broken into small pieces. 2 quarts of boiling salted water. 1 cupful of milk. 2 tablespoonfuls of flour. ¼ to ½ pound of cheese. ½ teaspoonful of salt. Speck of cayenne pepper.

Cook the macaroni in the boiling salted water, drain in a strainer, and pour cold water over it to prevent the pieces from adhering to each other. Make a sauce out of the flour, milk, and cheese. (See p. 23.) Put the sauce and macaroni in alternate layers in a buttered baking dish, cover with buttered crumbs, and heat in oven until crumbs are brown.

Macaroni and Cheese No. 2.

A good way to prepare macaroni and cheese is to make a rich cheese sauce and heat the macaroni in it. (See p. 23.) The mixture is usually covered with buttered crumbs and browned in the oven. The advantage of this way of preparing the dish, however, is that it is unnecessary to have a hot oven, as the sauce and macaroni may be reheated on the top of the stove.

Macaroni with Cheese and Tomato Sauce.

Boiled macaroni may be heated in tomato sauce and sprinkled with grated cheese just before serving.

Italian Macaroni and Cheese.

1 cupful of macaroni broken into small pieces. 2 quarts of boiling salted water. ½ onion. 2 cloves. 1½ cupfuls of tomato sauce. ½ cupful or more of grated cheese.

Cook the macaroni in the boiling salted water with the onion and cloves. Drain, remove the onion and cloves, reheat in tomato sauce, and serve with grated cheese.

Cheese and Macaroni Loaf.

½ cupful of macaroni broken into small pieces. 1 cupful of milk. 1 cupful of soft bread crumbs. 1 tablespoonful of butter. 1 tablespoonful of chopped green pepper. 1 teaspoonful each of chopped onion and parsley. 3 eggs. 1 teaspoonful of salt. ½ cupful of grated cheese.

Cook the macaroni in boiling salted water until tender, and rinse in cold water. Cook the parsley, onion, and pepper in a little water with the butter. Pour off the water or allow it to boil away. Beat the egg white and yolk separately. Mix all the ingredients, cutting and folding in the stiffly beaten whites at the last. Line a quart baking dish with buttered paper; turn the mixture into it; set the baking dish in a pan of hot water, and bake in a moderate oven from one-half to three-fourths of an hour. Serve with tomato sauce.

Baked Rice and Cheese No. 1.

1 cupful of uncooked rice and 4 cupfuls of milk; or, 3 cupfuls of cooked rice and 1 cupful of milk.

2 tablespoonfuls of flour. ½ pound of cheese. ½ teaspoonful of salt.

If uncooked rice is used, it should be cooked in 3 cupfuls of milk. Make a sauce with one cupful of milk, add the flour, cheese, and salt. (See p. 23.) Into a buttered baking dish put alternate layers of the cooked rice and the sauce. Cover with buttered crumbs and bake until the crumbs are brown. The proteids in this dish, made with rice cooked in milk, are equal to those of nearly 1¾ pounds of average beef. If skimmed milk is used, the fuel value is equal to nearly 3½ pounds of beef. Whole milk raises the fuel value still higher. Estimated cost (see p. 23), 28 cents.

Baked Rice and Cheese No. 2.

¼ pound of cheese grated or cut into small pieces. 1 cupful of rice. Milk as needed.

Cook the rice; put into a buttered baking dish alternate layers of rice and cheese; pour over them enough milk to come halfway to the top of the rice; cover with buttered crumbs and brown.

If the rice is cooked in milk either whole or skimmed, and one cup of milk is used to pour over it, this dish has as much protein as 1¼ pounds of beef of average composition, and a much higher fuel value.

Baked Crackers and Cheese No. 1.

9 or 10 butter crackers or Boston crackers. ¼ pound of cheese or 1 cupful of grated cheese. 1½ cupfuls of milk. ¼ teaspoonful of salt. Flour.

Split the crackers, if the thick sort are selected, or with a sharp knife cut them into pieces of uniform size. Pour the milk over them and drain it off at once. With the milk, flour, cheese, and salt, make a sauce. (See p. 23.) Into a buttered baking dish put alternate layers of the soaked crackers and sauce. Cover with bread crumbs and brown in the oven, or simply reheat without covering with crumbs.

The above is a very satisfactory substitute for macaroni and cheese, and can be prepared in less time.

Baked Crackers and Cheese No. 2.

9 or 10 butter crackers or soda crackers. 2 cupfuls of hot milk, whole or skimmed. 1 cupful of grated cheese. ¼ teaspoonful of salt.

This is more quickly prepared than the preceding recipe, but as the milk is likely to curdle, it has not so good a consistency.

Soak the crackers in the milk; place them in a buttered baking dish in alternate layers with the cheese; pour the remaining milk over them and bake. This dish may be covered with buttered crumbs. Variety may be secured, in either this recipe or the preceding one, by putting a very small amount of mixed mustard on each cracker.

Cheese Rolls.

A large variety of rolls may be made by combining legumes, either beans of various kinds, cowpeas, lentils, or peas, with cheese of various kinds, and adding bread crumbs to make the mixture thick enough to form into a roll. Beans are usually mashed, but peas or small Lima beans may be combined whole with bread crumbs and grated cheese, and enough of the liquor in which the vegetables have been cooked may be added to get the right consistency. Or, instead of beans or peas, chopped spinach, beet tops, or head lettuce may be used. Homemade cottage cheese, and the soft cream cheese of commerce, standard cheese, or English dairy may be used.

Boston Roast.

1 pound can of kidney beans or equivalent quantity of cooked beans. ½ pound of grated cheese. Bread crumbs. Salt.

Mash the beans or put them through a meat grinder. Add the cheese and sufficient bread crumbs to make the mixture stiff enough to be formed into a roll. Bake in a moderate oven, basting occasionally with butter and water. Serve with tomato sauce. This dish may be flavored with onions, chopped and cooked in butter and water.

Pimiento and Cheese Roast.

2 cupfuls of cooked Lima beans. ¼ pound of cream cheese, commercial or homemade. 3 canned pimientos chopped. Bread crumbs.

Put the first three ingredients through a meat chopper. Mix thoroughly and add bread crumbs until it is stiff enough to form into a roll. Brown in the oven, basting occasionally with butter and water.

Nut and Cheese Roast.

1 cupful of grated cheese. 1 cupful of chopped English walnuts. 1 cupful of bread crumbs. 2 tablespoonfuls of chopped onion. 1 tablespoonful of butter. Juice of half a lemon. Salt and pepper.

Cook the onion in the butter and a little water until it is tender. Mix the other ingredients and moisten with water, using the water in which the onion has been cooked. Pour into a shallow baking dish and brown in the oven.

Cheese and Spinach Roll.

2 quarts of spinach. 1 cupful of grated cheese. 1 tablespoonful of butter. Salt. Bread crumbs.

Cook the spinach in water for 10 minutes. Drain off the water, add the butter, cook until tender, and chop. Add the grated cheese and then bread crumbs enough to make a mixture sufficiently stiff to form into a roll, or leave more moist and cook in a baking dish.

Vegetable and Cheese Rolls.

For the spinach of the above recipe there may be substituted beet tops, Swiss chard, or the outer leaves of lettuce.

Cheese Used in the Stuffing of Meat.

The mixtures in the preceding two recipes may be used for stuffing veal or beef. Eggs may be added if desired, and chopped onions or parsley may be cooked with the greens. In Italy roasts thus prepared are sprinkled with a little finely chopped garlic, and covered with celery tops and thin slices of bacon or fat pork before roasting.

Creamed Cheese and Eggs.

3 hard-boiled eggs. 1 tablespoonful of flour. 1 cupful of milk. ½ teaspoonful of salt. Speck of cayenne. ¼ cupful or 1 ounce grated cheese. 4 slices of toast.

Make a thin white sauce with the flour and milk and seasonings. Add the cheese and stir until melted. Chop the whites and add them to the sauce. Pour the sauce over the toast, force the yolks through a potato ricer or strainer, sprinkle over the toast.

Baked Eggs with Cheese.

4 eggs. 1 cupful, or 4 ounces, of grated cheese. 1 cupful of fine, soft, stale bread crumbs. ¼ teaspoonful salt. A few grains of Cayenne pepper.

Break the eggs into a buttered baking dish or into ramekins and cook them in a hot oven until they begin to turn white around the edge. Cover with the mixture of crumbs, cheese, and seasonings. Brown in a very hot oven. In preparing this dish it is essential that the oven be very hot or the egg will be too much cooked by the time the cheese is brown. To avoid this, some cooks cover the eggs with white sauce before adding crumbs.

The food value of the dish is very close to that of a pound of beef of average composition. The estimated cost (see p. 23) is about 14 cents.

For those who are particularly fond of cheese the amount of cheese in this recipe may be very much increased, thus making a much more nourishing dish. Or the amount may be reduced so as to give hardly more than a suggestion of the flavor of cheese.

Scrambled Eggs with Cheese.

½ pound of cheese grated or cut into small pieces. 8 eggs 1 tablespoonful of chopped parsley. A pinch of nutmeg. ½ teaspoonful of salt.

Beat the eggs slightly, mix them with the other ingredients, and cook over a very slow fire, stirring constantly, so that the cheese may be melted by the time the eggs are cooked. In food value the dish is equal to nearly 2 pounds of average beef. The calculated cost (see p. 23) is about 30 cents.

Swiss Eggs.

4 eggs. ½ cupful of cream. 1 tablespoonful of butter. Salt and pepper. ¼ cupful of grated cheese.

Heat the butter and cream together, break in the eggs whole, sprinkle with salt and pepper. When nearly done, add the cheese. Serve on buttered toast. Strain the cream over the toast.

Cheese Omelet No. 1.

Cheese may be introduced into omelets in several ways. An ordinary omelet may be served with thin cheese sauce made in the following proportions:

1½ tablespoonfuls of flour. ¼ cupful of grated cheese. 1 cupful of milk.

This sauce may also be added to omelets in which boiled rice, minced meat, or some other nutritious material has been included.

Cheese Omelet No. 2.

Grated cheese may be sprinkled over an ordinary omelet before it is served.

Cheese Omelet No. 3.

Yolks of 2 eggs. 2 tablespoonfuls of hot water. 1 cupful of grated cheese. Salt and pepper. Whites of 4 eggs. 1 tablespoonful of butter.

Beat the yolks until lemon colored and add the hot water and the seasoning. Beat the whites until they are stiff, and add the cheese. Cut and fold the two mixtures together. Heat the butter in omelet pan and cook the mixture very slowly until it is brown on the underside. If possible, cook the top of the omelet in the oven or by means of a hot plate held over it.

Breakfast Cereals with Cheese.

That cheese combined with cereal foods makes a rational dish as regards the proportion of nutrients it supplies has been pointed out on another page (p. 18). Cheese and some of the crisp “ready to serve” cereal breakfast foods is a combination which is common, the cheese being melted with the cereal food, or simply served with it.

There are many who relish a piece of cheese with the cooked cereal so commonly eaten for breakfast and find such a combination satisfying to appetite and taste. Oatmeal or some other home-cooked breakfast cereal prepared with cheese is palatable, and such dishes have an advantage in that they may be served without cream and sugar. Since such a dish contains considerably more protein than the breakfast cereals as ordinarily served, it has a further advantage in that it may well serve as the principal item of a breakfast menu, instead of a preliminary to other courses. Such a combination as cereals cooked with cheese, toast, fruit, and tea, coffee, or chocolate, makes a palatable as well as nutritious breakfast and one which does not require much work to prepare and to clear away. A recipe for preparing oatmeal with cheese follows. Wheat breakfast foods, either parched or unparched, corn meal, and hominy may be prepared in the same way.

Oatmeal with Cheese.

2 cupfuls of oatmeal. 1 cupful of grated cheese. 1 tablespoonful of butter. 1 level teaspoonful of salt.

Cook the oatmeal as usual. Shortly before serving, stir in the butter and add the cheese, and stir until the cheese is melted and thoroughly blended with the cereal.

The cheese should be mild in flavor and soft in texture. The proportion of cheese used may be increased if a more pronounced cheese flavor is desired.

Cheese with Mush.

Cheese may be added to corn-meal mush or to mush made from any of the corn or wheat preparations now on the market. The addition of cheese to corn-meal mush is particularly desirable when the mush is to be fried.

Fried Bread with Cheese No. 1.

6 slices of bread. 1 cupful of milk. 2 ounces of cheese, or ½ cupful of grated cheese. ½ teaspoonful of salt. ½ teaspoonful of potassium bicarbonate. Butter or other fat for frying.

Scald the milk with the potassium bicarbonate; add the grated cheese, and stir until it dissolves. Dip the bread in this mixture and fry it in the butter. The potassium bicarbonate helps to keep the cheese in solution. It is desirable, however, to keep the milk hot while the bread is being dipped.

Fried Bread with Cheese No. 2.

Cut stale bread into thin pieces. Put two pieces together with grated cheese between them; dip into a mixture of egg and milk and fry in butter or other fat.

Roman Gnocchi.

¼ cupful of butter. ¼ cupful of flour. ¼ cupful of cornstarch. 2 cupfuls of milk. 2 egg yolks. ¾ cupful of grated cheese. Salt.

Melt the butter; cook the cornstarch thoroughly, and then the flour in the butter; add the milk gradually; cook three minutes, stirring constantly; add the yolks and one-half cupful of the cheese. Pour into a buttered shallow pan and cool. Cut into squares; place them on a platter a little distance apart; sprinkle with remaining cheese, and brown in the oven.

The proteid value is that of three-fourths of a pound of average beef, the fuel value that of 1¾ pounds. Calculated cost (see p. 23), 17 cents.

Cheese Soufflé.

2 tablespoonfuls of butter. 3 tablespoonfuls of flour. ½ cupful of milk (scalded). ½ teaspoonful of salt. A speck of cayenne. ¼ cupful of grated cheese. 3 eggs.

Melt the butter; add the flour and, when well mixed, add gradually the scalded milk. Then add salt, cayenne, and cheese. Remove from the fire and add the yolks of the eggs, beaten until lemon colored. Cool the mixture and fold into it the whites of the eggs, beaten until stiff. Pour into a buttered baking dish and cook 20 minutes in a slow oven. Serve at once.

The proteid of this recipe is equal to that of half a pound of beef; the fuel value is equal to that of three-fourths of a pound.

Cheese Soufflé with Pastry.

2 eggs. ■ cupful of thin cream. 1 cupful of grated cheese. ½ cupful of Swiss cheese cut into small pieces. Salt, cayenne pepper, and nutmeg.

Add the eggs to the cream and beat slightly, then add the cheese and seasoning. Bake 15 minutes in a hot oven, in patty tins lined with puff paste.

Cheese Croquettes.

3 tablespoonfuls of butter. ¼ cupful of flour. ■ cupful of milk. Yolks of 2 eggs. 1 cupful of cheese cut in very small pieces. ½ cupful grated cheese. Salt and pepper.

Make with a white sauce, using the butter, flour, and the milk. Add the unbeaten yolks and stir until well mixed, then add the grated cheese. As soon as the cheese melts, remove from the fire, fold in the pieces of cheese, and add the seasoning. Spread in a shallow pan and cool. Cut into squares or strips, cover with an egg and crumb mixture, and fry in deep fat.

Fried Cheese Balls.

1½ cupfuls of grated cheese. 1 tablespoonful of flour. The whites of 3 eggs. Salt, pepper, cracker dust.

Beat the whites of the eggs; add the other ingredients; make into balls and roll in cracker dust. If the amount of flour is doubled, the mixture may be dropped from a spoon and fried without being rolled in crumbs.

CHEESE SOUPS AND VEGETABLES COOKED WITH CHEESE.

In these dishes the cheese is used not only to add nutritive value, but also to give its characteristic flavor either to materials otherwise rather mild in taste (as in potatoes with cheese) or to combine its flavor with that of some more highly flavored vegetables (as in cheese and vegetable soup). The ingenious housekeeper whose family is fond of cheese can doubtless think of many desirable ways of making such combinations besides those given in the following recipes:

Milk and Cheese Soup.

3 cupfuls of milk, or part milk and part stock. 1½ tablespoonfuls of flour. 1 cupful of grated cheese. Salt and paprika.

Thicken the milk with the flour, cooking thoroughly. This is best done in a double boiler, with frequent stirrings. When ready to serve, add the cheese and the seasoning.

The proteids in this soup are equal in amount to those in five-sixths of a pound of beef of average composition; its fuel value is higher than that of a pound of beef.

Cheese and Vegetable Soup.

2 cupfuls of stock. 2 tablespoonfuls of finely chopped carrots. 1 tablespoonful of chopped onion. A very little mace. 2 tablespoonfuls of butter. 2 tablespoonfuls of flour. 1½ teaspoonfuls of salt. 1 cupful of scalded milk. ¼ cupful of grated cheese.

Cook the vegetables a short time in one-half of the butter, add the stock and the mace, boiling 15 or 20 minutes. Strain and add the milk. Thicken with flour cooked in the remaining butter. Just before serving, stir in the cheese and cook until it is melted.

Scalloped Potatoes with Cheese No. 1.

Put into a buttered baking dish alternate layers of cheese sauce No. 1 (see p. 22) and cold boiled potatoes, sliced or cut into dice. Cover with buttered crumbs and bake.

Scalloped Potatoes with Cheese No. 2.

Put into a buttered baking dish alternate layers of white sauce and cold boiled potatoes, either sliced or cut into dice. Put over the top a layer of grated cheese and then a layer of buttered bread crumbs. Brown in the oven.

Scalloped Cabbage or Cauliflower with Cheese.

Cauliflower or cabbage may be scalloped according to either of the recipes given for scalloped potatoes and cheese. Sometimes a cauliflower is boiled whole, spread with grated cheese, then with buttered bread crumbs. It is browned in the oven and served with white sauce poured around it.

Cheese with Potato Puffs.

1 cupful of mashed potatoes. ¼ cupful of milk. 1 egg. ½ teaspoonful of salt. ½ cupful of grated cheese.

Beat the potatoes and milk together until thoroughly mixed. Add the egg and the salt and beat thoroughly. Finally add the cheese. Bake in muffin tins in a slow oven 10 or 15 minutes.

A similar dish may be made by scooping out the inside of a baked potato and mixing it with cheese as above. Fill the potato-skin shell with the mixture, return to the oven, and bake until light brown.

Potatoes with Cheese Sauce.

Cut boiled potatoes into cubes and serve with cheese sauce No. 1. (See p. 22.) This is one of the cheese and vegetable dishes most frequently found on restaurant menus.

CHEESE SALADS, SANDWICHES, AND SIMILAR CHEESE DISHES.

Cheese of one sort or another is a very common accompaniment of salads, and the combination is rational as well as palatable, for the constituents of the succulent foods—chiefly water and cellulose—supplement the protein and fat of the cheese. Cheese is often used also as a part of the salad.

A number of recipes are given below for cheese salads and other cheese dishes which may be served with dinner or other regular meals, or served as part of a special lunch or special supper. Many of the cheese dishes discussed in other sections are also commonly used for such occasions when something savory is desired which can be easily and quickly prepared.

Cheese with Salads.

Cheese or cheese dishes are an acceptable addition to salads. Neufchâtel or other cream cheese, either plain or mixed with pimientos and olives, may be passed with lettuce or may be cut into slices and served on lettuce.

Cheese balls are often served with salad. They are made of some soft cream cheese, and are frequently combined with chopped chives, olives, sweet peppers, chopped nuts, etc., for the sake of adding flavor. Cooked egg yolk, spinach extract, etc., are sometimes mixed in for the sake of color. If the balls are rolled in chopped chives or parsley, both flavor and color are supplied.

Plain Cheese Salad.

Cut Edam or ordinary American cheese into thin pieces, scatter them over lettuce leaves, and serve with French dressing.

Olive and Pimiento Sandwich or Salad Cheese.

Mash any of the soft cream cheeses and add chopped olives and pimientos in equal parts. This mixture requires much salt to make it palatable to most palates, the amount depending chiefly on the quantity of pimiento used. The mixture may be spread between thin slices of bread or it may be made into a roll or molded, cut into slices, and served on lettuce leaves with French dressing.

Cheese and Tomato Salad.

Stuff cold tomatoes with cream cheese and serve on lettuce leaves with French dressing.

Cheese and Pimiento Salad.

Stuff canned pimientos with cream cheese, cut into slices, and serve one or two slices to each person on lettuce leaves with French dressing.

Cheese Jelly Salad.

½ cupful of grated cheese. 1 tablespoonful of gelatin. 1 cupful of whipped cream. Salt and pepper to taste.

Mix the cheese with the whipped cream, season to taste with salt and pepper, and add to the gelatin dissolved in a scant cupful of water. This may be molded in a large mold or in small molds.

When the jelly begins to harden, cover with grated cheese. The jelly should be served on a lettuce leaf, preferably with a cream dressing or a French dressing, to which a little grated cheese has been added.

Cheese Salad and Preserves.

Epicures have devised a dish which consists of lettuce with French dressing served with cream cheese and thick preparations of currants or other fruits preserved in honey or sugar, which, owing to the fact that the seeds have been extracted by a laborious process, are fairly expensive. The soft cheese often found in market is also relatively expensive. There is a suggestion in this dish, however, for others which are much less costly. Buttermilk cream (see p. 21), or ordinary cottage cheese served with lettuce or other green salad and a small amount of rich homemade preserves, is a combination with much the same character, and also very appetizing.

Deviled Eggs with Cheese.

In making deviled eggs, either to be eaten alone or upon lettuce leaves in the form of salad, a little grated cheese may be mixed with the yolks in addition to the usual salad dressing and flavorings with which the yolks are mixed.

Cheese and Celery.

Cut stalks of celery having deep grooves in them into pieces about 2 inches long. Fill the grooves with cream cheese salted or flavored with chopped pimientos, and serve with bread and butter as a salad course or serve as a relish at the beginning of a meal.

Although not cheese dishes, strictly speaking, the following salad dressings made with buttermilk cream (see p. 21) may be included in this section.

Buttermilk Cream Salad Dressing.

½ cupful of buttermilk cream (see p. 21). 1 tablespoonful of vinegar. ¼ teaspoonful of salt. Cayenne pepper.

This dressing is particularly suitable for serving with cucumbers.

Buttermilk Cream Horseradish Salad Dressing.

To buttermilk cream add a little grated horseradish and vinegar and salt. Serve on whole or sliced tomatoes.

Cheese Sandwiches.

Mash or grate American cheese, add salt, a few drops of vinegar and paprika, and a speck of mustard. Mix thoroughly and spread between thin slices of bread.

Cheese and Anchovy Sandwiches.

To the mixture mentioned in the preceding recipe, add a little anchovy essence. Sardines mashed or rubbed into a paste or any other fish paste may be used in a similar way.

Pimiento, Olive, and Cheese Sandwiches.

These sandwiches are referred to on page 34.

Cuban Sandwiches.

This sandwich may be described as a kind of club sandwich with cheese. It is usually made large so that it is necessary to eat it with a knife and fork. It may be made in such proportions as to supply a large amount of nourishment.

Cut the crusts from slices of bread. Between two slices lay first lettuce with a little salad dressing or salt on it, then a slice of soft mild cheese and finally thin slices of dill pickles or a little chopped pickle.

Toasted Cheese Sandwiches.

Plain bread and butter sandwiches with fairly thick slices of cheese put between the slices are frequently toasted, and on picnics, or at chafing-dish suppers, are often browned in a pan in which bacon has just been fried.

CHEESE PASTRY, CHEESE SWEETS, AND SIMILAR DISHES.

In the foregoing pages a large number of recipes have been included in which cheese is combined with materials without cooking, as in salads, or used in cooked dishes of creamy or custard-like consistency, as in soufflés and Welsh rabbit or in combination with vegetables or cereals, such as rice.

There are a number of cheese dishes of quite different character in which the cheese is combined with dough, batter, or pastry in various ways, and a number of dishes in which cheese or cheese curd is used in combinations suitable for dessert. Such sweet dishes were once much more common than they are to-day, as reference to old cookery books will show, but some of them are well worth retaining.

In cheese sweets, flavor and richness are both contributed by the cheese.

When cheese is used in pastry or dough it may serve simply as a flavor, as in cheese sticks or cheese straws, or it may wholly or in part replace with its fat the usual shortening, as butter or other fat, and with its protein (casein) the protein (albumin) of eggs. As an illustration of such a use of cheese, cheese gingerbread may be cited.

Using cheese in this way is often an economy when eggs are scarce. Better results will be obtained if soft cheese is used which can be worked into the dough in much the same way as butter or other shortening. To those who like cheese the flavor which it imparts would be an advantage. However, if a very mild cheese is used in combination with molasses or spice the dish differs a little in flavor from one prepared in the usual way.

CHEESE PASTRIES AND SIMILAR DISHES.

Cheese Biscuit No. 1.

2 cupfuls of flour. 4 teaspoonfuls of baking powder. 2 tablespoonfuls of lard or butter. ■ of a cup of milk. ¼ teaspoonful of salt. Grated cheese sufficient to give desired flavor.

Mix all the ingredients excepting the cheese as for baking powder biscuits. Roll thin, divide into two parts, sprinkle one half with grated cheese, lay the other half of the dough over the cheese, cut out with a small cutter, and bake.

Cheese Biscuit No. 2.

¼ pound of soft cheese. 2 cupfuls of flour. 1 cupful of water. 4 teaspoonfuls of baking powder. 1½ teaspoonfuls of salt.

Mix and sift the dry ingredients, then work in the cheese with a fork or with the fingers, and add the water gradually. The approximate amount of water has been given; it is impossible to give the exact amount, as flour differs in its capacity for taking up moisture. Toss the dough on a floured board and roll out and cut with a biscuit cutter. Place in a buttered pan and bake in a quick oven from 12 to 15 minutes. The biscuit may be sprinkled with cheese before being put into the oven.

If the cheese is sufficiently soft it can be measured just as butter is. This recipe, then, would call for ½ cupful.

Cheese Drops.

2½ tablespoonfuls of milk. 1 teaspoonful of butter. 1¼ cupfuls of flour. ■ teaspoonful of salt. 1 egg. 2 tablespoonfuls of grated Parmesan cheese or dry American cheese.

Heat the butter and milk to boiling point, add the flour and the salt and stir thoroughly. Remove from the fire, add the egg and cheese and stir until well mixed. When cold, drop in small pieces in deep fat and brown. This makes a good addition to any clear soup or to consommé.

Cheese Wafers.

Spread grated cheese on thin crackers, heat in the oven until the cheese is melted. Serve with soup or salad.

Cheese Relish.

Spread bread which has been toasted or fried in deep fat with grated cheese, or with grated cheese mixed with a little mustard, then heat in the oven until the cheese is melted. This may be served with salad, or as a relish to give flavor to some dish such as boiled rice or hominy, which has no very marked flavor.

Cheese Straws.

Roll out plain or puff paste until one-fourth of an inch thick. Spread one-half of it with grated cheese. Fold over the other half and roll out again. Repeat the process three or four times. Cut into strips and bake. Serve with soup or salad.

Salad Biscuit.

½ pound of cheese. 2 cupfuls of flour. 4 teaspoonfuls of baking powder. 1½ teaspoonfuls of salt. 1 cupful of water.

Mix as for cheese biscuits No. 1 or No. 2, depending on whether the cheese is hard or soft. (See p. 36.)

Cheese Gingerbread No. 1.

1 cupful of molasses. 4 ounces of cheese. 1 teaspoonful of soda. ½ cupful of water. 2 cupfuls of flour. 2 teaspoonfuls of ginger. ½ teaspoonful salt.

Heat the molasses and the cheese in a double boiler until the cheese is melted. Add the soda and stir vigorously. Mix and sift dry ingredients and add them to the molasses and cheese alternately with the water. Bake 15 minutes in small buttered tins.

Cheese Gingerbread No. 2.

½ cupful of molasses. ½ cupful of sugar. 4 ounces of cheese. 2 cupfuls of flour. 1 teaspoonful of soda. 2 teaspoonfuls of ginger. ½ teaspoonful of salt. ¾ cupful of water.

Rub the cheese and the sugar together. Add the molasses. Mix and sift the dry ingredients and add them to the cheese mixture alternately with the water.

Cheese Custard.

1 cupful of grated cheese. ½ cupful of cream or rich milk. Yolks of 2 eggs. A speck of salt and of paprika.

Mix the cream and the cheese and heat until the cheese is melted. Remove from the fire and add the yolks of the eggs. Bake in paper cases or buttered ramekins. Serve with jelly or preserves.

Cheese Cakes.

1 quart of milk. Rennet. 1 ounce of sugar. Yolks of 2 eggs. A speck of nutmeg. 1½ ounces of butter. 1 ounce of dried currants or small raisins.

Warm the milk and add the rennet, using the amount prescribed on the package. Let the milk stand until the curd forms, then break up the curd and strain off the whey. Add the other ingredients to the curd; line patty tins with pastry, fill them with the mixture, and bake.

Brown Betty with Cheese.

Arrange in a deep earthenware baking dish, alternate layers of bread crumbs and thinly sliced apples. Season with cinnamon, also a little clove if desired and brown sugar. Scatter some finely shaved mild full-cream cheese over each layer of apple. When the dish is full, scatter bread crumbs over the top and bake 30 to 45 minutes, placing the dish in a pan of water so that the pudding will not burn.

If preferred, this may be sweetened with molasses mixed with an equal amount of hot water and poured over the top, a half cupful of molasses being sufficient for a quart pudding dish full.

Cheese may be used in place of butter in a similar way in other apple puddings. Apple pie made with a layer of finely shaved cheese over the seasoned apple and baked in the usual way is liked by many who are fond of cheese served with apple pie.

CONCLUSION.

In the foregoing pages information has been summarized regarding the food value of cheese, an important agricultural product, and ways of preparing it for the table. It has been pointed out that, judged by the kind of nutrients it supplies—chiefly nitrogenous material and fat—and the proportion in which they are present, it resembles such foodstuffs as meat, fish, and eggs, which means that like them its rational use in the diet is in combination with other staple foods, to form well-balanced meals.

Experiments have shown that when eaten either raw or carefully cooked, cheese is as thoroughly digested as other staple foods and is not likely to produce physiological disturbance.

An ounce of cheese roughly is equivalent to 1 egg, to a glass of milk, or to 2 ounces of meat.

Although uncooked cheese resembles meat in composition, cheese dishes prepared after ordinary recipes, with milk and shortening, are likely to contain more fat than meat dishes prepared in the usual ways. When, therefore, such cheese dishes are served with other staple foods the combination is likely to contain more fat than the usual meal. If little fat is ordinarily used, this may be an advantage. If a great deal of fat is ordinarily used, it may be desirable to lessen the amount in the cheese dishes. This can readily be done by omitting the shortening and using skim milk or water in the preparation of such dishes, a change which also lessens their cost.

The fact that cheese, like meat, contains neither starch nor cellulose suggests that, like meat, it should be combined with bread, potatoes, and other starchy foods, with vegetables and with sweets. The concentrated character of cheese and many cheese dishes suggests the use of succulent fruits and vegetables with them. The high percentage of fat in cheese suggests the use of correspondingly small amounts of fat in the accompanying dishes, while the soft texture of cheese dishes as compared with meat makes it reasonable to serve the harder and crustier breads with them.

When cheese is not used as the chief nitrogenous food of a meal it may be introduced into bills of fare in many incidental ways, and thus add materially to that portion of the diet needed for building and repairing body tissue.

Though cheese is so generally used in some way in most families, yet the making of menus with cheese as a central dish is less well understood than more usual food combinations, since there is less experience to serve as a guide. More thought is therefore usually required to arrange such cheese meals in order that they may be palatable and at the same time reasonable in nutritive value.

In order that the diet may remain well balanced, cheese, if used in quantity, should replace foods of similar composition rather than supplement them. The builder who has a choice of materials must have a knowledge of their relative properties if he wishes to use stone instead of brick, or wood in place of iron. It is the same with the housekeeper who wishes to use her available food supply intelligently and whose choice of foods is influenced by their relative cost at a given time or season. The woman who has a knowledge of the relative food value of different articles of diet, and their real food qualities as distinguished from their market value, who understands good methods of cooking and serving foods, and who plans her meals and other housework so that unnecessary labor and expense may be avoided, is taking account of the things which make for economical living as well as for good living.

Some persons seem to believe that cheese or fish or other food is the ideal food for some particular circumstance and that there is a special food or diet suited to each kind of work and to every circumstance of our daily life, and that it would be a great advantage if we could regulate our daily fare with the accuracy a chemist uses in making an experiment. Work, recreation, the amount of clothing we wear, and other details of our daily life are not so regulated, and it is the belief of those who have studied the subject that the best interests of persons living under normal conditions are served if the ideal be rather the regulation of the diet along general lines in accordance with good sense, the teachings of experience, economy, and the available knowledge gained from a scientific study of the subject, due care being taken that the different staple foodstuffs are so combined that all the needs of the body are provided, excessive waste is prevented, and that both undernourishment and excess or overeating are avoided.

Dishes which are liked and the methods followed in preparing them will vary in different countries and at different times, yet this does not of necessity mean that the nutritive value of the diet varies correspondingly. In the same way it is possible for us to vary the selection of our foods and the character of our diet at will, according to the demands of our taste and our purse, without correspondingly changing its value for supplying the needs of the body. This means that the housekeeper, in suitable ways, can use cheese, meat, fish, eggs, and other foods of similar composition as substitutes for one another, being governed by their relative market value at different times and seasons, by the tastes of her family, and similar considerations. If she uses the different

foodstuffs with reference to their nutritive value and is skillful in preparing foods in appetizing ways and in serving them in attractive combinations, the daily fare may be both adequate and pleasing, whether she selects cheese or meat or fish or eggs or other foods to supply nitrogenous material and fat. Here, as in all that pertains to housekeeping, true economy is dependent upon a knowledge of materials and skill in using them.

Transcriber’s Notes

pg 8 Removed repeated word the from: If cream is removed the the cheese pg 12 Changed brought about chiefly by the action of enzyms to: enzymes pg 15 Changed 90 per cent of the nitrogeous to: nitrogenous pg 20 Changed the curd assumes a custardlike to: custard-like pg 24 Added period after No in: Cheese Fondue No 1. pg 24 Added period after: 1 tablespoonful of butter pg 25 Changed Corn and Cheese Souffle. to: Soufflé. pg 31 Added period after: Salt, cayenne pepper, and nutmeg

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Accounting theory and practice, Volume 1 (of 3)

Roy B. Kester

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Transcriber's Notes:

Underscores "_" before and after a word or phrase indicate _italics_ in the original text. Equal signs "=" before and after a word or phrase indicate =bold= in the original text. Small capitals have been converted to SOLID capitals. Illustrations have been moved so they do not break up paragraphs. Typographical and punctuation errors have been silently corrected.

ACCOUNTING THEORY AND PRACTICE

A TEXT-BOOK FOR COLLEGES AND SCHOOLS OF BUSINESS ADMINISTRATION

BY ROY B. KESTER, PH.D.

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VOLUME I (FIRST YEAR)

SECOND EDITION

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To My Father and Mother AN APPRECIATION OF THEIR STEADFAST INTEREST IN MY WORK

PREFACE

The basic soundness of the method of instruction in Accounting developed in this book has received substantial demonstration throughout five years of test. The Introduction to the first edition contained the following statement regarding the development of the subject:

"The method of approach as given in this volume is perhaps not orthodox but it has seemed that the student, given an understanding of the purpose which the accounting records are to serve, will be able to make that record with real intelligence instead of by rule-of-thumb. Accordingly, the balance sheet and the profit and loss statement are presented first, as the goal towards which all record-keeping looks. The student is taught to analyze business facts and conditions from the very beginning. He is then led, step by step, through the use of non-technical terms, into the ledger, where he sees the way in which the data which he has been using are summarized. The books of original entry are next explained, and the method by which the information is classified as it is brought onto the books. Finally, the business papers and documents which constitute the source of all entries are described."

To quote again from the original Introduction: "The subject is developed in such a way that the student knowing something of bookkeeping has little or no advantage over the one without such knowledge. This book has been written for the use of students in our colleges and universities desiring a first course in accounting. It gives the scope of the work in accounting offered in the first year of the School of Business of Columbia University."

The method then advocated and used in a few institutions has become quite generally accepted. It has justified itself by the ease and extent to which students without any previous training in accounting have grasped the essentials of the subject. Experience with the book in the classroom, however, and changing ideas with regard to manner of presentation and sequence of material, have shown as desirable a rearrangement of some parts and an addition of new material in places. Accordingly, a systematic revision has been made.

The arrangement of the subject matter of the first portion of the book has been altered but slightly. The use and function of the balance sheet and profit and loss statement have been somewhat amplified. The working sheet has been introduced earlier than in the first edition to afford an easy summary of the period's results. It should later on be made a part of the regular work of summarization. The controlling account is also explained earlier so as to afford more practice in its use. The accounting features of the partnership and of the corporation are given continuous treatment. Here a new chapter has been added, which discusses certain features of the corporation not treated in the original book such as the issue and sale of treasury stock and of bonds, bond interest as related to premium and discount, sinking fund, sinking fund reserve, redemption of bonds, etc.

The material presented in the last quarter of the book deals with the interrelations of accounting, financial management, buying, and marketing. Thus the chapters dealing with the handling of cash, notes receivable and payable, cash discounts, and balance sheet valuation, treat of the relations between accounting and financial management. Several chapters at the end treat of some special methods of accounting practice and of the basic principles of single entry. In this portion of the book new chapters on balance sheet valuation and on buying have been added.

Entirely new problem material has been furnished, carefully graded and related so far as possible to the subject matter of the chapters of the text. For the convenience of the student this material is separated from the text, and grouped in three appendices. A few of the problems have been drawn from the examinations of various state boards and the regents of the University of the State of New York, and from other miscellaneous sources, to all of which acknowledgment is due. The author is indebted to Mr. George B. Kelley for assistance in building up a large part of the practice material. It need hardly be said that a fundamentally sound knowledge of accounting cannot be gained without ample practice work. Theory can never be sure of itself until put to the test of practice.

The author desires to acknowledge again his debt to the many friends whose counsel and aid counted so largely in the first writing of this book. In the revision he finds himself still further indebted to many instructors in all sections of the country for criticism and suggestion. He desires especially to express his appreciation of the active co-operation of his associates on the Columbia staff of instructors in First Year Accounting, in particular Miss Nina Miller and Messrs. Ralph T. Bickell and E. Gaylord Davis. In the actual work of revision Messrs. Eskholme Wade, John Jaffee, and Raymond Gatchell have given valuable assistance.

ROY B. KESTER Columbia University, New York City, July 22, 1922

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Accounting—Theory and Practice

CHAPTER I

BASIC RELATIONSHIPS—PROPRIETORSHIP

=Records and Their Functions.=—As far back as our knowledge reaches, records of some sort have been kept and used and they have frequently formed the basis on which our knowledge rests. In a broad sense a record may be defined as a written memorial, a register or history of events, a testimony. Even though the desire to make and hand on to the future a record of achievement is a deep-seated characteristic, record-making has seldom been an end in itself. Knowledge of what has been done has always been a starting point and a guide for future achievement. The longhand or narrative record is indispensable in some fields of knowledge; the shorthand or statistical record is equally necessary in others. The statistical method and accounting are, without question, most potent agencies for the advancement of human knowledge and for the control of human relationships. They provide the basis in fact on which judgments must largely rest. This book, therefore, may begin by sketching the relation of accounting to some of the larger fields of human endeavor—the economic organization of society and the law—to point out its place in the business unit and briefly state the basic function it performs therein.

=The Business Unit.=—To carry on its various activities, economic society has organized itself into numberless separate units or business organizations. These units are the means through which society operates, their ultimate purpose being the easy and efficient satisfaction of human economic wants. Individual business units, conducted as they are by members of society, are under the broad general supervision of society as a whole. This is evidenced everywhere by the laws, licenses, and regulations by which society attempts to regulate the activities of the individual for the larger interest of society as a whole. As business is conducted in most parts of the world, it is highly individualized rather than communized. There is a growing tendency, however, for society to exercise a larger control and supervision over all types of individual activity, particularly with a view to conserving the welfare of its members. The business unit is thus the medium through which society works to satisfy its economic wants.

=Internal Organization of the Business Unit.=—Society early found that only by means of a highly specialized division of its activities was it possible to satisfy without waste its rapidly increasing economic wants. Individual business units are thus organized for the purpose of carrying on some one or more of these greatly subdivided activities. Within itself the business unit is organized into departments or divisions for the efficient and thrifty handling of its work. The two large divisions in any business undertaking have to do with what the economist calls the production and exchange of wealth, that is, commodities, services, and so forth. In carrying on these activities of production and exchange it has usually been found desirable to segregate into separate departments certain major functions which are common both to production and to exchange. What the major departments may be depends very largely upon the size of the business unit, its relative complexity of organization, and to some extent on the individual ideas of its managers. Throughout the business world one notes, however, a quite general departmentization under the following heads:

1. Finance 2. Procurement or production 3. Marketing or distribution 4. Personnel 5. General administration

There are two main activities under the control of the finance division of a business: (a) the problem of original investment, including that of location and acquisition of a plant suitable for the conduct of a contemplated business; and (b) the problem of operating finance, that is, of providing the business with a fund of working capital for its efficient operation. The financing of purchases, sales, credits, operating expenses, and so forth, comprises a large part of the work of finance of an operating or going concern.

In the second of the major departments, that of procurement or production, one finds these activities: (a) the purchasing of the stock-in-trade to be dealt in, if the concern is a trading business; or (b) the manufacture of the stock-in-trade, if the concern is a manufacturing business.

In the department of marketing or distribution, the following activities center: (a) those having for their purpose the creation of a market or demand for the commodity dealt in—the sales organization, the advertising activities, and so forth; (b) the actual selling of the commodity; and (c) the transportation and delivery of the product.

In the personnel department are included the human relations between employer and employee. The hiring and training of the employee, his classification and rating, his welfare and promotion, are the major activities here.

The function of the department of general administration is in the main that of supervision and management of the business as a whole. The general manager must have a view of all of the activities of the business. He must see that the various departments through which its activities are carried on are properly correlated, that it is so organized that its departments function smoothly and efficiently in the performance of their several duties. A consideration of the means employed by the general manager for the proper performance of his duty indicates the place of accounting in the business unit.

=Place of Accounting in Business.=—In a small business where the owner and manager is in close and intimate contact with these several departments, or perhaps where he focuses all of them within himself, he has no need of special means of keeping himself informed concerning the activities of his assistants, nor does he require an elaborate system of records to indicate the condition and state of the business at any time. In large businesses, however, where the volume and complexity of the commercial activities make it impossible for the executive, on whom rest the responsibilities for the successful conduct of the business, to have an intimate personal knowledge of all phases of the business, it is very necessary that some means be employed for supplying him with this vital information. Two types of information are necessary to him: (1) information about the business unit itself, its activities and condition; and (2) information about general economic conditions in the country, and particularly about other businesses in the same line of activity as his own. It is the function of accounting to supply information of the first type; it is the chief purpose of statistics to supply information of the second type. The accounting department, therefore, deals largely with the internal activities of the business, while the statistical department provides knowledge of the external relations of the business. A proper control and management of business affairs cannot be exercised without the information supplied by both departments. In the accomplishment of its function to supply the internal information, the accounting department reaches out into all of the main departments indicated above for data from which to make its record of the various activities of the business unit.

=Purpose of Accounts.=—Accounts record the business history of a concern. Their main purpose is to secure information concerning the results of business activity and endeavor. The record required for this purpose can be condensed and made very brief, although the full history of every business comprises a multitude of transactions with a great mass of details. The whole scheme and method of account-keeping is designed chiefly to collect the detail and use it mainly for building up a summary which shall give in rapid review the entire record for the fiscal period.

Account-keeping is to the bookkeeper what shorthand is to the stenographer—an abbreviated method of making the record. The uses to which the records are put, however, differ radically. Stenography abbreviates the writing of the spoken word with a view to its transcription into longhand; accounting records business transactions in abbreviated form with a view to summarizing them further so as to secure a bird's-eye view of the operations of the business as a whole and to use it in the formulation of administrative judgments and policies.

In a large business there are executive duties within each of the five main departments. Accounting must supply the information on which each departmental executive will base his judgments and policies. The student will see, therefore, that the accounting department brings together a record of the activities of each of the main departments of a business. He will see, too, how the final output or product of the accounting department must be a summarization and interpretation of these departmental activities in order to provide a basis for the various executives on which to formulate their judgments and business policies. Accounting is, therefore, a handmaiden of the executives in the conduct and management of the business. It is the purpose of this volume to develop the technique of the bookkeeping and accounting record and to indicate some of its uses in the management of business.

=Relation of Accountancy to Economics.=—Economics is sometimes defined as the science of wealth, by which is meant a body of classified knowledge relating to wealth in the aggregate. Under the present-day political and social system, the ownership of wealth is very largely private. Furthermore, the division of labor, as industry is now organized, has been carried to a very high degree. Because of these facts the present elaborate organizations for producing wealth have given rise to an urgent need for some effective means of keeping record of their activities.

The effort of every individual engaged in industry is to increase wealth. He labors to extract the raw materials from nature, to shape and mould them so as to supply the wants of his fellowmen. He then distributes them by means of markets and exchanges so as to secure the greatest possible returns for his effort. As competition becomes keener and the margin of return per unit of product becomes smaller, he has to increase his volume of business to secure the same amount of profit as when he did a lesser volume of business.

To produce goods it is necessary to use the saved wealth of former periods to pay the expenses of materials, labor, management, etc., of the present period. One must consume wealth to produce wealth. After his product is made, he must seek the best market for its exchange or sale. This necessitates the use of a complex system of transportation and communication. Finally, during the whole process of production and exchange the estimated returns from the article must be distributed among the several parties engaged in their creation. To make this distribution on the basis of estimated returns, gives rise to the need—the absolute necessity—of an accurate record of the costs of the activities and processes all along the line. The record, then, of the value of the rights and properties of the various parties to the production and distribution of wealth, as society is now organized for its economic well being, is the special field assigned to Accountancy as related to Economics.

=Relation of Accountancy to Law.=—The determination of the rights of the several parties to the creation, exchange, and ultimate consumption of a product is the field of Law, more particularly Business Law. The determination by means of its records of the value and extent of these rights is the province of Accountancy as related to Law. Accountancy is thus seen to be the handmaiden of both Economics and Law. None of them can progress far without the help of the other two. All being related to, and arising out of manifold human endeavors, their progress and development is dependent upon, and limited only by, the progress of these endeavors.

=The Fundamental Problem of Accountancy.=—The aim of all private businesses being the increase of wealth, the first problem of accountancy is to determine how much wealth is invested in a given enterprise and what ownership or proprietorship exists at given periods, so that by comparison the increases and decreases in the proprietorship may be known. When accurate information is obtained, an intelligent plan of action can be adopted to remedy such ills of the business as are shown and to increase any profitable line of activity. Accordingly, proprietorship and its changing values are the basic problems of accountancy as well as of business.

=Definition of Terms.=—Before proceeding to a definition or determination of proprietorship, it is necessary to understand what is meant by the terms "assets" and "liabilities." The root idea of the word "assets" is "sufficiency." Specifically, assets are the "entire property of all sorts, of a person, association, or corporation applicable or subject to the payment of debts." Similarly, the liabilities of a person, firm, or corporation are his or its pecuniary obligations or debts. Proprietorship is the difference between the value of the assets and the amount of the liabilities, and is defined and measured by the equation:

Assets - Liabilities = Proprietorship

This proprietorship equation is a basic formula. It is also written:

Assets = Liabilities + Proprietorship

It will thus be seen that proprietorship represents the equity of the owners of an enterprise in its assets. The assets are first applied in paying the claims of creditors of the business, and whatever of them remains belongs to the owners of the business.

=Development of the Proprietorship Equation—The Balance Sheet.=—To indicate the basis of the standard form of the proprietorship equation, several illustrations will be given. The equation is in its simplest form when it indicates proprietorship in a new business immediately after the owner has invested cash to provide the business with capital. For example, assume that on January 1, 19—, James T. Runyon starts business by investing $5,000 cash capital in the enterprise.

Here the proprietorship equation is:

Assets (cash $5,000) = Proprietorship ($5,000)

As yet there are no liabilities. However, in order to carry on his business, Runyon must purchase a stock of merchandise and equipment for his store. Accordingly, he purchases store furniture and fixtures from Lowell Brothers for $500, of which he pays $250 in cash, and owes the balance. He also buys a stock of groceries for $2,500 from Reid Murdock & Co. on 10 days' time. He now has more assets than the original $5,000 cash, but he has become indebted for the additional amount, so that the amount of his proprietorship has not changed—as is shown by the following equation, somewhat more complex than the first:

ASSETS - LIABILITIES = PROPRIETORSHIP Cash $4,750 Lowell Bros. Furniture 500 Claim $ 250 Merchandise 2,500 Reid Murdock Claim 2,500 ------ ------ $7,750 - $2,750 = $5,000

Runyon now begins operations and after six months finds that his activities have comprised the purchase of delivery equipment for $300 cash; sale of goods amounting to $6,000; the payment of $1,000 cash for rent, clerk hire, and advertising; and sundry purchases of stock-in-trade and other items as needed. As a result he now has $1,000 cash on hand; customers owe him $3,000; his stock of goods still on hand is worth $2,100; he owes creditors $1,000 for goods bought and his clerks $50 for services rendered.

It is readily seen that as the number of assets and liabilities increases, the method of showing them that was used above becomes awkward and cumbersome; therefore, still using the equation, we make the following vertical tabulation to determine and show proprietorship:

Assets Cash $1,000.00 Customers 3,000.00 Merchandise 2,100.00 Furniture 500.00 Delivery Equipment 300.00 --------- Total Assets $6,900.00

Liabilities Creditors for Merchandise $1,000.00 Clerks for Services 50.00 --------- Total Liabilities 1,050.00 ---------

Proprietorship

Capital $5,850.00 =========

This method of expressing the proprietorship equation is called a "Balance Sheet," or "Financial Statement."

Further analysis of the above information discloses the amount of Runyon's purchases and of his payments to creditors. Taking the transactions involving cash, we find that he had $5,000 to start with and received $3,000 from sales, or $8,000 in all. He bought furniture and delivery equipment for $800, and paid expenses of $1,000, in all $1,800. There is therefore a balance of $6,200 to be accounted for. $1,000 cash is still on hand, so that he must have paid creditors $5,200. Since he still owes creditors $1,000 for goods bought, his purchases must have been in all $6,200.

The ability to make accounting statements and to analyze accounting data for various purposes constitutes a very important part of the equipment of the accountant.

CHAPTER II

ASSETS, LIABILITIES, AND CAPITAL

Before discussing the form and content of the balance sheet and some of its major uses, the chief classes of assets, liabilities, and proprietorship or capital will be explained so that the student will have an intelligent notion of what is meant by each asset, liability, and capital item.

=Kinds of Assets.=—Accounting terms are not wholly standard. An account title is often used in one business to include items not mentioned under that title in another business. One finds also terms and titles peculiar to particular businesses. However, there is a tendency towards a standardization of the terms used in balance sheets. It is the purpose here to present and explain those which are common to practically all businesses. These include the asset titles Cash, Notes Receivable, Accounts Receivable, Merchandise, Investments, Deferred Charges or Expense Assets, Furniture and Fixtures, Delivery Equipment, Buildings, and Land.

CASH. Cash includes all kinds of money and usually whatever serves as a medium of exchange, which is in the possession or control of the business—deposits in banks, moneys in the safe and cash drawers, and sometimes funds in the possession of agents. Checks received in the regular course of business and not yet deposited in the bank are usually classified as cash.

NOTES RECEIVABLE. The formal promises to pay, made by others for debts owed the business, are classified under the general title Notes Receivable. Time drafts drawn on the debtors of the business and accepted by them may be included under this title, although they are sometimes shown under a separate title, such as Acceptances Receivable. This is particularly true when the acceptances are trade acceptances. It will be seen later that the promissory note has a somewhat different legal status from the open account claim against a debtor, and should therefore be classified under such title as will indicate the exact nature of the item.

ACCOUNTS RECEIVABLE. These usually represent the claims of the business against its trade customers for goods sold on open account and not paid for. The term is, however, broader than this, being sometimes used—although the practice is to be deplored—to include all claims against debtors except those which are in the form of notes.

MERCHANDISE. This asset represents the stock-in-trade in which the business deals. It is of course a sort of revolving asset, that is, merchandise is purchased and sold continuously, so that the stock-in-trade is constantly being turned over. The rate of turnover is very important, as will later be seen.

INVESTMENTS. This asset represents the stocks and bonds of other companies, municipalities, school districts, and so forth, owned by the business. As a usual thing there are seasons of the year when the cash funds of a business are built up and lie idle in the bank unless they are invested in securities of some sort. These securities can be reconverted into cash when the business requires a larger fund of cash.

DEFERRED CHARGES. Certain types of expenditure are necessary in every business to secure operating supplies. Fuel must be purchased for heating and power purposes; brooms, oil, waste, and other similar supplies are needed for cleaning and maintaining the business plant; stationery, stamps, wrapping paper, twine, cartons, packing materials, and so forth must always be on hand; insurance policies giving protection against fire are usually purchased for from one to three years and so are seldom completely used up at any given date. All items of this sort, necessary for the operation of the business but not dealt in as stock-in-trade, are called “expense assets.” The portions of these assets on hand at a given time, the use of which will be deferred to a later period, are classified as “deferred charges.”

FURNITURE AND FIXTURES. A business plant must be equipped with furniture and fixtures suitable for the display of the stock-in-trade, for the accommodation of customers, for the care and protection of the necessary records of the business, for the efficient performance of duties by the employees, and for other similar purposes. Assets of this type which are not a permanent part of the business plant but are removable should the business desire to change location, are listed under the title of Furniture and Fixtures. This may be subdivided to suit conditions. Sometimes several titles—Store Furniture and Fixtures, Office Furniture and Fixtures, Factory Furniture and Fixtures, Machinery and Tools—are used.

DELIVERY EQUIPMENT. If a business delivers its commodities it will usually have its own delivery equipment. This may comprise horses, wagons, harness, automobile trucks, and so forth. The delivery equipment may be used for both inbound and outbound deliveries.

BUILDINGS. All buildings owned by the business, whether used for business purposes or not, will usually be classified under the asset title Buildings. Store, office, factory, warehouses, residences owned and rented to employees—all assets of this type are to

be listed here.

LAND. This item represents land—city lots, plant sites, and so forth—owned in fee simple or subject to mortgage. Sometimes when a plot of land is leased for a term of years and a lump sum payment made at the beginning of the lease, the asset may be included either under the title Land, or under the broader title Land and Leaseholds.

=Kinds of Liabilities.=—Just as with assets, there is not entire uniformity in terminology for the various classes of liabilities. The more common types of items met with are: Notes Payable, Accounts Payable, Accrued Expenses, Mortgages Payable, Bonds Payable, and so forth.

NOTES PAYABLE. These represent the formal promises to pay, signed by the business or its owners. They represent the formal claims of others, that is, creditors, against the business. Just as with notes receivable, it is sometimes desirable to make a more distinct classification of notes payable. In such cases the titles Acceptances Payable, Trade Acceptances Payable, Long-Term Notes Payable, etc., are used.

ACCOUNTS PAYABLE. Under this title are listed the liabilities to creditors on open account, as distinguished from those formally acknowledged by a written promise to pay. These include obligations to trade creditors for merchandise, supplies, equipment, and property of almost any kind purchased for use by the business. In a broad sense an account payable includes any item for which the business is liable.

ACCRUED EXPENSES. Accrued Expenses represent usually the accumulating but unpaid claims against the business for service rendered it, as distinguished from the Accounts Payable, which usually represent purchases of an asset of one kind or another. Thus the amounts due at a given time to employees for work done since the last date of payment of their wages, salaries, or commissions, to the landowner for the rent of leased premises, to lenders for interest on moneys borrowed, are items properly to be listed under this title.

MORTGAGES PAYABLE. These represent the claims of creditors against particular properties owned by the business but against which the creditors have been given a lien or preferred claim as security for the borrowed or unpaid amount. Mortgages are evidenced by a formal legal document and are usually recorded in the county clerk's office.

BONDS PAYABLE. These are a type of long-term mortgage which is split into lots of more or less standard amount and so made available to a larger number of holders than is usually the case with the ordinary mortgage payable. This type of liability is limited almost exclusively to corporations.

The student should realize that usually the owner or owners of a business enterprise have both assets and liabilities other than those employed in the business. These personal properties and obligations of the owners are not to be taken into account when showing the proprietorship of a business unit or enterprise. They are to be considered only in showing the total proprietorship of any individual owner, when of course all of his properties, both inside and outside of the business, must be listed.

=Kinds of Proprietorship.=—Proprietorship, called also Net Worth, is shown under such titles as Capital, Investment, Capital Stock, Surplus, Undivided Profits, Reserves, and so forth. The title used depends largely on the type of organization under which the business is operated.

CAPITAL. Under this title is shown the amount of the investment of each owner in a single proprietorship or partnership business. To show each owner's share in the ownership the title Capital is preceded by his name. Illustration of this is given on pages 19 and 20.

INVESTMENT. This title usually is synonymous with capital. Sometimes it is used to indicate the amount of original investment in the business as distinguished from the present investment.

CAPITAL STOCK. Under this title is indicated the sum total of the portions of net worth owned by the shareholders as evidenced by stock certificates and subject to their individual control. On page 20 is given an explanation of the way in which the proprietorship or net worth of a corporation may be composed of two (or more) parts: (1) the capital paid in by the owners; and (2) the capital, representing profits made but not distributed to the owners. While capital stock usually represents the capital contributed by the owners, it sometimes arises from other sources, such as the distribution of a stock dividend; but the portion of the net worth owned and controlled individually by the owners is the capital stock.

SURPLUS. In a corporation this represents the second portion of the net worth, as indicated in the preceding section. Surplus is sometimes defined as the excess of the net worth over the capital stock. In other words, it is the difference between the assets and the sum of the liabilities and the capital stock.

UNDIVIDED PROFITS. This is a term used chiefly in financial institutions to indicate the portion of the net profits concerning the disposal of which no action has been taken.

RESERVES. Under this title are included whatever portions of the surplus are set aside or reserved for specific purposes.

Where Surplus, Undivided Profits, and Reserves appear as parts of Net Worth, they together represent the difference between Net Worth and Capital Stock. The reason for the careful segregation of these items from the Capital Stock is given in the explanation of the corporate form of organization, on page 20.

=Types of Business Organization.=—Before proceeding with a discussion of proprietorship as it appears on the balance sheet, the three general types of business organization will be treated briefly, because the manner of indicating proprietorship is dependent to a certain extent on the type of organization. These types are: (1) the single or sole proprietorship, (2) the partnership, and (3) the corporation.

=The Single Proprietorship.=—The simplest form of business enterprise is that conducted by a single proprietor. This form is well adapted to businesses where the capital necessary for efficient production is small, where the processes are simple and capable of being handled by the average individual, and where the risks are slight. Very few legal obstacles are placed in the way of the individual desiring to go into business for himself, nor is a great deal required of him. In some cases registration and a license are necessary. The observance of the general laws, concerning the payment of taxes and of local regulations concerning disease and fire is all that is usually expected. Subject to the general restrictions which ordinary business acumen and foresight impose, one can enter practically any field of enterprise, as a single proprietor, have entire freedom and privacy in the conduct of his business, and share with none the results of his endeavor.

On the other hand, these conditions oftentimes prove to be decided disadvantages. As industry is at present organized, many fields of activity demanding large capital and many kinds of technical knowledge, are closed to the single proprietor. Freedom of action carries with it sole responsibility, and oftentimes the counsel and advice of others would prevent the disasters which sometimes overtake the single owner of a business.

=The Partnership.=—A partnership is “a contract of two or more legally competent persons to combine their money, property, skill, and labor, or some or all of them, for the prosecution of some lawful business and to divide the profits and bear the losses in certain proportions.” There are different kinds of partnerships, as will later be shown, but the essence of each from the point of view of a working organization is mutual agency, each partner being the agent of the others, and, within the limitations of the partnership agreement, capable of acting as a principal for the firm. The partnership is subject to practically as few restrictions as the individual. In some localities, to secure the right to sue and be sued in the firm name, it is necessary to file in a public office a brief statement of the firm name and the names of its members.

The chief advantages of the partnership are larger capital and therefore access to fields closed to the individual; the combining of the business wisdom, skill, and knowledge of several individuals; the subdivision of duties and therefore the opportunity for specialization. While in the view of the business community the partnership is an entity or a business unit, it is not so in the sight of the law, each member of the firm being held liable to creditors for the entire debts of the partnership as if it were his sole business. If any one member has to pay the firm debts, he has a claim against his copartners for contribution.

Some of the disadvantages of this type of organization are the possibility of friction among the partners and consequent delay of action; the extension to the firm of credit based not on the firm property but rather on the total property of the members, and the consequent liability of each partner and his entire private fortune for the debts of the firm.

It is important to note that the partnership agreement should be very carefully drawn to cover in detail the relations of the partners, their duties and their rights, particularly as to their shares in the profits or losses of the firm.

=The Corporation.=—The corporate type of business organization is distinguished from the other types discussed:

1. By the freedom of each owner from the personal liability for the debts of the business to any greater extent than his stock interest in the business, though frequently in financial corporations, and in a few states for all corporations, his liability is double that stated.

2. By each share of ownership being evidenced by a formal document called a certificate of stock.

3. By each owner being allowed a voice in the affairs of the business only to the extent of his stock ownership therein.

4. By the necessity of securing from the proper authorities permission to do business.

5. By the necessity of complying strictly with the terms of this permit and submitting to certain requirements such as the filing of annual reports, payment of special taxes, and the like.

The owners of a corporation, or its stockholders as they are called, conduct the business through a board of directors which they elect for that purpose and they review its management periodically, usually annually. In this way they exercise indirect supervision over the business. This remoteness of personal interest and supervision has been somewhat overcome by electing to the board only those largely interested in the business, and by retaining on the board those whose ability as managers has been tried and proved. The board usually hires and delegates to others the active management of affairs.

The advantages of the corporate form of organization are: (1) it limits the liability of its owners; (2) it lends itself well to accumulation of the large funds of capital necessary for the promotion of large-scale enterprises; and (3) it secures through its board of directors a convenient and effective means of centralized control and management.

=Showing the Proprietorship of These Types=.—The methods of showing in the balance sheet the proprietorship for these three types of organization differ somewhat. The title under which proprietorship is listed is Capital. In a single proprietorship such title is preceded by the proprietor’s name, as shown in the following illustration:

Assets Cash $2,000.00 Accounts Receivable 5,000.00 Merchandise 3,000.00 Furniture and Fixtures 500.00 --------- Total Assets $10,500.00

Liabilities Accounts Payable $4,450.00 Due Clerk 50.00 --------- Total Liabilities 4,500.00 ---------- _Proprietorship_ James Runyon, Capital $ 6,000.00 ==========

In a partnership the capital is not shown in one item, each partner’s interest being stated separately, thus:

Assets Cash $ 2,500.00 Accounts Receivable 10,250.00 Merchandise 8,750.00 Furniture and Fixtures 625.00 ---------- Total Assets $22,125.00

Liabilities Notes Payable $ 1,660.00 Accounts Payable 5,465.00 ---------- Total Liabilities 7,125.00

Proprietorship Represented by: James Runyon, Capital $ 8,000.00 Philip Adams, Capital 7,000.00 $15,000.00 ---------- ==========

In a corporation, proprietorship is shown by the aggregate of the outstanding shares of stock, which are valued at a fixed par, or cost, under the single title Capital Stock, and if the proprietorship is greater than that indicated under this title, the excess is listed separately under the title Surplus or some of the other proprietorship titles already explained. This method of showing proprietorship is prescribed by law and is an effort to inform creditors, or those who may become creditors, that the corporation has observed the legal requirement not to distribute to stockholders any of its original capital. Hence, the capital stock of the corporation must be listed separately from the other items of proprietorship. Any changes in proprietorship during the life of the corporation are taken care of under these other titles, somewhat as illustrated below.

Assets Cash $ 1,850.48 Notes Receivable 1,645.65 Accounts Receivable 15,285.35 Merchandise 10,045.94 Supplies 1,145.37 Furniture and Fixtures 1,636.97 Delivery Equipment 1,427.50 Buildings 8,000.00 Land 2,000.00 --------- Total Assets $43,037.26

Liabilities Accounts Payable $ 5,762.26 Notes Payable 4,250.00 Salaries Due but Unpaid 25.00 Mortgage on Land and Buildings 3,000.00 ---------- Total Liabilities 13,037.26

Proprietorship Represented by: Capital Stock $25,000.00 Surplus 5,000.00 $30,000.00 ---------- ==========

CHAPTER III

THE BALANCE SHEET

=Purpose and Use.=—The balance sheet of a business is designed to show its financial condition at a given time. As previously illustrated, it marshals the assets in one list or schedule, and the liabilities in another. The difference between the totals of the two schedules gives the present or net worth of the business. In compiling a balance sheet it is not sufficient to give simply the figures of proprietorship or net worth; schedules of assets and liabilities must be drawn up to show the items making up that net worth. From the viewpoint of a prospective investor or purchaser, a banker to whom the business has applied for a loan, or a concern considering the advisability of extending it credit on a bill of goods, it makes all the difference in the world to know that with a net value of $10,000 the business has assets of $15,000 and liabilities of $5,000; or to know that its assets are $260,000 and its liabilities $250,000.

The ratio of total assets to total liabilities is almost as important information to an investor, purchaser, banker, or creditor as is the character of the assets and liabilities. If the assets are in properties for which there is not a ready market and the liabilities are claims which mature soon and will have to be met, the situation is unfavorable. If there are large values invested in easily salable assets; if there is a large balance of cash on hand after meeting current claims and providing for those which will soon mature; if other liabilities are of a more permanent nature, such as mortgages or long-time notes not requiring immediate attention—the situation may show evidence of too large a capital, or of inefficient management as indicated by the failure to invest a part of the surplus cash in properties from which some return might be secured.

=Form and Content.=—Questions of the kind raised above are not usually capable of definite answer from the information contained on the balance sheet alone. Oftentimes information as to the volume of business done, future plans for expansion or contraction of business operations, and so forth, is needed in addition to that supplied by the balance sheet. Of immediate interest to us, however, is the information contained in the balance sheet. Here two main problems are met: that relating to the form of the balance sheet, and that concerned with the content of the balance sheet.

By form of the balance sheet is meant its physical appearance—the arrangement and classification of its items. The form is not standard. In this country there are few legal regulations governing the way in which the records of a business are to be kept or its reports are to be made. Some efforts have been made, however, to establish a more or less standard form of balance sheet and to secure the use of standard titles in the balance sheet so that wherever found those titles can be relied upon to mean one and only one thing. Because balance sheets are not always drawn up for similar purposes, such regulations should not be too inflexible. The form of any business statement or report should always have regard to the purposes it is to serve. Standardization of form is desirable within this limitation.

By content of the balance sheet is meant the items that are admitted to it and the basis of their valuation.

These two problems of the balance sheet—form and content—are fundamental and will be briefly considered here.

=Titles—Main and Group.=—Instead of “Balance Sheet,” other terms are used as names for the statement itself, such as “Financial Statement,” “Statement of Resources and Liabilities,” “Statement of Assets and Liabilities.” Within the statement, Resources is an alternative title for Assets; and Net Worth, Present Worth, and Net Assets, for Proprietorship. For the present, use of the terminology previously employed will be continued, with the substitution, however, of the term Net Worth for Proprietorship.

The title of a statement should be full; it should include the name of the business enterprise and date, and should appear somewhat as follows:

SHONGOOD & GOODWELL BALANCE SHEET December 31, 19—

As stated, this should be followed by the schedules of Assets, Liabilities, and Net Worth. Since the statement is a formal one, due regard should be had for its general appearance, which should be neat and attractive. Further consideration will be given to some of these features in Chapters XXVI and XXVII.

=Classification and Arrangement.=—As indicated above, the balance sheet is used to picture the financial condition of a business at a given time. Some of the questions which arise in determining the financial condition of a business have already been mentioned. The chief use to which a balance sheet is put is the determination of the solvency of the business for purposes of getting credit extensions. By solvency is meant the ability of the business to pay its debts when due. Regardless of how great the excess of assets over liabilities is, if it is tied up in assets which cannot be used for the payment of debts, the creditors of the business will become impatient and may ask a court to take the control of the business away from its owners and place it in the hands of a representative of the court and the creditors, who will conduct the business for the purpose of converting assets into

cash to a sufficient extent to pay all debts.

A balance sheet should therefore be so arranged that the condition of the business, viewed from the standpoint of its ability to pay its debts, will be clearly and easily determinable. Cash is usually the only medium used for the payment of debts. In the regular course of business, debts are incurred which come due at different dates. Hence it is not necessary to have on hand at a given time cash sufficient to pay all of the debts of the business. Certain classes of debts will not wait. The sums owed employees for services must usually be paid when due. The debt to the government for taxes, to the public service company for heat, light, and power, to the landlord for rent, to the bank for money borrowed—all these debts must usually be paid immediately as they come due.

The cycle of business operation includes the purchase of merchandise, the payment of operating expenses, and the conversion of merchandise into cash through sale, either directly, as when the sale is for cash, or indirectly as when credit is extended a customer and cash is later collected from him. This cycle or turnover of merchandise recurs constantly in the management of the financial affairs of a business. It is necessary so to order the buying and selling of goods and the collection of accounts from customers that there will be on hand at all times sufficient cash to pay the expenses of operating the business and the debts contracted in the purchase of merchandise. This is the vital and fundamental problem of the business executive. In the solution of that problem it may sometimes be necessary to borrow funds from the bank. Before lending money, the banker assures himself that the business will be in a position to repay the borrowed money when due.

The balance sheet, accordingly, should be so arranged that the condition of the business as related to its ability to pay its debts will be apparent. This requires a classification or marshaling of the assets which are concerned in the trading cycle on the one side, and the liabilities which must be assumed in conducting the business during the trading cycle, on the other.

At the head of the list of assets is the item Cash, the most liquid of all, as it can be used directly for the payment of debts. Following Cash come in order Notes Receivable, which, with proper indorsement, can be sold to the banker and converted into cash almost immediately; Accounts Receivable, which represent the claims against customers for merchandise sold and which are collectible within the term of credit extended to the customer; and finally, the Merchandise on Hand, which must be sold either for cash or on credit and then converted into cash by the collection of the outstanding accounts. Sometimes, also, there is included in this group the asset Investments, representing stocks and bonds of other companies which can be converted into cash by sale on a stock exchange. On such securities, and also on the notes receivable, there is usually at the date of the balance sheet some interest which has accrued and may not yet be collectible. It is customary to include the amount of this interest receivable in the same group with the assets from which it arises.

This group of assets, comprising Cash, Notes and Accounts Receivable, Merchandise, and so forth, is called the group of Current Assets. Asset items are classified as current if conversion into cash is expected within three to six months. These are the assets to which the current creditors of the business will have to look for the payment of their claims.

The claims of current creditors are usually included under the titles Notes Payable, Accounts Payable, and Accrued or Unpaid Expenses. The classification of a creditor in the current liability group is usually determined on a time basis. Thus, all debts that will have to be met within six months' or one year's time from the date of the balance sheet are usually classed as Current Liabilities.

The excess of current assets over current liabilities is called the working capital of the business; that is, an amount of the current assets equal to the current liabilities will have to be used for the payment of these debts, leaving the excess or difference free for use within the business. While it is not possible to determine, without considering all the circumstances in a given case, how large this working capital should be, the standard rule-of-thumb is that it should equal the amount of the current liabilities. It will thus be seen that the standard ratio of current assets to current liabilities is two to one. The solvency of a given business is always judged by a comparison of the current asset group with the current liability group.

The next main group of assets is given the title Deferred Charges. The content of this item was explained on page 12. Thus, if a management has paid some of its expense bills in advance—rent for January paid during December, for example—when showing its financial condition as at the end of December it is proper and necessary, in order to make an accurate showing, that all such prepaid expenses be listed as assets; for, had the payment not been made until the service which it purchased had been used up, the asset cash would have been larger by the amount of the prepaid expenses.

Similarly, with regard to the Accrued Expenses mentioned on page 14, whatever expenses have been incurred that properly belong to the past period, such as wages due but unpaid, are liabilities; for the cash would be smaller by the amount of such postponed or

accrued items had the claims been met during the period. The close relationship of both deferred charges and accrued expenses to cash is thus apparent—the one as an indirect addition to the cash, the other as an indirect deduction from or claim against cash. Accordingly, deferred charges are shown on the balance sheet immediately following the group of current assets, whereas accrued expenses are listed with the current liabilities as noted above.

The next group of assets is called Fixed Assets. Under this title are listed those assets which are used for carrying on the business but are not bought for the purpose of being resold. A certain amount of capital must be invested in the physical business plant. Furniture and fixtures, delivery equipment, buildings, land, machinery and tools, and so forth, must be purchased before the business can commence operating. It is assets of this type that comprise the class of fixed assets. There is a corresponding group among the liabilities which are known as Fixed or Long-Term Liabilities. All debts maturing a year or more after the date of the balance sheet are classed as fixed liabilities. As examples of this class, we have long-term notes payable, mortgages payable, bonds payable, and so forth.

The difference between the fixed assets and the fixed liabilities indicates the amount of owner's capital which has been invested in the business plant.

The final group of assets is called simply Other Assets, and includes all assets which cannot be classified in any other groups, such as good-will, patents, trade-marks, accounts and notes receivable having a credit term longer than six months, and other similar items. If there are any liabilities not capable of classification in the two groups of liabilities given above, they may be put in a group called Other Liabilities.

For the purpose of an easy showing of these various groups and their titles, it is customary to list the amounts of the several detailed items of each group in an inner money column, and to extend the total into the adjoining money column on the line of the last item in the group. A similar arrangement is made of the groups of liabilities so that not only the items in the various groups but the group totals as well are available. The totals of the various groups give the grand totals for the assets and the liabilities respectively.

The balance sheet as now classified and arranged provides first a formal title, giving the name of the business and the date of the balance sheet; then the assets, under which appear the groups Current Assets, Deferred Charges, Fixed Assets, and Other Assets; under the liabilities appear the groups Current Liabilities, Fixed Liabilities, and Other Liabilities. The showing of Proprietorship or Net Worth under the three different kinds of ownership has already been set forth. The illustration on page 31 shows a typical form of classified balance sheet. This should be studied carefully, as it is the type which will be used hereafter.

=The Problem of Content.=—The form of the balance sheet serves the purpose of making easily available the information contained in the balance sheet. Form is of little value unless the content is accurate. What a balance sheet contains is, after all, far more important than its form. The problem of content comprises a consideration of two points: (1) the proper inclusion of all items, both assets and liabilities, belonging in the balance sheet; and (2) the correct valuation of the items so included.

With regard to the first, it may be said briefly that care must be exercised to see that all assets belonging to the business and having value, and that all claims against the business of whatever nature, are included.

Assuming that a given balance sheet contains a list of _all_ the assets and _all_ the liabilities, the further problem of the proper valuation of these items must be considered. A balance sheet in which the title Cash includes counterfeit bills, N. G. (that is, uncollectible) checks and other similar items, would not be considered a reliable balance sheet. Similarly, the basis for the valuation of each of the asset items must be investigated and determined correct before the balance sheet may be considered to represent the true financial condition of the business. It is the experience of every business that it cannot collect all of the credits extended to customers. Regardless of how carefully credit is granted, it will be found that some customers do not pay their debts. Accounts and notes receivable must, accordingly, be valued with a proper consideration for the estimated amount of the uncollectible portion. The stock of merchandise on hand must be valued according to the standard formula, at cost or market, whichever is the lower. The deferred charges group of assets will show the value of the unconsumed portions of the assets purchased, with due regard to the time element. Thus, a three-year insurance policy purchased at the beginning of the year will at the close of the year be valued at two-thirds of its original cost. The fixed asset group will be valued at cost less depreciation, which represents the amount of the loss in value of the assets due to wear and tear, lapse of time, and obsolescence.

In determining liabilities, providing they have all been included, there is not the danger of an understatement, because their amount is subject to verification on the basis of the creditors' claims. For obvious reasons the liabilities are seldom overstated.

=General Principles Governing Form and Content.=—In drawing up a balance sheet, the form must be flexible enough to meet whatever requirements for information may be placed upon it. Thus, a balance sheet to be presented to the banker as the basis of a loan should be carefully classified so as to show clearly the financial condition, and sufficient detail should be given to indicate the basis used in valuing the various items. A balance sheet drawn up for publication may, on the other hand, contain less detailed information and less attention need be given to its form. A balance sheet drawn up for use within the business itself may well contain very full information and its form should be such as will accurately portray the status of affairs. A balance sheet which shows on its face that cognizance is taken of uncollectible accounts and of the loss in fixed assets due to depreciation, is much more valuable as a financial statement than one lacking that information, provided of course it is to be used to indicate that consideration has been taken of those elements. Excepting for the general remark that regard must always be had to the purpose for which the balance sheet is drawn up, no hard-and-fast rule can be laid down in the matter of the relative fullness of detail with which it should be made.

=Illustration.= To illustrate the features of the balance sheet discussed in this chapter, the following statement showing the financial condition of the partnership of Jackson & Edwards is given:

JACKSON & EDWARDS BALANCE SHEET June 30, 19—

Assets Current Assets: Cash $ 2,365.00 Accounts Receivable $8,500.00 _Less_—Reserve for Doubtful Accounts 170.00 8,330.00 --------- Merchandise 10,425.00 $21,120.00 --------- Deferred Charges: License Fees Paid in Advance $ 175.00 Unexpired Insurance 75.00 Supplies 80.00 330.00 ---------- Fixed Assets: Furniture and Fixtures $ 750.00 _Less_—Reserve for Depreciation 75.00 $ 675.00 --------- Buildings $9,680.00 _Less_—Reserve for Depreciation 242.00 9,438.00 Land 2,500.00 12,613.00 --------- --------- Total Assets $34,063.00

Liabilities Current Liabilities: Notes Payable $2,500.00 Accounts Payable 6,750.00 Wages Accrued 250.00 Interest Accrued 75.00 $ 9,575.00 --------- Fixed Liabilities: Mortgage on Land and Buildings 2,500.00 ---------- Total Liabilities 12,075.00 --------- _Net Worth_ Represented by: S. J. Jackson, Capital $10,267.00 P. R. Edwards, Capital 11,721.00 $21,988.00 ---------- ==========

CHAPTER IV

THE COMPARATIVE BALANCE SHEET

=Comparison of Net Worths.=—The aim of every business enterprise is to increase its net worth. If James Runyon at the beginning of the year is worth $5,000 and at its close $7,500, it is evident that he has increased his wealth by $2,500. Very little information is given him or anyone else as to the manner in which the increase took place, except that it came about in the ordinary course of business. No criterion is given by which to compare effort with result. An increase of $2,500 may or may not be commensurate with the labor expended in effecting it. However, since a business is not likely to remain stationary, there is a degree of satisfaction in knowing merely the extent of the change in its net worth. The taking of an inventory, the appraising of the value of the assets from time to time, and the setting of the liabilities for the same dates over against them, is the method of determining the corresponding net worths. A comparison of these net worths shows their increase or decrease during the period. A further analysis of the individual items may be made. A comparison of each asset at the beginning of the period with its value at the end of the period, shows the increase or decrease in that item. A similar comparison of each liability item brings out the increase or decrease during the period.

=How a Gain or Loss May Be Evidenced.=—During a period a gain or increase in net worth may come about in one of four ways:

1. The assets may remain the same and the liabilities may decrease. 2. The liabilities may remain the same and the assets may increase. 3. The assets may decrease but the liabilities suffer a greater decrease. 4. The assets may increase but the liabilities undergo a smaller increase.

Provided no more money has been invested in the business, and none has been withdrawn, there has been in all the above instances an increase in net worth, that is, a profit has resulted. If the reverse of the above relationships obtains, there has been a decrease in net worth, or a loss.

The following statements illustrate the points discussed above.

AARON CONNERS BALANCE SHEET, June 30, 1921

Assets Cash $ 1,000.00 Notes Receivable 250.00 Accounts Receivable 5,250.00 Merchandise 8,500.00 Store Fixtures 525.00 ---------- Total Assets $15,525.00

Liabilities Accounts Payable $ 5,365.00 Notes Payable 1,250.00 ---------- Total Liabilities 6,615.00 ----------

Net Worth Aaron Conners, Capital $ 8,910.00 ==========

One year later Conners' financial condition is shown to be:

AARON CONNERS BALANCE SHEET, June 30, 1922

Assets Cash $ 850.00 Notes Receivable 100.00 Accounts Receivable 6,425.00 Merchandise 10,260.00 Store Fixtures 472.50 Delivery Equipment 350.00 ---------- Total Assets $18,457.50

Liabilities Accounts Payable $ 6,192.75 Notes Payable 950.00 Accrued Salaries 50.50 ---------- Total Liabilities 7,193.25 ----------

Net Worth Aaron Conners, Capital $11,264.25 ==========

The various types of information essential to judging the financial condition as disclosed by the above balance sheets will now be discussed.

=Comparison of Balance Sheets.=—A comparison of balance sheets gives more information than merely the amount of profit for the year. It indicates trends in the business. Thus a comparison of the notes and accounts receivable for the two years may give some indication of the vigor with which collections are pressed. If the volume of business done, that is, the amount of sales made, was about the same during the two years, and if there are more uncollected accounts at the close of the second year than at the close of the first, it would tend to show that collections were less satisfactory during the second year. Investigation may show that this is due to general conditions of business in the country rather than to failure to push collections vigorously. If there is any marked change in the amount of the stock of merchandise on hand it would invite inquiry. If the stock is much larger at the end of the second year than at the end of the first, it might indicate that the business man is speculating in merchandise, that he considers the buyer's market during the year particularly favorable and has laid in an abnormally large stock. A banker with large experience in similar businesses can formulate a fairly accurate judgment of how much working capital a concern should have invested in merchandise. With that as a criterion he can tell the normal amount of merchandise the business should carry.

A comparison of current liabilities for the two periods will indicate the extent to which borrowed working capital is being used. Thus, an unusual increase in stock-in-trade may be offset by an equally large increase in current liabilities, and so would indicate that the merchant has done his buying on credit or has used borrowed working capital to increase his stock. The danger of this is apparent in a fluctuating merchandise market, particularly if the swing is generally downward. A comparison of the working capital for the two periods gives useful information. A decrease in the amount of working capital may indicate an investment of it in fixed plant which, if continued, will lead to trouble with current creditors. An increase in working capital may point to the advisability of greater sales effort.

A comparison of fixed assets for the two periods will show the increase or decrease in the plant investment. If this has been offset by a corresponding increase or decrease in fixed liabilities, no additional capital of the owners has become tied up in fixed plant, while the reverse is true if there is not that correspondence between fixed assets and fixed liabilities. Where the ratio between current liabilities and fixed liabilities has increased, it may point to the desirability of funding some of the current debt. Short-term liabilities have apparently been incurred for the purpose of extending the fixed plant. It is usually desirable to convert, that is, fund these current liabilities into long-term liabilities in order to conserve working capital to pay current debts.

Thus it is seen that a proper understanding of the items in the two balance sheets and of their various interrelationships will oftentimes give very valuable information. Banks and business houses which are called upon to extend credit, maintain regular files of credit information, including periodic balance sheets, concerning their present and prospective customers, so that they can judge fairly accurately the condition of the businesses.

=The Comparative Balance Sheet—Its Content and Form.=—A comparison of the above balance sheets shows an increase of net worth of $2,354.25 during the year. It shows also that this profit is accounted for by an increase of $2,932.50 in the assets, which is offset by an increase of $578.25 in the liabilities, leaving a net increase of $2,354.25.

The two statements thus separated do not lend themselves easily to a comparison of individual items. Accordingly, a method of showing the comparison known as the “Comparative Balance Sheet” form is used. This brings all the data into juxtaposition and so makes comparison easy. The balance sheet for the current year is shown first, followed by that for the preceding year. The increase and decrease column uses the current year as a basis for comparison with the preceding year.

AARON CONNERS COMPARATIVE BALANCE SHEET June 30, 1922 and June 30, 1921

Increase and _Assets_ 1922 1921 Decrease Current Assets: Cash $ 850.00 $ 1,000.00 - $ 150.00 Notes Receivable 100.00 250.00 - 150.00 Accounts Receivable 6,425.00 5,250.00 + 1,175.00 Merchandise 10,260.00 8,500.00 + 1,760.00 ---------- ---------- --------- $17,635.00 $15,000.00 + $2,635.00 ---------- ---------- --------- Fixed Assets: Store Fixtures $ 472.50 $ 525.00 - $ 52.50 Delivery Equipment 350.00 + 350.00 ---------- ---------- --------- $ 822.50 $ 525.00 + $ 297.50 ---------- ---------- --------- Total Assets $18,457.50 $15,525.00 + $2,932.50 ---------- ---------- ---------

Liabilities Current Liabilities: Accounts Payable $ 6,192.75 $ 5,365.00 + $ 827.75 Notes Payable 950.00 1,250.00 - 300.00 Accrued Salaries 50.50 + 50.50 ---------- ---------- --------- Total Liabilities $ 7,193.25 $ 6,615.00 + $ 578.25 ---------- ---------- ---------

Net Worth Aaron Conners, Capital $11,264.25 $ 8,910.00 + $2,354.25 ========== ========== =========

While it is true that a great deal of valuable information can be secured from a comparative balance sheet, and that this form of balance sheet locates definitely the changes in the asset and liability items, summarizes those changes, and shows the net profit, it nevertheless fails to disclose the forces within the business organization which have brought about the changes—it sets forth effect or result but not cause. A supplementary or rather a complementary statement is needed to show the reasons for the changes. This is discussed in the following two chapters.

CHAPTER V

THE ECONOMIC OR PROFIT AND LOSS ELEMENTS OF A BUSINESS

=Fuller Information Needed.=—As indicated in Chapter IV, in the summarization of the business transacted during a given period, it is not usually sufficient to know how much net worth has changed; nor is the whole story told when it is known exactly what items are responsible for the change, that is, which of the properties are worth more and which are worth less at the end than at the beginning of the period. Additional information is necessary to account for the changes shown by the comparative balance sheet.

The proprietor who knows simply that his cash is $1,000 less now than it was at the corresponding time in the last fiscal period, has not the kind of control over his business that his competitor has who knows that the $1,000 was expended for an increased stock of goods, or that an outstanding liability of that amount has been settled, or that his expenses for the period have been larger by $1,000 than for the former period. His competitor may be worse off but he at least has the advantage of knowing the reason for his being so. He has made a correct diagnosis of the pulse beat of his business. If he cannot heal its ills or secure aid for it, he can at least have the satisfaction of giving it a respectable burial, and the autopsy will then disclose that he failed to take advantage of his information until it was too late.

However, the point should be clearly held in mind that the proprietor who knows exactly what is happening in his business is in a position to exercise a definite and sure control over it. Hence, the accounting department, to justify its existence, should aim to give full information as to what is taking place within the business and what eventually will be the result in its financial life. Only in this way can the department serve as a means of control.

=Kinds of Records.=—A business must have assets and usually must incur liabilities; a plant must be used, stock-in-trade must be bought, and sold, and usually sufficient capital must be provided for the extension of credit to customers. Capital for the payment of the operating expenses of the business, the maintenance of the plant, the payment of salaries and wages of employees, and so forth must at all times be provided. While it is true that the balance sheet shows the financial condition of the business, it gives little information as to the volume of business operations. It indicates the net worth and may even indicate the increase or decrease in net worth if the comparative balance sheet is used. Yet as to how that increase or decrease in net worth came about, little or no

information is given. The balance sheet, in other words, is static; it indicates a quiescent state. It is a snapshot, showing the wheels of business momentarily stopped.

To give a full survey of the operations during a given period, a motion picture of the events between the dates of the balance sheets must be shown. Such a picture is dynamic. It gives a realization of the whirl and bustle of business being carried on. It pictures volume, content, and extent, whereas the balance sheet indicates the state arrived at as of a given moment. For purposes of management, which must control all the phases of business activity, a balance sheet is insufficient. A review of the factors producing results up to a given time must be had. Accordingly, the accounting department must supply not only information as to the present state of the assets and liabilities, but also information which indicates how the changes in assets and liabilities since the last fiscal period were brought about—what volume of transactions occurred, what expenditures of assets and energy were necessary to accomplish the results attained. This information, for purposes of internal management, is more vital than that concerning simply the present status of assets and liabilities. It is complementary to that obtained by a comparison of net worths and it is therefore explanatory of the changes in net worth.

=The Net Worth Section Expanded.=—In its operation of buying and selling goods, a business executes many different types of transactions. As was indicated in Chapter I, in the development of the proprietorship equation, some types of transactions have no effect on proprietorship, that is, they involve neither a profit nor a loss; while other types of transaction—the really vital types, because it is for these that the business is carried on—involve a change in proprietorship, either increasing or decreasing it. Goods are bought for one price and sold at a price sufficiently higher to pay for all the expenses of operating the business and leave a reasonable margin of profit. For example, goods may be bought for $1,000 and sold for $1,800, bringing about an increase of $800 in the sum total of the assets. This $800 may represent temporarily an increase in proprietorship but the increase must be used first to meet the expenses of operating the business during the period in which the sale is made, after which the net result represents the real or permanent increase in proprietorship. The temporary increase of $800 is offset by a temporary decrease of, say, $600 for operating expenses. It is vital to business management to have information not only concerning the net increase in proprietorship but also concerning these temporary increases and decreases. To give this information the net worth section of the balance sheet might be expanded as in the illustration given below.

EDWIN MARKHAM BALANCE SHEET, December 31, 19—

Assets Cash $ 5,000.00 Accounts Receivable 75,000.00 Merchandise 20,000.00 Plant 50,000.00 ---------- Total Assets $150,000.00

Liabilities Accounts Payable $30,000.00 Accrued Expenses 5,000.00 Mortgage on Plant 30,000.00 ---------- Total Liabilities 65,000.00 --------- _Net Worth_ Edwin Markham: Capital at the beginning of the year $70,000.00 Profits during the year: Sales $200,000.00 Cost of Goods Sold 140,000.00 ----------

Temporary Increase in Proprietorship $ 60,000.00 Operating Expenses 45,000.00 ---------- Net Increase in Proprietorship 15,000.00 ---------- Capital at the end of the year $ 85,000.00 ----------

In the net worth section of this balance sheet, the capital with which the owner started operations for the year is given first. To this is appended a summary of the operations for the year resulting in a net increase in proprietorship which, added to the beginning capital, gives the capital in the business at the end of the year. This method of setting up the information concerning the operations of the business is not used to any extent because the information is of such vital importance that it deserves more display. Accordingly, a separate statement, known as the “Statement of Profit and Loss,” or “Statement of Business Operations,” is drawn up to explain the balance sheet net worth item, Net Increase in Proprietorship for the year, which shows just the amount of the net profit. The detail of this item is given in this complementary statement. The above illustration is given merely for the purpose of pointing out the relationship between the statement of operations and the balance sheet. From this it will be seen that the statement of profit and loss is really a part of the net worth section of the balance sheet.

TEMPORARY PROPRIETORSHIP RECORDS.—The proprietorship records, indicating as they do the sources of changes in net worth, are kept day by day as transactions take place, are summarized at the close of the period, and the net result is determined. They are called temporary because, as is seen, they do not at the time of record have regard for the final change in proprietorship. At the end of the regular periods, to determine the total or final change, the temporary proprietorship records are closed or transferred to the summarized record called the “Profit and Loss Summary.”

Referring to the case of Aaron Conners discussed in Chapter IV, assume that the accounting department furnishes the following additional information from its records:

During the year from July 1, 1921 to June 30, 1922, Conners bought $22,362.50 worth of goods; his sales amounted to $28,465.20; he paid for help $3,050.50; his other expenses were $2,405.45; and he estimated the wear and tear on furniture at 10%, or $52.50. As shown in his statement for 1922, he had $10,260 worth of merchandise on hand on June 30, 1922.

The analysis of this information explains the changes in his net worth during the year. The goods he started with plus those purchased during the year are the total goods to be accounted for, which amounted to $30,862.50 ($8,500 + $22,362.50 = $30,862.50). These goods were accounted for by his sales during the year and the amount on hand. Knowing how much was on hand June 30, 1922, viz., $10,260, he determined that the goods sold must have been the difference or $20,602.50 ($30,862.50 - $10,260 = $20,602.50). The price which he received for these goods sold was $28,465.20; hence, his profits from sales were $7,862.70, the difference between selling price and cost.

We find, also, that the expenses he incurred in selling his goods and conducting his business generally were $3,050.50 for clerk hire, office help, delivery boys, etc.; and other expenses, such as rent, taxes, repairs, delivery upkeep, supplies, heat, light, and the like, amounted to $2,405.45. He estimated that his store fixtures depreciated in value $52.50. All these items, representing costs of doing business, amounted to $5,508.45 ($3,050.50 + $2,405.45 + $52.50 = $5,508.45), which subtracted from his profits from sales, $7,862.70, gives him a net gain of $2,354.25 ($7,862.70 - $5,508.45 = $2,354.25). This gain tallies with the increased proprietorship of that amount shown by the balance sheet of June 30, 1922.

Without regard to a form which would be technically correct, the data of the preceding paragraphs may be shown as follows:

Goods on hand at the beginning, July 1, 1921 $ 8,500.00 Goods bought during the year 22,362.50 ---------- Total goods to be accounted for $30,862.50 Goods accounted for, now on hand 10,260.00 ---------- Goods accounted for, by being sold $20,602.50 ==========

Selling price of goods sold $28,465.20 Cost price of goods sold, as above 20,602.50 ---------- Profit from sales $ 7,862.70 Expenses of doing business: Clerk hire $3,050.50 Other expenses 2,405.45 Depreciation 52.50 --------- Total expenses 5,508.45 ---------- Net profit, or increase in net worth $ 2,354.25 ==========

The technical form of the summary of the temporary proprietorship elements will be presented in the next chapter.

CHAPTER VI

THE PROFIT AND LOSS SUMMARY

=Type of Information Needed.=—The need and purpose of the information to be furnished by the temporary proprietorship records was pointed out in Chapter V. Without information of this sort, proper control of business operations cannot be exercised. These records supply a summarized picture of the activities of the business during a definite period, which have as their goal the increase in proprietorship—the making of a profit. In attaining this goal, two main types of activities or operations are entered into, usually classified under the heads of: (1) income or earnings, by which is meant those activities which immediately and directly increase proprietorship; and (2) expenses or outgo, comprising those activities which decrease proprietorship. Expenses are the costs incurred in securing income, and are therefore deductions from it. A fuller explanation of these terms will now be given.

=Income.=—Income is usually of two types: operating and non-operating. These terms are always relative; that is, what is an operating income in one business may be a non-operating income in another business. The term “operating income” is used to indicate the main sources of income in a given business. It is always the duty of the accounting department to indicate the sources of income. Thus in a trading or mercantile business, the selling of goods to customers is the main source of income. In a professional business, the selling of services, often titled “professional fees,” is the main source; in a brokerage or commission business, commissions earned; in institutions, tuition and other fees; in a financial business, interest earnings; in a society, membership fees. These are typical titles for indicating the main source of income in the several kinds of undertakings mentioned.

While sales are the major source of income in a trading concern, there may be supplementary sources. It may own stocks and bonds from which income may be derived. In a manufacturing or mining enterprise the company may own dwelling houses and rent them to its employees. Conditions of travel and communication may also force it to provide stores, places of amusement, and so

forth for its workers. From all these supplementary activities it will derive income. As it was not organized primarily for these purposes, but chiefly to manufacture, or mine a commodity, the income from these collateral activities is classed as non-operating income.

The distinction, then, between operating and non-operating income is, as mentioned above, always a relative one and will be determined in any given instance on the basis of major activities and supplementary or minor activities. Some of the titles under which income is recorded will now be explained:

SALES. Under this title is recorded the amount of sales of the stock-in-trade in a merchandising or manufacturing concern. The two elements included here, namely, the decrease of the asset merchandise and the increase of proprietorship—the true income element—will be discussed later.

SALES RETURNS. This title does not represent income but, as its name indicates, shows the amount of the goods sold which have been returned because of dissatisfaction with the quality or condition of the goods or some error in sending the wrong kind.

SALES ALLOWANCES. These are similar to sales returns in that they indicate a deduction from the sales income for the allowances made to the purchasers who for one reason or another have just cause to be dissatisfied with the goods but agree to retain them providing an allowance from the original selling price is made.

INTEREST INCOME. Under this title is recorded the income from money loaned or credit extended. Notes receivable and bonds are the usual sources. Sometimes open accounts receivable also bring interest.

RENTAL INCOME. Under this title is recorded income received from the lease of premises, lands, or buildings.

PROFESSIONAL FEES. Under this title is recorded the income from charges made for professional services.

COMMISSIONS EARNED. Included under this title is the income received from services rendered in the selling of commodities for a principal.

PURCHASE DISCOUNT. This represents the deduction allowed from the original charge for paying a debt in advance of the date named in the purchase contract.

=Expenses.=—Expenses are also of two types: operating and non-operating. The same distinction is made here as with income. Those expenses incurred in securing operating income are operating expenses, while those incurred in securing non-operating income or for other purposes are called non-operating expenses.

To secure control over the operating and non-operating types of activities, it is necessary to compare operating income with operating expenses, and non-operating income with non-operating expenses, in order to measure the return by the effort expended in securing that return. Some of the more common titles under which the record of expenses is made are as follows:

SALARIES (WAGES). Under this title is included the cost of the services rendered by employees. This may be classified in accordance with the department in which the service is rendered; for example, factory wages, salesmen’s salaries, office salaries, and so forth.

TRAVELING EXPENSES. The costs of railroad fare, entertainment, and so forth, when traveling in the interests of the business.

ADVERTISING. The cost of publicity in making known the commodities offered for sale by the business.

BUYING EXPENSE. The costs incurred in making purchases for the business. These may comprise the salaries of buyers and all expenses in connection with maintaining a purchasing department.

RENT. The cost for the use of premises not owned.

PLANT MAINTENANCE. The cost of upkeep, repairs, and so forth, on the plant used by the business. The cost, by purchase or manufacture, of light, heat, and power is included here.

DEPRECIATION. The decrease in value of a fixed asset due to wear and tear, lapse of time, obsolescence, etc.

BAD DEBTS. The amount of outstanding accounts receivable which have proven or are judged to be uncollectible.

SALES DISCOUNTS. The cost incurred because of the financial policy of charging a customer a smaller amount than the amount of the bill, provided he pays by a given date.

TELEPHONE, TELEGRAPH, STATIONERY, POSTAGE, INTEREST COST, COMMISSIONS PAID, AND SO FORTH. These all indicate by their titles the nature of the expense or cost items.

The student should understand that expenses may be set up in very much greater detail than that indicated by the above titles. Usually the title under which record of an expense is made will indicate with sufficient clearness its character.

=The Profit and Loss Summary.=—As indicated in Chapter V, the profit and loss summary shows the manner in which the net worth of the business has been changed as the result of operations of the business, as distinguished from changes brought about through withdrawal or investment of capital. Although it is really a part of the balance sheet, which shows financial condition, because of its importance it is, however, set up as a separate statement. It amplifies and fills out the record shown by the balance sheet. It is a supplementary record because it gives additional information, and is complementary to the balance sheet because it rounds out and completes the story of business life there recorded.

Just as with the balance sheet, the main problems of the profit and loss summary relate to: (1) its form; and (2) its content. After an explanation of some of the terms used in connection with the summary, these two problems will be discussed.

=The Fiscal Period.=—Because of the work involved and the frequent incompleteness of the records at the close of each day, a daily statement of condition is very seldom made up. The business experience of a particular enterprise determines the frequency of preparation of these statements. Whatever the period may be between statements, be it a month, three months, a half-year, or a year, it is called the fiscal period, i.e., it is the period at the end of which records are summarized for the purpose of ascertaining the profit or loss for the period. For purposes of comparison with preceding and following fiscal periods, under similar conditions, the fiscal period should be, and usually is a period of regular length—a half-year or year being perhaps the most common, though in many enterprises it is customary to draw up supplementary monthly statements.

=Need for the Physical Inventory.=—Again, because of the work involved, especially where the product dealt in is small in value and sales are numerous—as in stores dealing in clothing, food, and the like—no record of the cost of each article is kept as it is sold, only the sale price being recorded. It is not possible, therefore, to determine from the records as usually kept, the cost of the goods on hand at a given time. The records are kept in this way, not because systems of accounting cannot be devised to make both records, but because the results obtained by such systems are not justified by their cost when other and less expensive means can be used with almost as satisfactory results.

The customary method of finding the cost of goods sold was indicated in Chapter V. Summarized, it requires that from the sum of goods on hand at the beginning and those purchased since, there be subtracted the goods on hand and unsold at the close of the period. This last item, the goods on hand and unsold, is secured by making an actual count and valuation of such goods at the close of the fiscal period. The expedient of physical inventory-taking is therefore brought in as an aid to the accounting records, but only in the interests of economy.

Form of Profit and Loss Summary

GENERAL PRINCIPLES GOVERNING MAKE-UP. The profit and loss statement, as the complement of the balance sheet, is just as formal in character and the same general considerations govern as the make-up of the balance sheet, viz.: (1) the general purpose it is to serve; (2) the likelihood of obscuring essential facts through too great detail; and (3) the general appearance is to legibility, clearness of form and expression, and arrangement on the page.

TITLE. The heading of the summary must show the name of the business, followed by the title of the summary and the statement of the exact period covered by it. It was noted in Chapter V that whereas the balance sheet is a statement of financial condition as at a given date, the profit and loss summary is a statement of operations which have taken place during a given period. Hence, it is not sufficient merely to state the date of the close of the period. If, as is usually the case, the fiscal periods are of uniform length in a given business, the phraseology “For the Period Ending ...” will be sufficient for use within that business. It is better, however, for all statements of operation to indicate the length of the period covered. A typical heading for the profit and loss summary is indicated below:

JAMES R. ROBINSON & COMPANY STATEMENT OF PROFIT AND LOSS For the Six Months' Period Ending December 31, 19—

ARRANGEMENT. The arrangement of the summary has already been indicated. The income from operations, that is, the operating income, is shown firsthand, and is followed by the operating expense, and then by the amount of the difference or the net result of operation. Next is shown the non-operating income, followed by the non-operating expense. The net result of this combined with the net result from operations gives the net result for the period, which is the figure shown on the balance sheet, the detail of which is explained by the profit and loss summary.

=Content of Profit and Loss Summary.=—The content of the profit and loss summary is determined by the need of information for purposes of management. A profit and loss summary which is sufficient for a small business, where the proprietor is in intimate contact with all phases of the business, would not give sufficient information for the proper control of a large business, where the managing executives are dependent for their information as to the various phases of business activity on reports made to them. There is, however, a fairly standard outline or skeleton in accordance with which this summary is usually drawn up. It is the purpose here to explain that outline.

The first section of the statement has for its purpose the separation of the sales item into its two elements, referred to above: (1) the Cost of Goods Sold, which indicates the amount by which the asset merchandise has been decreased through sale of goods; and (2) the Gross Profit or the excess of selling price ever cost, out of which must be met the costs of operating the business before the net change in proprietorship can be determined. This section is usually spoken of as the "trading" section of the statement. The set-up of this section shows, accordingly: (1) the Sales item, from which is shown deducted the amounts of sales returns and sales rebates and allowances in order to arrive at the figure of net sales; and (2) the Cost of Goods Sold, under which is listed the cost of goods sold as explained in Chapter V. This cost requires the showing of the initial inventory, the purchases for the period, the inward costs of laying down the merchandise at the place of business, such as insurance on goods in transit, freight and cartage costs, and so forth. From the sum of these items will be shown deducted the returned purchases and the amount of the final inventory, the difference indicating the cost price of goods disposed of by sale. With the "inward" cost of goods is sometimes included the sum total of all buying expenses. In other cases, particularly where a complete purchasing department is maintained, a separate buying expense section is set up to summarize these costs.

Following this trading section comes the formal statement of operating expenses which are usually classified for purposes of information into the groups: Selling Expenses, General Administrative Expenses, and Financial Management Expenses. Under each one of these groups should be listed the detailed items. Thus, under the selling expense group should be shown such items as salaries to salesmen; the traveling expenses incurred by them; the cost of publicity, advertising, and so forth; the sales management expense; and the delivery expenses, although these expenses are sometimes set up in a group by themselves.

The student will note that under the head of selling expenses are grouped all of the direct costs incurred in making sales.

Under the general administrative expenses should be shown such items as office salaries, stationery and supplies, postage, telephone and telegraph, light, heat, insurance, depreciation, and all other items which cannot be charged to definite departments of the business but must be borne by the business as a whole.

Under financial management expense should be listed the various items of expense which represent the financial activity of the business as related to its major purposes and which are operating financial expense items. Here will be shown such items as interest on money borrowed for operating the business; sales discounts granted customers in order to secure cash payments from them at an earlier date than the limit of the normal credit period allowed them; collection costs, and so forth.

A final section of the _operating_ portion of the profit and loss statement lists the items of income arising out of the management of the working capital finances of the business. Interest received on customers' notes and on cash balances in the bank, and purchase discounts, are usually the only items of income under this head.

The difference between gross profit on sales and the sum of these operating expenses minus the financial income, is the operating profit of the business, sometimes called Net Operating Profit.

The section following this is devoted to the marshaling of the items of Non-operating Income and Expense. Whichever of these two groups is the larger is set up first, and from its total is deducted the total of the other group. The net amount is then shown extended under the item of net operating profit, to which it is added if it is a net income item and from which it is subtracted if it is a net

expense item. The resulting figure is the Net Profit for the period.

Occasionally there are extraordinary items of profit or loss not to be classified under any of the above heads, which have to be shown in additional sections of the profit and loss statement. These are matters which will be taken up later.

It should be noted that the above paragraphs outline a simple statement of profit and loss for a commercial or trading business as distinguished from an industrial or manufacturing enterprise, the statement for which is somewhat more complex even in its general outlines.

=Algebraic Content of the Profit and Loss Statement.=—An algebraic presentation of the profit and loss statement is oftentimes valuable. The cost-of-goods-sold portion becomes:

(1) Initial Inventory + Purchases - Final Inventory = Cost of Goods Sold

(2) Sales - Cost of Goods Sold = Gross Trading Profit

The rest of the statement is covered by the following equation:

(3) Gross Trading Profit - (Selling Expenses + General Administrative Expenses + Financial Management Expense - Financial Management Income) ± (Non-operating Income - Non-operating Expense)

= Net Profit

=The Disposition of the Net Profit.=—The net profit for the period belongs to the proprietor and constitutes an increase in his proprietorship or investment, unless he has already drawn out some of these profits as they accrued. In this case, his drawings must be subtracted from the net profit indicated before showing the increment to his net worth. Accordingly, a final section of the profit and loss statement may give the disposition of the net profit and its appropriation or addition to the previous net worth or proprietorship item. This section, when used, is known as the appropriation section. If the business is a partnership, this section should show in detail the distribution of net profit among the several partners according to the agreement among them as to the proportions in which they are to share gains or losses. If a corporation, it should give the disposition made of the net profit in the way of dividends to the stockholders, and any other appropriation made of these profits, including transfer to surplus.

Two illustrations—one very simple, the other more complex—typical of profit and loss summaries are given for the guidance of the student.

Illustration 1

AARON CONNERS STATEMENT OF PROFIT AND LOSS For the year ending June 30, 1922

Sales for the year $28,465.20 Goods on Hand July 1, 1921 $ 8,500.00 Purchases during the year 22,362.50 $30,862.50 --------- Goods on Hand June 30, 1922 10,260.00 --------- Cost of Goods Sold 20,602.50 --------- Gross Trading Profit $ 7,862.70

Clerk Hire $3,050.50 General Expenses $2,405.45 Depreciation 52.50 2,457.95 5,508.45 --------- --------- --------- Net Profit for the year $2,354.25 =========

Illustration 2

KIMBALL AND MOREY STATEMENT OF PROFIT AND LOSS For the Year Ending June 30, 19—

Sales $525,600.00 _Less_: Sales Returns $ 5,000.00 Sales Rebates and Allowances 600.00 5,600.00 ---------- ---------- Net Sales $520,000.00

Cost of Goods Sold: Inventory, July 1, 19— $ 96,670.00 Purchases during the year 350,000.00 Freight-In 1,000.00 Insurance (Goods in Transit) 750.00 $448,420.00 ---------- _Less_: Purchase Returns $ 1,750.00 Final Inventory, June 30, 19— 105,000.00 106,750.00 ---------- ---------- Cost of Goods Sold 341,670.00 ---------- Gross Profit $178,330.00

Selling Expenses: Salesmen’s Salaries $ 20,000.00 Advertising 25,000.00 Delivery Expense 5,000.00 $ 50,000.00 ----------

General Administrative Expenses: Office Salaries $ 10,000.00 Stationery and Supplies 1,500.00 Postage 250.00 Telephone and Telegraph 750.00 Light and Heat 1,750.00 Insurance (Stock and Fixtures) 1,500.00 Depreciation: Furniture and Fixtures $2,000.00

Buildings 1,500.00 3,500.00 --------- Miscellaneous Expenses 750.00 20,000.00 ----------

Financial Management Expenses: Interest Paid $ 250.00 Sales Discounts 5,000.00 Bad Debts 1,000.00 Collection Costs 250.00 6,500.00 ---------- ---------- Total Operating Expenses $ 76,500.00

Financial Management Income: Interest Received $ 1,350.00 Purchase Discounts 3,500.00 4,850.00 ---------- ---------- Net Operating Expense 71,650.00 ---------- Net Operating Profit $106,680.00

Non-Operating Expense and Income: Income--Interest on Liberty Bonds $ 2,000.00 Expense--Loss on Stocks Sold 900.00 1,100.00 ---------- ---------- Net Profit for the year $107,780.00 ========== Appropriation of Net Profit: J. H. S. Kimball, ■ share $ 43,112.00 H. F. C. Morey, ■ share 64,668.00 $107,780.00 ---------- ==========

=The Two Methods of Determining Net Profit.=—It is particularly important to note that the profit shown by the profit and loss statement must be the same as that developed by the comparative balance sheet, since both cover the same period and constitute merely two ways of developing the same result. For this reason they are valuable in proving the correctness of results, acting as checks against each other. The student must bear in mind, however, that the increase or decrease in net worth as shown by the comparative balance sheet must always be adjusted by taking account of additional investments or withdrawals of capital before the net profit for the period can be determined, and therefore before this figure can be used as a check against the amount of net profit shown by the statement of profit and loss.

The accounting department keeps both classes of records, viz., the asset and liability records and the temporary proprietorship or income and expense records, not because both are needed to develop the amount of net profit—either class would do this—but because both are needed for the additional information which they give and which is valuable and necessary for the intelligent management of the business.

CHAPTER VII

INTERRELATION BETWEEN THE ECONOMIC AND THE FINANCIAL ELEMENTS OF A BUSINESS, AND SOME INTER-RATIOS

=Various Aspects of the Temporary Proprietorship Records.=—The profit and loss statement has been explained as a summary of the temporary proprietorship records kept for the purpose of registering the changes in net worth as they occur from day-to-day, and also for the purpose of noting the source or cause of many of the changes in assets and liabilities. The temporary proprietorship records may be regarded as the chronicle or history of the economic life of the business. The efforts of the business to produce income with the least possible outgo in the form of costs or expenses, may be viewed as the work of forces or agencies striving towards that end. Every effort is offset by the cost of that endeavor, and unless the result of the effort be more than its cost, its aim, viz., the increase of net worth, is not accomplished.

=Relation between Profit and Loss and Financial Elements.=—These income-producing efforts are the agencies that bring about the changes in the values of assets and liabilities. Expenses and costs are incurred for the purpose of securing income. Every expense or cost that is settled causes a diminution of business assets, usually of the asset cash. If not settled, it causes an increase in the liabilities, usually the accounts payable, for the business becomes bound by or liable for it. Both of these conditions result in a decrease in the net worth.

On the other hand, every item of income, as when a sale of goods is made, is reflected in an increase of assets or a decrease of liabilities. The result of every sale is usually an increase in the cash or in the claims against persons, the accounts receivable. The sale may sometimes result in a lessening of liabilities through a cancellation of the claims of creditors by means of the claims against customers arising out of the sale. This would be true when goods are bought from, and sold to, the same person. Thus there is constantly a direct interrelation between the financial and the profit and loss elements of every business.

=Exchanges within the Asset and Liability Groups.=—All changes in individual assets and liabilities, however, are not always the result of business or economic forces. There may be an even exchange of one asset for another asset, as when delivery equipment is purchased for cash. The asset Delivery Equipment is increased by the same amount as the asset Cash is diminished. Or if a bill of goods is purchased on credit, an increase of assets is exactly offset by an increase in liabilities. These changes are illustrated in the second example in Chapter I, showing Runyon’s proprietorship.

It is seen, therefore, that the changes in individual assets and liabilities are not so certain an index of changes in proprietorship as those registered by the temporary proprietorship records. The vital history of a business is its profit and loss record, the story of its economic life. As a means of control this is of first importance because it chronicles the causes of most changes in financial condition. The statement of financial condition may be looked upon as a picture of the framework, the skeleton of the business personality, upon which is superimposed its economic structure. When both the financial framework and the profit and loss summary are given, it is possible with reasonable accuracy to tell the whole history of the business activities for the period covered.

=Confusion between Profit and Loss and Balance Sheet Items.=—The beginner frequently has trouble in making a proper classification of income items and sometimes of expense items. Take Interest Income as an example. The asset Cash Received is confused with the title Interest Income, which denotes the source of the cash received. The accounting department maintains both types of records. The receipt of cash arising out of interest income would be classified and recorded under two heads: (1) the asset Cash, to indicate the increase in that asset; and (2) the temporary proprietorship record Interest Income, to give the profit and loss information necessary for purposes of management.

Similarly, the beginner oftentimes confuses the sales income record with the cash record of a cash sale transaction. Also, when cash is disbursed for expense purposes, the decrease in the asset is often confused with the expense record. When an expense is incurred it brings about either a decrease in assets, usually cash if the transaction is settled at once; or an increase in liabilities, usually an accrued expense item if the transaction is not immediately settled. Accordingly, in making the record the accounting department must show the decrease in the asset or the increase in the liability in the balance sheet group of records and the source of that decrease or increase under some expense title in the profit and loss group of records. Familiarity with the titles appearing in the profit and loss statement should prevent this confusion.

=Illustration.=—To show the interactions between the balance sheet and the profit and loss groups of records, the following illustration is given. There is shown first a comparative balance sheet, indicating the condition of a business at the beginning and the end of a period. This comparative balance sheet, it will be noted, shows a net profit of $33,250. There is also given a statement of profit and loss, showing the sources of the income and the expenses of the business. The statement indicates a net profit of $33,250 for the period. By starting with the financial condition as indicated by the balance sheet at the beginning of the period and working into it the operations for the year as shown by the statement of profit and loss, and by using the balance sheet at the end of the period as a goal, we can trace the probable interaction of the two types of records for the period.

JACKSON L. GORDON COMPARATIVE BALANCE SHEET December 31, 1922 and December 31, 1921

Increase and Assets 1922 1921 Decrease Cash $ 10,000.00 $ 15,000.00 - $ 5,000.00 Accounts Receivable 100,000.00 119,000.00 - 19,000.00 Merchandise 70,000.00 65,000.00 + 5,000.00 Unexpired Insurance 1,000.00 250.00 + 750.00 Plant and Equipment 350,000.00 325,000.00 + 25,000.00 ---------- ---------- ---------- Total Assets $531,000.00 $524,250.00 + $ 6,750.00 ---------- ---------- ---------- _Liabilities_ Notes Payable $ 30,000.00 $ 35,000.00 - $ 5,000.00 Accounts Payable 50,000.00 40,000.00 + 10,000.00 Accrued Sales Salaries 2,500.00 1,500.00 + 1,000.00 Mortgage Payable 150,000.00 200,000.00 - 50,000.00 Depreciation Reserve Plant and Equipment[1] 50,000.00 32,500.00 + 17,500.00 ---------- ---------- ---------- Total Liabilities $282,500.00 $309,000.00 - $26,500.00 ---------- ---------- ---------- _Net Worth_ Jackson L. Gordon, Capital $248,500.00 $215,250.00 + $33,250.00 ========== ========== ==========

[1] The student should note the manner of showing depreciation reserves in the comparative balance sheet. This is done solely for the purpose of eliminating the detail column in the assets needed to handle the subtraction item. This method of showing is countenanced only in comparative statements where saving of space is a chief consideration.

JACKSON L. GORDON STATEMENT OF PROFIT AND LOSS For the Year Ending December 31, 1922

Sales $470,000.00 Sales Returns 20,000.00 ---------- Net Sales $450,000.00

Cost of Goods Sold: Merchandise on Hand December 31, 1921 $ 65,000.00 Purchases 305,000.00 Inward Freight and Cartage 15,000.00 $385,000.00 ---------- _Deduct_—Merchandise on Hand December 31, 1922 70,000.00 ---------- Cost of Goods Sold 315,000.00 ---------- Gross Profit $135,000.00

Selling Expenses: Sales Salaries $ 20,000.00 Advertising 30,000.00 Sundry Sales Expense 10,000.00 $ 60,000.00 ---------- General Administrative Expenses: Office Salaries $ 10,500.00 Insurance 3,000.00 Sundry Office Expense 2,000.00 Depreciation 17,500.00 33,000.00 ---------- Financial Management Expenses: Interest Cost $ 10,000.00 Sales Discounts 7,000.00 17,000.00

---------- ---------- Total Operating Expenses $110,000.00

Financial Management Income: Interest Income $ 250.00 Purchase Discounts 8,000.00 8,250.00 ---------- ---------- Net Operating Expenses 101,750.00 ---------- Net Profit for the year $ 33,250.00 ==========

INTERRELATION BETWEEN SALES INCOME, ACCOUNTS RECEIVABLE, AND CASH. In these two statements, if to the outstanding accounts at the beginning of the period we add the net sales for the period as shown in the profit and loss summary, and if from their sum we deduct the sales discounts allowed customers and the accounts outstanding at the close of the period, as shown by the comparative balance sheet, we arrive at the amount of cash received from customers during the year. This is shown by the following statement:

Accounts Receivable, December 31, 1921 $119,000.00 Net Sales for the year 450,000.00 $569,000.00 ---------- _Deduct_: Sales Discounts $ 7,000.00 Accounts Receivable, December 31, 1922 100,000.00 107,000.00 ---------- ---------- Cash Received from Customers during year $462,000.00 ==========

INTERRELATION BETWEEN PURCHASES, ACCOUNTS PAYABLE, AND CASH. The amount of cash paid for merchandise during the year may be arrived at similarly, as indicated by the following statement:

Accounts Payable, December 31, 1921 $ 40,000.00 Purchases during the year 305,000.00 $345,000.00 ---------- _Deduct_: Purchase Discounts $ 8,000.00 Accounts Payable, December 31, 1922 50,000.00 58,000.00 ---------- ---------- Cash Paid for Merchandise during year $287,000.00 ==========

INTERRELATION BETWEEN CASH AND OTHER BALANCE SHEET AND PROFIT AND LOSS ITEMS. If to the amount of cash on hand at the beginning of the period we add the cash received from customers, as determined above, and that received from interest income, as indicated by the profit and loss statement, we arrive at the total cash available for use during the period.

Cash expenditures have been made for the following purposes:

1. Payments to creditors for merchandise of $287,000 as above. 2. Inward freight and cartage $15,000, as shown by the profit and loss statement. 3. Sales salaries $19,000. (This amount is determined by considering the expense of $20,000, as shown by the profit and loss statement, in conjunction with the unpaid sales salaries, as shown by the comparative balance sheet. Thus, if to the unpaid sales salaries amounting to $1,500 at the beginning of the period, we add the sales salary expense of $20,000 incurred during the period and from their sum we subtract the amount of unpaid salaries, $2,500, at the end of the period, we arrive at the amount of $19,000 spent for salaries during the period.) 4. Advertising $30,000. 5. Sundry selling expense $10,000. 6. Office salaries $10,500. 7. Insurance $3,750. (This amount is also determined by considering the amount of unexpired insurance as shown by the comparative balance sheet in conjunction with the cost of insurance used during the current period, as shown by the profit and loss statement. It will be noted that $250 worth of insurance was in force at the beginning of the period, that $3,000 worth of insurance was used during the period—hence it must have been necessary to buy additional insurance amounting to $2,750 during the period. When we find, however, that there is unexpired insurance at the end of the period amounting to $1,000, it will be seen that there must have been purchased during the period $3,750 worth of insurance.) 8. Sundry office expense $2,000. 9. Interest cost $10,000. 10. Plant and equipment $25,000. (It will be noted from the comparative balance sheet that there has been a net increase of only $7,500 in plant and equipment. While $25,000 was added to the plant and equipment asset during the year, there was a decrease in value due to depreciation, amounting to $17,500, as shown by the profit and loss statement. This depreciation expense is reflected as a decrease in the value of the asset Plant and Equipment and does not therefore decrease the asset Cash.) 11. Notes payable $5,000—the decrease being shown by the comparative balance sheet. 12. Mortgage payable $50,000—also shown on the comparative balance sheet.

If from the total cash available for use there is deducted the cash expended, as indicated above, the difference should indicate the amount of cash on hand at the close of the period. This balance of $10,000, as indicated by the tabulated statement below, is the amount shown by the comparative balance sheet as being on hand.

Cash Receipts: Balance on Hand December 31, 1921 $ 15,000.00 From Customers, as above 462,000.00 Interest Income 250.00 ---------- Total Cash available for use $477,250.00

Cash Expenditures: For Purchases as above $287,000.00 Inward Freight and Cartage 15,000.00 Sales Salaries 19,000.00 Advertising 30,000.00 Sundry Selling Expense 10,000.00 Office Salaries 10,500.00 Insurance 3,750.00 Sundry Office Expense

2,000.00 Interest Cost 10,000.00 Plant and Equipment 25,000.00 Notes Payable 5,000.00 Mortgage Payable 50,000.00 467,250.00 ---------- ---------- Balance of Cash on Hand December 31, 1922, per Balance Sheet. $ 10,000.00 ==========

By a careful study of the interrelations between various items as explained above, the student will see that the interactions between all of the transactions for the year as set forth in the comparative balance sheet and the profit and loss statement, have been indicated and proved. The proof is secured in the tie-up between the figure of cash as shown by the cash statement, and that shown in the comparative balance sheet statement as cash on hand at the end of the period.

=Inter-Ratios and Their Uses.=—Before leaving the study of the balance sheet and profit and loss statement and their interrelations, it is desirable to explain certain ratios between items found on both statements. These are ratios which are watched very carefully in judging the financial condition of a business. Their significance is apparent.

1. MERCHANDISE TURNOVER. By merchandise turnover is meant the rate at which the merchandise stock is moved or turned over by sale during the fiscal period. The ratio expressing the rate of turnover is found by dividing the cost of goods sold, as shown in the profit and loss statement, by the average inventory carried for the year. Where there are available only the figures of opening and closing inventory, the amount of the average inventory is taken as one-half of the sum of these two inventories. The rate of turnover varies in different businesses, ranging as high as 15 or 20 in some and as low as 1 or 2 in others. The value of a rapid turnover is apparent. One dollar invested in merchandise where the rate of turnover is 10 is equivalent to $10 invested where the rate is only 1. The more work a dollar does, the greater the profit possibilities.

2. WORKING CAPITAL TURNOVER. The amount of sales as indicated by the profit and loss statement, divided by the working capital—the excess of current assets over current liabilities—as determined from the balance sheet, is called the “working capital turnover.” This indicates the rate at which the working capital is used in securing sales. Where the amount of working capital on hand varies markedly at different periods of the year, the average should be used as the basis for estimating the rate of turnover.

3. ACCOUNTS RECEIVABLE TO SALES. The fraction represented by dividing the amount of outstanding accounts at the end of the year by the volume of sales during the year, indicates the portion of sales which has not yet been collected in cash. If this fraction is multiplied by the length of the fiscal period, expressed in months, and the result compared with the normal credit term allowed customers, it will indicate the trend of collections. For example, if the outstanding accounts at the close of the period are $150,000, the sales for the year are $1,200,000, and the normal credit period is 30 days, it will be seen that by the above ratios the $150,000 of outstanding accounts represents on the average the sales for approximately 1½ months

(150,000) (--------- × 12 months = 1½ months). (1,200,000)

Since the credit term is only 30 days, the indication is that collections are slow and should be pushed more vigorously. It must be understood that this ratio indicates merely a trend and must be judged in the light of other significant facts in the business.

4. PROFITS TO NET WORTH. The net profit for the period divided by the net worth at the beginning of the period is used to indicate the per cent of earnings on the capital invested.

=Other Ratios.=—For the purpose of watching the progress of business operations, it is customary to develop the following ratios:

1. Cost of goods sold to net sales. 2. Gross profit to net sales. 3. Selling expenses to net sales. 4. General administrative expenses to net sales. 5. Net financial management expenses to net sales. 6. Net profit to net sales.

These ratios, set up each fiscal period and compared with similar ratios for previous periods, indicate very definitely the trend of income and expenses and are useful in the determination of business policies.

CHAPTER VIII

THE ACCOUNT

=The Goal of Account-Keeping.=—Throughout the preceding chapters constant reference has been made to records or data of the business furnished by the accounting department. Knowing the use made of these data in the compilation of financial and profit and loss summaries, we shall trace the process of gathering that information in exactly reverse order; first, through the ledger, where it is grouped and summarized in accounts and made ready for the preparation of statements; then into the books of original entry, where the information is first sorted and classified for posting to the proper ledger accounts, with a view always to fit it ultimately

into the final statements of financial and business condition; and finally, to the business papers arising out of the transactions, which are the basis or first source of all accounting records.

=The Ledger and Its Content.=—The ledger may be defined as the book of accounts. In it are collected most of the data needed for the final statements showing the financial condition of the business. By means of its account titles, it makes an analytical record of all transactions, according to the information desired, and through the mechanism of the account it groups and summarizes all data affecting each particular account, thus furnishing the proprietor with totals instead of items. In the ledger, therefore, must be kept two main classes of accounts, viz., those used for making up the balance sheet and those used for making up the profit and loss statement. The one group shows assets and liabilities, and the other temporary proprietorship increases and decreases brought about by the receipt of income and the payment of expenses. The ultimate or net proprietorship is determined by the summarization of all temporary accounts in the way shown in preceding chapters.

THE LEDGER ACCOUNT DEFINED.—An account may be defined as a record of one or more items, either similar or dissimilar, relating to the same person or thing, kept under an appropriate heading or title. The record is kept in such a way as to make easy the addition of similar items and the subtraction of dissimilar items. Accounts are kept both with persons, as the accounts receivable and payable already mentioned, and with things, such as land, buildings, machinery, merchandise, cash, and the like. Some asset accounts and some accounts kept with persons are usually composed of both similar and dissimilar items. For example, the cash account is composed of both cash received and cash paid out items; the accounts receivable record both the items for which the person is in debt to the business and those which show the cancellation or settlement of the debt, in part or in full; and the accounts payable record the items for which the business is in debt to the person and those which show cancellation of the debt or settlement by the business. Accounts which record income and expenses usually comprise only similar items, as where all sales of merchandise are recorded under one head or account and all purchases under another.

THE ACCOUNT TITLE.—The title given to an account is important. It should indicate clearly the content of the account. Accuracy is a basic necessity in accounting. Correct titles are therefore essential. A title which does not clearly and truthfully indicate the nature of the account, or one which is so chosen that under it may be recorded items of various and doubtful kinds, gives prima facie evidence of an imperfect knowledge of accounting principles or of a desire to hide data which will not bear close scrutiny. Therefore, care should be exercised in the selection of titles.

=The Two Sections of the Account.=—To separate similar from dissimilar items, the account is divided into two sections, a left and a right section, as we shall call them for the present, which are shown in the standard form given in Form 1.

The account head or title is placed in the center over the division line. At the extreme left of each section are the date columns—year, month, and day. Note particularly where the “year” is shown. The space following is for explanatory matter; the next column, left blank in the illustration, is a reference column whose use will be explained later; and the last column in each section is the money column, where the dollar subsection column is further divided into columns for each digit of the amount. Care must be exercised to observe such rulings when writing in the amounts. The account with Cash in the illustration shows on the left a receipt of $150.25 from J. B. Givens, and on the right, the payment of $5.50 for stationery. These two items are entirely dissimilar. Another receipt of $72.69 on January 3 from cash sales is shown on the same side of the account as the record of the previous receipt and directly under it. Note that the name of the month is not repeated.

=The Mechanism of the Account.=—Thus the mechanism of the account is designed not only to give a brief history of each item entered therein, but primarily to bring together all items of the same kind relating to that account, so that they may be summarized. It should be thoroughly understood that all items on each side of the account are similar items, though the two sides themselves are of exactly opposite kinds. Where the account has entries on both sides, i.e., is composed of dissimilar items, a comparison of the totals of each group shows the condition of the account. In the Cash account given, the total of the left side, $222.94, showing receipts, compared with the total of the right, $5.50, showing disbursements, indicates that there is $217.44 cash now on hand. It is evident, therefore, that the account is a mathematical device for holding on one side all items to be added and on the other all items to be subtracted. Only in this way can addition and subtraction be performed within the account.

[Illustration: Form 1. Form of Ledger Accounts]

=The Number of Accounts.=—The number of accounts to be kept in the ledger is determined by the minuteness of detail desired for the guidance of the management of a business. The financial and profit and loss statements usually lack detail and for this reason the items appearing thereon are frequently subdivided in the ledger into numerous accounts.

CHAPTER IX

THE ACCOUNT (Continued)

=The Balance of the Account.=—As stated in Chapter VIII, the account is divided into two sections, a left and a right, for the purpose of separating items relating to the same account which are dissimilar, and thus affording a comparison between the totals of these dissimilar groups. An account containing dissimilar items may have the same total on both sides, in which case it is said to balance, i.e., the class of items on one side exactly balances or cancels those on the opposite side; or one side of the account may be larger than the other, in which case the amount of the excess is called the “balance” in the account, or of the account. An account takes its nature or classification from the larger side, on which the balance appears. The account balances are shown in summarized form on the balance sheet or the profit and loss statement.

=The Account Title Indicative of Its Classification.=—The account title or name should be so plain as easily to indicate its main classification. The two main classes of accounts are, as stated above, those relating to assets and liabilities, or property—things owned and things owed; and those relating to proprietorship—those showing the increases or decreases in net worth. The title of an account should clearly indicate whether the account belongs to the asset or liability class, or to the proprietorship class.

The accounts called Cash, Accounts Receivable, Mortgages Payable, Accrued Wages, clearly show assets and liabilities; while those entitled Sales, Rent Income, Wages, Expenses, indicate factors affecting proprietorship.

=The Meaning of Account Balances.=—In the asset accounts the larger side, and therefore the balance of the account, is normally on the left, i.e., the balance of Cash, Land, Buildings, Furniture and Fixtures, Notes Receivable, and the like are normally left-side balances. It follows, therefore, that all entries showing the acquisition or increase of assets are made on the left side of their accounts, and all entries showing the disposal or decrease of assets are made on the right side of the accounts. Very seldom are the cancellations listed on the right side in excess of the assets listed on the left.

In the liability accounts the balance is normally on the right side because liabilities are subtraction items from the assets and should, therefore, normally be on the opposite side of the account. Notes Payable, Accounts Payable, Mortgages Payable, Interest Payable, Rent Payable, and the like, have normally right-side balances. It follows, therefore, that all entries showing the assumption of liabilities are made to the right side of the account, and all entries showing the cancellation of these liabilities are made on the left side. Rarely are liability cancellations in excess of the liabilities owed.

As will be explained in Chapter XII, in the group of accounts indicating decreases in proprietorship, the balance, or larger side, is normally on the left; in the group showing increases in proprietorship the balance is normally on the right. The balances of the accounts, Wages, Salaries, Rent Expense, and all other expenses, are normally left-side balances. It follows, therefore, that entries showing the cost of such expenses to the business are made on the left side of suitably named expense accounts, and entries showing a reduction in the expenses are made on the right side. Items for wages, for example, are shown on the left side of the Wages account, and any subtractions because of overpayment or for other reasons, are shown on the right side of the account.

The balances of the accounts Sales, Rent Income, Interest Income, and other kinds of income, are normally right-side balances. From this it follows that entries showing income are made on the right side of a suitable account, and entries indicating a reduction or subtraction from the income shown are made on the left side of the account. For example, income from sales is shown on the right side of the Sales account, while any reduction of that income, as when goods are returned by customers, is shown on the left side.

Knowing, therefore, to what main class each account belongs—asset, liability, expense, or income—one always knows on which side the balance is normally, and also that the items on the opposite side are subtraction items. Subtraction can be shown in the account only by thus separating dissimilar items.

=Relation of the Account to the Financial Statements.=—The equation of the balance sheet is the equation of the ledger. The fundamental proprietorship equation is written in two ways:

(1) Assets - Liabilities = Proprietorship (2) Assets = Liabilities + Proprietorship

The ledger (that is, the accounts in the ledger) is constructed in accordance with the second form of the proprietorship equation. In it are found all the accounts of the business, which are included under the classes Assets, Liabilities, and Proprietorship. Under

Proprietorship are the subgroups: (a) Net Worth, or capital at the beginning of the period, and (b) Current Profit or Loss. The Current Profit or Loss is in turn shown by the two groups of accounts: (1) Income, and (2) Expense. This classification of the accounts and their relation to the balance sheet are illustrated graphically in the chart shown in Form 2.

The asset accounts have net left-side balances, as previously explained. Hence, if all the detailed accounts which record assets are brought together, the sum total of the left-side balances of these accounts will represent the total assets of the business. Liability accounts have right-side balances, as also explained. Therefore, if all the accounts that record the liabilities of the business are brought together, the sum total of their right-side balances will represent the total liabilities of the business. The proprietorship accounts have right-side and left-side balances. The _net total_ of all the proprietorship accounts will be a right-side balance, however, and will show the present net worth of the business.

[Illustration: Form 2. Chart of Accounts]

Accordingly, when one views the accounts in the ledger in their fundamental groupings—namely, assets, liabilities, and proprietorship—it is seen that the equation of the balance sheet is also the equation of the ledger. The account is thus seen to be an integral part of the balance sheet. It is so arranged, however, as to sort and handle additions and subtractions and to furnish a net result for use in the balance sheet.

The asset portion of the proprietorship equation is in the ledger broken up into the various kinds of assets, record of which is desirable and necessary for purposes of adequate control of the business. In keeping the record, all the transactions affecting—that is, either adding to or subtracting from—a given asset are recorded in the account kept with that asset. In this way each account brings about a sorting of the transactions affecting it. It separates these transactions into two kinds, those which add to and those which subtract from its value, and by means of its net balance at any given time it summarizes the numberless transactions which have affected it during a period and gives a net result showing its present status.

In much the same way the liability item of the proprietorship equation is broken up in the ledger for purposes of detailed information, into a large number of individual liability accounts. The sum total of the balance of these accounts is the liability item of the proprietorship equation.

The proprietorship section of the equation is a little more complex when split up, as it is in the ledger. In accordance with the chart given in Form 2, it will be seen that proprietorship is classified in the two main groups: (1) capital at the beginning of the period, and (2) changes of capital during the period. It is this latter group of accounts which, as they are carried in the ledger, have both right-side and left-side balances. The income accounts, which tend to increase capital and which, when merged with the capital accounts at the beginning of the period, add to that capital, have right-side balances. The accounts which tend to decrease capital, that is, the expense accounts, because they are subtraction items, have left-side balances. The net increase (or decrease) in capital for the period is the excess (or deficit) of the total income accounts over the total expense accounts. The summarized result therefore of current changes in capital added to the capital at the beginning of the period, gives the proprietorship of the business at any given time.

At the beginning of a business enterprise the accounts in the ledger will be an opening balance sheet of the business. Day by day by day as transactions take place, there will be a constant change in the values of the assets, liabilities, and the proprietorship account which will thus express the changing financial condition of the business. Some assets will be increased while others will be decreased; liabilities will also change; and with these changes there will be brought about a change in proprietorship—an increase or a decrease. The ledger must record these changing values as they take place, so that the condition of the business can be determined practically at any time.

The ledger is thus seen to contain and comprise the balance sheet of the business at all times. Certain groupings, summarizations, and adjustments may be necessary before a balance sheet technically correct as to form and content can be taken from the ledger, but the fundamental balance sheet equation is always contained in the ledger. This is pictured graphically in the chart shown in Form 2. A further consideration of the relationships between assets, liabilities, and proprietorship leads us to an explanation of the principles or philosophy of debit and credit, a matter which will be taken up in the next chapter.

CHAPTER X

THE PHILOSOPHY OF DEBIT AND CREDIT

=Double-Entry Bookkeeping.=—Several systems or methods of keeping business records have at various times been in use. The method which at the present time is used by all businesses, excepting those of the simplest sort, is called “double-entry bookkeeping” and is the method which is being set forth here. It is based on the proprietorship equation expressed in the form: Assets = Liabilities + Proprietorship. It is possible to make a balance sheet if only asset and liability records are kept, because proprietorship is always the difference between them. Such a system of record-keeping would fail completely in giving the information as to the current increases and decreases in proprietorship and the causes of such changes. As was indicated in an earlier chapter, such a system would have the disadvantages which the comparative balance sheet has as a means of managing and controlling a business enterprise. The information which is given by the profit and loss records of the business would be entirely lacking.

Double-entry bookkeeping, accordingly, keeps a record not only of assets and liabilities, but also of proprietorship and its constantly changing value. The advantages of such a system were discussed when the need for the information furnished by the profit and loss statement was pointed out (see page 39). Not only does double-entry bookkeeping give this full and complete information, but it ties this information into a system whose mathematical accuracy and correctness can be proved. It is an invention or device whose purpose is definitely to give the desired information and to demonstrate the mathematical correctness of that information.

As already stated, the system of double-entry bookkeeping is based on the proprietorship equation. An equation is an expressed equality. The ledger kept by double-entry bookkeeping always maintains this equality. The sum total of the entries on the left side of all the accounts must equal the sum total of the entries on the right side of the accounts. The way in which the ledger becomes an expanded or detailed balance sheet was explained fully in the previous chapter. There it was shown that the sum of the net balances of all asset accounts, as carried in the ledger as left-side balances, at all times equals the sum of the net balances of the liability and the proprietorship accounts carried in the ledger as right-side balances.

It is evident that, if in place of the net balances of each group of accounts, the gross left- and right-side totals are substituted, the equation would still be maintained, inasmuch as the net balance in each instance is secured by subtracting the same amount, namely, the lesser total, from both sides of the account.

Under double entry, therefore, the equality of the left side of the ledger, that is, the total of the left-side amounts of all of the accounts, is constantly maintained with the right side of the ledger, that is, the total of the right-side amounts of all the accounts. The vertical division of the ledger separating an account into its left and right sides, may with little stretch of the imagination be considered an equality sign, which thus makes one big equation out of all the accounts in the ledger. Under double-entry bookkeeping, therefore, the principles of entry in the ledger are based on no logic or philosophy other than that which attaches to the fundamental proprietorship equation of the balance sheet. Double entry is an invention, a device, and its use requires adherence to the principles of entry necessary to maintain its equation. What these principles are will now be explained.

=The Business Transaction Defined.=—Reference has constantly been made to business transactions. It may be well to show the idea at the bottom of such transactions. We may define a business transaction as an exchange of values. It may be between persons, as when a sale is made, or it may be between accounts within the business itself, as when a transfer is made between accounts, i.e., when an item is taken from one account and transferred to another for the sake of more clearly showing its nature. Some authors further analyze transactions as _complete_ when the bargain is fully consummated between the parties, as when delivery is made and the money is paid in cash; or _incomplete_ as where something still remains to be done by either or both parties to the transaction. In this latter case, claims or rights of action at law arise to protect the parties until the transaction is consummated. But, since from the accounting standpoint a claim or right is one kind of property or asset, there is little need of this finer analysis.

=Analyzing the Transaction as to Its Accounting Record.=—When a transaction occurs in a business, it must first be classified before proper record can be made of it under the account title which groups transactions of a like nature. Its elements must be analyzed, its effect on assets and liabilities, or on expenses and income, must be determined. Has the transaction increased or decreased assets or liabilities, or has it increased or decreased proprietorship, or has it resulted in simply a transfer between accounts—these are the first questions to be determined. The basis of all fundamental classifications is the effect of the transaction upon the balance sheet and profit and loss statements. They are the goal towards which all records look, but the principle which determines the subdivisions in the main classes of accounts and the titles to be given to the accounts which are to be carried in the records, is the amount and kind of information desired by the management throughout the fiscal period. After the transaction has been properly classified, it is merely a matter of recording it according to the standards or forms of good accounting, which is

merely a device for abbreviating the work of recording, i.e., the transaction is translated into correct accounting language.

=The Use of Debit and Credit.=—To show the side of the account affected by a transaction, the words “debit” and “credit” are used, indicating left and right respectively. The use of these words had its origin with transactions between persons and the accounts kept with them. The person owing was charged or debited, while the person to whom the business owed a debt was credited. Through use the terms have come to have the meaning stated first above, though still retaining their original connotation when applied to persons.

=Fundamental Principle of Debit and Credit.=—As stated in Chapter V, every transaction is recorded from two viewpoints, viz., its effect on the assets and liabilities and its effect on the proprietorship or net worth. Sometimes, however, the transaction may require merely a transfer entry, i.e., a transfer of an amount from one account to another without affecting the fundamental classes, as was shown above when defining the transaction as an exchange of values. If it is remembered that from long-continued custom asset accounts are debit accounts, i.e., normally have debit or left-side balances, and liability accounts are credit accounts; that expense accounts are debit and income accounts are credit, the fundamental principles for determining the debit and credit involved in every transaction become pretty well established in one’s mind.

Starting, therefore, with the original investment, whatever form it may have, the transaction is reducible to the fundamental equation:

Assets = Liabilities + Proprietorship

in which “liabilities” may or may not be a “zero” quantity, depending on the nature of the investment. All transactions thereafter must be viewed according to their effects on the three terms of the equation above. We may summarize the effects produced by the various transactions of the business as:

Increase or decrease of assets ” ” ” ” liabilities ” ” ” ” proprietorship

with this qualification: that some transactions result in transfers only without affecting the totals of any of the three groups above, as when an asset is transferred from one account to another for purposes of more accurate classification.

=The Debit and Credit Schedule.=—Bearing in mind the customary distinction between debit and credit, and the fact that entry of a transaction is always made from a double viewpoint—that of cause and effect—every transaction may have its debit and credit determined by the following schedule:

========== _Debit_: | _Credit_: (1) Increase of Assets | (a) Decrease of Assets (2) Decrease of Liabilities | (b) Increase of Liabilities (3) Decrease of Proprietorship | (c) Increase of Proprietorship

=Debit and Credit Determination Illustrated.=—Examples illustrating the various classes of transactions and the manner of determining their debit and credit will now be given. The student should strive to understand the double point of view necessary in determining debit and credit. It is perhaps well to call attention to the fact that the illustrations are entirely unrelated, i.e., do not constitute a sequence of events in any business. It should also be kept in mind that transactions are recorded always from the standpoint of the business whose records are being kept.

1. The purchase of merchandise for cash. The result is an increase of the asset Merchandise caused by the decrease of the asset Cash. Accordingly, the debit and credit of the entry for the transaction are shown by the above schedule under (1) and (a), i.e., debit Merchandise and credit Cash. The transaction is also an illustration of the transfer entry, in which there is no increase or decrease of total assets, liabilities, or proprietorship.

2. The purchase of merchandise on account. This results in an increase of assets caused by the increase of liabilities. The schedule above shows under (1) and (b) a debit to Merchandise and a credit to the personal account payable, indicated by the name of the creditor.

3. The receipt of cash for services performed, as when a broker receives the amount of his commission in cash. The result here is an increase of the asset Cash, caused by the increase of proprietorship, as the performance of services is the chief source of the broker’s income. The schedule shows under (1) and (c) a debit to Cash and a credit to some temporary proprietorship account by name, as Commissions Earned.

4. The payment of a note payable in cash. This results in a decrease of the liability, Notes Payable, caused by the decrease of the asset Cash. Accordingly, debit Notes Payable and credit Cash, (2) and (a).

5. The settlement of a personal account payable by giving a note payable. The effect here is simply a cancellation of one kind of liability with another kind; it is a transfer entry. Debit the personal account payable; credit Notes Payable, (2) and (b).

6. The rendering of a business service to a creditor, thereby canceling an indebtedness to him; as when a physician renders medical aid to his creditor from whom he has purchased supplies. The effect is a decrease in liabilities and an increase in proprietorship. Debit the personal account payable, by name, and credit some temporary proprietorship account, by name, as Fees or Services, (2) and (c).

7. A workman is paid his wages in cash. The result is a decrease in proprietorship and a decrease in the asset Cash. Wages are a cost of doing business and therefore decrease Proprietorship. They are a service rendered to the business instead of by it—an expense as distinguished from an income. Debit the temporary proprietorship account, Wages, and credit Cash, (3) and (a).

8. The account of a lawyer is credited for the amount of his fee. A decrease of proprietorship, for the service rendered the business, and an increase in liabilities. Debit Legal Expense and credit the personal account payable, (3) and (b).

9. Transfer the net gain shown by the Profit and Loss account to the Surplus account. The result is a simple transfer, causing a decrease in proprietorship as shown in the Profit and Loss account and an increase in proprietorship as shown in the Surplus account. Debit Profit and Loss and credit Surplus, (3) and (c).

In a similar manner, all transactions may be analyzed and their entry in the accounts determined.

=Necessary Equilibrium of Debits and Credits.=—Before passing to more detailed rules for debit and credit, the necessary equality of debits and credits should again be pointed out. Starting with the proprietorship equation expressed in this form:

Assets = Liabilities + Proprietorship,

of which the left side is represented in the accounts by debits and the right side by credits, the equality of the debit balances and the credit balances of the accounts in the ledger is readily seen. If, now, for all succeeding transactions an entry is made having an equal debit and credit, evidently the equilibrium of the total debits and credits in the accounts is maintained and the two sides of the ledger are in agreement. The making of an equal debit and credit for every entry is fundamental and must be strictly observed.

CHAPTER XI

DEBIT AND CREDIT AS APPLIED TO ASSET AND LIABILITY ACCOUNTS

=Student's Use of Working Rules.=—In order to indicate the more usual types of transactions which affect the asset, liability, and proprietorship accounts, a set-up of the various groups of accounts will be given, under which will be shown transactions recorded as debits and those recorded as credits. Accounts will be shown in the order in which they appear in the balance sheet. The accounts under each group will, of course, bear their own individual titles and not the title of the group. Only such entries as are more frequently met with will be given. Since in the group accounts given as guides only those entries appear which affect these group accounts, it is deemed impracticable to attempt to show the contra, or other side of each entry arising out of the transactions. However, the student should always supply mentally the contra of each entry shown in the group reference account. For the sake of clarity, the personal pronouns "we" and "us" will be used instead of the impersonal name.

=Accounts with Cash and Notes Receivable.=—Entries to the Cash and Notes Receivable accounts are comparatively simple and are shown in the following schedule:

(NAME OF ACCOUNT) ========== _Debit_: | _Credit_: (1) For all receipts | (a) For all disbursements or incoming items. | or outgoing items.

Transactions with cash are self-explanatory.

The accounts representing transactions with notes require some explanation. When, in the course of business, we receive a note, Notes Receivable is debited and the person who gives it is credited, because our asset Notes Receivable is increased and the claim against the open account of the person giving the note is decreased. Similarly, when that note is disbursed by us, i.e., goes

out of our possession, the asset is diminished and therefore Notes Receivable is credited.

A note receivable can be disposed of in several ways:

1. Through its release on payment by the maker, 2. Through its transfer by us to another person in settlement of a claim against us, or 3. Through its sale to the bank.

In all of these cases the credit goes to Notes Receivable. In cases 1 and 3, the asset increased, viz., Cash, is debited; and in case 2 the liability canceled or decreased is debited. It may be stated, however, that in cases 2 and 3, instead of making the credit direct to the asset account Notes Receivable, it is better carried to a supplementary account, Notes Receivable Discounted, in order to show the liability arising from the fact that, through our indorsement, we guarantee to pay the note at its maturity in case the maker fails to do so. This is later explained in detail.

Accounts with Customers

(NAME OF CUSTOMER) ========== _Debit_: | _Credit_: (1) For amount he owes us | (a) For money he pays us on account. at beginning. | (b) For notes he gives us on account. (2) For goods we sell him | (c) For goods he returns to us. on account. | (d) For discounts we give him. | (e) For claims we allow him.

The balance owing us by a customer is an asset, and therefore a debit item.

Goods sold on account are charged to the customer because our claim against him constitutes an asset; at the same time the income account, Sales, is credited.

When a customer pays us on account, his account is credited and Cash is debited, showing an increase of the asset Cash and a decrease of the asset Accounts Receivable. Such an entry is simply a transfer from one account to another, an increase of one asset offset by a decrease of another asset.

When a customer gives us his note, his account is credited and Notes Receivable is debited, usually, with the face of the note.

When a customer returns goods to us, he is credited to decrease the original charge to his account and Sales or Returned Sales is debited to reduce the income originally credited to Sales. It is not necessary to make any other record of the returned goods, because, as was explained in Chapter VI, no day-to-day record is kept to show the decrease of the asset Merchandise through Sales. So, when goods are returned by a customer, the increase of the asset Merchandise will be shown at the end of the fiscal period when the merchandise inventory is taken, and no other record than that indicated is necessary.

When a customer is allowed a discount for the early payment of his bill, he is credited to reduce the original charge by the amount of the discount, and some temporary proprietorship account, as Discount on Sales, is debited to show the decrease in proprietorship resulting from the allowance of the discount.

When a customer is allowed a claim for reduction in his bill on account of damaged goods or the like, the entry is similar to the one next above—debit Claims and Allowances and credit the customer.

The Merchandise Account

MERCHANDISE ========== _Debit_: | _Credit_: (1) For merchandise on hand at the | (a) For sales of merchandise. beginning. | (b) For returns of merchandise (2) For purchases of merchandise. | purchased. (3) For all costs necessary to | bring the merchandise from | its place of purchase to its | place of sale. | (4) For goods returned by customers.|

Entries in the Merchandise account require no explanation excepting the debit entry (3). The value of the asset Merchandise is not the price paid for it at the point where purchased, for it is of no value to the business until it is placed on the shelves ready for sale. Accordingly, the value of the asset Merchandise is not determined merely by the price paid the vendor, but by this price plus all of the costs necessary to bring the merchandise to the store. Inasmuch as the merchandise is sold normally for more than it cost, the credit entry in the Merchandise account includes two items: (1) the decrease of the asset, as indicated by the cost price of the goods sold; and (2) the amount of profit on the sale, that is, the amount of the increase in proprietorship.

The record of merchandise transactions is thus seen to be rather complex and will be explained fully in Chapter XIII. The above schedule is simply an indication of the types of transactions recorded in the Merchandise account and will be sufficient for the present. It will be seen that the sale of goods results in a debit to the customer's account and a credit to Merchandise.

=Accounts with Fixed Assets.=—Accounts with fixed assets are those with land, buildings, and equipment of all sorts.

(NAME OF ACCOUNT) ========== _Debit_: | _Credit_: (1) For full cost to the business | (a) For sale or loss, in position ready for use. | at cost price.

The debit to this account is not for invoice or first cost only, but should include all expenditures necessary to secure full title or to place the equipment in position for use by the business, such as abstract of title costs, freight, drayage, and, in the case of machinery, setting-up and placement costs. The corresponding credit is usually to Cash, or to Notes or Accounts Payable.

The account is credited for the sale of all or a portion of the asset at the same price at which it was originally charged, so that the balance in the account shows the pro rata cost of the part left. A loss from fire or otherwise is treated similarly. If the asset is sold at a profit (an unlikely occurrence), the account is credited with its cost price, while the excess of the sale price over the cost price is credited to a proprietorship account, such as Profit on Sale of Machinery. The debit corresponding to these two credits is usually to Cash or some other asset received in payment. Where the asset is sold at a loss, the account is credited with: (1) the sum received, and (2) the difference between this sum and the cost of the asset, which difference represents a loss. The loss or deficiency is debited to a proprietorship account, such as Loss on Sale of Machinery, and the additional debit is to Cash or some other asset received. This latter debit amount plus the debit to Loss on Sale of Machinery must, of course, equal the two amounts credited to the fixed asset account and representing the cost of the asset sold.

Fixed asset accounts are further considered in Chapter XIII, where the manner of recording loss through depreciation is shown.

=Accounts with Notes Payable.=—When we issue our own note, the credit is to Notes Payable and the debit is either to the liability account reduced or to the asset account increased. When we call the note in, either by paying it or by canceling our claim against the person returning the note, Notes Payable is debited and Cash or the person returning the note is credited.

Accounts Payable

(NAME OF CREDITOR) ========== _Debit_: | _Credit_: (1) For money we pay him on account. | (a) For amount we owe him (2) For notes we give him on account. | at beginning. (3) For goods we return to him. | (b) For goods he sells us (4) For discounts he gives us. | on account. (5) For claims he allows us. |

As will be noted by reference to the customer's account, the entries to the creditor's account, being viewed from the opposite standpoint, are exactly the reverse of the entries to the customer's account.

=Other Liability Accounts.=—Accounts with other liabilities, such as Mortgages, Bonds, Expenses Payable, and the like, follow in the main the general principles laid down (pages 81 to 83). Specific treatment will be given them as they are met in the discussion. In the case of long-time notes payable supported by mortgages, record should be made under the title "Mortgages Payable" rather than "Notes Payable."

CHAPTER XII

DEBIT AND CREDIT AS APPLIED TO PROPRIETORSHIP ACCOUNTS

=Proprietorship Accounts Defined.=—Proprietorship accounts are the accounts which record the effects, both temporary and ultimate, of business transactions upon proprietorship. The study of the two preceding chapters has made clear the fact that transactions which involve the receipt of income or the payment of expenses result respectively in an increase or decrease of proprietorship, and that these increases or decreases are temporarily recorded in suitable income and expense accounts until the close of the fiscal period, at which time the accounts are summarized to determine the net effect of all transactions upon proprietorship or the capital invested in the business. Therefore, the proprietorship accounts are of two general kinds: temporary and vested. Temporary proprietorship accounts make temporary and immediate record of the results of the agencies or forces at work within the business to produce a profit. They set forth the efforts to increase the net worth of the business. They record the costs of the effort and its yield in earnings, the record being made under appropriate titles to show the kind of cost and the source of the yield. Vested proprietorship accounts record the ultimate or summarized results of business transactions. They therefore record

the original investment and its subsequent net increases and decreases.

=Fundamental Consideration of Proprietorship Debits and Credits.=—Income and expenses comprise the temporary proprietorship items which, after being summarized, show their ultimate effect upon vested proprietorship. In other words, they are proprietorship items set up temporarily to furnish detailed information for aiding in efficient management and control and are later transferred to the ultimate or vested proprietorship records. Since, from the mathematical necessity of the proprietorship equation, proprietorship items normally have credit balances, it is evident that all income, or earnings, must be placed on the credit side of their appropriate accounts. Cost of management and all expenses of operation are deductions from that income and must therefore be recorded on the left or debit side of appropriately named accounts.

=Income Debits and Credits.=—With regard to their debits and credits, income accounts follow this rule:

INCOME (under appropriate titles) ========== _Debit_: | _Credit_: (1) For all deductions from the | (a) For the yield. yield shown contra. |

Income accounts normally have entries only on the credit side. They are debited, however, for the purpose of deducting from the yield shown on the credit side, (1) because of overstatement of the amount of the yield in the first place; (2) because of error in the original placing of the item of income, which is now transferred to its proper account; and (3) for the purpose of summarizing when it becomes necessary to transfer all income and expense items to one summary account. The entries made for the purposes of transfer and summarization are sometimes called “adjusting” and “closing” entries.

=Expense Debits and Credits.=—With regard to their debit and credit, expense accounts follow this rule:

EXPENSE (under appropriate titles) ========== _Debit_: | _Credit_: (1) For the cost. | (a) For all deductions from the cost, | shown contra.

Expense accounts normally have entries only on the debit side. Their credits are for purposes similar to the debits to income accounts as stated just above.

Examples of temporary proprietorship items can be found in Chapters V, VI, and VII, where the profit and loss summary is treated.

=Vested Proprietorship Debits and Credits.=—Two accounts should be kept on the ledger with the proprietor, a capital and a personal account, i.e., “John Doe, Capital” and “John Doe, Personal.” The capital account records the original investment or the amount of capital now in the business as shown by the last financial statement. The personal account shows all direct changes made in the capital during the fiscal period either through withdrawal or the additional investment of funds or properties. The capital account, therefore, shows no change until the close of the fiscal period, when the increase or decrease in net worth is transferred to it.

An exception to this is sometimes made when there is evident intention to withdraw during the period some of the invested capital, in which case such withdrawal is shown in the capital account as a debit or subtraction item. Also, if there is evident intention to increase the investment during the fiscal period, record of it is sometimes made in the capital account. Practice in this regard is not uniform.

The ordinary transactions with the proprietor, such as more or less regular withdrawals of cash or goods and other similar transactions, are recorded in his personal account. This is his current account as distinguished from his more permanent capital account. Both of these accounts may be termed vested proprietorship accounts. Their debit and credit schedule appears as follows:

(NAME OF ACCOUNT) ========== _Debit_: | _Credit_: (1) For amounts or values | (a) For amounts or values withdrawn. | invested.

The capital account usually shows only one item throughout the period until its close; the personal account shows both debits and credits, made according to the above schedule. The personal account ordinarily shows transactions of the following kind: on the debit side, withdrawals in funds or goods, the payment or assumption by the business of the personal debts of the proprietor, and his retention of any funds or properties belonging to the business, such as collections from customers; on the credit side, the investment in the business of any funds or properties, the retention by the business of any funds or properties belonging to the proprietor, as where the business collects and retains a debt due him personally, and the payment or assumption by him personally

of any debts of the business.

=Further Consideration of Expense Items.=—In explaining the debits to fixed asset accounts it was pointed out that all costs necessary to place the asset in position for use by the business constituted a part of the value of the asset and should be recorded in the asset account. Similarly, it was explained that in the Merchandise account there was included as a part of the value of the merchandise all the costs incident to putting the merchandise in position for sale by the business. Costs of this kind are classed as incoming costs and are almost without exception treated as additions to the value of the asset. The costs incurred from this point on, in the course of business operations, are classed as expenses or proprietorship decreases.

It might sometimes appear that all these operating costs—the kind shown in the profit and loss statement—also add to the value of the assets of the business. Such is not the case. In a mercantile concern, business is conducted for the purpose of selling merchandise. Profit arises through the purchase of merchandise at one price and its sale at a price sufficiently higher to pay for all operating expenses and leave a margin. The cost of merchandise to the customer reimburses the proprietor for his original outlay in merchandise and for a fair portion of the operating expenses incident to the maintenance of the store. The customer is willing to pay this additional amount because it is cheaper for him to pay the merchant a margin over the cost of the merchandise sufficient to induce the merchant to conduct a market for merchandise, than to undergo the necessary expenditures—of time, expense, and inconvenience—entailed in making the purchase from the original vendor.

The economic organization of business is based on this hypothesis. In the management of a business there is a very large element of risk. The sale price of commodities at a given time is not always determined on the basis of the original cost of the commodity plus the costs of maintaining a store for its sale. Competition sometimes enters in to drive the price down below this amount. While every merchant _expects_ in the long run to receive from the sale of his merchandise not only what he himself has paid for it but also the cost of conducting his store and a fair margin of profit, for a given period and for a given item of merchandise he may not be so fortunate.

In recording business transactions, therefore, prudence demands that the costs of operating the business be not recorded as increases in the value of the merchandise dealt in, but rather that they be set up separately and charged against the income received from the sale of the merchandise before the increase (or decrease) in the value of the assets is determined and made a part of the asset record. As merchandise is converted into cash the amount received is recorded as an increase in the asset cash. This cash includes the original cost of the merchandise plus some of the costs of operating the business. These are costs which must be incurred and they add value to the business as indicated by the willingness of the customer to pay the merchant for them. Because the added value is problematical at the time the costs are incurred, they are recorded as expenditures which must be made good out of the sale of the merchandise at a sufficiently enhanced price to cover them, i.e., they are _expenses_ which are to be treated as deductions from sales income.

The net difference between the income and the cost of securing the income, as indicated by the expense accounts, will represent the value added to the assets of the business, and will therefore be reflected tangibly in an increase in the value of the assets by that amount. This increase will usually be reflected either in the cash holdings or in claims against customers.

It may not be out of place at this point to call attention to the fact that, as the bookkeeping record is usually handled, the only relationship between asset increases, liability decreases, and expenses (proprietorship decreases) arises from the fact that all of them are debits and are so placed because of the mathematics of the fundamental equation on which double entry rests. Assets, liabilities, and proprietorship are three distinct and separate groups of accounts related only by the logic of the proprietorship equation. As the subject of accounting is developed the student will see the increasing importance of drawing sharply the lines of division among these groups and he will see also the difficulty at times of maintaining this distinction.

CHAPTER XIII

DEBIT AND CREDIT AS APPLIED TO MIXED ACCOUNTS

=Mixed Accounts Defined.=—In the course of business operations certain accounts which at the beginning of the period belong definitely to some one of the three groups, asset, liability, and proprietorship, with the progress of the period take on a mixed character. That is, included under one account title there is a mixed record of asset and expense, or other combination of two or more groups. For example, the machinery which belongs to the asset group at the beginning of the period depreciates in value day by day, both through use and the lapse of time. This daily decrease in value is of slight amount and in the management of the

business it is not necessary that it be shown on the books. While it is theoretically possible to record this daily loss, practically nothing would be gained by so doing. Hence, the machinery account is allowed to carry both the asset value of the machinery at a given time and the amount of its depreciation. Only periodically, usually at the close of each fiscal period, is the account separated into its two parts, the one which shows the true asset value and the other which indicates the amount of depreciation and which is therefore the expense or proprietorship-decrease portion of the account.

In the previous chapter the way in which the Merchandise account takes on a mixed character was briefly explained. It was shown that the credit side reflected both a decrease of the asset and an increase of the proprietorship by the amount of the gross profit on the goods sold. Thus, because of the way in which accounts are kept practically, as distinguished from a theoretically correct method, which would maintain at all times a sharp line of division between assets, liabilities, and proprietorship, certain accounts are allowed to become mixed. It is the purpose of this chapter to discuss the proper handling of the more common mixed accounts.

=Analysis of a Sale Transaction.=—The impracticability of immediately separating each sale of goods into its two elements of cost and profit and the taking of a physical inventory as a means to this end, was discussed in Chapter VI. The necessity for this later separation may be made clear by analyzing a sale transaction.

Suppose an article costing $10 is sold for $12. At the time of its purchase a debit was made to Merchandise account and a credit, say, to Cash. When the article is sold, it would seem that the credit should be to Merchandise to show the decrease in that asset. However, in the sale price of $12 is included something more than the amount by which the stock of merchandise is decreased. This additional amount is the profit of $2. Hence, a credit to Merchandise of $12 would result in too large a subtraction from the asset Merchandise, if it is intended that the Merchandise account shall always show by its balance the value of the unsold stock. Theoretically the best method of entering this sale would be to debit Cash for $12, and to credit Merchandise with $10 and Profit with $2.

=The Old Merchandise Account, Its Content and Significance.=—It is impracticable, however, to compute and record the cost of every unit sold. Using the above illustration, instead of crediting Merchandise with $10 and Profit with $2, the entire $12 may be credited to the Merchandise account. There is a disadvantage in this procedure, in that the Merchandise account then no longer represents the one asset Merchandise, but is a mixture of an asset element, merchandise, and a proprietorship element, profit; two elements which must be separated at the close of the period.

Originally, the Merchandise account was kept in this way; it was a _mixed_ account and followed the rules of debit and credit as shown below, the amounts being given for purposes of illustration:

(A) MERCHANDISE ========== _Debit_: | _Credit_: (1) For goods on hand | (a) For sales 25,000.00 at beginning 10,000.00 | (b) For returned (2) For purchases, | purchases 2,000.00 sometimes including | (c) For purchases freight-in, | rebates and drayage-in, | allowances 100.00 etc. 20,000.00 | (3) For returned sales 1,000.00 | (4) For sales rebates | and allowances 500.00 |

Where the account is kept in this manner it is usually burdened with the additional data listed under (3), (4), (b), and (c). Sales being a credit item, it is plain that subtractions from sales (3) and (4), must appear on the debit side, and, purchases being a debit item, subtractions from purchases (b) and (c) must appear on the credit side. If these subtractions were actually performed instead of being indicated in the account, the debit side would show net goods to be accounted for, viz., goods on hand at the beginning, $10,000, plus _net_ purchases, $17,900, making a total of $27,900; and the credit side would show _net_ sales, $25,000 minus $1,500, or $23,500.

If, now, the cost value of the goods on hand at the close of the period (as determined by a physical inventory) equals $8,000, it is evident that the cost price of the goods sold is equal to the cost value of the goods to be accounted for, minus the cost value of the goods left on hand, that is, $27,900 minus $8,000, or $19,900. To secure this subtraction within the account, it is necessary to enter on the credit side this $8,000, the cost value of the final inventory. Accordingly, an additional credit item (d) is inserted, after which the account will show:

(B) MERCHANDISE ========== _Debit_: | _Credit_: (1) For goods on hand | (a) For sales 25,000.00 at beginning 10,000.00 | (b) For returned (2) For purchases, | purchases 2,000.00 sometimes including | (c) For purchases freight-in, | rebates and drayage-in, | allowances 100.00 etc. 20,000.00 | (d) For goods on hand (3) For returned sales 1,000.00 | at end 8,000.00 (4) For sales rebates | and allowances 500.00 |

The account is now a pure proprietorship account, the balance showing the gross profit on sales, amounting to $3,600.

=Modern Practice in Showing Merchandising Transactions.=—Actual subtraction, however, within the account is contrary to the method of showing subtractions in the account. Therefore, the mixed Merchandise account cannot show the figures representing “net purchases,” “net sales,” “total goods to be accounted for,” and “cost of goods sold”—information which is very essential to proper management. While containing all the data necessary to give the final information, viz., the “gross profit,” the mixed account does not show the separate factors leading up to it. Analysis of the mixed account is necessary to find the elements of which it is composed. The best accounting practice provides for this analysis as the transaction takes place. The old Merchandise account is no longer used; in its place separate accounts are set up to represent the various elements mentioned above. Each account thus contains only one kind of item as indicated by its title. These accounts are:

(1) MERCHANDISE INVENTORY ========== | | |

(2) PURCHASES ========== | | |

(3) INWARD FREIGHT AND DRAYAGE ========== | | |

(4) RETURNED PURCHASES ========== | | |

(5) PURCHASES REBATES AND ALLOWANCES
========== | | |

(6) SALES ========== | | |

(7) RETURNED SALES ========== | | |

(8) SALES REBATES AND ALLOWANCES ==========
| | |

Accounts (1), (2), (3), (7), and (8) correspond to the four classes of debits shown above in the mixed Merchandise account, and accounts (1), (4), (5), and (6) correspond to the credits. Explanation of the use of account (1) for both the initial and final inventories is given in detail in Chapter XV.

The advantage of the use of these accounts instead of the one Merchandise account is in the availability of the information they contain and in the saving of labor, because now there is no need to analyze the Merchandise account for information relating to returns, allowances, and so forth. By later transferring the totals of the Returned Sales and of the Sales Rebates and Allowances to the Sales account, the balance of this account will show the “net sales.” A similar transfer of the Inward Freight and Drayage, the Returned Purchases, and the Purchases Rebates and Allowances to the Purchases account, and a transfer to it of the initial and final inventories, make it show by its balance the “cost of goods sold” which set over against “net sales” shows the figure of “gross profit.”

The student will understand that the use of these detailed accounts does not free the record of merchandise transactions from the mixture of different elements, decrease of the asset and increase of the profits. It does, however, make the record more valuable because of the information it makes available.

=Accounts with Assets Subject to Depreciation.=—Another kind of mixed account requiring explanation is that of the fixed asset subject to depreciation. Due to ordinary wear and tear, and some other causes, most fixed assets lose part of their value as time goes by. At the end of each fiscal period the amount of this loss and the present value of the asset must be estimated, after an inventory has been taken, when necessary, of their number, weight, or other units of measurement. Such an estimate is called an appraisal. The difference between the present appraised value of the asset and its former cost or appraised value constitutes the loss from wear or other causes, and is termed depreciation.

Since depreciation takes place day by day, but for practical reasons cannot be recorded daily, fixed asset accounts, as they stand valued in the ledger, represent true asset values only for the date of their entry. Except on that date, these accounts, then, include depreciation and hence are mixed accounts including both asset and proprietorship elements. As with the Merchandise account, an adjustment is made periodically to separate the two elements. Since the asset account is a debit account, entry of the amount of the depreciation to the credit side would result in the account showing, by its balance, the appraised value of the asset at any given time. It is, however, desirable to leave the account in its original condition, in order not to lose sight of the cost of the asset.

Therefore the usual practice is to enter this figure of depreciation to the credit side of a separate account called Depreciation Reserve for the particular asset, using the word “reserve” in the sense of “estimate.”

If the latter method is followed, each asset has two accounts, one showing original cost and the other estimated depreciation, and it is necessary for a true valuation of the asset to read the two accounts together; that is, from the asset account showing original cost, the amount credited to the reserve account must be deducted to show the true value of the asset. Because of this, the reserve account is often called a valuation account or an offset account, as it gives the amount of the offset to the original asset account necessary to show its correct value. Similarly, when an increment in the value of an asset is kept separate from its face or par value—as when the premium paid for stock or bonds is shown separately from the par value of the stock or bonds—the account showing the increment is called an adjunct account and must be read with the asset account to secure true valuation. The offset account, then, is a subtraction item and the adjunct an addition item to the corresponding asset account. The showing of the asset and its periodic valuation is made as follows:

MACHINERY ========== 1921 | Jan. 1 5,000.00 |

DEPRECIATION RESERVE MACHINERY ========== | 1921 | Dec. 31 500.00 | | 1922 | Dec. 31 500.00

A reading of the two accounts taken together shows the original value of machinery as $5,000, the value after one year’s use $4,500 and after two year’s use $4,000. The contra debit for the credit in the reserve account is made to an account called Depreciation, which represents the expense of the depreciation for the period, that is, the deduction from profit or proprietorship. Sometimes, this charge is made direct to Profit and Loss, as will be shown in a later chapter.

=Capital and Revenue Expenditures.=—The fixed asset accounts usually show the investment of some of the original capital and therefore are sometimes called capital asset accounts. A fundamental distinction must be made between expenditures for the purchase and installation of the asset itself and expenditures for expenses in connection with its repairs, maintenance, and upkeep. These two classes of expenditures are usually called “capital expenditures” and “revenue expenditures” respectively.

The asset account itself is chargeable with all costs incurred up to the point of putting the asset in shape for use in the business. It may be charged also with subsequent expenditures resulting in an increase in its value. Expenditures, however, which are for the purpose of repairs or of keeping the property from too rapid depreciation without adding anything to its original value, must be charged to a properly labeled _expense_ account. These revenue expenditures for expenses, such as repairs, maintenance, upkeep, together with depreciation, are subtractions from profit and proprietorship, while asset expenditures usually constitute an exchange of the asset cash for some other asset, which exchange has no effect on proprietorship.

Sometimes two items of expenditure are seemingly of the same nature, while in fact they belong to separate groups, as the original painting cost of a building and the cost incurred later for repainting. In the first instance the expenditure is an asset, a part of the original cost necessary to put the building in a finished condition; in the other instance, it is an expense necessary to maintain the asset in something near its original condition. In order to secure accuracy in the records, careful discrimination between capital and revenue expenditures is a matter of great importance.

CHAPTER XIV

PERIODIC WORK ON THE LEDGER

The work preliminary to summarizing the record of transactions for a period and preparing the balance sheet and profit and loss statement is comprised under three heads: (1) the Trial Balance, (2) Adjusting Entries, and (3) Closing Entries. These three steps will be discussed at this point sufficiently for practice work in closing the ledger. Fuller treatment of the subject is reserved for later chapters, after the nature of the transactions that may complicate the closing of the ledger have been explained.

=The Trial Balance.=—When all transactions for the fiscal period have been entered on the ledger, it is desirable to make sure that the ledger is in equilibrium, i.e., to make sure that for every entry on the debit side there is an equal credit entry, and that for every credit entry there is an equal debit entry; in other words, that the ledger equation explained in Chapters IX and X is maintained. This proof of the mathematical correctness of the ledger is accomplished by means of a device called the “Trial Balance,” which consists of a debit and credit list of either all account totals or of all account balances. If the total debits equal the total credits, the mathematical equilibrium is demonstrated. A trial balance is usually set up somewhat as follows:

TRIAL BALANCE, June 30, 19—

Dr. Cr. Cash $ 1,000.00 Notes Receivable 1,500.00 A. B. Casey 500.00 B. C. Darby 450.00 C. D. Ebbets 200.00 D. E. Field 300.00 E. F. Gall 150.00 F. G. Hiller 350.00 Merchandise Inventory 4,000.00 Store Equipment 500.00 Depreciation Reserve Store Equipment $ 75.00 Notes Payable 1,000.00 Hill & Innes 350.00 Jones & Kanter 175.00 Lunt & Mason 200.00 Noble & Oberly 150.00 P. I. Richards, Capital 5,000.00 P. I. Richards, Personal 1,000.00 Sales 20,000.00 Purchases 12,000.00 Salaries 2,500.00 Insurance 500.00 General Expenses 2,000.00 ---------- ---------- $26,950.00 $26,950.00 ========== ==========

=Work Preliminary to the Trial Balance.=—Before taking a trial balance, the accounts should be totaled on each side. These totals are shown in small but legible pencil figures immediately beneath the last entry, sufficient space being left for a regular entry on the line immediately below the pencil footing. Reference to the illustration in Form 3 makes this bookkeeping detail clear. The difference between the totals of the account should now be shown in pencil in the explanation column on the side of the larger amount. Taking the trial balance thus becomes merely a transcription of pencil balances, debit or credit as the case may be, from the list of accounts.

=Balancing an Account.=—Sometimes it is desirable, as in the Cash account, to show on the face of the account the difference between the total debits and credits, i.e., the balance of the account. This may be accomplished by writing the balance on the side with the smaller total, and by formally ruling up the account and entering in ink the totals on both sides, which totals, of course, are now equal. It should be noted that the total rules in the money columns are drawn on the same line on both sides of the account, thus leaving several blank lines on the debit side. This is done so that the entries in the new section of the account will start on the same line for both debits and credits. On the next line below the double ruling, the balance item is brought down to its proper side. The account is now said to have been closed as to all items above the rulings and shows its open balance in the one item beneath the rulings. The method of balancing and ruling accounts is illustrated in the Cash account shown in Form 3.

It is important to bear in mind that the closing balance of the account is on the side showing the smaller _pencil_ total, whereas the opening balance which appears beneath the ruling is on the opposite side. The only purpose of the entry on the smaller side is to force an equality of the two sides, thus formally closing all entries to that point and showing the “balance” as a single item in the new portion of the account.

It should be noticed that this “balance” entry does not disturb the equilibrium of the books, because it is entered on both the debit and credit sides of the same account.

=Use of Red Ink.=—The total and closing rulings and the balancing entry are sometimes made in red ink, but black ink is preferable. The use of red ink is usually reserved for recording subtraction items in the same column with those from which the subtraction is to be made. Where red ink is so used, the total of the “red” is subtracted from the total of the “black” amounts and the net result is shown in the total of the column. When there are only a few “red” items, this method of recording obviates the use of a separate column for them. Such red ink entries are not found in the standard ledger, being confined to special ledgers and columnar statements of various kinds.

[Illustration: Form 3. Account Balanced and Ruled]

=Rulings.=—The single lines above the totals, indicating the addition, extend only through the money columns and are on the same line on both debit and credit sides. The closing rulings beneath the footings are double and extend through the date columns, the money columns, and the posting reference columns. The diagonal line on the debit side from the total line to the date column for the last entry is for the purpose of filling all blank lines, and preventing any further entries on them after the account is formally closed, as such entries would have the effect of falsifying the totals shown. Thus the diagonal line which may be on either debit or credit side serves as a safeguard against fraud. Diagonal rulings, however, are not used so extensively as formerly.

=Transferring.=—When for any reason it is desirable to transfer an account from one page to another, the transfer is made by means of an entry similar to the “balance” entry shown in the Cash account above. Instead of the word “Balance,” the word “Transfer” or “Forward” is used, and in the column between the explanation and money columns is entered the number of the page to which the transfer is made. On that page the account name appears, and the first entry is the amount transferred from the old account, with a page reference to the old account in the reference column. In making the transfer it is customary to close the portion of the account on the old page in the manner explained above, and to transfer only the balance.

Sometimes an entry may be made in an account in error and for this or some other reason may need to be transferred. Assuming, for the purpose of illustration, that such an entry is a credit, its amount is first written as a subtraction item on the debit side in the old account, with proper reference to the page to which it goes. On the new page it appears on the credit side, like the original item, and may be considered as the contra to its transfer record in the old account. In the new account the old page number must be entered. Great care should be exercised in all transfer entries to show correct cross-indexing.

Sometimes it is desired to transfer not the balance but the total debits and credits of an account. In this case the total debit amount may be entered on the credit side of the old account and the total credit amount on the debit side, with proper page and explanatory references. This forces the equality of the two sides and the account may now be totaled and ruled off. The total debit amount of the old account is then entered on the debit side and the total credit amount on the credit side of the new account.

A much simpler and more workable method, however, is to treat the new account as a continuation of the old. There is then no necessity of formally balancing the old account. The transfer is effected by totaling both sides of the old account and indicating the new page to which these totals are transferred, taking care to enter the totals on the proper side of the new account, with proper references to the old account page. This procedure is illustrated in Form 4.

=Rulings and Entries in Personal and Note Accounts.=—Some peculiarities met with in the entries and rulings of personal and note accounts, both receivable and payable, will be discussed here.

In John Adams' personal account (Form 5) notice that his address is included in the heading, that the terms of credit extended to him on each sale are shown in the explanation space on the debit side, and that his payments are entered on the credit side according to the date on which they are received. If a payment appears directly opposite the corresponding charge, with no other credits intervening, lines are ruled underneath both the debit and the credit items to show that down to that point the account balances. The record of dealings with each customer should be as full as possible in order to furnish an accurate basis for credit rating. If he is prompt in his payments, taking advantage of the discounts offered him, the account should show this.

[Illustration: Form 4. Transfer of Account to New Page]

[Illustration: Form 5. Personal and Notes Payable Accounts]

A convenient method of showing clearly the taking of discounts, without the need of calculating the time between dates of charge and payment, is to enter the discount in small ink figures above the net amount received. When two partial payments are made, as on October 1 and 15, to settle the charge of September 20, and there are no other credits intervening, the two credits, with the total in small figures, may be ruled off against the single charge. At the time the trial balance is taken—in the illustration on August 31, September 30, and October 31—the balance of the account is calculated and shown in pencil on its proper side, debit or credit, just to the left of the reference column on the line of the last entry on that side.

Sometimes, when payments are made out of order or on account and it is desired to show to what particular charges they apply, an index number or letter showing the cross-reference is used, as shown in the Notes Payable account. As notes are issued by the business, they may be numbered, and when it pays a particular note, the entry should show the number of that note.

These remarks apply also to notes receivable. If full payment is received on each note as it comes due, the entry may be made on the same line on which the note was first recorded. This may result in the entries to the account appearing out of chronological order, but it assists in an easy determination of the outstanding notes. Numbering, or preferably lettering, the entries in an account may be applied with advantage also to the entries in personal accounts, as it aids in locating unpaid items, especially where payments cannot be recorded in the order in which the items to be settled have been entered.

The method of ruling and thus canceling items as explained above, is usually limited to notes and accounts receivable and payable, that is, to the accounts on which particular payments are received or made and the balance of which it is desirable to ascertain at frequent intervals. On the other hand, it is advisable that the method of showing periodic balances, by means of small pencil figures for use in the trial balance, be applied to all accounts.

CHAPTER XV

PERIODIC ADJUSTMENTS AND SUMMARIZATION

=Why Current Records of the Ledger Need Adjustment.=—At the end of the fiscal period the ledger does not present a true record of financial condition. The fixed assets of the business are constantly depreciating in value; merchandise tends to become out of date, shopworn, stale, or soiled; some merchandise has been sold, while some is still on hand; some of the accounts receivable may prove uncollectible, and some of the notes receivable may be dishonored. Also, at the end of the period liabilities such as taxes, salaries, rent, and the like may have been incurred, but because there is no creditor's invoice or other business paper as evidence of such liability they are not usually entered on the books until payment is made.

Again, it may be that the services paid for during this period, as shown by the various expense accounts, have not been entirely used, as where a supply of coal for heating purposes remains on hand, or when, as in the case of insurance bought for a given period of time, a part of the protection period extends beyond the close of the current fiscal period. In these and similar cases, the items must be separated into their two component elements, one part belonging to the current period, and the other part to a later period. The part of the expense to be deferred and used up in a later period represents an asset at the close of the current period and must therefore appear on the balance sheet under the heading of "Deferred Charges."

Similarly, income is sometimes received in advance to cover services which have not yet been rendered, or rendered only in part, as when rent is received in advance to cover a given number of months, some of which belong to the next fiscal period. Consequently, only a part of this income applies to the current period, the balance being deferred to later periods.

For these reasons certain asset accounts need to be adjusted and certain liability accounts must be opened to bring the ledger into accord with the actual condition of things and show the true financial status of the business. The entries required for this purpose are called "adjustment entries" to distinguish them from the closing or summarizing entries to be described later in this chapter.

First in importance among the adjusting entries are those required to show the correct value of the stock-in-trade, the fixed assets, and the accounts receivable. Whether the merchandise items are kept in one or several accounts, the value of the stock on hand is not shown at any given time during the fiscal period. Goods have been purchased at one price and sold at another, and no record of the value of the merchandise inventory on hand is available. Similarly, no current record has been made of the depreciation of buildings, furniture, fixtures, or other equipment, nor has any provision been made for the accounts receivable that may prove uncollectible.

=Basis of Adjustment Entries.=—These items, then, merchandise, asset depreciation, bad debts, prepaid and accrued expenses and income, are the occasion of the adjustment entries. An inventory is required to find the value of the stock-in-trade; an appraisal is made of the depreciating assets to determine the amount of depreciation for the current period; and proper consideration must be given to the prepaid and accrued income and expense items for the period under review. The following illustrations are concerned with the several classes of adjustment entries. The detail of the account is not shown in each case, but only the balance.

=Adjusting and Closing the Merchandise Records.=—Unlike the method shown in the debit and credit schedule for merchandise in Chapter XIII, the modern practice is to keep the merchandise record by means of the separate accounts used in the profit and loss statement, viz., Merchandise Inventory, Purchases, Inward Freight and Cartage, Returned Purchases, Purchases Rebates and Allowances, Sales, Returned Sales, and Sales Rebates and Allowances. It should be understood that this detailed record of merchandise transactions is preferable to the single merchandise account only because it gives more information. The detailed record does not in any way maintain a sharper separation of the asset and income elements of the merchandise transactions than does the single merchandise account. It does, however, make immediately available information as to volume of business, purchases, returns, and so forth—items which in any well-managed business are watched carefully. These detailed accounts taken together comprise the merchandise record and are equivalent to the single merchandise account.

It is apparent from a consideration of the single merchandise account that at any given time it includes these three items: (1) the net cost of the total goods to be accounted for; (2) the decrease in the asset merchandise brought about by sale; and (3) the profit on the goods sold. In order to bring about the separation of the merchandise records into the two elements (a) goods still on hand, that is, the asset element, and (b) the profit on goods sold, that is, the income element, it is necessary to bring the detailed accounts together for the purpose of summarization. This summarization is accomplished in much the same way as in the profit and loss statement. The net amount of sales and the net cost of goods sold are determined and set up against each other in order to indicate the gross profit. In arriving at the cost of goods sold it is necessary to bring together the opening inventory, the purchases, the inward freight and cartage, and from their sum to subtract the purchase returns, the purchase rebates and allowances, and the final inventory. How this is accomplished in the ledger is explained by an illustration, in which the adjustments or transfers between

accounts are traced by means of cross-index letters.

Assume the following facts: Goods on hand January 1, 19—, $10,125.67; purchases for six months $47,897.42; inward freight and cartage $560.25; returned purchases $2,125.40; purchase rebates and allowances $267.92; sales $65,283.21; returned sales $3,924.83; sales rebates and allowances $392.48; and goods on hand June 30, 19—, $11,267.40. Each of these items appears as the first entry on the proper side of its account, and is distinguished by not being marked with a bracketed letter. The items comprise the ledger record previous to summarization at the close of the fiscal period.

MERCHANDISE INVENTORY ========== 19— | 19— Jan. 1 10,125.67 | June 30 Purchases (B) 10,125.67 --------- | --------- June 30 (E) 11,267.40 |

PURCHASES ========== 19— | 19— June 30 | June 30 (Total purchases) 47,897.42 | Returned Purchases Inward Freight | (C) 2,125.40 and Cartage | Pur. Rebates & (A) 560.25 | Allow (D) 267.92 Mdse. Inventory, | Inventory, Jan. 1 (B) 10,125.67 | June 30 (E) 11,267.40 | Profit & Loss (F) 44,922.62 --------- | --------- 58,583.34 | 58,583.34 ========= | =========

INWARD FREIGHT AND CARTAGE ========== 19— | 19— June 30 (Total) 560.25 | June 30 Purchases (A) 560.25 ------ | ------

RETURNED PURCHASES ========== 19— | 19— June 30 Purchases (C) 2,125.40 | June 30 (Total) 2,125.40 -------- | ---------

PURCHASES REBATES AND ALLOWANCES ========== 19— | 19— June 30 Purchases (D) 267.92 | June 30 (Total) 267.92 ------ | ------

SALES ========== 19— | 19— June 30 | June 30 Returned | (Total) 65,283.21 Sales (G) 3,924.83 | Sales Rebates & | Allow (H) 392.48 | Profit & Loss (I) 60,965.90 | --------- | --------- 65,283.21 | 65,283.21 ========= | =========

RETURNED SALES ========== 19— | 19— June 30 (Total) 3,924.83 | June 30 Sales (G) 3,924.83 -------- | --------

SALES REBATES AND ALLOWANCES ========== 19— | 19— June 30 (Total) 392.48 | June 30 Sales (H) 392.48 ------ | ------

PROFIT AND LOSS ========== 19— | 19— June 30 Purchases (F) 44,922.62 | June 30 Sales (I) 60,965.90 --------- | ---------

To show the total cost of goods bought during the period, the freight-in of $560.25 is transferred or closed into Purchases. To show the “_gross_ cost of goods to be accounted for,” amounting to $58,583.34, the inventory of January 1 of $10,125.67 is transferred to the debit side of Purchases account. To show the _net_ cost of goods to be accounted for, the returned purchases and allowances are deducted from this gross cost by being transferred to the credit side of Purchases. The balance in Purchases account at this point, viz., $58,583.34 minus $2,393.32, or $56,190.02, indicates the net cost of goods to be accounted for.

This item of $56,190.02 is not indicated in the account, however, but is given here simply to make the discussion intelligible. Part of this $56,190.02 (net cost of goods to be accounted for), amounting to $11,267.40, is the cost value of the unsold goods according to the inventory of June 30, and the balance of $44,922.62 ($56,190.02 minus $11,267.40) constitutes therefore the _cost of the goods sold_. This final inventory is also shown as an asset on the debit side of Merchandise Inventory in the new section of the account, i.e., the portion of the account following the _initial_ inventory section which has now been closed and ruled off as shown on page 118.

Put in a somewhat different form, we may say that the cost of goods sold is found by subtracting from the gross cost of goods to be accounted for, $58,583.34, first the returns and the rebates, $2,393.32, and then the amount of the closing inventory of June 30, $11,267.40. The balance left of $44,922.62 represents the _cost of goods sold_. This balance is now transferred to the debit of Profit and Loss account.

All the transfer entries given above have their debits and credits determined as explained in Chapter XIV. The student should note that the same additions and subtractions are thus brought about in the Purchases account as are made arithmetically in the section of the profit and loss statement given over to cost of goods sold.

The Sales account is debited with the balances of the Returned, Sales and Sales Rebates and Allowances, thus showing a balance of net income from sales which is transferred to the credit of Profit and Loss. The Profit and Loss account then shows net income from sales on the credit side, and cost of goods sold on the debit side. The difference between the two sides is gross profit on sales. All of the merchandise accounts, except the Inventory account, are now balanced, and should be ruled off in the manner explained in Chapter XIV.

The second illustration covers the case where the stock-in-trade record is kept in one mixed account called Merchandise. Using the same data as in the other illustration, the account appears as follows:

MERCHANDISE ========== 19— | 19— Jan. 1 Inventory 10,125.67 | June 30 Sales 65,283.21 June 30 Purchases 47,897.42 | Returned Purchases 2,125.40 Returned Sales 3,924.83 | Sales Rebates | Purchases Rebates and Allow 392.48 | and Allow 267.92 Inward Freight | and Cartage 560.25 | Inventory, June 30 11,267.40 Profit and Loss 16,043.28 | --------- --------- | 78,943.93 | 78,943.93 ========= | ========= June 30 Inventory 11,267.40 |

When the merchandise record is kept under separate accounts the freight-in is _transferred_ to the debit of the Purchases account; but when a single mixed account is kept with merchandise, freight-in is usually entered directly to the debit of that account. To adjust the account when kept in this manner, the new inventory is entered to the credit of Merchandise. The balance of the Merchandise account now shows the gross profit on sales, $16,043.28. This is transferred to the credit of Profit and Loss. (It will be noted that this _transferred_ item is identical with the _balance_ of the Profit and Loss account of the first illustration.) The Merchandise account is now totaled and ruled off. On the debit side, beneath the ruling, the new inventory is entered, being the contra to the credit entry of $11,267.40 above the ruling. The equilibrium of debits and credits is thus maintained. In this open item of $11,267.40 the account shows an asset, the goods on hand June 30.

The handling of merchandise transactions according to the second illustration is not considered good accounting but is shown because it is frequently met with in bookkeeping practice.

=Underlying Theory in the Adjustment of Merchandise Records.=—Careful analysis and study of the adjustment of the merchandise records should be made in order to see the way in which the logic of the trading section of the profit and loss statement is worked out in the ledger. The record of the merchandise asset should be kept, in strict theory, in the same way as that of every other asset, namely, the accounts should be charged with the full cost of the asset and credited at cost price with the portion sold, the profit or loss on the sale being carried in a separate account. The balance of the Merchandise account would then show the value of the asset merchandise on hand at any time.

Theory, however, gives way to the practical difficulties of handling the account in this way. Therefore, periodically the mixture of asset decreases and income increases brought about through this practical method of handling merchandise records must be corrected, or “unmixed,” so that these elements will appear separately. The Purchases account, after the opening inventory, the inward freight, and the purchase returns, rebates, and allowances are transferred to it, gives the net total of the merchandise asset for the period. This net total represents two things: (1) merchandise still on hand, and (2) merchandise sold. By way of adjusting the records, the goods on hand, as shown by the physical inventory, are separated from the total and put into the Merchandise Inventory account, which shows by its title that it is an asset. That leaves in the Purchases account the cost of goods sold. The credits which should indicate the decrease in the asset, equal to the cost of goods sold, are found in the net merchandise sales, as shown by the Sales account after transferring to it the sales returns, rebates, and allowances. But these credits are here mixed with the gross profit. The portion of the net sales representing the cost of sales of merchandise should now, in strict theory, be transferred from the Sales account to the Purchases account. This transfer would effect the balancing of the Purchases account, indicating that there are no merchandise asset values in that account, these having been transferred to the Merchandise Inventory account. The result of this theoretically correct procedure would be to bring about a segregation of the merchandise records into their two elements, the asset element as shown by the Merchandise Inventory account and the income element as shown by the remaining balance in the Sales account.

Once again, however, strict theory gives place to the more practical need of requiring the accounts to give full information for management purposes. Accordingly, instead of handling them in the way just indicated, the adjustment procedure explained on pages 118 to 120 is followed.

=Handling Depreciation of Fixed Assets.=—As shown in Chapter XIII, the method of handling depreciation of assets consists of nothing more than separating the expense element from the asset element, both of which are carried currently under the title of the asset. For reasons explained in Chapter XIII, the credit to the asset which effects the separation is not recorded in the asset account but in a supplementary account entitled “Depreciation Reserve” for the particular asset. This reserve account is an integral part of the asset record and must always be considered in connection with the asset account in determining the value of the asset. The credit entry in the reserve account is a sort of suspended credit, recorded there temporarily for purposes of information. The offsetting debit to this credit is made in the expense account Depreciation.

The adjustment entry thus effects a separation of the asset account into the two elements, (1) present value of the asset as shown by the asset account and its depreciation reserve account, and (2) the expense element recorded under the Depreciation expense account. The following illustration indicates the bookkeeping procedure:

FURNITURE AND FIXTURES ========== 19— | Jan. 1 750.00 |

DEPRECIATION RESERVE FURNITURE AND FIXTURES ========== | 19- | June 30 (A) 75.00

DEPRECIATION ========== 19— | 19— June 30 (A) 75.00 | June 30 Profit & Loss (B) 75.00 ----- | -----

PROFIT AND LOSS ========== 19— | June 30 Depreciation (B) 75.00 |

The asset Furniture and Fixtures, valued at $750 at the beginning of the year, is estimated by appraisal to have depreciated 10%, or $75, during the half-year. This cost or expense is charged to an account called Depreciation, and credited not to Furniture and Fixtures, but to the valuation account “Depreciation Reserve Furniture and Fixtures.” The Furniture and Fixtures account and its valuation account, _taken together_, show the appraisal value of $675. Thus the credit adjusting entry is made to record a decrease in asset values. The Depreciation account, carrying the debit of $75, is an expense account and is closed into Profit and Loss, just as any other expense account is closed.

=The Estimate for Doubtful Accounts.=—At the close of a fiscal period, when an accurate statement of the financial condition of the business is to be drawn up, all assets must be very carefully valued. The bookkeeping procedure necessary to show the correct value of fixed assets subject to depreciation has been explained. The outstanding claims against customers also require evaluation. Every business man knows from past experience that he will be unable to collect all of his outstanding accounts. He may not know which of the accounts will prove uncollectible, but he does know that there will be a loss in the sum total of these claims against customers. The amount of this estimate is based on past experience in each business.

A standard basis for the estimate is not possible because in some businesses credit is extended much more carefully than in other businesses and in some collections are followed up more vigorously than in others. In making the estimate two methods are used, one being a certain percentage of the outstanding accounts, the other being a certain percentage of the sales made during the period. Where experience shows the necessity, the loss from both outstanding accounts and notes receivable is provided for.

The same bookkeeping procedure is used here as with the estimate of depreciation. An expense account, usually entitled “Bad Debts,” is debited, and an account called “Reserve for Doubtful Accounts” is credited for the amount of the estimated loss. The effect of the entry is to separate the claims against customers into their two elements, namely, the true asset element, represented by the difference between the asset account and its valuation reserve account, and the expense element as indicated by the Bad Debts account.

The following illustration sets forth the method of handling bad debts on the books of account:

ACCOUNTS RECEIVABLE ========== 19— | June 30 100,000.00 |

RESERVE FOR DOUBTFUL ACCOUNTS ========== | 19— | June 30 (A) 2,000.00

BAD DEBTS ========== 19— | 19— June 30 (A) 2,000.00 | June 30 -------- | Profit and Loss (B) 2,000.00 | --------

PROFIT AND LOSS ========== 19— | June 30 Bad Debts (B) 2,000.00 |

It is known, from past experience, that the asset Accounts Receivable, $100,000 in this instance, will not be collected in full. To bring this book value down to its real value, the estimated loss, which it is thought will be 2% of the outstanding accounts, is reserved from their value, that is, credited to a reserve account, which is to be taken in conjunction with the asset account. The offsetting debit is to Bad Debts, an expense account. It represents an expense which the current period has to bear, and is closed into Profit and Loss with other expense accounts.

=Handling Prepaid and Accrued Expenses and Income.=—The method of handling the estimates or inventories of prepaid and accrued expenses and income is very similar to that shown for handling the mixed Merchandise account. Illustrations follow:

INSURANCE ========== 19— | 19— Jan. 1 (Paid) 150.00 | June 30 (Unexpired) 125.00 | Profit and Loss 25.00 ------ | ------ 150.00 | 150.00 ====== | ====== June 30 (Deferred) 125.00 |

RENT INCOME ========== 19— | 19— June 30 (Unearned) 250.00 | June 15 (Received) 300.00 Profit and Loss 50.00 | ------ | ------ 300.00 | 300.00 ====== | ====== | June 30 (Deferred) 250.00

WAGES ========== 19— | 19— June 30 (Paid) 2,125.00 | June 30 Profit and Loss 2,325.00 (Accrued, unpaid) 200.00 | -------- -------- | 2,325.00 | 2,325.00 ======== | ======== | June 30 (Accrued) 200.00

INTEREST INCOME ========== 19— | 19— June 30 Profit and Loss 145.00 | June 30 (Received) 127.50 | (Accrued, due us) 17.50 ------ | ------ 145.00 | 145.00 ====== | ====== June 30 (Accrued) 17.50 |

The first account, Insurance, shows the method of handling a deferred or prepaid expense. At the close of the period the account is a mixed account, the unexpired portion of the insurance representing an asset to be shown on the balance sheet as a deferred charge, the expired or consumed portion representing an expense for the period to be closed into Profit and Loss. Insurance has been paid, in this case for a three-year term; hence only one-sixth of it is chargeable to the first half-year, the remainder being deferred to later periods. The amount of the inventory or unexpired portion is entered to the credit of the account in order to effect subtraction of the amount, the balance of $25 thereby showing the insurance cost for the current period. This balance is carried to Profit and Loss. After closing the account, the inventory is entered to the debit side below the ruling, thus showing the so-called “deferred asset” portion which will appear in the balance sheet.

The next account, Rent Income, is a mixed account with income and liability elements. It shows that rent has been received for a period which extends beyond the current fiscal period. On June 15, rent for the period of, say, June 15 to September 15 was received. Only one-sixth of this income applies to the term January 1 to June 30; therefore the balance of $250 must be deferred or carried over to the next fiscal period. The adjustment is made by an entry of $250 for unearned rent on the debit side to effect its subtraction from the earnings for the current period, thus reducing them to $50. This income of $50 is transferred to the credit of the Profit and Loss account. After the Rent account is ruled off, the deferred income is entered below the ruling on the credit side, forming a part of the earnings of the next period. It is shown among the liabilities in the balance sheet for the current period, usually under the caption of “Deferred Income.”

The third account, Wages, shows wages paid to June 30 of $2,125. At that date wages earned but not yet paid, perhaps because the pay-day did not coincide with the date of closing the books, amounted to $200. This item is obviously an expense of the current period incurred during the short interval between the last pay-day in June and June 30. The adjustment is therefore made by entering $200 on the debit side of the Wages account, to effect the _addition_ of this sum to the expense already shown there. The

total amount of the account is transferred to Profit and Loss and the account is ruled off. The amount of unpaid wages, $200, is shown on the credit side beneath the ruling. In the balance sheet it appears as a liability, usually under the caption of “Accrued Expense.”

Similarly with the fourth account, Interest Income. Income to date is $127.50; earned but not yet due on June 30, $17.50, showing full earnings of $145 for the current period. This total is transferred to Profit and Loss, the account is ruled off, and the earned but not received portion is shown as a debit beneath the ruling, and as an asset in the balance sheet.

Great care must be exercised in the adjustment of all inventories to maintain the equilibrium of the ledger by the entry of each amount to both the debit and credit sides.

Besides the four illustrations given above, there are many other accounts requiring the same kind of adjustment entries. In certain special cases it may be necessary to make adjustments on both sides, as for example in a general expense account or in a mixed interest account showing both interest income and interest expense. For illustration a mixed interest account is shown. The debit opening item of $100 in the new section of the account represents an asset, an interest claim against outsiders, while the credit opening item of $50 represents the liability to others for interest due them but not yet paid. For the sake of accuracy and clarity, however, the better bookkeeping practice is to keep separate accounts for Interest Income and Interest Cost.

INTEREST ========== 19— | 19— June 30 (Paid) 400.00 | June 30 (Received) 500.00 (Unpaid) 50.00 | (Accrued, due us) 100.00 Profit and Loss 150.00 | ------ | 600.00 | 600.00 ====== | ====== June 30 (Accrued) 100.00 | June 30 (Unpaid) 50.00

=Summarizing the Ledger—The Profit and Loss Account.=—After all the types of adjustments have been made, the accounts in the ledger are restored to their fundamental classifications, namely, assets, liabilities, and proprietorship. There is now no intermixture of these basic elements. The proprietorship group of accounts shows both the vested proprietorship, that is, the capital at the beginning of the period, and the temporary proprietorship, that is, the increases and decreases (as indicated by the income and expense accounts) which have taken place during the current period.

At the close of the fiscal period, when the temporary proprietorship accounts have served their purpose by showing the day-to-day changes in proprietorship and the results must be summed up, these accounts are closed for the current period so as to keep the records separate from those of the next period. For the purpose of summarizing the profit and loss group of accounts, an _account_ called Profit and Loss is opened in the ledger and to it the balances of all temporary proprietorship accounts are transferred.

The Profit and Loss _account_ in the ledger must not be confused with the formal _statement_ of profit and loss, made up outside the ledger just as is the balance sheet. On the credit side of Profit and Loss will appear all credit or income account balances, and on the debit side will appear all debit or expense account balances. Accordingly, if the balance of the Profit and Loss account is a credit balance, it shows a net profit for the period; if a debit balance, it shows a net loss for the period.

The net profit or net loss shown by the Profit and Loss account represents either an increase or decrease in proprietorship, and as such is transferred to the proprietor’s personal account. As explained in Chapter XII, this account usually shows his drawings during the period against these profits as they were assumed to be accruing. The personal account thus indicates whether the amount which he has drawn out is larger or smaller than the net profits as determined by the Profit and Loss account. If his profits are larger than his drawings, his capital has been increased by the amount of the credit balance in his personal account and the transfer of this balance to the credit side of his capital account will then show the total net worth of the business. If his drawings are larger than the profits, there is a decrease in capital, as shown by the debit balance of his personal account, and the transfer of this balance to the debit side of the capital account reduces the former capital amount.

The summarization of results at the close of a period is called “closing the ledger.” The procedure consists, first, in a transfer, i.e., in a closing out, of all the temporary proprietorship accounts to the Profit and Loss account; second, in the transfer of the balance of this account to the owner’s personal account; and third, in the transfer of the balance of the personal account to the owner’s capital account. After all temporary proprietorship accounts, the Profit and Loss account, and the owner’s personal account have been closed, the only accounts remaining open on the ledger are those showing either assets, liabilities, or capital. A formal statement of the balances of these accounts constitutes the balance sheet. The accounts through which the income and expense records of the business are closed, summarized, and transferred to the vested proprietorship account, are shown below, with typical entries:

PROFIT AND LOSS ========== 19— | 19— June 30 | June 30 Purchases (Cost | Sales (Net income of Goods Sold) 15,000.00 | from sales) 30,000.00 Sales Salaries 5,000.00 | Delivery Expense 500.00 | Office Salaries 2,400.00 | Supplies, Postage, | etc. 200.00 | Insurance 150.00 | Bad Debts 500.00 | Interest 150.00 | Depreciation 200.00 | John Doe, Personal | (Balance) 5,900.00 | --------- | --------- 30,000.00 | 30,000.00 ========= | =========

JOHN DOE, PERSONAL ========== 19— | 19— Jan. 5 Cash 300.00 | June 30 Profit and Loss Feb. 10 ” 250.00 | (Net profit) 5,900.00 Mar. 3 ” 150.00 | Apr. 1 ” 200.00 | May 10 ” 300.00 | June 3 ” 250.00 | 30 John Doe, Capital | (Balance) 4,450.00 | -------- | -------- 5,900.00 | 5,900.00 ======== | ========

JOHN DOE, CAPITAL ========== | 19— | Jan. 1 75,000.00 | June 30 John Doe, | Personal | (Net increase | in proprietorship) 4,450.00

CHAPTER XVI

SOURCES OF DATA FOR THE LEDGER

=Insufficiency of the Ledger Record.=—In an earlier chapter a business transaction was defined as an exchange of values, and the ledger as the book in which transactions are grouped under predetermined titles or names. Thus, all transactions relating to machinery are grouped under the title “Machinery”; those relating to cash under the title of “Cash”; those to purchases under the name “Purchases”; etc. Even in a small business the ledger may contain a large number of accounts, all necessary to give a clear-cut presentation of the volume and significance of business transactions.

The ledger record presents an analysis of transactions into their component elements, each transaction being classified and recorded, usually, in at least two ledger accounts, and frequently in more. Consequently, in order to learn the nature of a given transaction, to see it in its entirety, it may be necessary to refer to a number of separate ledger accounts. This process, even if the ledger is small, is not always easy; and when the ledger contains a large number of accounts, it becomes practically impossible. Accordingly, another kind of record is needed.

=The Book of First Record.=—This other record shows in one place the transaction in its entirety; it gives a complete statement of the conditions and all other data relating to the transaction. It also shows the fundamental analysis of the transaction into its debit and credit elements under appropriate titles. It is called the original or first record. Usually it is not the very first record made of the transaction but it is the first record made in the books of account. The book in which this record is kept is called the “Journal.” The record as kept in the ledger is a secondary record based on the original or first record in the journal. Because of its secondary nature, courts will not accept the ledger as evidence without verification.

=Posting to the Ledger.=—The act of transferring the original entry from the journal into the ledger is called posting to the ledger. In order not to lose sight of the original record in the journal it is important that the ledger entry show by letter and number the book and page where the original entry can be found. This index is entered in what is called the reference column of the ledger account, which is just to the left of the money column. In this manner every entry in a ledger account has a reference to the original entry pertaining thereto.

=The Journal.=—A journal may be defined as a diary or log in which the happenings or transactions of a business are recorded in chronological order; that is, consecutively day by day as they arise. Formerly it was sometimes called a day-book or blotter. As usually operated, however, the day-book or blotter contained a rough record giving all the essential data relating to each transaction without regard to accounting terminology, i.e., without regard to the formulation of the debit and credit of each transaction. The day-book entry was a sort of memorandum from which a formal record was made in the journal. This day-book or blotter, though still in use in some places, has very largely been discarded and only the formal journal is used. This latter was originally a single book but in modern accounting practice it has become separated into many special journals.

=Characteristics of the Journal.=—1. Being of the nature of a diary, the journal shows each day’s transactions in consecutive order with little regard to grouping. The first characteristic, therefore, of the journal is that it is a book of chronological entry, a record of each transaction just as it took place, with the entries made according to the dates of the transactions.

2. Another characteristic of the journal entry is that it is an analytical and classifying record. Before the entry is made, the transaction is analyzed into its two elements of debit and credit, determined according to the effect the transaction has in increasing

and decreasing assets, liabilities, or proprietorship. The account titles used in the journal are the same as those used in the ledger and are selected on the basis of a detailed subclassification of the three fundamental groups of accounts. The degree of detail in classification depends on the desired minuteness of the information required. The guiding principle in giving these titles is to use such names as will tell truthfully and accurately what kind of information is recorded under each head. A journal entry is therefore an analytical record as to debit and credit, which classifies the different elements of the transaction under such titles as will later be used in the ledger.

3. A final and a very essential characteristic of the journal is that every entry should carry in addition to account titles, with their debit and credit amounts, a brief but complete summary of all the conditions and data relating to the transaction, so that, if referred to in the future, the journal record will call to mind the essentials of the entire transaction.

Because of these three characteristics, and particularly the last two, the journal record is of prime importance.

=Equilibrium of the Journal Entry; Compound Entries.=—As explained in a preceding chapter, the debit and credit elements of all transactions must be equal in amount. Since the journal entry is an analysis of the transaction, it must obviously show equal amounts in the debit and credit columns. In case the analysis and classification require an entry consisting of more than one debit and one credit item, the total of the several debit items must equal the total of the several credit items. Such an entry is called a compound journal entry.

=Standard Form of Journal.=—The standard form of journal provides spaces for the following information: date, classification as to debit and credit, ledger index column, money columns to show both the debit and credit amounts, and full record of the essentials of the transaction. The following form illustrates a complete journal entry:

========== 19— | | | | Jan.| 10 | Notes Receivable | 10 | 1,000.00 | | | James Jackson | 14 | | 1,000.00 | | 60-day note, payable at | | | | First National Bank, | | | | Perryville, Maryland, | | | | with interest at 6% per | | | | annum. Due March 10, 19— | | |

Form 6. Standard Form of Journal

The date is sometimes shown in the middle of the first blank line; but it is better to place it at the extreme left. The account titles are placed on separate lines unencumbered with other data, because they are of first importance in posting. The name of the debit account is shown on the extreme left of the explanation column, with a uniform margin to the right for the credit account. The debit and credit amounts are placed in the left and right money columns respectively. Data giving full explanation of the entry are shown directly below the classified debit and credit entry, slightly to the right of the margin of the credit account title, and a uniform margin is maintained down the page. The column to the left of the money columns shows the ledger pages to which the entry is posted. The entry is read thus: Notes Receivable, debit; James Jackson, credit, $1,000.00.

CHAPTER XVII

THE SUBDIVISION OF THE JOURNAL

=Inadequacy of the Old Journal.=—As explained in the previous chapter, every business transaction was formerly entered in the journal. This necessitated the making of a formal debit and credit entry for every item, many of which were of the same kind. As the object of every business is to sell something, during any business day a large number of sales, in consequence, had to be analyzed, classified, and entered separately. The entry in each case was a credit to Sales, and either a debit to the customer if the sale was “on time,” or a debit to Cash if the sale was for cash. It was soon perceived that instead of making a separate entry for each sale, one entry could be used for bringing into the books all the sales for a given day. This was accomplished by carrying a memorandum of the individual transactions until the close of the day when a formal summary or compound entry was made in the journal. Such a summary or compound journal entry is illustrated below:

A. Jackson 175.00 D. Hayes 25.00 J. M. Marshall 132.50 T. P. Pollard 79.40 I. M. Cranston 93.20 M. V. Johnson 17.15 Sales 522.25 To record the day’s sales.

The memorandum of each sale was made in a blotter to record the quantities and kind of goods sold but such entry formed no part of the double-entry record, being merely the source of information for the formal summary entry.

=The Special Journal a Labor-Saving Device.=—This use of the journal can also be made in connection with other transactions, with similar great saving of labor. Throughout the day in every business there is a large number of cash transactions—receipts and disbursements—which require a debit and credit record. Also purchases of merchandise, although not numerous for any particular day, comprise a large number of entries during the course of a month or year. To save the labor of so many entries, the original journal is divided into separate books known as special journals, each containing the original entries for a particular group of similar transactions, the number of books corresponding to the number of groups into which the various transactions are divided.

For instance, where the policy of the business is to encourage the settlement of outstanding customers' accounts by notes, the use of a notes receivable book or journal effects a very appreciable saving of labor. Through the use of such a book, limited to a record of nothing but notes receivable, it is unnecessary to write each time a note is received, a complete journal entry as follows:

Notes Receivable 1,500.00 James Jackson 1,500.00

Instead, the entry of Jackson's name in the notes receivable journal is in itself evidence of a debit to Notes Receivable account. Thus only the credit side of the entry need be shown, with appropriate explanation and detail, the formal debit being suppressed. When, however, the books are closed at the end of each regular period, the total of all these entries in the notes receivable journal is formally labeled "Notes Receivable, Dr." and posted to the debit of the Notes Receivable account. This procedure brings on the ledger one debit entry for the transactions of the entire month. The corresponding credits have been posted in detail day by day from their journal record.

So also, when it is the practice of the business to issue many of its own notes either in payment of purchases or for discount purposes, a "Notes Payable Journal" may be used. The method of handling this book is similar to that of handling the notes receivable journal as described above. A similar procedure is followed in the case of sales, purchase, and cash transactions referred to above. The method of handling these four groups of transactions will be explained in detail in the chapters which follow.

=Basis of Subdivisions.=—The basis for dividing the one general journal into special journals is the relative frequency with which transactions of a similar nature occur. It would evidently be of no utility to create a special journal if the number of transactions to be recorded in it was small, as the saving in the labor of making the entries would be more than offset by the trouble of using an extra book.

=Customary Subdivisions.=—The special journals most frequently met with are those for purchases, sales, and cash. The Purchase Journal contains the original entry of purchases, the Sales Journal the original entry of sales, and the Cash Journals the original entry of cash transactions. All _other_ original entries are made in the general journal. For the sake of brevity, the general journal is usually designated by the single term "Journal."

It should be thoroughly understood that no matter how many special divisions of the journal may be in use, such books combined with the general journal comprise the _journal_ record of transactions. None of them is merely a memorandum record to be summarized and to be formally recorded later. The record made in each is formal, although abbreviated, and each must be posted completely, both debit and credit, in order to secure in the ledger a full record of all business transactions.

A brief explanation will be given in following chapters of the more simple forms of special journals.

CHAPTER XVIII

THE PURCHASE AND THE SALES JOURNALS

=Types of Purchase Journal.=—For recording purchases of stock-in-trade, a separate special journal called "Purchase Journal" is used. Sometimes this special journal takes the form of what is called an "Invoice Book," explanation of which is given in a later chapter. The purchase journal is sometimes used to record all sorts of purchases, as for example, purchases of store and office supplies, of advertising and printing, and even of services such as labor, and of uses, such as the use of a building. Such use of the journal is more commonly made by manufacturing concerns than by mercantile houses and the journal is then known as a "Voucher" or "Accounts Payable Register," which is explained in Volume II. The present discussion is limited to the purchase journal as a record of purchases of stock-in-trade by a mercantile firm.

=Analysis of the Purchase Transaction.=—The debit and credit analysis of a transaction covering a purchase of stock-in-trade may result in either one of two groups of entries: (1) if the transaction is on credit, a debit to Purchases and a credit to either a personal

account payable or to Notes Payable account; or (2) if the transaction is for cash, a debit to Purchases and a credit to Cash. Whether the purchase is on open account, on a note, or for cash, it is often desirable to keep the accounts in such a way as not only to indicate the vendor in each instance, but also to show the volume of business done with each creditor. This is accomplished when the purchase is for cash or for a note, by opening an account with the creditor in much the same way as when it is on open account.

Thus every purchase transaction is first recorded as follows:

(1) Purchases Vendor

If the purchase is a cash purchase, the liability to the vendor is immediately canceled by the entry:

(2) Vendor Cash

The vendor's account is canceled by being credited and then immediately debited with the same amount. This leaves on the books as the net result of these two entries a debit to Purchases and a credit to Cash. This record of the transaction is seen therefore to agree with the analysis of the cash purchase transaction as previously explained.

Instead of opening individual accounts with each vendor, in the case of cash purchases, the same result is sometimes accomplished by the use of one account called "Sundry Cash Creditors." To it all such cash purchase transactions are posted both from purchase journal and cash book. This method records the combined liability to all vendors in one account. It does not, however, show the volume of business done with each creditor.

If the purchase is on a note, the liability to the vendor as set up in entry (1) is immediately canceled by the entry:

(3) Vendor Notes Payable

The net result of these entries, (1) and (3), is seen to be a debit to Purchases and a credit to Notes Payable—a record which corresponds with the original analysis of the transaction.

Since a purchase on open account also results in a debit to Purchases and a credit to Vendor, it is seen that all types of purchase transactions may be recorded as a debit to Purchases and a credit to Vendor. Accordingly, in making the current record in the purchase journal, the debit element may be omitted, since it is always the same, and only the credit element, which differs in each case, may be set up. Periodically, usually at the close of each month, the debit element is formally set up for the total amount of purchases for the period. (See Form 7, a typical purchase journal.) Thus the one formal debit is made to offset the numerous credits set up during the month. The purchase journal is thus seen to be as fully a debit and credit journal as the general journal, even though in making its day-to-day record the debit element is, for the sake of economy in labor, omitted.

Other methods of handling the cash and note purchase transaction are explained on page 152.

=Form and Method of Using the Purchase Journal.=—The simplest form of purchase journal is the same as that of the standard journal. It provides space for date, classification, explanation, ledger index, and two money columns. In the purchase journal the money columns do not have "debit" and "credit" significance, but the first may be used for the detailed extensions and the other column for the total of each purchase. Assume, for the sake of illustration, that the following purchases have been made:

January 10, 19—, from S. C. Bontell, terms 2/10, n/30: 5 tons hay @ $12.00 100 bu. corn @ .90 1,000 bu. wheat @ 1.10 30 tons coal @ 4.50 January 18, 19—, from P. V. Stewart, terms 2/10, n/30: 50 tons hay @ $12.00 130 tons coal @ 5.00 January 22, 19—, from I. S. Van Doren, terms n/30: 100 tons coal @ $ 4.50 600 bu. wheat @ 1.00 January 28, 19—, from S. M. Sax, terms 2/10, n/60: 510 bu. wheat @ $ 1.10

The purchase journal record, using the simple form of the standard journal, would be as follows:

[Illustration: Form 7. Purchase Journal]

Usually, however, a form of purchase journal is used which is better adapted to its purpose. In this, instead of giving the detailed explanation, the file number of the original invoice is written as part of the explanatory matter, which usually comprises only this file reference and the terms of the purchase. This modern type of journal is illustrated below.

[Illustration: Form 8. Modern Type of Purchase Journal]

=Posting the Purchase Journal.=—In posting the purchase journal, it is customary to post daily the credits to the various vendor accounts as they are entered from day-to-day in the journal. In this way the true status of the amounts due these creditors may be known at any time by reference to their ledger accounts. The offsetting debit to Purchases account is posted only at the end of the month when the purchase journal is summarized. In the meantime the ledger is out of equilibrium because only the credit side of all purchase transactions has been entered in the ledger. This equilibrium is restored, however, by the monthly posting of the debit to Purchases account which must always be made before the trial balance is taken.

An essential part of posting is the cross-indexing of the two records, the journal and the ledger. The cross-reference column in the ledger account must show the initial and page of the journal from which each item is posted. For example, “P. 10” in the ledger would refer to purchase journal, page 10. Likewise the ledger folio (L.F. or Folio) column in the journal must show the ledger page of the account to which the item has been posted. Thus, in the illustration, Stewart’s account is on page 125 of the ledger, where he is credited with $1,250. At the end of the month the purchase journal is footed and the summary entry, “Purchases, Dr.,” is made and posted to the debit of Purchases account on page 10 of the ledger. This one debit item in the ledger brings about the equilibrium with the individual credits posted to the various personal accounts payable. The purchase journal is then ruled off and thus made ready for new entries for the next month immediately below the rulings.

=Departmental Analysis of Purchases.=—When it is desirable to separate various classes of purchases so as to determine the profit from each class, particularly in a business which is departmentized, a purchase journal similar to the one shown in Form 9, which has an additional money column for each class of purchases, may be used. If there are three classes or departments, at least four money columns are required. The entry in the first column is for the total amount of the purchases; and the entries in the other three columns, which are headed each with the name of a class or department, are for the total purchases of the respective departments. It is evident that the totals of these three columns, added together, must at all times be equal to the total of the first column. This affords a check on the accuracy of the distribution. At posting time a separate account is opened in the ledger corresponding to each of these classes of purchases. The summary entry in a purchase journal of this kind appears as follows:

[Illustration: Form 9. Departmental Purchase Journal]

Purchases are classified under separate titles, usually because it is desirable to make a corresponding classification of sales and so secure departmental results of operation.

=The Sales Journal—Analysis of the Sales Transaction and Method of Record.=—For recording sales of stock-in-trade, a record called the “Sales Journal” is used, which is limited to sales of merchandise. A sales journal practically identical in form with the purchase journal serves this purpose. Its columns are ruled and current entries are made in it just as in the purchase journal.

The analysis of a sales transaction shows a credit to Sales and a debit either to Customer, Cash, or Notes Receivable, according as the sale is “on time,” for cash, or against a note given by the customer. In handling cash sales and sales against the customer’s note, the same procedure is followed as with purchases, i.e., accounts with customers are opened for _all_ sales, and are immediately closed off if cash or a note is received at the time of the sale.

The current entry in the sales journal shows only the debit item, i.e., the charge to the customer’s account, the credit to Sales account being omitted. At the end of the month, however, the total of all sales is indicated by the summary entry and is posted to the credit side of the Sales account in the ledger. In order to keep the customers’ accounts up to date, the current entries in the sales book, giving the names of the customers and the amounts, are transferred to the customers’ accounts in the ledger at the close of each day.

=Summarization of the Sales Journal.=—At the end of the month or other posting time, the sales journal is totaled and the summary entry is made and posted, thus bringing the ledger into equilibrium by one credit to Sales account for the sum of all the debits to customers accounts made day by day. The closing rulings are then made. The treatment is exactly similar to the work in the purchase journal, the only difference being in the summary entry, where “Sales, Cr.” takes the place of “Purchases, Dr.” If it is desired to keep the sales record by departments or classes of commodities, analysis columns will effect the distribution. In this type of sales record the closing summary indicates the various departmental or other sales accounts to which postings are to be made, instead of the one general account, Sales, precisely as the departmental purchase journal (Form 9) indicates the departmental or other purchases accounts to which purchase entries are to be posted.

=Goods Sold to the Owner.=—The treatment of goods sold to the owner of the business requires brief consideration. The proprietor usually withdraws goods at cost price. There is thus no element of profit in the transaction as there is in other sales. A strict analysis of the transaction shows that it brings about only a decrease of the asset unmixed with any element of income. Theoretically, then, such transactions should not be recorded with the regular sales, but should be shown as a credit to Purchases account. In practice, however, entering them in the sales journal is the easiest method of recording them, and since they are not usually large in volume, this method does not vitiate the total sales figure as a basis for estimating percentages of profit. This matter is discussed in detail on page 273.

CHAPTER XIX

THE CASH JOURNALS

=The Cash Book.=—For recording transactions involving cash, two journals are used. One of these records receipts and the other disbursements of cash. They are known respectively as the “Cash Receipts Journal” and the “Cash Disbursements Journal.” Instead of being separate books, however, they are usually bound together and comprise what is called the “Cash Book.” When bound together their pages alternate throughout the book. The cash receipts journal occupies the left-hand pages, i.e., the even numbered pages—2, 4, 6, etc.—and the cash disbursements journal the right-hand pages—3, 5, 7, etc.—page 1 not being used. This method sets up the cash record, receipts and disbursements, on facing pages and the movement of cash is thus under easy and constant review.

=The Cash Receipts Journal—Analysis of a Cash Receipt.=—If $100 cash is received on account from John Doe, a customer, an analysis of the transaction shows “Cash” debit and “John Doe” credit.

Cash 100.00 John Doe 100.00

So with all receipts of cash; the “cash” element is a debit. The record of cash receipts being made in a journal devoted exclusively to receipts of cash, the “Cash, Dr.” element of the entry may be omitted and only the “credit” element need be shown; the very fact that the entry is made in the cash receipts journal is sufficient to indicate that “Cash” is a debit. The cash receipts journal (Form 10)—the left or debit side of the cash book—is operated, therefore very much like the purchase journal.

[Illustration: Form 10. Cash Book (left-hand page) (Cash Receipts Journal)]

=The Cash Disbursements Journal—Analysis of a Cash Disbursement.=—If $10 is paid for expenses of some kind, the analysis gives “Expense” debit and “Cash” credit.

Expense 10.00 Cash 10.00

So with all disbursements of cash. A separate journal being devoted exclusively to cash disbursements, the “Cash, Cr.” element of the entry may be omitted and only the debit shown. The cash disbursements journal is thus seen to be operated in the same way as the sales journal.

Thus, all left-hand pages in the cash book show receipts and all right-hand pages show disbursements. Because it is unnecessary to _write_ the debit element of cash received and the credit element of cash paid out, a great saving of labor is effected. Nevertheless, it must be remembered that the entry on either side of the cash book is essentially a journal entry, and that the missing elements—cash debit on the left page and cash credit on the right page—are supplied at the end of the period by the totals when the two journals are summarized in preparation for posting to the Cash account in the ledger.

[Illustration: Form 11. Cash Book (right-hand page) (Cash Disbursements Journal)]

=Form of the Cash Journals.=—In the cash journals, just as in all other journals, provision is made for date, account classification, explanation, ledger posting index, and money columns. In a simple form of cash book, just as in the purchase and sales journals, two money columns are usually provided, the one for detail—a day’s or week’s detail—and the other for totals. Such a form is shown in Forms 10 and 11. The student should note carefully how the cash receipts journal is summarized. The balance of cash brought forward from the previous week is entered in the second or total column so that the detail column shows only the current week’s receipts. Inasmuch as the Cash account in the ledger already shows the balance of cash at the beginning of the week, i.e., $5,000, this amount must not be included in the summary entry for the current week. In summarizing the cash receipts journal, therefore, the total only of the detail column, showing the cash received since the last summary, is set up as a “Cash, Dr.” item. In

summarizing the cash disbursements journal, since there is normally no balance carried over from the previous week, the total of the journal—representing the cash disbursed since the last summary—is set up as a “Cash, Cr.” item. This is shown as $365, the amount being posted to the credit of the ledger Cash account on page 1.

=Cash Book Taking the Place of the Cash Account.=—Because the two cash journals are set up on facing pages, the record contains essentially the same information as a detailed Cash account in the ledger. The double page record brings together both the receipts and the deductions from receipts—cash being normally a debit account. For this reason the cash book record is itself sometimes used as a ledger account and when it is so used its totals are not posted to the ledger account. The balance of the cash book must, however, be included in the trial balance of the ledger, because when so used the cash book is not only a _journal_ but a _ledger account_ as well.

When, however, the totals of both cash receipts and disbursements are posted to a Cash account in the ledger, the balance used in the trial balance is taken from the ledger account and not from the cash book, although of course the balances in both are the same.

Whichever of these two methods is used, it must always be remembered that the cash book is essentially a journal and that therefore its classifications of business transactions must be transferred to their proper accounts in the ledger.

Best accounting practice, however, requires that a Cash account be carried in the ledger so that the ledger will be a complete record of all transactions and will be independent of all other records for proof of its equilibrium.

=Posting the Cash Book.=—In posting the debit side of the cash book to the ledger, it is important to remember that the debit element of the transaction is merely indicated by the fact that the entry appears on the left-hand page of the cash book. The account name written in the Account Classification column is the credit element and must be posted to the credit of the corresponding account in the ledger. Similarly, on the right-hand side of the cash book, the cash credit element of the entry is suppressed and the named account should be posted to the debit of the corresponding ledger account.

After the posting of the individual items has been completed, the “Cash, Dr.” and the “Cash, Cr.” as shown by the summary entries must be posted to the ledger Cash account, as explained on page 143.

As stated above, each side of the cash book is, in reality, a journal in itself—a cash receipts journal and a cash disbursements journal—and it is only because these two journals are shown side by side that the cash book is sometimes made to serve the purpose of a ledger Cash account.

=Balancing and Ruling the Cash Book.=—The cash book in its simple form is balanced and ruled in the same manner as a ledger account. When the balance is brought down to the new section it is usually entered in the second or total column, thus reserving the first or detail column for the daily or weekly cash receipts, and separating these items from the balance brought down from the previous period. (See Forms 10 and 11.)

When the record is to be transferred to a new page, either the current page (double page) is balanced and ruled and only the balance is carried forward, or the current page is totaled and both debit and credit footings are carried forward as shown in Chapter XIV for the ledger cash account. The cash book is closed, ruled, and transferred as of the same date and on the same line for both sides, although usually there is room for more entries on one side or the other, which may be closed by diagonal ruling. This is done in order to keep the record of the receipts of a given period and that of the disbursements in nearly exact juxtaposition, and thereby facilitate a review of the cash movements for that period.

=The Cash Short and Over Account.=—It sometimes happens that when the cash book is balanced, the amount which ought to be on hand as shown by this balance, does not agree with the amount of cash on hand as shown by actual count. The discrepancy may be due to failure to enter some items of receipts or disbursements in the cash book, or to errors in making change; or it may be due to petty thieving by the cash clerk. If the error cannot be rectified at the time, an entry is made in the cash book, on whichever side necessary, in an amount sufficient to bring the book balance into agreement with the actual cash balance. The account to be debited or credited, as the case may be, is entitled “Cash Short and Over.” If the correct charge or credit is afterwards determined, the item or items should be transferred from Cash Short and Over to their proper accounts. Usually the Cash Short and Over account is treated as an income or expense account and closed into Profit and Loss at the close of the period. Sometimes it is treated as an asset or liability account, depending upon the nature of its contents, i.e., the amount of the discrepancy shown and its probable cause.

=The Cash Purchase and Sales Transactions.=—A standard method of handling the cash purchase transaction when it is desired to keep a record of the volume of business done with each vendor, was explained on page 140, where the purchase was shown to be “washed” or cleared through the vendor’s account. A more direct method is sometimes used.

When purchases are made for cash, a complete record of the transactions is made by the entry:

Purchases Cash

Here there is evidently a conflict of places of original record. The transaction being a purchase, record should be made in the purchase journal; and since it is also a cash transaction, record should also be made in the cash book. However, if an independent record were made in both places, a duplication of the transaction would result, since entry in either journal is a complete debit and credit record. The transaction would be entered twice in full, causing an inflation of the purchases and cash disbursements. In the purchase journal, the credit to Cash would be set up at the time of the transaction and at the time of summarization the debit to Purchases would be included in the total of the Purchases, thus completing the ledger record. In the cash book the debit to Purchases would be set up at the time of the transaction, and when the summary was made the credit to Cash would be in the Cash total. Entry in both journals would, when posted to the ledger, bring about two debits and two credits for the same transaction.

To overcome this difficulty the following methods are commonly employed:

1. The record is made complete in both journals, but the credit to Cash from the purchase journal record is not posted, because that credit will be posted from its record in the cash book. Similarly, when posting the cash disbursements journal, the debit to Purchases is _not_ posted, because that will be posted from the purchase journal. In this way original record may be made in both journals and each journal will then show by its total what it is intended to show, viz., total purchases and total cash disbursed, respectively. In the secondary record, the ledger, only half of each journal entry is set up, the debit to Purchases from the purchase journal and the credit to Cash from the cash book. This prevents the inflation mentioned above and does not destroy the equilibrium of the ledger because there is omitted, when posting from the cash book, a debit equal in amount to the credit omitted when posting the purchase journal.

2. The method explained on page 140 is used with this variation: The record in each journal shows the individual vendor’s account, but at posting time no vendor account is set up in the ledger, neither the credit to the vendor’s account shown in the purchase journal nor its offsetting debit shown in the cash disbursements journal being posted.

It is necessary, when making the original entries in the journals, to indicate all postings which are to be omitted, by entering a check mark, ✔, or a cross, ■, in the ledger folio column of the journal.

The purchase on a note payable, one method of recording which was explained on page 140, may also be handled more directly by either of the methods explained above for a cash purchase. In the case of the note, however, the journals used are the purchase and general journals.

Similar methods are employed, also, for handling the cash sale and the sale against a customer’s note.

=Columnar Analysis of Cash Receipts and Disbursements.=—As illustrated in the chapters on purchase and sales journals, additional money columns are often used for the purpose of analyzing the purchases and sales by departments or classes of commodities. A similar analysis of both the cash receipts and cash disbursements may aid in segregating certain classes of cash items and thus save labor in posting. Of cash receipts, two classes are usually more active than all others combined. More cash is received from cash sales and from customers on account than from any other source. Accordingly, two additional columns may be used with these headings. _All_ cash receipts must be entered in the Total, Bank, or Net Cash column, as it is variously termed, and then distributed into any special columns provided. Thus all “Cash Sales” would be extended, both in the Net Cash and in the Sales column, and all receipts from customers would be entered in the Net Cash and in the Accounts Receivable column.

In the case of cash disbursements, the number of columns depends upon the degree of analysis desired. At least two additional columns are frequently found, one for creditors and one for expenses. Where cash purchases are numerous they may be segregated, or where any particular _class_ of expense is of frequent occurrence it may be shown in a separate column. Where one ledger is used for customers, creditors, and general accounts, there is little gain in segregating customers and creditors by special columns in the cash book, except as a slight aid in posting. Where separate ledgers are used, it is important to have separate customers and creditors columns in the cash book, as will be shown later in connection with the subject of controlling

accounts. Illustration and explanation of the columnar cash book are given on pages 158 and 159.

=Cash Discounts Analyzed.=—Sales and purchase discounts are another class of transactions best handled through the cash book, although, strictly speaking, they are not cash transactions. When a customer buys goods on account, he is usually offered two bases of settlement, depending on the length of the credit term allowed. Thus, 2% off is frequently allowed if payment is made within 10 days; otherwise the full amount of the invoice must be paid. Because the vendor does not know, at the time of entry on his books, on which basis settlement will be made, he makes the charge at the full invoiced amount. If the customer takes advantage of the discount offered, he pays less than the amount at which his account stands debited, yet the vendor must credit his account for the full amount of the original charge, in order to cancel his entire claim against the customer. To illustrate, a customer buys $100 worth of merchandise, with 2% off if paid within 10 days. On the 10th day he pays $98. The sale entry would be:

(1) Customer 100.00 Sales 100.00

The cash entry would be:

(2) Cash 98.00 Customer 98.00

But this does not cancel in full the $100 claim against the customer. The $2 discount, an allowance for early payment, is an expense to the business and must be charged to an expense account called “Sales Discount,” and the customer must be given $2 additional credit, the entry being:

(3) Sales Discount 2.00 Customer 2.00

Entries (2) and (3) are usually combined in one as follows:

(4) Cash 98.00 Sales Discount 2.00 Customer 100.00

Entry (4) is known as a compound entry. If entry (2), which is the part involving cash, is made in the cash book, then the additional entry (3) will have to be made in the general journal because there is no cash element in it and theoretically nothing but cash should be recorded in the cash book.

=Handling Discounts in the Cash Book.=—This recording in two separate places of what is really one transaction has led to the introduction into the cash book of a non-cash column in order to bring the whole transaction together. The customer’s payment being a receipt of cash, the record must be made on the debit side of the cash book. Reference to entry (4) shows that Sales Discount is also a “debit.” Where the cash book is limited strictly to cash transactions, the cash debit record shows only the “credit” element of the entry. The use of a Sales Discount column on the debit side of the cash book for the sake of making a complete record in one place thus introduces an extraneous element, one out of harmony with the other entries made there. In posting, great care must be exercised not to transfer Sales Discount to the credit side of its ledger account but to the _debit_ side.

=Alternative Treatment for Cash Discounts.=—Sometimes another treatment of sales and purchase discounts in the cash book is met with. This treatment for sales discount is based on the fiction that the full amount of the original charge is received from the customer and that an immediate return is made to him of the amount of the discount. To use the example cited on page 155, the entries would be:

Cash 100.00 Customer 100.00

showing receipt of the full invoice price and therefore full credit to the customer; and

Sales Discount 2.00 Cash 2.00

representing the fictitious payment in cash of a discount on sales of $2. In the cash book these two entries would appear as follows:

Dr. CASH CASH Cr. ========== ========== Customer 100.00 Sales Discount 2.00

This method of entering discount on sales would have the same ultimate result in the ledger as the columnar method, but the objection to it is that it makes the cash book show more money received and paid out than has actually been the case, thus making it difficult to check the cash against the bank record of deposits and checks. Another objection is that by this method the cash book does not show in one place a full record of the transaction, since the two items are shown on opposite sides of the cash book. Moreover, these items are seldom on contiguous lines because one side of the cash book is often considerably “ahead” of the

other. Cash discount on purchases is sometimes handled by a similar unsatisfactory method.

The first method shown, requiring special discount and net columns on either side of the cash book, is the approved method.

=Illustration and Explanation of the Analytic Cash Receipts Journal.=—An example of a columnar cash book debit side is given (Form 12) for the purpose of illustrating some points in the discussion. It should be understood that there is little uniformity in the columnization of cash books. The needs of the business govern the ruling suitable in any given case. The illustration shown is therefore not presented as a standard form but is given only for the purpose of illustrating the method of analysis of cash receipts.

[Illustration: †This balance is taken from the credit side of the cash record appearing on page 159.

Form 12. Columnar Cash Book—Debit Side]

[Illustration: Form 13. Columnar Cash Book—Credit Side]

As shown in the illustration, all _actual cash receipts_ are entered in the Net Cash column, which in connection with the Sales Discount column comprises the total corresponding to the Total column of the other subsidiary journals when an analytic record is made. All items received from customers are entered in the Accounts Receivable column; but it is important to note that the _amount_ entered in that column is not the _actual cash receipt_ but the _full amount_ of the original charge to the customer. Sales discount, if any, is entered in the Sales Discount column, and the _net_ amount, the actual cash received from the customer, is the amount appearing in the Net Cash column. Cash sales are entered in the Cash Sales column and also in the Net Cash column. All other kinds of receipts are extended to the Sundry column.

In the ledger folio column, checks are placed for the individual cash sales entries, the posting usually being made from the summary in the sales journal, as explained a little later, or from the total of the Cash Sales column in the cash book if the other method is not employed. In the summary entry of the illustration, it is assumed that a Cash account is kept in the ledger. Hence “Cash, Dr.” is shown posted to ledger Cash account on page 4; and the total Sales Discount, also _debit_, on page 20. The student should note the method of showing the amount of cash received during the current week, this amount comprising the “Cash, Dr.” posting to the ledger Cash account. Of course, the itemized credits, except the cash sales, are posted to their respective accounts, as indicated in the ledger folio column.

The use of the Sundry column for extension of the miscellaneous items makes proof of the distribution possible. The sum of “Net Cash” and “Sales Discounts”—both debit items—must equal the sum of all the other columns.

=Handling Columnar Analysis of Cash Sales.=—If all sales, both cash and “on time,” are entered in the sales journal, the totals of these two classes of sales are posted to the ledger Sales account from the summary in the sales journal. In this case there is no need of a separate Cash Sales column in the cash book, because such a column would simply duplicate the Cash Sales entry in the sales journal. Needless to say, cash sales always appear in the Net Cash column of the cash book, because they are cash receipts, but the “Ledger Folio” must be checked.

Sometimes two sales accounts are kept in the ledger, one for cash and the other for “time” sales. Here, also, if there is a Cash Sales column in the sales journal, no posting of cash sales from the cash book is necessary. On the other hand, if cash sales are omitted from the sales journal, then the cash book should provide for a Cash Sales column and the posting must be made from the total of this column in the cash book.

=Illustration and Explanation of the Analytic Cash Disbursements Journal.=—The cash disbursements columnar record corresponding to the cash receipts shown above, would appear as in Form 13. As with cash receipts, the illustration is not presented as a standardized form but merely for the purpose of showing the method of analysis. Postings are made or omitted, and the same considerations govern the making and posting of the summary entry, as in cash receipts. Being few in number, cash purchases are not shown in a separate column. The treatment of discounts received on purchases is exactly parallel to that of sales discount.

Since all net cash appears in Net Cash column on either side of the cash book, the cash balance is found by taking the difference between these two columns. The two sides must be ruled up and closed on corresponding lines and as of the same date.

CHAPTER XX

=Matter Left for Record in the Journal.=—By the use of a cash receipts, a cash disbursements, a purchase, and a sales journal, four principal classes of transactions are taken out of the old-time journal and entered in separate books of record. If transactions of any other class are numerous enough to justify the use of a separate book of record, such a record should be set up. Although the number of subsidiary journals, each recording one kind of transaction, may become very large, nevertheless in practically all cases it is necessary to retain the general journal (often referred to simply as “the Journal”), in order to take care of such miscellaneous items as are not recorded in any of the special journals.

The standard form of journal was illustrated in Chapter XVI, where it was stated that a journal must provide space for date of entry, account classification, ledger folio index, debit and credit money columns, and explanation. As an explanation of the form, method of use, proper observance of margins, etc., was made there, it need not be repeated here.

=Kinds of Transactions Recorded in the Journal.=—When the number of subsidiary journals used is limited to the cash receipts, cash disbursements, purchase, and sales journals, as is frequently the case, all items not affecting these four books should be entered in “the Journal”; i.e., transactions involving notes receivable and notes payable; adjustments with customers and creditors resulting from return of goods or claims and allowances thereon; and all formal opening, adjusting, and closing entries. Furthermore, there is usually a number of other transactions, which because of their special and unusual nature cannot be grouped with the items of the special journals and must therefore be entered in the general journal.

=Journal Explanations.=—When these various classes of transactions are entered in the Journal, a very complete explanation should be given the entry. In fact, all entries covering settlements and adjustments with outsiders and within the business itself are of primary importance and the explanation should be so carefully worded as to make the intent of the entry plain and intelligible.

=Closing and Posting the Journal.=—No particular formality attaches to the closing and posting of the ordinary standard form of journal. There is no summary entry, no totaling, and there are no rulings to be made. Ordinary care must be exercised to see that the debits and credits are correctly posted. Since the entry in the Journal is given in its complete form and no debits or credits are suppressed, as is the case in the special journals, posting is not difficult.

=The Analytic Journal with Divided Columns.=—One form of the journal has its debit and credit columns separated, the debit money column appearing at the extreme left of the page, followed in order across the page by columns for date, account classification, ledger folio, and credit money amount. This kind of journal is called a divided or split-column journal and is ordinarily used to collect the totals to be posted to controlling accounts and thus to secure control over subsidiary ledgers. This matter will be fully discussed in later chapters. When the journal is so used it is provided with additional debit and credit analysis columns on each side according to the subsidiary ledgers employed. A divided-column journal with three debit and three credit columns is shown in Form 14. There is always a general money column on each side, the other columns depending on the kind of analysis required by the business.

[Illustration: Form 14. Divided Column Journal]

In the illustration referred to, an Accounts Receivable and an Accounts Payable column are provided. It is obvious that the Accounts Receivable column should usually appear on the credit side and the Accounts Payable column on the debit side; although in some cases provision is also made for an Accounts Receivable column on the debit and an Accounts Payable column on the credit side. The account of S. J. White, a customer, which is paid by his note, should be credited for the amount of $510.20 and consequently the item is extended to the Accounts Receivable column.

=Illustrations—Opening Entries.=—Illustration will be given of a few typical transactions requiring journal entry. The standard two-column journal will be used.

For the purpose of illustrating opening entries, assume the following data:

On September 30, 19—, Jack Gibson started in business, with the following assets and liabilities: Cash $3,500; Notes Receivable $800; Merchandise $4,000; Furniture and Fixtures $450; Accounts Receivable $2,100; Accounts Payable $1,500; and Notes Payable $1,200.

An analysis of this transaction shows that no part of it belongs to either the purchase or sales journals. The part relating to cash is entered in the cash receipts journal. However, in order to show the complete investment in one place, the entire transaction

including the cash part, is entered in the Journal and posted from there, with the exception of the cash item. The reason for this exception is that the cash investment is also entered in the cash book and will find its way to the ledger Cash account through the total cash debits at the end of the period. Because of this the cash item in the _Journal_ should be checked and not posted to the Cash account in the ledger.

Likewise, the investment item in the _cash book_, showing a credit of $3,500 to Jack Gibson, Capital account, should be checked and not posted to the credit of his account in the ledger because this item forms a part of the total investment of $8,150 posted to his credit from the Journal entry.

If the student has difficulty in determining the debits and credits of entries of this kind, it may be helpful to set up the data informally first, in the form of a balance sheet. Using this as a _guide_, he should then make his journal entry, debiting the asset items and crediting the liability and net worth items.

[Illustration]

[Illustration: Form 15. Opening Entries on Books]

The above entries bring the transaction completely on the books of original entry and show the ledger folios to which the various items are posted. Notice the check in the L. F. column in the Journal opposite “Cash” and in the cash book opposite “Jack Gibson, Capital,” which is inserted to prevent posting the same item twice.

For opening entries full explanation and details, where necessary, should be given in the Journal, covering lease agreements and contracts entered into when commencing business, and other similar data. It should be noted that with _opening_ entries it is customary for the explanation to precede the formal showing of debits and credits, rather than to follow it as in the case of all other journal entries.

=Adjusting and Closing Entries.=—Other typical entries to be illustrated are those made at the close of a fiscal period: (1) to adjust the books in accordance with certain data that were not obtainable before; (2) to transfer all temporary proprietorship accounts to the summary account, Profit and Loss; and (3) to transfer the net profit, i.e., the balance of the Profit and Loss account, to the proprietor’s personal account, and the balance of this latter account to the proprietor’s capital account.

The debits and credits of the entries necessary to effect the record of the data and transfers mentioned, can be determined as in the operations with ledger accounts previously shown.

The following data relate to Jack Gibson’s business and are given to illustrate the three classes of entries mentioned above:

During the year, sales amounted to $33,000; purchases to $25,000; selling expenses to $3,500; and general administrative expenses to $2,025. It is estimated that of outstanding accounts $350 are uncollectible; that furniture and fixtures have depreciated in value $45. Merchandise inventory shows $5,000 on hand. Gibson drew $1,000 during the year.

The first thing necessary is to make the adjustments on account of depreciation, bad debts estimate, and present inventory. These adjustment entries are made in the Journal as follows:

19— Sept. 30 Depreciation 20 45.00 Depreciation Reserve Furniture and Fixtures 6 45.00 To bring on the books the expense due to estimated depreciation and to effect the proper valuation of Furniture and Fixtures. Bad Debts 21 350.00 Reserve for Doubtful Accounts 3 350.00 To bring on the books the expense due to estimated loss from uncollectible accounts. Purchases 16 4,000.00 Merchandise Inventory 4 4,000.00 To transfer the goods on hand at the beginning of the year to Purchases. Merchandise Inventory 4 5,000.00 Purchases 16 5,000.00 To transfer the inventory of merchandise now on hand to Merchandise Inventory account.

The first two entries, when posted, will bring on the book valuation accounts for furniture and fixtures and accounts receivable, and will set up the expense accounts, Depreciation and Bad Debts. The third Journal entry, when posted, will transfer the goods on hand at the beginning of the year so that they can be added to the Purchases made during the year. In this connection it will be remembered that the sum of these two items, old inventory plus purchases during the year, constitutes the primary factor of “cost of goods to be accounted for.” The fourth entry shows the asset Merchandise now on hand and, by its credit to Purchases, effects a subtraction from Purchases, so that the balance of Purchases, $24,000, shows the “cost of goods sold.”

The books are now adjusted and ready for summarization by means of the Profit and Loss account. The following Journal entries, transferring all temporary proprietorship items to the Profit and Loss account, will effect the closing operation:

19— Sept. 30 Sales 15 33,000.00 Profit and Loss 14 33,000.00 To close. Profit and Loss 14 29,920.00 Purchases 16 24,000.00 Selling Expense 18 3,500.00 General Administrative Expense 19 2,025.00 Bad Debts 21 350.00 Depreciation 20 45.00 To close. 29,920.00 Profit and Loss 14 3,080.00 Jack Gibson, Personal 11 3,080.00 To transfer net profit for the year. Jack Gibson, Personal 11 2,080.00 Jack Gibson, Capital 10 2,080.00 To transfer the portion of the year's net gain left in the business.

The first entry transfers the sales income to the credit of Profit and Loss. The second entry charges the Profit and Loss account with the cost of goods sold and all other expenses for the fiscal year. When the posting has been completed up to this point, the balance of the Profit and Loss account shows a net gain of $3,080, which, belonging to the proprietor, is transferred to the credit of his personal account, as shown by the third entry. He has drawn against prospective profits to the extent of $1,000, leaving $2,080 of profit remaining in the business as an addition to his permanent investment. Hence, this balance is transferred to Gibson's capital account by the fourth entry.

=Objection to the Direct Ledger Method of Adjusting and Closing the Books.=—These adjustment and closing transactions are sometimes recorded directly in the ledger without first entering them in the Journal. Usually this is not satisfactory because it does not show in one place a complete record of all the adjustment and closing summaries necessary at the close of a fiscal period. These summaries are matters of sufficient concern to the business to warrant their entry in the Journal where full and complete explanations can be given. The more complex entries often needed to adjust and close the books of a business where numerous income and expense accounts are kept, follow the same general principles as those discussed above. Adjusting and closing entries are given fuller treatment in Chapters XXVII and XXVIII.

The two illustrations given above cover certain types of Journal entries which are of a more difficult character than the customary purchases, sales, and cash entries. A keen analysis is often required to formulate the debits and credits of these entries, and the explanatory matter should be worded with sufficient care to render them intelligible even after the immediate interest in them has been lost and their recording ink has become "cold."

=Entries Affecting Several Journals.=—Transactions sometimes require entry in two or more journals. A basic principle of bookkeeping is that there should be no duplication of entry in the various journals. A transaction that can be completely entered in one journal should not be entered in any other journal. The one exception to this principle is made in the case of an investment transaction, as explained on page 171. Sometimes, however, there may be a conflict of places of entry, as in the case of cash purchases and sales, already explained, where entry is made in both journals in order to allow each journal to perform its proper function. Two examples will illustrate the proper method of handling such transactions.

PROBLEM 1. Assume that a customer, James Robbins, buys $1,000 worth of goods, paying $300 cash, giving a note for $500 and leaving the balance on open account.

The following entries should be made:

(a) James Robbins 1,000.00 Sales 1,000.00 (b) Cash 300.00 James Robbins 300.00 (c) Notes Receivable 500.00 James Robbins 500.00

It will be noted that three journals are involved. Entry (a) is recorded in the sales journal; entry (b) in the cash receipts journal; and entry (c) in the general journal. The net effect of the three entries is:

James Robbins 200.00 Cash 300.00 Notes Receivable 500.00 Sales 1,000.00

Because special journals are used, however, the transaction must be split up as indicated above.

PROBLEM 2. Assume that the business purchases from the Investment Trust Co. a building site valued at $5,000, paying for it $2,000 cash and a note for the balance supported by a mortgage.

Two methods are used to record this transaction, neither having any special advantage over the other.

FIRST METHOD: (a) Land 2,000.00 Cash 2,000.00 (b) Land 3,000.00 Mortgage Notes Payable 3,000.00

Entry (a) is made in the cash disbursements journal, and entry (b) in the general journal. This method of entry requires the splitting of the land value into two parts and breaks up what is really a unit transaction by recording it in two places. Because of this, the general journal portion of the entry should be followed by a very full explanation of the _entire_ transaction, in which reference to

the partial cash payment should be made. In the cash disbursements journal the only explanation needed will be a reference to the general journal entry.

SECOND METHOD.—To bring about a complete record of the land item in one place, the following method is often used:

(a) Land 5,000.00 Investment Trust Co. 5,000.00 (b) Investment Trust Co. 2,000.00 Cash 2,000.00 (c) Investment Trust Co. 3,000.00 Mortgage Notes Payable 3,000.00

Entry (a) in the general journal sets up an account with the vendor, the Investment Trust Co. Entry (b) in the cash disbursements journal and entry (c) in the general journal show the cancellation of the liability to the vendor through the payment of cash in the one case and the giving of a mortgage in the other. The net effect of the entries is:

Land 5,000.00 Cash 2,000.00 Mortgage Notes Payable 3,000.00

It will be noted that this method sets up a formal account with the vendor—a desirable thing—but that it requires one more entry than the first method.

The other entries recorded in the Journal ought not to give the student any particular difficulty.

CHAPTER XXI

BUSINESS PAPERS—NEGOTIABLE INSTRUMENTS

The books of original entry, i.e., the journals, having been explained, the attention of the student will be directed next to the sources of information on which the entries in the various journals depend. Accordingly, some of the important papers and methods used in business will be discussed, after which further accounting principles and methods will be given adequate treatment.

=Use of the Note Receivable.=—The purpose of sales is the ultimate conversion of stock-in-trade into cash to provide for the payment of services and for the purchase of commodities for future sale. This conversion of stock-in-trade into money may be immediate, as when goods are sold for cash, or deferred, as when goods are sold on account. In the latter case the conversion is indirect, because the charge against the customer must be collected before conversion is complete.

Frequently the “note receivable” acts as an intermediate step in the process of converting stock-in-trade into cash. It is an instrument in which the customer formally promises to pay his debt at a fixed time in the future. The kind of claim represented by a note receivable is, legally, different from the open account claim; generally speaking, a note is considered _a better_ claim than an open account. This is because the note implies a prima facie acknowledgment of the correctness of the original charge, and in event of suit relieves the holder from proving the original items of the claim.

Accordingly, when a promissory note is received from a customer, the open account claim against him ceases to exist and a different kind of claim evidenced by his promissory note is acquired. Therefore the open account is credited to show cancellation of the original charge, and Notes Receivable is debited to show the new claim. It may be well to remark here that the same instrument which is a _note receivable_ to the vendor is a _note payable_ to the customer.

In some businesses, it is the policy to encourage customers to give notes. In such cases it is often advantageous, particularly for the credit information shown, to set up the note transactions with each customer under individual names, e.g., “John Doe, Notes Receivable.” Such a title plainly indicates the nature of the items listed under it; viz., claims against John Doe, witnessed by his promissory notes. As a general rule, however, the notes received from any one customer or all customers are usually relatively small in number and for this reason they are for the most part brought together under one class title, Notes Receivable.

=Negotiable Instruments—Their Use and Requisites.=—Notes receivable belong to a class of business papers termed negotiable instruments, the distinctive feature of which is that in many ways and for many purposes they _take the place of money_. The negotiable instrument, usually of small size but often representing a large sum of money, is used in the commerce of the world as a _medium of exchange_, in place of heavy and bulky coin or valuable bank notes which when lost or stolen can be passed as currency.

From a legal standpoint a negotiable instrument is one which gives a bona fide holder an absolute right to it, whether the preceding holder had acquired it lawfully or not. It is in this respect distinguished from other objects of value, as a horse, for example, the

present possessor of which is the legal owner only if he acquired it in good faith from one who in turn had acquired it lawfully.

To be negotiable, an instrument must have the following requisites:

1. It must be in writing and signed by the maker or drawer.

2. It must contain an unconditional promise or order to pay a fixed sum of money—and the payment must be made in legal tender.

3. It must be payable on demand or at a time which is either fixed or can be determined.

4. It must be payable to bearer or to order.

=Negotiable Instruments—Kinds and Definitions.=—Any formal or informal written promise to pay possessing these essentials is a negotiable instrument. Examples are: promissory notes—notes receivable and notes payable—drafts, checks, money orders and, with certain restrictions, warehouse receipts.

A promissory note may be defined as an unconditional promise to pay a specified sum of money at a certain time. It usually has a form similar to the following:

[Illustration: Form 16. Promissory Note]

=The Draft.=—A draft is a written order by one party on a second party to pay to a third party the amount of money named. To be negotiable, it must be so drawn as to meet the requirements of negotiability named above. A draft may have a form similar to the following:

[Illustration: Form 17. A Draft]

It will be noticed that there are three parties to a draft—the drawer, the drawee, and the payee. The drawer is the person who draws the draft and whose signature appears at the lower right-hand corner of the draft. The drawee is the person on whom the draft is drawn, George S. Perkins, above. He is sometimes called the payer. The payee is the person who is to receive the payment ordered, James Stanley Jackson & Co.

To understand the use of the draft as an instrument of business, suppose the following relations exist between the three parties named above:

1. George S. Perkins bought goods from Bert V. Robbins on account for $175.

2. Robbins bought goods from James Stanley Jackson & Co. to the amount of $125.75 on account.

The problem will be discussed from the standpoint of Bert V. Robbins. From the above data it is clear that Robbins has a claim against Perkins for $175 and owes $125.75 to Jackson & Co. Instead of collecting the claim against the former and paying his debt to the latter, he writes out a draft for $125.75 on Perkins, with Jackson & Co. as payee, thereby requesting (or ordering) Perkins to pay $125.75 to Jackson & Co. This draft he sends to Jackson & Co. and they present it through their bankers to Perkins. Under ordinary circumstances Perkins acknowledges the correctness of the draft and writes his acceptance _on the face of it_, thereby promising to pay the amount when due. Acceptances are usually worded in the following manner:

Accepted, Oct. 6, 19— Payable at First National Bank of Providence GEORGE S. PERKINS

It should be said that the three-party draft is not usually made use of without the consent of the drawee previously obtained, as in the case of a bank check, which is a draft on the bank drawn by the depositor. Very often in ordinary drafts, particularly when drawn against an export of goods, the drawer makes out the draft in favor of himself and indorses it in blank, thus making it transferable to bearer.

=The Accepted Draft.=—When accepted, the draft becomes, to all intents and purposes, an ordinary promissory note—Perkins' promise to pay Jackson & Co. $125.75. Until the draft is accepted by Perkins, it simply constitutes a request from Robbins to Perkins to pay the amount named and the draft as such does not bind Perkins in any way. Hence, no entry is made on the books of account of any of the three parties until acceptance. Of course, a memorandum is kept of all drafts drawn.

=Illustrative Entries.=—Upon acceptance by Perkins, the following entries are made:

1. On the books of Jackson & Co., the payee:

Notes Receivable 125.75 Bert V. Robbins 125.75 Robbins' draft on G. S. Perkins, accepted by Perkins, payable December 5.

Perkins' acceptance, in possession of Jackson & Co., constitutes a claim against Perkins, and Jackson & Co. therefore debit Notes Receivable. They credit Robbins because this draft was sent to them by Robbins in payment of Jackson's open claim against Robbins for $125.75.

2. On the books of Perkins, the drawee:

Bert V. Robbins 125.75 Notes Payable 125.75 Accepted Robbins' draft at 60 days' sight, favor of J. S. Jackson & Co.

This entry cancels Perkins' liability on open account to Robbins, and shows as a substitution therefor the amount of his acceptance in favor of Jackson & Co. at Robbins' request.

3. On the books of Robbins, the drawer:

James Stanley Jackson & Co. 125.75 George S. Perkins 125.75 To record the cancellation of our liability to Jackson & Co. on open account, and to credit Perkins with his acceptance of our draft on him at 60 days' sight.

From the point of view of Bert V. Robbins, the acceptance by Perkins means two things: (1) the cancellation of a part of Robbins' claim against Perkins, and for this reason Robbins credits Perkins with $125.75; (2) the cancellation of Robbins' debt to Jackson & Co., hence Jackson & Co. is debited on Robbins' books for $125.75.

It is important to note here that in case Perkins fails to pay the note at maturity, Robbins becomes liable to Jackson & Co. Robbins may therefore be considered the first indorser of the accepted draft. The discussion of the manner of booking Robbins' liability contingent upon Perkins' failure to pay is deferred to Chapter XLIII.

=Entries After Payment of the Draft.=—Upon payment by Perkins, the following entries are made:

1. On Perkins' books, a debit to Notes Payable and a credit to Cash.

2. On Jackson & Co.'s books, a debit to Cash and a credit to Notes Receivable.

=Draft and Cash Compared as Instruments of Payment.=—The following two diagrams may further illustrate the utility of the draft as an instrument of trade.

1. Showing the settlement of the several claims in _cash_—in case Robbins had collected $125.75 from Perkins and had paid $125.75 to Jackson & Co., the payments being made independently in each case:

[Illustration]

2. Showing a settlement by draft—a clearing house method:

[Illustration]

The commercial, three-party draft is little used now. With the larger function of banks in the conduct of modern business, other kinds of drafts as discussed below have come into use. The three-party relationship is the basis of all draft transactions, however, and must therefore be thoroughly understood.

=Classification of Drafts.=—There are several kinds of drafts, which may be either sight or time instruments. A draft drawn "at sight" is a request on the drawee to pay at sight, i.e., immediately upon presentation to him. The use of the sight draft in making collections is quite common. A delinquent customer is drawn on at sight and collection is attempted through the bank. The method is oftentimes effective because refusal to pay may reflect on the drawee's credit with his own bank. Usually no formal book entry is made of such drafts until paid. A draft drawn, say, "at 60 days' (or 30 days') sight" is a request to pay 60 (or 30) days after presentation. Hence, the dating of the acceptance of such a draft is of prime importance. Such a draft is, of course, a time draft.

A draft drawn "60 (or other number) days after _date_" is called a date draft and is payable 60 days from the date of the instrument—not, as in the first case, 60 days after presentation or acceptance. It also is a time draft. It is not necessary, although customary, to present time drafts for acceptance.

Drafts may be “commercial” or “bank” according as the drawee is a merchant or a bank, respectively. B. V. Robbins’ draft on Perkins shown above is a merchant’s draft. A bank draft is a request by one bank on a correspondent bank to pay a given amount of money to a named payee. A customary method of remitting money is by the purchase and remittance of a bank draft, for the issuing of which banks usually charge a fraction of a per cent. To illustrate its use, take the following situation:

L. W. Roberts of Denver owes Field & Co. of Chicago $210 on account. Roberts goes to his Denver banker and buys a bank draft which may read as follows:

[Illustration: Form 18. A Bank Draft]

Before sending this draft to Field & Co., Roberts indorses it in favor of Field & Co., who upon its receipt deposit it with their own bank and through it secure its collection from the Second National Bank. Roberts pays his bank for the draft $210 plus exchange.

Drafts may be foreign or domestic. They are domestic when they are drawn and payable within the same state or country; otherwise they are foreign. According to the present usage, the term “draft” is used whenever the parties concerned live within the United States, although they may reside in different states, and the term “bill of exchange” is applied to all such instruments where some of the parties live abroad.

=The Trade Acceptance.=—The Federal Reserve Board defines a trade acceptance as “a bill of exchange drawn by the seller on the purchaser of goods sold and accepted by such purchaser.” The chief characteristic of this document as contrasted with the ordinary draft is the showing on its face of the origin of the transaction giving rise to the draft, usually by means of the following statement: “The obligation of the acceptor hereof arises out of the purchase of goods from the drawer.” The following requirements to make a trade acceptance eligible for rediscount by the federal reserve banks have been laid down by the Federal Reserve Board:

1. It must have arisen out of an actual commercial transaction, usually the purchase and sale of commodities.

2. It must have been drawn under a credit opened for the purpose of conducting or settling accounts resulting from business transactions involving the shipment or storage of goods.

3. At the time of presentation to a federal reserve bank for discount or as collateral for the loan of money, it must have a maturity of not more than three months exclusive of days of grace.

Trade acceptances are promissory notes just as are any other accepted drafts. Because they comprise a very liquid asset, it is not unusual to record them in an account, Trade Acceptances, and so distinguish them from other notes and drafts. If they are few in number, they are more usually recorded as Notes Receivable.

=Checks.=—A check is a draft on a depositary bank. It is an individual’s order to his bank of deposit to pay a named or designated payee a certain sum of money. Two illustrations are given below, somewhat different in form but identical in nature. In the first, likeness of the check to a draft is very evident.

[Illustration: Form 19. Forms of Checks]

The _certified check_ is usually an individual’s or firm’s check bearing the certification of the bank’s cashier that the check is good. This certification is evidenced by writing across the face of the check these or similar words:

Good when properly indorsed FIRST NATIONAL BANK F. G. MOFFITT, CASHIER

Such a certification makes the bank responsible for its payment.

A cashier’s check is a bank’s own check drawn on itself in favor of a third party and signed by its cashier. As a medium of exchange it ranks higher than the check of a private person, due to the superior credit of the bank and to the fact that the bank is usually more generally known in a community.

=Other Negotiable Instruments.=—_Express_ and _postal money orders_ are drafts payable at sight, drawn respectively by one express agent on another and by one postmaster on another.

A warehouse receipt is a receipt from a warehouse, elevator, or other storage concern acknowledging the receipt of goods or property. Such a receipt usually contains the contract agreements entered into by the parties, covering the conditions according to

which the goods are accepted for storage. The warehouse receipt is usually negotiable, or partially so, in that title to the property may pass with its transfer.

=Principles Governing the Writing of Commercial Paper.=—Ordinary prudence requires commercial paper to be drawn in a way that will make forgery difficult if not impossible. To this end the following two rules should be observed:

1. Leave no blank spaces, particularly where the amount is written. This is not so important when the amount is perforated, with a perforated star at each side.

2. Write the indorsement at the top margin. Unless this is done, some statement might be inserted which would change materially the effect of the signature; e.g., the payer might later write above the signature that the check is accepted in full payment for a definite bill.

=Kinds of Indorsement.=—An indorsement is usually for the purpose of transferring title. There are several kinds of indorsement, as follows:

1. A _blank_ indorsement, which consists only of the payee's signature; this renders the instrument payable to bearer.

2. A _full_ indorsement, which reads as follows: "Pay to the order of .....," giving the name of the indorsee, i.e., the person to whom the instrument is transferred, and followed by the signature of the indorser, who before his indorsement was the payee.

3. A _qualified_ indorsement, which is either a blank or full indorsement with the words "without recourse" added to it. This kind of indorsement transfers title with no liability attaching to the transferor in case of non-payment by the maker at maturity.

4. A _restrictive_ indorsement, giving the name of the party to whom the check is transferred, the words "for collection" or "for collection and deposit" being added and followed by the signature. This indorsement does not transfer title but merely appoints the person or bank named as agent for the purpose of collection.

CHAPTER XXII

BUSINESS PAPERS—THE GOODS INVOICE AND BILL OF LADING

=Definition.=—When a business transaction takes place, a record or memorandum of its amount and nature is usually made out. Thus, the amount of cash received for a sale may be rung up on the cash register or a sales clerk may make out a duplicate sales ticket and turn over the carbon copy as a sales memorandum to the bookkeeper; for cash disbursed a receipt, to be the basis for formal entry on the books, may be demanded from the person to whom the payment is made.

These memoranda of business transactions are called "business papers." They comprise all of the more or less formal and informal documents which constitute the firsthand evidence of most transactions. Among the most common business papers may be mentioned: the goods invoice for purchases or sales; negotiable paper, including the check, note, draft, money order, and warehouse receipt; the statement and account sales; the shipping order and bill of lading; the bill of sale; the lease agreement; and contracts of all sorts. A few of the business papers most frequently used will be explained.

=The Invoice.=—When a merchant sells goods to a customer he writes out an itemized "bill" which is sent along with the goods. This bill, loosely called an "invoice," is from the seller's viewpoint more accurately described as a sales invoice, and from the customer's or buyer's viewpoint as a purchase invoice. It is an itemized statement of goods bought or sold, and should state the names of vendor and vendee, the address of the vendor and the date of sale, the quantities, kinds, and prices of the goods, the terms of sale, and additional information as to method of shipment, etc.

=Handling the Purchase Invoice.=—When goods are bought the purchase invoice should be verified or audited. The method of audit depends upon the organization of the business. In a small business, if the invoice is received before arrival of the goods, it is usually held till their arrival and then checked against them as to quantities, quality, and price. The extensions and total are verified and entry made in the purchase journal, using the audited invoice as a basis. The invoice should then be placed in a temporary file till paid, after which it is usually filed under the vendor's name for future reference. The check in payment of the invoice, when returned canceled by the bank, is frequently attached to the invoice for which it was issued as evidence of its settlement. At any rate the paid invoice should bear on its face a notation to show the payment.

In a large business where the clerical work is divided among departments, several copies of the original purchase order sent to the vendor are usually made out—one copy, for instance, for the purchasing department, one for the receiving room, one for the auditing department and so on. The procedure of auditing is then more complex. The copy furnished the receiving room is usually left blank as to quantities, and sometimes the description of the goods ordered is also omitted. When the goods are received, quantities and kinds are filled in by the receiving department, and the copy is sent to the auditing department where it is checked against the auditor's copy of the original order and the purchase invoice from the vendor. If found correct as to quantity, kinds of goods, extensions, and additions, the invoice becomes the basis for entry in the purchase record—journal or voucher register as the case may be—after which it follows the customary routine as to filing. The invoice remains in a temporary file as long as it is unpaid. Upon payment it is placed in a permanent file, either under the name of the vendor, by invoice number, or according to whatever system may be in use.

=Handling the Sales Invoice.=—Practically all systems of handling sales require that at the time of the sale some record or memo of the transaction be made. In retail establishments the use by each salesman of a book of sales tickets with provision for duplicate or triplicate impression is very general, whether the sale be cash or charge. The cash and charge tickets are usually put up in separate books and a different color of paper is used for each. At the close of the day the total cash tickets are checked against the cash received from cash sales, and the total charge tickets give a controlling figure for charges to customers. The total of the cash tickets plus that of the charge tickets gives the total credit to Sales.

These sales tickets are usually entered on a daily sales sheet provided with distributive columns for analysis according to departments or kinds of commodities. A recapitulation giving the totals of each of these columns is made and posted to the ledger, while the customers ledger accounts may receive their charges direct from the sales ticket. This recapitulation really constitutes the sales journal record, as is explained in Chapter XLVII.

Where the number of charge accounts is not large, a folder system is sometimes used. Each charge sales ticket is placed in the folder which takes the place of that customer's account, thus avoiding the necessity of making a formal entry on the ledger. When the customer pays this bill, the sales ticket is so marked and is either left in the folder or transferred to a permanent file. The successful operation of the folder system presupposes that the customer will pay the exact amount of his bills shortly after the date of the ticket, no provision being made to care for overlapping credits. Whatever the system, the sales ticket is the original record of the transaction and therefore valuable as evidence in case of dispute. These tickets should be filed away and kept until all danger of dispute is past.

=Credits and Returned Goods Invoices.=—If for any reason goods purchased prove unsatisfactory and are returned, record of their return should be kept by the shipping clerk and used as a basis for securing proper credit from the vendor. The vendor usually sends a returned goods invoice, which, though similar in form to the purchase invoice, constitutes a _credit_ to the purchaser instead of a charge. These credit memos, as they are termed, are always of some distinctive color, frequently red, in order to distinguish them readily from the regular invoice.

Similarly, when dissatisfied customers return goods, or when the business makes them an allowance on goods sold, a credit invoice or credit memo is sent them and the duplicate copy of this memo retained in the office becomes the basis for entering the transaction on the books.

=Shipping Goods—The Bill of Lading.=—The purchase and sale of goods usually involve dealings with railroads. It is not the purpose of this chapter to give an extensive system or method of handling shipments, but merely to explain the purpose of the railroad documents and their use as business papers.

A shipment of goods is evidenced always by a "bill of lading," a contract under which the railroad accepts freight for carriage, defines its liabilities as a transportation company or warehouseman, and states its duties and those of the shipper. Its standard content is prescribed by the Interstate Commerce Commission, although any additions to it not in conflict with the standard content are not forbidden. If the shipper so desires, he may have bills of lading printed to conform in size with his own files, instead of using those furnished by the railroad. There are two standard forms, the _straight_ bill of lading which is not negotiable and the _order_ bill of lading which is negotiable.

The bill of lading is always made out in triplicate, the original and the two copies being identical except as to titles and signatures. The original is signed by the shipper and the railway agent, and constitutes the shipper's receipt for the goods delivered to the railroad. The second copy called the "shipping order," is signed by the shipper only. It is his order to the railroad to ship the goods,

and is held by the railroad as evidence of its authority. The third copy or memo is an exact duplicate of the original. Like the first copy, it is signed by the shipper and the agent, and is held by the shipper as a duplicate receipt. Sometimes it is forwarded with the invoice to the customer, but otherwise should be filed by the shipper with the original bill of lading. In case of claim against the railroad for loss or damage to goods in transit, the original bill of lading is required as evidence and should therefore always be kept in the shipper's possession.

=Freight Notice and Expense Bill.=—A notice, called "freight notice," is sent by the railroad to the consignee upon arrival of the goods. A more or less formal order is given by the consignee to the teamster or drayage company to call for the freight. This order authorizes the railroad to deliver it to the teamster or drayage company. Upon its delivery, an "expense" or freight bill is sent to the consignee itemizing the freight charges due on the shipment. The freight notice and the freight bill are usually made at one impression, the heading on the one being a notice of the arrival of freight, while on the other the heading is that of an ordinary invoice or bill showing the freight charges on the designated goods. Some railroads make three copies at one impression, consisting of (1) the freight notice, (2) the delivery receipt, and (3) the freight bill. Copy (2) is a receipt surrendered by the consignee upon delivery of the goods.

=C. O. D. Shipments.=—C. O. D. shipments are handled through the agency of an express company, the post-office, or a bank. Express companies accept for shipment freight which is to be paid for upon delivery, agreeing to collect and remit the amount of the invoice to the consignor less collection and remittance charges. This method of shipping sometimes gives the consignee the privilege of examination before acceptance. It is used with customers who are unknown to the shipper or with those whose credit is doubtful.

When the parcels post service is used for shipping goods C. O. D., the post-office makes the collection for the shipper. The shipper must, of course, always prepay the postage, although this may by agreement become a charge against the customer.

When a bank is made the shipper's agent to collect on delivery, a draft is drawn on the consignee and sent to the bank along with a special C. O. D. bill of lading, the _order_ bill referred to above. This original C. O. D. bill together with the attached draft is sent by the bank to its correspondent located in the same city as the consignee. The correspondent bank presents the draft to the consignee for acceptance or payment, as the case may be, and thereupon delivers the special bill of lading to him. The shipper's order to the railroad provides that the goods are to be delivered only upon presentation by the consignee of this special bill of lading. In the use of the order bill of lading, it is customary for the original copy to show the goods consigned to the order of the shipper himself. This copy, indorsed by the shipper, and the attached draft are the documents used by the bank in making the collection.

=Duties of the Traffic Department.=—In a large business a special department known as the traffic department is authorized to handle all shipments. Briefly, its duties are to look after all incoming freight, its receipt in good condition and its proper distribution to the several departments; to handle all outgoing freight, its proper routing so as to secure lowest tariffs and speedy delivery; and to secure the adjustment of claims for damage or loss of goods in transit.

=The Statement of Account.=—When goods are sold, an invoice or bill showing terms of sale, quantities, items, prices, and total amount of sale is sent to the customer. Periodically, frequently the last of the month, a statement is rendered each customer whose account shows a debit balance. Frequently the date of sending the statement is recorded in the explanation column of the ledger account, which, from a credit point of view, is a desirable practice.

The statement of account is a transcript, sometimes a summary, of the customer's ledger account, i.e., it contains all charges and all credits for the period covered. If there is a balance outstanding at the beginning of the month, the current statement opens with the balance item and is followed by lists of all charges, payments, and other credits for the current period; the total credits are subtracted from the total charges and the balance constitutes the amount now due and owing. Sometimes a statement of account is made out in detail, giving a copy of the original invoices which evidence the several sales transactions. Statements of account are issued in many different forms, but the following illustration shows all the essentials:

[Illustration: Form 20. Monthly Statement of Account]

CHAPTER XXIII

BANKS AND THEIR METHODS

=Service of the Bank to the Community.=—Practically all business houses at the present time take advantage of the banking facilities to be found in every community where there is enough business transacted to justify the establishment of a bank. A bank is sometimes defined as an institution which deals in money and credit. One of its chief functions and the one on which its main income is _based_ is that of acting as a place for the deposit of moneys, these deposits forming the basis for its loans and discounts. Among its other important functions and services are to collect drafts and checks drawn on other banks; to issue and sell its own drafts on other banks, thereby enabling its customers to make payments to out-of-town creditors; to discount commercial paper, i.e., to loan money to its patrons on approved security; and to issue paper currency.

=Opening an Account with the Bank.=—Because so much of the bank's business is based on the honor and integrity of its customers, a prospective depositor is usually required to present a card of introduction signed by a customer of the bank or someone else known to it. A depositor who wishes to open a checking account is asked to file a "signature" card bearing the signatures which he will use in signing checks. As considerable expense attaches to handling depositors' accounts, some banks require that the balance of the account shall never fall below a fixed minimum.

=The Deposit Ticket.=—When an account is opened, the depositor is provided with a pass-book and check book. All deposits are made by means of deposit tickets, discount memoranda, or collection notices. The deposit ticket is in form similar to the following:

[Illustration: Form 21. Bank Deposit Ticket]

All moneys and checks deposited are listed on this ticket under the indicated classifications. The deposit is handed to the receiving teller of the bank, who, after verifying the ticket, makes an entry of the amount in the depositor's pass-book. Duplicate deposit tickets are usually kept by the depositor. It is important to note that checks must be indorsed before they are deposited, so as to make them collectible by the bank.

=The Pass-Book.=—The pass-book is the record of the depositor's dealings with his bank and, although written up by the bank teller, it is usually kept from the depositor's viewpoint, i.e., the bank is debited with all deposits and credited with all checks presented for payment. At stated intervals, say monthly, the book is left with the bank for balancing, at which time the _total_ amount of checks paid by the bank is entered in the pass-book and the canceled checks are returned to the depositor. Sometimes the pass-book is kept in account form, the left page indicating deposits, and the right page payments by the bank. More frequently, however, the pages of the pass-book do not have debit and credit significance but constitute a continuous record. In this case, at the end of the period, the deposits are footed and the total of the checks is _subtracted_ from the total deposits, thus showing the balance due the depositor.

A method coming into quite general use among banks is to send a monthly statement of account just as trading concerns do. This statement is a transcript of the bank's ledger account kept with each depositor, showing deposits and withdrawals. When this is done, withdrawals are not entered on the pass-book, which thus serves only as a memo or receipt of the moneys deposited.

=The Check Book.=—The check book is provided either with a stub, counterfoil, or interleaf, for making a duplicate record of the check drawn. Provision is usually made in the check book for the entry of the deposits. Sometimes each check is subtracted from the previous balance and the amount of the new balance shown; more often, total checks and total deposits are shown separately and in this way, while it is an easy matter to find the balance by subtracting the total checks from the total deposits, the actual figure does not appear and hence is not available to curious eyes.

The balance shown in the monthly statement or by the periodic balance of the pass-book is seldom the same as that shown in the depositor's check book, due to the fact that certain checks issued by the depositor have not yet been presented for payment to the bank. The method of reconciling the pass-book with the bank balance is treated in Chapter L, "Accounts Current."

=Securing a Loan through the Discount of a Note.=—A common practice of business men in borrowing money is to discount or sell to their bank or to a broker their own promissory notes and those received from customers. When merchants discount their own notes at a bank, the notes bear only one signature, that of the merchant, and for this reason they are called "one-name" paper. If a merchant receives a note from a customer, indorses it, and then discounts it at the bank, two signatures appear on it—that of the original maker and that of the indorser. Notes of this kind are called "two-name" paper. Banks usually prefer two-name paper because, if the maker fails to pay the note at maturity, the indorser can be held liable for its payment, while in the case of one-name paper the bank has recourse to no one except the maker.

When a merchant makes out a promissory note of, say, $1,000 due 90 days after date, and discounts it at his bank, the bank usually deducts interest at, say, 6%, from the face of the note; i.e., the merchant is credited not for the full $1,000 but only for $985, and when the note matures he either pays the amount, $1,000, or his account is debited with it. The $15 is called “discount” because it is “subtracted” from the face of the note; but since this item is paid for the use of the amount loaned by the bank, it is of the same nature as interest. There is no reason, therefore, for keeping two separate ledger accounts, one for discount and one for interest paid, the two usually being combined under one title, “Interest and Discount” or “Interest.”

=Principles to be Observed in the Calculation of Interest.=—In connection with interest computations it is important to observe the following points, the principles involved in each case being best explained by making use of suitable illustrations.

1. In commercial practice, when the interest period is expressed in months, the interest for each month is one-twelfth of the annual interest, i.e., a note for $1,000 dated April 11, 19—, due “three months from date,” matures July 11 and the interest at 6% is 6% of $1,000 divided by 12 multiplied by 3, or

$1,000 × .06 × 3 ---------- = $15 12

2. Were the same note worded “ninety days from date,” it would mature _July 10_ instead of July 11, the number of intervening days being 19 in April, 31 in May, 30 in June, and 10 in July; total 90 days. The interest would amount to

$1,000 × .06 × 90 ---------- = $15 360

3. If a note is dated March 6, 19—, and matures, say, on April 30, the interest period is 55 days (25 in March and 30 in April). Usually, in computing the number of days in the interest period the opening date is omitted but the closing date is included. In some instances the practice is to include both days.

It is important to note that it is almost a universal custom to use 360 as a denominator in all these cases, although the theoretically correct number is 365. This is done for the reason that the use of 360 greatly facilitates the computation. The government of the United States makes an exception to this rule and counts the year as 365 days, and disregards the month as a unit base; i.e., instead of counting the month of January as $^{1}/_{12}$ of a year, its computation requires the use of the fraction $^{31}/_{365}$ as the multiplier. Interest on $1,000 for, say, 12 days, by this method, amounts to

$1,000 × .06 × 12 ---------- = $1.97 365

instead of

$1,000 × .06 × 12 ---------- = $2 360

The incorrectness resulting from the commercial method (using 360 days as denominator) usually is negligible and is fully justified by the economy of time in computation. It may be noted that under this practice the amount of annual interest is $^{1}/_{12}$ more than under the method used by the government.

4. When paper is discounted by a bank, even though its term be given in months, the bank invariably counts the exact number of days in estimating the amount of the discount. Take a note dated June 25 with a term of 3 months and due therefore on September 25, but discounted at the bank on July 25. The term of discount, instead of being 2 months, would be for 62 days, a gain to the bank of 2 days on a 360-day basis.

=Short Methods of Interest Computation.=—In calculating interest or discount, the so-called 12% or 6% method seems the easiest of application. Its base is taken as $1. In the 12% method the interest for a year is therefore 12 cents, for a month 1 cent, and for a day ■ mill. In the 6% method, the interest for a year is 6 cents, for a month ½ cent, and for a day ■ mill. Using these fractions with the years, months, and days as multipliers, the result is the interest on $1 for the given period. This result multiplied by the face of the note gives the required interest, assuming that the interest rate is 12% or 6%.

A variation of the above gives the following rule, somewhat easier to apply. Reduce the time to days—using a 360-day year, 30-day month basis; multiply the time by the face, point off three places (i.e., treat the product as mills), and divide by 3 or 6 according as the calculation is on a 12% or 6% basis. If the basis used is 6%, but the actual rate is different, add or subtract whatever aliquot part the given rate is more or less than 6%; i.e., if the rate is 8%, add $^{2}/_{12}$ or ■; if 5%, subtract ■; etc. The following example will illustrate:

A note for $1,000 dated June 10, 19—, for 4 months, with interest at 7%, was discounted July 30 at 8%. Find the net proceeds. The note when due will be worth $1,000 plus 4 months' interest at 7%. That becomes the basis for the discount calculation.

Applying the 6% method:

4 months = 120 days Multiplied by 1,000 (face of note) ------- 120,000 Marking off 3 points 120 Take ¹/■ (index for 1 day) ¹/■ --- 20 = interest @ 6% Add ¹/■ 3.33 ---- 23.33 = interest @ 7% Add 1,000 -------- Value of note on October 10 1,023.33 -------- This amount (1,023.33) is the basis on which the discount is to be figured.

Multiply by the term of discount (72 days[2])

1,023.33 72 --------- 2,046.66 71,633.1 --------- 73,679.76 --------- Marking off 3 points 73.68 Take ¹/■ (day index) ¹/■ --------- 12.28 = discount @ 6% Add ²/■ or ■ 4.09 --------- 16.37 = discount @ 8% --------- Value of note on October 10 1,023.33 Less discount 16.37 --------- Net proceeds on July 30 1,006.96 =========

[2] The 72 days are arrived at as follows:

1 day in July 31 days in August 30 " " September 10 " " October -- 72

CHAPTER XXIV

METHODS OF POSTING

=The Journal and Ledger Records Differentiated—Posting.=—When a correct and complete record of business transactions has been made in the various journals, practically all the current information needed by the business has been secured. However, because this information is recorded in chronological order, it is not available for use. It requires sorting, grouping, and indexing. To meet this requirement the original chronological record must be transferred to other records which provide for the desired grouping. The separation of the general journal into journals for different classes of transactions such as sales, purchases, and cash, results in making certain kinds of information somewhat more available, but more than this is required for business management. The original records must be grouped and summarized under proper account titles, so that the total results for the period may be had under review at one time. The book containing these account titles is called the ledger, and the transfer of the original record to the ledger is called posting.

=Time of Posting.=—Where subsidiary journals are used, it is not customary to post all entries at the same time. The entries affecting personal accounts, i.e., those of customers and creditors, should be posted daily. Inquiries from customers as to their balances are received every day, and in order that this information may be given promptly and correctly, customers ledger accounts should be kept up to date in every respect. This is a matter of great importance because, if the information desired by the customer is not given promptly, or if an error is made in giving it, thus calling for correction at a later date, the customer's good-will may be lost and his trade transferred to others. For this reason personal accounts, especially those with customers, should be posted daily, and great care should be exercised in doing the work.

All other accounts may have their postings made periodically—once a week or once a month—the frequency depending upon the need of the business for the information furnished by the accounts. The flow of cash—always of importance—is shown daily by the cash book record; the volume of sales each day can be had from the sales journal; but information as to expenses can usually be had only from the ledger after completing the weekly or monthly postings.

=Methods of Posting.=—Knowing that errors in posting are easily made and that when made they may cause great confusion, it is important for the bookkeeper to know what kinds of errors occur most frequently, and to study means of avoiding them. Certain methods of posting have been found to produce a minimum of error. Some points in connection therewith will be considered here.

One of the chief errors in posting is to make entry on the wrong side of the account, i.e., to post a debit as a credit, or vice versa. The use of subsidiary journals has done away with a large part of errors of this kind, yet it is advisable to keep the following points constantly in mind when posting:

1. The sales journal is a "charge" journal, i.e., the individual items represent debits and must therefore be posted to the debit side of the proper ledger accounts. The sales _summaries_, however, are credits and must be posted as such.

2. The purchase journal is a “credit” record and all postings, except summaries, are made to the credit side of the respective accounts.

3. In the cash receipts journal, each individual item represents a credit, as explained in a previous chapter, and each individual item in the cash disbursements journal represents a debit. Hence, postings of the individual items on the debit side of the cash book must be made to the credit side of the ledger account, and postings of items on the credit side of the cash book must be made to the debit side of the ledger accounts. The posting of the summary entries of the cash book follows the debit and credit designation made at the time of summarization. The principles here involved were fully discussed in Chapter XIX.

4. In the Journal the debits and credits of each entry are fully expressed, i.e., neither element is suppressed. In posting from this record it is best to transfer all the debits consecutively and then all the credits. The possibility of posting a debit item as a credit is thereby greatly reduced.

=Cross-Indexing the Entries.=—An essential part of posting, in addition to recording the date and the amount, is to cross-index every entry, i.e., to index it both in the book of original entry and in the ledger. The “folio” column in each book is used for this purpose. The index in the ledger consists of the first letter of the book of original entry followed by the page number, and the index in the book of original entry shows the number of the ledger page to which the item is posted. (See Form 22.)

In this way, when the indexing in both books is completed it is possible without loss of time to trace the entry from the journal to the ledger, and vice versa. Usually the ledger folio is entered in the book of original entry immediately after each item is posted. When this is done the absence of a reference number in the journal indicates that the item has been omitted in posting. This check is frequently helpful in tracing errors. Some bookkeepers, however, before doing any posting, go through the book of original entry and from the account index of the ledger enter in the ledger folio column of that particular journal the ledger page numbers. By this method, much time is saved in finding the account in the ledger, but a _check mark_ should be placed after each item as soon as it is posted, to indicate the fact. Then the absence of the _check mark_ indicates an unposted item.

[Illustration: Form 22. Cross-Indexing in Posting]

=Explanatory Matter in the Ledger.=—In posting personal accounts it is customary to show the terms of credit in the explanation column of the account. In this way the face of the account shows whether the customer pays promptly or not, and affords a basis for his credit rating.

Notes Payable and Notes Receivable accounts in the ledger should show essential data, such as due date, interest rate, etc. However, when a separate note or bill book is used, these data are given therein and may be omitted from the account in the ledger.

With all other accounts, except sometimes the Profit and Loss account, little or no explanatory matter is carried. However, when a posting is made that is at all unusual, it is well to enter explanatory matter in the ledger. From the business man’s point of view, the ledger is the most important book of account, and if its record can be so made as to require a minimum of reference to original books, it serves its purpose so much the better. Where possible, the Profit and Loss account should carry the names of the accounts closed into it; in fact all transfers, whether made on the face of the ledger or by journal entry, should carry the account title and the ledger folio to which and from which the item is transferred. It is a fundamental principle that every entry must be indexed in such a way as to render reference to it easy at any time.

CHAPTER XXV

THE TRIAL BALANCE AND METHODS OF LOCATING ERRORS

=The Trial Balance.=—In Chapter XIV the trial balance was defined as a list of account _totals_, debit and credit, or account _balances_, debit or credit, for all the _open_ accounts in the ledger. This list is set up in two columns, debit and credit, and if the original entries in the journals and the postings to the ledger have been done correctly, the totals of these two columns should be the same.

Neither method of showing the trial balance has any inherent advantage over the other. Some concerns desire the account totals to be shown in the trial balance, as that indicates to some extent the volume of business. This would be true of all accounts which had been opened during the current period. As to those carried over from a previous period little current information would be given. As

a general thing, however, the status of _customers'_ accounts is better indicated when both total charges and total credits are shown. Where only the balance is shown, it does not provide any basis for determining whether that balance is normal for that particular account. In judging a request for a further extension of credit there is a rather close relationship between the volume of trade with a customer and the amount of his unsettled balance.

Sometimes, even the totals of accounts that _balance_ are shown in the trial balance, thus giving the status of _all_ accounts appearing in the ledger. Again, concerns desirous of knowing the net amount owing on customers' accounts and the net amount owed on creditors' claims, require _balances_ of all personal accounts and cash, but debit and credit _totals_ of all other accounts. No unalterable rule can be given. The manner of showing the accounts in the trial balance is governed by the way in which the trial balance is to be used and the purpose it is to serve. Manifestly, however, the trial balance cannot give information of every kind desired by a manager. As personal accounts are usually handled by canceling offsetting credits against corresponding debits and carrying only balances forward, the trial balance cannot well show at the same time both total transactions and outstanding balances. Only in small concerns could the trial balance give the information which in larger concerns would be gathered statistically and furnished in addition to the trial balance.

The tendency in modern accounting is to make the ledger record so detailed that all accounts are _currently_ "uniphase," i.e., have entries on but one side, and in connection with such accounts the two methods of entering them in the trial balance are identical, because the total of the one side of the account is at the same time the balance of the account. It must be observed that as a matter of course this modern tendency does not apply to personal accounts nor to adjustment and closing accounts.

=Errors in the Trial Balance.=—The manner of entering the small pencil footings of both sides of each account and also the account balances previous to taking the trial balance, was explained in an earlier chapter. This preliminary work should be done carefully so as to reduce errors to a minimum.

It is not purposed here to discuss all the kinds of errors that find their way into the accounting records. Errors are frequently made in the original analysis and classification of the transaction, which, as previously stated, result in an entirely incorrect showing of financial condition. Such errors do not affect the balance of the books and are not detected by the trial balance. Their detection is one phase of the professional auditor's work. This discussion has been qualified by saying that _if_ the work of original and secondary entry has been done correctly, then the ledger should prove. Some points in connection with errors which often occur in posting will be treated here.

The equality of the two totals of the trial balance proves that for every debit entry on the books there has been made an equal credit, or at any rate that the sum of all debit entries equals the sum of all credit entries; i.e., it proves only the _mathematical_ correctness of the work.

It might happen that an item, though posted to the _correct side_ of the ledger, has been entered in the _wrong account_. The trial balance would not detect an error of this kind. For example, John Doe's account might be debited with a charge belonging to Richard Roe, both being customers. This of course would make the books show wrong balances in those particular accounts, but would not cause an incorrect showing in the _total_ assets. However, more serious results may come from an error caused by posting to the wrong account.

According to the schedules shown earlier, all transactions bring about increases and decreases in the three main groups of accounts, viz., assets, liabilities, and proprietorship. A transaction resulting in an increase of assets may have its credit in any of the three classes—decrease of assets, increase of liabilities, or increase of proprietorship. A credit entry in any one of these would result in an exact offset to the debit and would therefore so far as that transaction was concerned, result in equal debits and credits in the trial balance; but were entry made to the wrong group of accounts, it would bring about absolutely false results. This would be the case if a proprietorship account were credited, resulting in an increased profit, when the credit should have been to the liability group with a resulting increase of the liabilities—two divergent results.

Thus, while the trial balance does not detect errors in posting to the wrong account, it has great value in that its equality is considered as good evidence of the correctness of the books. This is so because errors of the kind just referred to are not of so frequent occurrence as those involving only the mathematics of the work.

=Suggestions for Locating Errors.=—Where trial balance totals do not agree, it is certain that one or more errors have been made somewhere. The following suggestions may be useful in locating them:

1. If there is a difference of 1 in any column, i.e., .01, .10, 1.00, 10.00, etc., the error very likely results from wrong addition. Check additions of the trial balance and if the error is not located there, those of the ledger accounts must be checked as well.

2. If the difference between the two trial balance totals is an even number, divide this difference by two and look through the trial balance for an item of that amount but entered as a debit instead of a credit or vice versa. The amount of the error must be divided by two because the placing of a given item in the wrong column would result in a difference of _twice_ this amount in the totals of the trial balance. If the error is not located in the trial balance, it may be necessary to look through the ledger accounts because the wrong placing may have occurred there.

In checking through the ledger for an error of this kind, some aid is afforded by the fact that all postings from _even_ pages in the cash book (i.e., the cash receipts) appear on the _credit_ side of the ledger accounts, and all postings from the _odd_ pages in the cash book appear on the _debit_ side of the ledger accounts. If, therefore, in any of the _credit_ reference columns in the ledger is seen a reference like “C 13” or “C 29,” or in any of the _debit_ reference columns an index like “C 40” or “C 58,” it is probable that the error is due to posting to the wrong side.

3. If the mistake has not been found in this way, the trial balance should be checked against the ledger to be sure that no open accounts have been omitted. Examine all closed accounts to see that they balance.

4. Examine the posting index column of all books of _original_ entry to see that no items have been omitted in posting.

5. When the totals of the trial balance are unequal, the error may lie either in the debit total or in the credit total, or both may be wrong. Even when the trial balance “proves,” both totals may contain the same error. In order to determine what is the correct footing, the following method may sometimes be applied: Take the total of the previous trial balance, add to it the current totals from the several journals, and deduct the total of all accounts closed during the period. The result shows the correct footing for the present trial balance. Where the number of accounts closed during the period is large, the work entailed by this method may be prohibitive. The method is of easy application only when the trial balance is taken by means of debit and credit totals.

It may be left to the student to prove why this is a correct method for determining the present trial balance total. Suffice it to say that it is based on the fundamental fact that for every credit item in any of the journals there is of necessity a debit or group of debits the total of which corresponds with the credit item. Duplicating entries in two or more journals must be eliminated from the journal total.

The following table will serve to illustrate the above method:

Previous trial balance total $12,967.30 Sales journal total for current period 8,429.60 Purchase ” ” ” ” 5,627.40 General ” ” ” ” ” 564.90 Cash receipts ” ” ” ” 2,572.60 Cash disbursements ” ” ” 1,962.75 ---------- $32,124.55 Closed accounts total 1,211.41 ========== Correct trial balance total $30,913.14

6. If the difference between trial balance totals is divisible by 9, the error may be due to a _transposition_ of figures or to a _transplacement_, sometimes called a _slide_. A transposition is an interchange of figures, as 96 for 69, 215 for 512, 6,274 for 4,276, etc. The first is called a simple or one-column transposition, the second a two-column, and the last a three-column transposition. One-column transpositions may also occur in numbers of three or more figures, as 172 for 712, or 3,129 for 1,329.

=Transpositions.=—The following rules will be of help in locating errors of transposition. To determine divisibility by 9, the easiest way is to “cast out” the 9’s.

(a) If the difference between the trial balance totals is divisible by 9 and consists of less than three figures, i.e., 9, 18, 27, 36, a one-column transposition may be the cause of the error. Divide this difference by 9. If the quotient is 1, the difference between the two transposed figures is 1. If the quotient is 2 or 3 or 4, the difference between the transposed figures is 2 or 3 or 4, etc. For instance:

Correct Transposed Number Number Difference

54 45 9 divided by 9 = 1 87 78 9 ” ” 9 = 1

75 57 18 ” ” 9 = 2 97 79 18 ” ” 9 = 2

30 03 27 ” ” 9 = 3 85 58 27 ” ” 9 = 3

Thus the figures in the last column indicate the difference between the figures of the original item.

(b) If the difference is divisible by 9 and consists of two significant figures followed by one or more naughts, the error may be caused by a _one-column_ transposition between columns of a higher order. For instance:

The correct amount being 6,394 and the transposed amount 3,694 ----- the difference is 2,700

which divided by 9 gives 300. This indicates a transposition between figures in the “100” and “1,000” columns, the difference between these figures being 3. Reference to the example given will show this to be the case.

(c) When the difference between the trial balance totals is divisible by 9 and lies between 99 and 1,000, the error may be due to a _two-column_ transposition. Here the middle figure of the error is always a 9, e.g., an error of 297 resulting from writing 512 as 215. Dividing the number (27) formed by the two outside figures of the difference by 9, the quotient (3) is the difference between the two transposed figures, i.e., the 5 and the 2. For instance:

Correct Transposed Number Number Difference

514 415 99 9 divided by 9 = 1 735 537 198 18 ” ” 9 = 2 981 189 792 72 ” ” 9 = 8

Thus, the figures in the last column (1, 2, 8) indicate the difference between the two transposed figures in the correct item. Instead of dropping the middle figure of the difference and dividing by 9 as above, the entire difference figure may be divided by 99 with the same result.

(d) Similarly, when the difference is 999 or a four-figure amount with two 9’s in the middle, a three-column transposition may be indicated thereby. For instance:

Correct Transposed Number Number Difference

5,174 4,175 0,999 09 divided by 9 = 1 6,392 2,396 3,996 36 ” ” 9 = 4 7,081 1,087 5,994 54 ” ” 9 = 6

the figures in the last column (1, 4, 6) again indicating the difference between the transposed figures in the original.

Instead of dividing the number formed by the outside digits (9, 36, 54) by 9, we might divide the full amount of the difference (999, 3,996, 5,994) by 999; this would give the same result.

The reason for the divisibility of this difference by 999 in an error of this kind is apparent when a number is given algebraic notation instead of Arabic. The Arabic number 2,197 expressed algebraically would be 2,000 + 100 + 90 + 7. Generalizing, we may formulate any number of four figures by 1,000a + 100b + 10c + d, in which a, b, c, and d may have values from 0 to 9 inclusive. A transposition between the thousands and units digits, the “a” and the “d,” would result in the following number: 1,000d + 100b + 10c + a. The error would therefore be:

Original number 1,000a + 100b + 10c + d Transposed number a + 100b + 10c + 1,000d ---------- Difference 999a - 999d

This error is plainly divisible by 999, and the resulting quotient (a-d) is the difference between the two transposed digits.

It may be shown similarly why 99 is a divisor of the error cited under case (c) above.

=Transplacements.=—A transplacement or slide occurs when some or all of the digits of a number are moved one or more places to the right or left without change in the order of the figures; for instance, 736 written as 73.60, as 7.36, or as 700.36. The first is called a one-column slide, the second and third two-column slides. The error caused by a one-column slide is always divisible by 9, a two-column by 99, a three-column by 999, etc. The division by 9, 99, 999, etc., disregarding decimals, always gives the figures whose transplacement has caused the error. Thus the error caused by writing 736 as 73.60 is 662.40, which divided by 9 is 736; or 736 written as 7.36 produces an error of 728.64, which divided by 99 gives 736; or 736 written as 700.36 causes an error of 35.64, which divided by 99 gives 36, the part transplaced. The reason is similar to that given above for the transposition.

When a whole number of dollars is written as cents, the resulting error is divisible by 9 and moreover the cents _added to_ the dollars gives 99 in each case. For instance in writing:

.73 instead of 73.00, the resulting error is 72.27 .58 ” ” 58.00, ” ” ” ” 57.42 .16 ” ” 16.00, ” ” ” ” 15.84

When the error in the trial balance is of this kind, the amount transplaced may be found by subtracting the cents of the error from 100. In the above examples this difference would be 100-27, 100 -42, 100-84, or 73, 58, and 16 respectively, which are in each case the figures of the transplaced amount as seen in the example. Having determined this, the trial balance and ledger accounts should be gone over to look for a slide of the given number.

=Checking the Postings.=—From the above discussion, the impossibility of determining in all cases the nature of the error is quite evident—particularly as to whether it is one caused by a transposition or a slide. Unless the kind of error is readily discernible, it is usually advisable to employ the method of checking, i.e., going over all the work of posting to determine its correctness—or other methods to be discussed in Chapter LI. After all, careful work in making the record with legible figures and in proving additions and subtractions, wherever possible, more than pays for itself in the time saved hunting for errors caused by slovenly and inaccurate work.

CHAPTER XXVI

THE CLASSIFICATION OF ACCOUNTS

=Accounting Routine Related to Account Classification.=—The basic relationships between the accounts and the statements of financial condition were explained in Chapter IX, where a chart of accounts was given to illustrate the fundamental equation of the ledger. The complete record-making routine, comprising the use of business papers for memorandum entry, the use of the journals for the first formal record of transactions, and the use of the ledger for the classified entry, has now been explained. There remain, however, two classes of entries, the adjusting and closing, whose relationship to the journal-ledger routine has not yet been fully discussed although their relationship to each record has been separately considered. Since the closing of the books contemplates the drawing up of financial statements and since all record-keeping must have in view from the very beginning a proper classification of accounts giving the desired information to be reflected finally in the statements, it seems best at this point to consider some phases of account classification before proceeding with a detailed explanation of the method used in adjusting and closing the books.

=The Need for Classification.=—As explained in preceding chapters, accounts may be broadly classified into the three main divisions of assets, liabilities, and proprietorship. This threefold division, however, is inadequate for the purpose of presenting detailed information as to the kinds of assets owned by the proprietor, the nature of his liabilities, and the causes that have produced increases or decreases of proprietorship. Subdivisions of the three main groups must, therefore, be made, the minuteness of subdivision being determined by the amount of detailed information desired.

One of the main purposes of account-keeping is to summarize results on the financial statements. The items which appear on these statements represent the balances of one or more groups of accounts. Items, for instance, such as “Land” and “Buildings,” may each represent a single ledger account recording the value of the land, the factory, and the office buildings respectively; whereas the item “Accounts Receivable” represents the group of customers’ accounts, the number of which may run into the hundreds and even thousands and which may be kept in a ledger devoted exclusively to the recording of their detail. The reasons for grouping assets and liabilities on the basis of degree of liquidity, and the advantages resulting from such grouping when drawing up the summary statements of the period, were discussed and illustrated in Chapter III.

It is evident from the above that the classification or grouping of the ledger accounts is reflected in the items on the financial statements; and that, conversely, the kind of information which it is desirable to present on the statements will to a large extent govern the groupings in the ledger. This dependence of the account titles and groupings in the ledger upon the end and aim in view makes it necessary to draw up the original classification with great care. To aid in securing a record correct in the first instance, certain fundamental groupings or classification of accounts must always be made.

=Basic Classification.=—While other groupings of accounts have been made, the classification used here has been from the beginning a three-phase one, consisting of an asset, liability, and proprietorship nomenclature. The third group of accounts, proprietorship, is further divided into the two subclasses, temporary and vested, as explained in Chapter XII. At the end of the fiscal period, after the ledger has been closed, there appear only asset, liability, and vested proprietorship accounts; but during the fiscal period, the temporary proprietorship accounts come into being and certain asset and liability accounts take on a mixed character resulting from the method in which the record is kept. This method is dictated not by a pure accounting theory, but by a theory designed to accommodate itself to the practical requirements of the average business. It is because the practical method of making

the record falls short of the theoretically exact method, that adjustments must be made before summarizing.

For this reason, a record is not made daily of the portion of assets which has been consumed each day, but the asset accounts are adjusted at the close of each fiscal period to separate their asset and proprietorship elements. Also, when a note is discounted at the bank, its entire face value is set up as a liability. From the standpoint of accurate accounting, however, the face value of the note overstates the liability for the current fiscal period, if the note falls due in the following period, by the amount of the prepaid interest charge belonging to that next period. Only on the due date of the note does the record show the true condition of the liability. Thus, a “practical” method of keeping the record necessitates the use of certain “mixed” accounts. Fundamentally, however, the three-group classification given answers every necessary purpose.

=Fundamentals of a Good Classification.=—In judging the fitness of a particular classification, the end and purpose for which it is made must always be the criterion. Any classification of accounts must, therefore, have in view the fact that all accounts lead up to the balance sheet and profit and loss statement, and that they must provide the data necessary for the summaries of these statements. Classifications may be made from many different viewpoints and for many different purposes, but a classification which is logical and carries titles clearly indicating the purpose for which the accounts are intended, and which therefore needs little or no explanation, is a satisfactory classification. The three-group classification—assets, liabilities, and proprietorship—meets these requirements.

A two-group classification—real and nominal—is frequently used. Under this classification, asset and liability accounts are grouped as real, and proprietorship accounts comprise the nominal class. This is the standard classification. The student should be familiar with it, although the meaning of the groups is not so apparent as in the case of the three-group classification, referred to above.

=Classifying Business Transactions.=—When making the record of business transactions on the books of account, it is necessary, first, to determine the main account group or groups affected by the transaction. After this is done, it is usually easy to determine which particular account in the group is affected. Great care must be used in the determination of the main groups, since a wrong classification results in an incorrect showing in the summary statements at the close of the fiscal period.

To illustrate, in Chapter XIII reference was made to the fundamental distinction between capital and revenue expenditures. When making the original entry of some transactions this difference is frequently lost sight of and what should be charged to an asset account is charged to some expense account or vice versa. This charging to an asset account, of items which are rightly expense items and therefore cut down the proprietorship element of the business, is one of the easiest ways of inflating the profits for a period and so of making a better showing than would be the case if the facts were recorded correctly.

Correct classification of transactions is a matter of vital importance. An accurate analysis of every transaction must therefore be made before bringing it on the books. After determining the _main_ group of accounts in which record is to be made, further analysis as indicated above is necessary in order to fit a particular transaction into its place under a suitable _account_ title belonging to the main group.

=Detailed Classification.=—In dealing with account classification, the more detailed groupings must also be considered. Such consideration deals, (1) with account titles in detail and even with the kinds and classes of transactions to be recorded under particular titles, and (2) with the arrangement and use of these detailed accounts in the various sections of the summary statements at the close of the fiscal period. Certain broad principles have already been laid down which are to be followed in the selection of the account title, and the objection to the inclusion of unlike items under the same title, and the care to be exercised against a more detailed analysis than is required by the needs of the business, have also been explained. That system of accounts which groups only one kind of data under each particular account title is better than a system which mixes its records by grouping dissimilar data under a single head. Yet, caution is always to be exercised against too great detail and an unnecessary multiplication of accounts. Oftentimes essential facts and forces of business activity are lost sight of in a maze of detail.

Below is given a somewhat detailed classification of accounts in accordance with the two considerations stated above. No attempt is made at completeness; only the more usual titles are presented. This classification will be used throughout the rest of the volume.

CHART OF ACCOUNTS _Asset Accounts_

CURRENT Cash Petty Cash Notes Receivable Accounts Receivable _Reserve for Doubtful Accounts_[3] Merchandise Inventory Stocks and Bonds (for current investment) Accrued Income DEFERRED CHARGES TO OPERATION Shipping Supplies Insurance

Interest Office Supplies Etc.

FIXED Furniture and Fixtures _Depreciation Reserve Furniture and Fixtures_ Delivery Equipment _Depreciation Reserve Delivery Equipment_ Buildings Depreciation Reserve Buildings Good-Will Etc.

Liability Accounts

CURRENT Notes Payable Accounts Payable Dividends Payable Accrued Expenses

DEFERRED INCOME Rentals Interest Subscriptions Etc.

FIXED Mortgages Payable Long-Time Notes Payable Bonds Payable Debentures Etc.

Proprietorship Accounts

VESTED Proprietors, Capital Proprietors, Personal Capital Stock Surplus (Profit and Loss) Reserves of Profit (not valuation items)

TEMPORARY Income, Operating Sales _Sales Returns and Allowances_

Cost of Sales: Initial Inventory Purchases Inward Freight and Cartage _Purchases Returns and Allowances_ _Final Inventory_

Expenses, Operating Selling Expenses Salesmen's Salaries and Commissions Salesmen's Traveling and Entertainment Expenses Delivery Expense (wrapping, shipping room, horse and motor expenses, delivery salaries, etc.) Outward Freight Sales Management Salaries and Expense Advertising Depreciation on Salesroom Equipment, Delivery Equipment, etc. Sundry Selling Expenses

General Administrative Officers' Salaries General Salaries Stationery and Printing Legal Expense Postage Telephone and Telegraph Sundry Office Expense and Supplies Depreciation on Office Building, Equipment, etc. Light, Heat, and Power[4] Taxes Insurance[5] Financial Management Expense and Income Interest Expense Rent[6] Bad Debts Sales Discount Collection Expenses _Interest Income_ _Purchase Discount_ Non-Operating Expense Non-Operating Income

[3] The items in italics in this chart are to be handled as subtraction items from the account below which they are placed or from the group in which they appear.

[4] Light, heat, and power expense should in strict theory be distributed over the departments using it; the selling department to be charged with its share and the general administrative with its share. Where such procedure is difficult or undesirable, the expense is best classified as above.

[5] These items are sometimes distributed partly to Selling and partly to General Administrative where an equitable basis for distribution can be determined.

[6] These items are sometimes distributed partly to Selling and partly to General Administrative where an equitable basis for distribution can be determined.

=Method of Arranging Accounts in the Ledger.=—As to the order of arrangement of accounts in the ledger, one principle governs: Arrange all accounts in such a manner as to facilitate the drawing up of the final statements. Thus, assets should come first, arranged in the degree of their liquidity or availability, and each valuation account following its particular asset. Liabilities, coming as they do after the asset accounts, should be arranged in a similar order. Next should come the proprietor's accounts, the summary Profit and Loss account, and the income and expense accounts in the order in which they are to be used in the statement of profit and loss. Where only one ledger is kept, the personal accounts receivable and payable are usually recorded in distinct groups, after all the other accounts, towards the back part of the ledger rather than in the position required by the principle just stated.

A trial balance taken from a ledger in which the order of arrangement of the accounts is strictly in accordance with this principle, is called a "classified trial balance."

CHAPTER XXVII

THE WORK SHEET AND SUMMARY STATEMENTS

=Procedure Preliminary to Adjusting and Closing.=—Before tracing the detail of the adjusting and closing entries through the books, explanation will be given of the usual method of insuring the accuracy of this periodic work preliminary to the formal closing of the books. This preliminary work comprises the technical procedure employed in drawing up the balance sheet and profit and loss statement before the books are closed. It thus brings about a summarization of the period's results made _outside_ the books instead of _in_ them. Therefore, a proof of the accuracy and correctness of the work of adjusting and closing can be secured before the summarization entries are made in the books. After proof of accuracy has thus been secured, the statements are used as a guide in making the formal adjusting and closing entries.

The information for the balance sheet and profit and loss statements comes mostly from the regular monthly trial balance taken at the end of the period just _before_ the adjusting entries are made. This trial balance must of course be modified in order to include the effect of the adjustments. For the purpose of incorporating the adjustments in the trial balance and then separating the accounts into the two groups, namely, those which are to be summarized in the profit and loss statement and those which are to be used for the balance sheet, a regular form is used known as the accountant's "work sheet." This form and the method of its use will now be explained.

=The Work Sheet.=—For the work sheet "analysis" paper is used, which is ruled in its simple form as shown in the illustration on pages 226 and 227, space being provided for:

1. Account titles 2. Trial balance items 3. Adjustment items 4. Profit and loss items 5. Balance sheet items

For the purpose of illustration, a trial balance and a list of adjustments are given below, followed by the work sheet and the necessary explanatory detail.

The student must understand that the work sheet is no part of the formal accounting record, nor is the procedure employed by it a part of the formal work of closing the books. It is only a means by which a rough summarization of the period's results may be made _outside_ the regular accounting records and all the data needed for the formal statements be brought together. Its purpose is to secure and prove the accuracy of results before the formal adjusting and closing work is entered on the books. Where many or complicated adjustments are to be made, with a resulting probability of error and difficulty in an orderly arrangement of the adjusting entries, the method of the work sheet is almost indispensable. The formal adjusting entries are then made up from the adjustment columns of the work sheet.

=Illustration=

TRIAL BALANCE, December 31, 19—

1 New York National Bank $ 17,600.00 2 Petty Cash 100.00 3 Notes Receivable 15,000.00 4 Trade Customers 35,000.00 5 Reserve for Doubtful Accounts $ 875.00 6 Liberty Bonds 3,000.00 7 Merchandise Inventory 30,000.00 9 Office Furniture and Fixtures 2,800.00 10 Depreciation Reserve Office Furniture and Fixtures 700.00 11 Store Furniture and Fixtures 12,000.00 12 Depreciation Reserve Store Furniture and Fixtures 3,000.00 13 Delivery Equipment 4,500.00 14 Depreciation Reserve Delivery Equipment 2,250.00 15 Buildings 35,000.00 16 Depreciation Reserve Buildings 7,000.00 17 Land 15,000.00 18 Notes Payable 12,000.00 19 Trade Creditors 25,000.00 20 Mortgages Payable 17,500.00 21 U. R. Smart, Capital 90,000.00 22 U. R. Smart, Personal 10,500.00 24 Sales 195,000.00 25 Sales Returns and Allowances 1,850.00 26 Purchases 135,000.00 27 Purchases Returns and Allowances 5,400.00 28 In-Freight and Cartage 1,350.00 29 Salesmen's Salaries 13,500.00 30 Selling Supplies and Expense 1,600.00 31 Advertising 4,800.00 32 Out-Freight 400.00 33 Delivery Expense 3,300.00 34 Office Salaries 5,000.00 35 General Expense 2,000.00 36 Office Expense 4,500.00 37 Printing and Stationery 750.00 38 Taxes 2,840.00 39 Insurance 1,750.00 40 Interest Cost 900.00 41 Collection and Exchange 85.00 42 Sales Discount 850.00 43 Interest Income 1,500.00 44 Purchase Discount 1,300.00 45 Sub-Rentals Income 650.00 46 Special Police on Strike Duty 1,200.00 ---------- ---------- Total $362,175.00 $362,175.00 ========== ==========

ADJUSTMENT DATA, December 31, 19—

Inventory of Merchandise $26,500.00

Estimated Depreciation: Office Furniture and Fixtures, 10% of original cost Store Furniture and Fixtures, 10% of original cost Delivery Equipment, 16■% of original cost Buildings, 4% of original cost Doubtful Accounts, ¼% of Net Sales

Accrued Income: Interest Accrued on Notes Receivable 150.00

Deferred Expenses: Insurance Unexpired 250.00 Advertising Paid in Advance 300.00 Printing and Stationery Supplies on hand 150.00 Selling Supplies and Expense 200.00

Accrued Expenses: Taxes 340.00 Salesmen's Salaries 175.00 Interest on Notes Payable 50.00

Special Police on Strike Duty 150.00 Office Salaries 100.00

Deferred Income: Sub-Rentals Paid in Advance 50.00

The initial step in the use of the work sheet is to enter the trial balance in the first two columns, as shown on pages 226, 227. The accounts in the trial balance should be arranged in classified form before being entered on the work sheet, as this aids greatly in drawing up the statements. The various adjustment entries, debit and credit, which are almost the same as in the ledger, are then entered in the adjustment columns. The work sheet may be looked upon somewhat as a ledger, entries in whose accounts are to be made horizontally instead of vertically. The analogy to the ledger cannot be carried too far, however. It should be noted that when it is necessary to adjust any account in the trial balance by increasing its debit, this is accomplished by entering the item in the debit adjustment column on the same line with the account to be adjusted. On the other hand, if a subtraction is to be made from a debit amount shown in the trial balance, the amount to be deducted is entered in the credit adjustment column. A complete debit and credit entry must be made in the adjustment columns for each adjustment.

There is given below a debit and credit _list_ of these entries as they are to appear on the work sheet. The manner of making and cross-indexing these adjustment entries is indicated by the cross-reference letters used. It will be noted that, while in most instances these entries are exactly the same as the formal adjusting journal entries, there is a difference in the case of the merchandise inventories.

The student should understand that the _list_ of adjustment entries given below does not appear anywhere in the formal accounting records. It is shown here in _journal form_ only to indicate the debits and credits of the entries to the work sheet. Entries of the adjustment transactions are always made direct to the work sheet, never being set up in journal form. Each of these entries should be traced into the adjustment columns of the work sheet. The figures in parentheses just preceding the debit and credit amounts are, of course, not _ledger folios_ but refer to the similarly numbered items on the work sheet so that the student will have no difficulty in tracing them.

(a) Merchandise Inventory—Final (8) 26,500.00 (a) Merchandise Inventory—Final (8) 26,500.00 (b) Depreciation Office Furniture and Fixtures (51) 280.00 (b) Depreciation Reserve Office Furniture and Fixtures (10) 280.00 (c) Depreciation Store Furniture and Fixtures (51) 1,200.00 (c) Depreciation Reserve Store Furniture and Fixtures (12) 1,200.00 (d) Depreciation Delivery Equipment (51) 750.00 (d) Depreciation Reserve Delivery Equipment (14) 750.00 (e) Depreciation Buildings (51) 1,400.00 (e) Depreciation Reserve Buildings (16) 1,400.00 (f) Bad Debts (50) 482.88 (f) Reserve for Doubtful Accounts (5) 482.88 (g) Interest Income (Accrued) (52) 150.00 (g) Interest Income (43) 150.00 (h) Insurance (Deferred) (53) 250.00 (h) Insurance (39) 250.00 (i) Advertising (Deferred) (53) 300.00 (i) Advertising (31) 300.00 (j) Printing and Stationery (Deferred) (53) 150.00 (j) Printing and Stationery (37) 150.00 (k) Selling Supplies and Expense (Deferred) (53) 200.00 (k) Selling Supplies and Expense (30) 200.00 (l) Taxes (38) 340.00 (l) Taxes (Accrued) (54) 340.00 (m) Salesmen's Salaries (29) 175.00 (m) Salesmen's Salaries (Accrued) (54) 175.00 (n) Interest Cost (40) 50.00 (n) Interest Cost (Accrued) (54) 50.00 (o) Special Police on Strike Duty (46) 150.00 (o) Special Police on Strike Duty (Accrued) (54) 150.00 (p) Office Salaries (34) 100.00 (p) Office Salaries (Accrued) (54) 100.00 (q) Sub-Rentals Income (45) 50.00 (q) Sub-Rentals Income (Deferred) (55) 50.00

[Illustration]

[Illustration: Form 23. Work Sheet]

In order to set up some of these adjusting entries, it becomes necessary to add some new accounts on the work sheet. The student will note these appended at the end of the regular trial balance shown on the work sheet. They are, first, Bad Debts and Depreciation, under the latter of which the detail of the fixed assets subject to depreciation is given, and then follow in order the balance sheet classifications of Accrued Income, Deferred Charges to Operation, Accrued Expenses, and Deferred Income, provision being made to show under each of these titles the detail of the accounts involved.

It will be noted that some of the adjusting entries are not set up in the adjustment columns in exact accord with the way in which the same items are entered on the ledger, but rather in accord with the use to be made of the particular items in drawing up the periodic

statements. The purpose of the columns is not to make the adjustments and summarization in a formal manner as is done in the books, but to gather together all the adjusting data so that a correct separation of the balance sheet and profit and loss items can be made for use in the formal summary entries and in the statements. Thus, instead of transferring the initial inventory to the Purchases account, it is allowed to remain under its own title, because it will be needed as a separate item in drawing up the cost-of-goods-sold section of the profit and loss statement. Similarly, the final inventory is not shown deducted from Purchases, but is set up, debit and credit, in the adjustment columns, opposite the title “Merchandise Inventory—Final,” which is inserted immediately following the account “Merchandise Inventory—Initial.” At the time of summarizing, the debit item goes into the balance sheet, while the credit item goes into profit and loss. This method of handling provides in the profit and loss columns the detailed information needed for the cost-of-goods-sold section of the statement, comprising Initial Inventory, Purchases, In-Freight, Purchases Returns and Allowances, and Final Inventory.

The bad debts adjustment is entered in the adjustment columns as a debit to Bad Debts and a credit to Reserve for Doubtful Accounts. Similarly, the depreciation entry is shown as a debit to Depreciation in detail, the credits going to the various depreciation reserve accounts.

The adjustments covering deferred charges are shown as debits to the “Deferred Charges to Operation” classification in detail, the offsetting credits being to the various expense accounts as shown in the trial balance. These credits in the adjustment column will, when combined with the corresponding debit in the trial balance column, indicate the net amount of the charge to profit and loss. The other classes of adjustment entries follow the same procedure.

After all adjustments have been made, a complete distribution of the items in the trial balance and adjustment columns is made either to the profit and loss or the balance sheet columns. The difference between the profit and loss columns will thus show the net profit or loss for the period and must be transferred to the balance sheet as a vested proprietorship item. Instead of being shown as a definite addition to the proprietor’s capital, the transfer is indicated as the final item on the work sheet, being a debit in the profit and loss columns to balance them, and a credit in the balance sheet columns. This difference, $14,747.12 in our illustration, constitutes the net profit for the period, and when added to the credit side of the balance sheet columns should give a total equal to the total of the debit balance sheet column. This transfer of net profit effects a proof of the accuracy of the work.

When this proof has been secured, the formal profit and loss statement should be drawn up, all of the material for which will be found in the profit and loss columns of the work sheet, where it is arranged in almost the exact order needed for the formal statement. The information for the balance sheet is found similarly in the balance sheet columns, all of the detail being properly grouped but a rearrangement of the order of some items being necessary. Thus, while the detail of the deferred charges to operation has been gathered together in one place in the work sheet, in the formal balance sheet this group of items must appear immediately after the current asset section. See page 234 for the profit and loss statement and page 232 for the balance sheet.

It is thus seen that the work sheet provides a convenient method of passing through the trial balance the adjustments necessary to a summarization of the results of the period and of effecting a rough summarization of these results. The work sheet becomes the source of information for the formal statements and a preliminary stage to the adjustment and closing of the books.

The purpose of the formal adjusting entries and the manner of framing them are fully explained in Chapter XXVIII. After the information on which they are based is brought together and entered on the work sheet and after the work of summarization has been proven, the adjustment columns of the work sheet are made the source for these entries. The formal adjusting entries as they appear in the journal are given on page 245. They should be compared with the debit and credit list for the work sheet as given above and the differences noted.

=Need for the Summary Statements.=—Before setting up the formal journal entries necessary to adjust and close the books, the balance sheet and statement of profit and loss will be shown. These two periodic statements do not form an integral part of the books of account. They are drawn up periodically and submitted to the proprietor, because the latter does not always have ready access to the books of account and often lacks sufficient knowledge of accounting to interpret correctly the information shown by the journal and ledger. The periodic statements are intended to show the results of the year in a concise, non-technical form, so that a proprietor, even though not versed in the science of accounts, can readily understand them.

=The Two Forms of Balance Sheet.=—The balance sheet may be arranged in either of two forms. The first form (illustrated on page 232) follows the principles already laid down in Chapter III. This is called the “report form” and is based on the proprietorship equation when written

Assets - Liabilities = Proprietorship

Being non-technical, it is perhaps more favored by executives not versed in technical account-keeping.

The second form (illustrated on page 233) follows the proprietorship equation when written

Assets = Liabilities + Proprietorship

This form shows financial condition by means of the account form, the subtraction of the liabilities from the assets being indicated by their respective debit and credit positions in the account. It will be noticed, however, that this method of showing the subtractions is not strictly adhered to, some deductions being actually performed, as for instance in the case of the valuation reserves which are subtracted from the respective assets to which they apply. This is done in order to render the statement more intelligible. The same principles govern the arrangement of the items and groups of items as in the first form, viz., degree of liquidity for the assets and a similar arrangement for the liabilities. The account form is used almost always when the statement is submitted for publication.

=Two Forms for the Profit and Loss Statement.=—The statement of profit and loss is also made up in either of two forms, called the report form and the account form, based on the same principles as the two forms of balance sheet just discussed. Explanation of the report form has already been given in Chapters V and VI. The account form (illustrated on page 235) is very nearly a transcript of the ledger Profit and Loss account. It differs chiefly in that the information concerning “sales” which is summarized in the Sales account on the ledger is here set up in an inner column and shown summarized on the face of the statement. The information as to cost of goods sold is similarly summarized.

[Illustration]

[Illustration: Form 24. Balance Sheet—Report Form]

[Illustration: Form 25. Balance Sheet—Account Form]

[Illustration]

[Illustration: Form 26. Statement of Profit and Loss—Report Form]

[Illustration: Form 27. Statement of Profit and Loss—Account Form]

=Interim Statements.=—In many businesses, where the fiscal period is six months or a year, it is often desirable and important that at least approximate results be secured at interim periods. This can be accomplished by means of the work sheet without entailing the burdensome work involved in a formal closing of the books. At the time of the taking of any trial balance, the work sheet can be used as a means of making the necessary adjustments before securing results as to financial and operating condition. Accurate results would of course require as careful work as at the end of the regular fiscal period. The purpose of interim summaries is to indicate trends rather than to show accurate and definite results. At such times, therefore, the inventory is usually estimated, oftentimes the same amount being used as at the beginning of the period. Accruals and deferred items are not so carefully estimated nor in so great detail. Bad debts and depreciation must be taken into account. In this way approximate results for any period—frequently every month—may be secured without interfering with those for the regular fiscal period.

CHAPTER XXVIII

ADJUSTING AND CLOSING THE BOOKS

=Adjustment Entries—Kinds and Place of Record.=—In Chapter XV it was shown that the records as they are usually kept do not reflect the true condition of the business at any time _during_ the fiscal period. For this reason before summarizing the book record for the current period it is necessary to bring onto the books a number of entries the purpose of which is to “adjust” the mixed accounts and thus make the ledger reflect the true condition. These adjustments may be effected by entry made directly on the face of the ledger, but it is better to run them through the journal, thus making it possible to give ample explanation. A further advantage of first recording the adjustment entries in the journal is that in this way all such entries appear in one place in the books of account. The ledger should always be kept as a book of _secondary_ entry, with supporting data in some book of _original_ entry.

Seven types of adjustment entries are needed for the ledger of a mercantile concern. They are:

1. Merchandise Inventory 2. Depreciation 3. Bad Debts 4. Accrued Income 5. Deferred Expenses 6. Accrued Expenses 7. Deferred Income

All such items must be given consideration and entered upon the books before the final results for the period can be correctly shown. It is oftentimes necessary to make correcting entries for items the improper entry or the omission of which are not detected until the close of the fiscal period. These errors, whenever discovered, should of course be corrected at once. Because entries of this kind are in the nature of adjusting entries, consideration of them is included in this chapter.

It may be observed here that if a business manager has an intelligent insight into the development of his enterprise, and carefully watches the volume of sales, purchases, and expenses, he may be able to forecast with some degree of accuracy the approximate results for a given period; but only by making the actual count of stock now on hand and by carefully estimating the classes of items just mentioned, can accurate and dependable results be assured.

All these types of adjustment entries are not always found in every such business, however. Each type will be discussed in turn.

=Inventory of Stock-in-Trade.=—One of the most important adjustment entries is that by which the inventory of stock-in-trade is set up separately on the books. By reference to Chapter XIII it will be seen that none of the accounts connected with merchandise, viz., purchases, sales, returns, etc., contain any definite and up-to-date information as to the value of merchandise on hand. To determine the gross profit on sales this value must be known, and until the gross profit is determined the net profit cannot be ascertained. The balance sheet, the statement of profit and loss, and the Profit and Loss account, call for this information. Therefore, before these statements are made, and before the books can be closed, the value of goods on hand must be determined. The process by which this is done is called “inventory-taking.”

Without discussing the detail of a system of inventory-taking, three fundamental principles can be stated relative thereto:

1. Make sure that all goods belonging to the firm on the date of the inventory are included.

2. Make equally sure that there is no duplication of count, i.e., that no goods are counted twice.

3. See that the condition of the goods, viewed from the standpoint of salability, is indicated.

Two factors of importance enter into the determination of the inventory, viz., the quantity of the goods on hand and their value per unit. Inaccuracy in either factor may lead to a gross error in the final amount. By falsifying the count of the goods the inventory can, of course, be inflated. A usual and more elusive method, often resorted to, consists in raising the price per unit, since the addition of even a fraction of a cent per unit may have the effect of converting an actual loss into an apparent profit. Without further indication of the reason for such valuation, it is now generally required that the inventory be valued on the basis of cost, or market if market is lower than cost. The term “cost” should include all costs, incurred up to the point of placing the goods in condition ready for sale, not only the purchase price, but also duties, freight, drayage, insurance during transit, etc.

After the amount of the inventory has been determined, it is placed on the books. However, before this is done it is necessary that the Merchandise Inventory account be cleared of the goods on hand at the _beginning_ of the period by transferring the amount to Purchases. The following journal entry effects the transfer:

Purchases Merchandise Inventory To transfer the opening inventory to Purchases.

The posting of this entry automatically clears the Inventory account and, by its addition to Purchases, causes that account to show the “total goods to be accounted for.” Purchases, as it now stands, contains both the cost of goods which have been sold during the current period and those which are still on hand as shown by the inventory just taken. Accordingly, to separate the two items, the following journal entry is necessary:

Merchandise Inventory Purchases To set up the inventory of goods now on hand.

This entry when posted shows in the Merchandise Inventory account the asset element, and leaves in the Purchases account the cost of the merchandise sold. The effect of these two entries, then, is to adjust the books to true conditions so far as the merchandise is concerned.

=Depreciation, and Loss on Doubtful Accounts.=—As indicated in Chapter XV, the amount of depreciation of particular assets and the losses due to bad and doubtful accounts are carefully estimated at the close of the fiscal period. The individual depreciation

items are all summarized in a _single_ depreciation account—an _expense_ account—whose total debit is closed out to Profit and Loss. The _depreciation reserves_, however, which are credit items, are handled under separate account titles, and constitute the valuation account of the corresponding assets. The journal entry covering depreciation reads as follows:

Depreciation Depreciation Reserve Buildings Depreciation Reserve Furniture and Fixtures Depreciation Reserve Delivery Equipment Depreciation Reserve Machinery

The Reserve for Doubtful Accounts is the valuation account of Accounts and Notes Receivable. Assume, for instance, that the debit balances of the latter two accounts are $15,900, and the credit balance of their valuation account is $600. The difference between these two accounts, viz., $15,300, represents the present estimated value of Accounts and Notes Receivable. The journal entry made _periodically_ to record the estimated loss from uncollectible items is:

Bad Debts Reserve for Doubtful Accounts

When the two entries above, for estimated depreciation and bad debts, are posted, the present appraised values of those particular assets are brought on the ledger; i.e., from the values, as shown by the respective asset accounts, are taken the portions estimated to have been used up, lost through depreciation, or uncollectible. These lost portions are set up as expense items, leaving in the adjusted asset accounts true asset values as existing at the close of the period.

=Accrued Income.=—As to the asset portion of items of this kind, it is indicated in the account in a manner similar to deferred expenses, as explained on page 242. Take the case of interest income earned but not due. The entry for adjusting it is:

Interest Income (Accrued) Interest Income

The credit part is posted immediately, thereby showing an addition to the income already recorded as earned during the current period. The debit part is posted after the current account is adjusted and allowance made for the closing transfer entry to Profit and Loss. The debit part of the adjusting entry is then entered on the debit side of the _new_ portion of the account. Assume this debit item to be $50, and the interest received during the next period to be $170. The new account will indicate a _credit balance_ of $120, which is the amount actually earned during that period, since the previous period took credit for the $50 accrued or earned during _that_ period.

=Deferred Expenses.=—When a part of the expense paid during the current period applies to the next period, the prepaid portion must be taken out of the current expenses and held over—deferred—as a charge to the expenses of the next period. Taking insurance as an example, the following journal entry effects the required adjustment:

Insurance (Deferred) Insurance

In posting this entry, the credit part is posted first in order to take out of the excessive cost shown chargeable to this period the portion equitably belonging to the next period. When this is done, the _debit balance_ of the Insurance account indicates the amount to be charged to the current period and is the correct charge against the Profit and Loss for the period. After making allowance for the space needed for closing the account, the debit side of the above entry is posted, this debit becoming the first charge in the account for the next period. Note that the use of the bracketed “Deferred” is as a guide in posting. It indicates that that portion of the entry is not to be posted until provision has been made for closing the account. After posting is completed, the Insurance account appears as follows:

INSURANCE ========== Jan. 2 125.00 | Dec. 31 200.00 Apr. 10 250.00 | Aug. 15 300.00 | ------ | 675.00 | ====== | Jan. 1 200.00 |

There remains, of course, the transfer to Profit and Loss of the current balance before the account is _closed_. This closing work is treated later in the chapter.

=Accrued Expense Items.=—These items cover expenses which the business has incurred but has not yet paid, and which are properly chargeable to this period but have not yet been charged on the books. For instance, salaries earned up to the close of the period but not paid at its close constitute an additional charge to the period’s operations which must be entered on the books before they will show true conditions. This amount also constitutes a liability of the business. Accordingly, the journal entry is:

Salaries Salaries (Accrued)

thus charging the Salaries account with the amount due but not paid, and bringing this amount down as a credit balance to the new account for the next period. Assuming this unpaid amount to be $72, the account after closing will show this $72 as a liability on the _closing date_. Its effect, however, during the next period will be to _reduce_ the amount charged to salaries during that period, because this $72, although paid during that period, has already been charged to the previous period.

The credit to Salaries, therefore, serves two purposes, viz., that of showing the outstanding liability at the _close_ of the current period, and that of effecting a reduction of what would be, without this credit, an overcharge to _next_ period's salaries. For example, if the total salary paid during the next period is $600, the _balance_ of $528 is the amount applicable to that period, although the amount actually paid is $600.

=Deferred Income.=—Income received by the business during the present period which, however, belongs to the subsequent period is called "deferred income," as for instance, rent received in advance from a tenant. As to the liability portion of items of this kind, it is indicated in a manner similar to the accrued expense items. In this case the journal entry is:

Rent Income Rent Income (Deferred)

the effect being to decrease the amount of rent income for the current period and to show the portion belonging to the next period deferred to that period's account.

=Corrections.=—When an error has been made in any entry on the books, it should not be erased or scratched out, because by so doing suspicion may be raised as to what was expunged. The wrong item should be ruled out and the correct item written above it or wherever it belongs. This applies particularly to books of original entry whose use as evidence has often been destroyed because many erasures appeared in them.

Another way of making a correction, when an amount has been posted to a wrong account, is first to cancel the wrong posting through a similar entry on the _other side_ of the same account, and then to post it to the correct account. Cross-reference to the two accounts must be made.

When an amount has been posted to the _wrong side_ of _the correct account_, e.g., $100 to the credit side of John Doe's account, when it should have been posted to the debit side, the incorrect credit may be canceled by a debit of $100, and after this the original $100 should be entered on the debit side; or the cancellation and correction may be combined by entering $200 on the debit side. Better still, the incorrect posting may be ruled out and a correct posting made of the _original entry_ whose wrong posting caused the error. Adequate cross-reference should be given so as to make the tracing of the items easy and to indicate exactly what was done.

As these entries are of a somewhat unusual nature, their exact purpose should be plainly indicated in the explanation columns. According to the methods mentioned above, the various correcting entries are made directly on the face of the ledger. It is often preferable, however, first to make the required correction entries in the journal with full explanation, and then to post them to the ledger.

=Adjusting Entries Illustrated.=—In order to indicate clearly the routine and method to be followed in summarizing the books at the close of the fiscal period, the formal adjusting and closing journal entries needed for the books of U. R. Smart will now be set up, the illustrative data being the same as were used for the work sheet in Chapter XXVII to which reference should be made. In connection with the work sheet it was stated that the adjustment columns of the work sheet are used as a guide to making the adjusting entries. As to sequence in the journal, these follow immediately, without break, the last current entry for the month. The adjusting entries for U. R. Smart are:

Purchases 30,000.00 Merchandise Inventory 30,000.00 Merchandise Inventory 26,500.00 Purchases 26,500.00 Depreciation 3,630.00 Depreciation Reserve Office Furniture and Fixtures 280.00 Depreciation Reserve Store Furniture and Fixtures 1,200.00 Depreciation Reserve Delivery Equipment 750.00 Depreciation Reserve Buildings 1,400.00 Bad Debts 482.88 Reserve for Doubtful Accounts 482.88 Interest Income (Accrued) 150.00 Interest Income 150.00 Insurance (Deferred) 250.00 Insurance 250.00 Advertising (Deferred) 300.00 Advertising 300.00 Printing and Stationery (Deferred) 150.00 Printing and Stationery 150.00 Selling Supplies and Expense (Deferred) 200.00 Selling Supplies and Expense 200.00 Taxes 340.00 Taxes (Accrued) 340.00 Salesmen's Salaries 175.00 Salesmen's Salaries (Accrued) 175.00 Interest Cost 50.00 Interest Cost (Accrued) 50.00 Special Police on Strike Duty 150.00 Special Police on Strike Duty (Accrued) 150.00 Office Salaries 100.00 Office Salaries (Accrued) 100.00 Sub-Rentals Income 50.00 Sub-Rentals Income (Deferred) 50.00

=Purpose of Summarizing.=—After the adjusting entries are posted, the ledger reflects the true financial condition as of the date of these entries. However, at this stage the information contained in the ledger is usually scattered over a large number of accounts. To obtain a concise view of the results of the business, it is necessary to summarize this information. The Profit and Loss _account_ is the means by which the temporary proprietorship accounts are summarized and the net results as to profits or losses are indicated.

In this connection it will be remembered that the adjusting entries have already effected a separation of the elements of the mixed accounts, so that the temporary proprietorship items—expenses and income—applicable to the current period are now separately shown. The transfer of these _temporary_ proprietorship items to the _vested_ proprietorship accounts constitutes the work of closing. The use of the Profit and Loss account as a place of summary—a clearing house—through which the _net_ result can be passed on or transferred to the vested proprietorship accounts, constitutes a part of the method or technique of closing.

=The Closing Entries.=—The student is already familiar with the principles of debit and credit involved in making the closing entries. As indicated above, these are transfer entries and merely effect a transfer of all temporary proprietorship items to the Profit and Loss account for summary there and for the transfer of the net result to some vested proprietorship account or accounts. Like all other entries, these are made first in the journal and are posted from there to the ledger. The current sections of the various expense and income accounts are then ruled off and the ledger is said to be “closed.”

=Method of Closing the Books.=—As explained on page 129, the Profit and Loss account in the ledger is used for summarizing the temporary proprietorship accounts before transferring them, i.e., their net result, to the vested proprietorship accounts. The use of Purchases and Sales accounts for a partial summarization of the various merchandise accounts has also been explained. After this partial summarization has been made, the debit balance of the Purchases account, showing cost of goods sold, is transferred to the Profit and Loss account; and similarly, the credit balance of the Sales account, representing net sales, is transferred to the Profit and Loss account. Profit and Loss then shows on the credit side net sales and on the debit cost of goods sold, the difference being the income portion, i.e., the gross profit of the merchandising activities for the period. If it is desired to show on the face of the account the actual figure of gross profit, the Profit and Loss account may be balanced at this stage, though this is not usually done. The rest of the work of summarization is accomplished directly through the Profit and Loss account.

=Closing Entries Illustrated.=—The formal journal entries necessary to effect this summarization in the ledger are given below, being based on the illustration used for the work sheet and being made up directly from the various sections of the formal profit and loss statement shown on page 234. The way in which this is done should be carefully noted. As to their sequence in the journal, these closing entries will, of course, immediately follow the formal adjusting entries illustrated above.

Purchases 1,350.00 In-Freight and Cartage 1,350.00 Purchase Returns and Allowance 5,400.00 Purchases 5,400.00 Profit and Loss 134,450.00 Purchases 134,450.00 Sales 1,850.00 Sales Returns and Allowances 1,850.00 Sales 193,150.00 Profit and Loss 193,150.00 Profit and Loss 25,225.00 Salesmen’s Salaries 13,675.00 Selling Supplies and Expense 1,400.00 Advertising 4,500.00 Out-Freight 400.00 Delivery Expense 3,300.00 Depreciation 1,950.00 Store Furniture and Fixtures 1,200.00 Delivery Equipment 750.00 --------

Profit and Loss 18,560.00 Office Salaries 5,100.00 Office Expense 4,500.00 General Expense 2,000.00 Printing and Stationery 600.00 Taxes 3,180.00 Insurance 1,500.00 Depreciation 1,680.00 Office Furniture and Fixtures 280.00 Building 1,400.00 -------- Profit and Loss 2,367.88 Interest Cost 950.00 Sales Discount 850.00 Bad Debts 482.88 Collection and Exchange 85.00 Interest Income 1,650.00 Purchase Discount 1,300.00 Profit and Loss 2,950.00 Profit and Loss 1,350.00 Special Police on Strike Duty 1,350.00 Sub-Rentals Income 600.00 Profit and Loss 600.00 Profit and Loss 14,747.12 U. R. Smart, Personal 14,747.12 U. R. Smart, Personal 4,247.12 U. R. Smart, Capital 4,247.12

It will be noted that after the net sales and cost of goods sold are transferred to the Profit and Loss account, all expenses directly connected with sales, such as Salesmen’s Salaries, Advertising, Delivery Expense, Depreciation of Delivery Equipment, of Store Furniture and Fixtures, and similar items, are closed into the Profit and Loss account.

The groups of accounts closed next are those covering General Administrative Expenses, Financial Management Expenses, Financial Management Income, Non-Operating Expense, and Non-Operating Income. It will be noticed that the _order_ of closing follows the order in which the same items appear in the profit and loss statement.

The Profit and Loss account now shows on the credit side the items of income and on the debit side the costs and expenses applicable to the current period. Its balance then gives the net profit (or loss) covering the period's transactions.

Throughout the period, as the profit accrues, the proprietor may have drawn against it for personal use, as shown in his Personal account. To show the amount of profit remaining in the business, the balance of the Profit and Loss account is transferred to the Personal account, the balance of which then gives the amount of undrawn or overdrawn profit. The balance of the Personal account is closed into the Capital account, the credit balance of which then represents the net worth of the business at the end of this period and at the commencement of the next.

=The Profit and Loss Account.=--In posting the closing journal entries to the Profit and Loss account in the ledger, usually only the group totals as indicated by the entry will appear. In small concerns where expenses and income are not classified in much detail, the individual items composing the group total are often shown. These items are, of course, the same as appear in the part of the journal entry which is contra to the group total charged or credited to Profit and Loss. The ledger Profit and Loss account for the illustration will appear as follows when completely posted:

[Illustration: Form 28. Profit and Loss Account in Ledger]

=Profit and Loss Not an Account for Current Entry.=--It should be kept clearly in mind that the process of closing the books is merely a method or device by which the transactions for the year are _summarized_ and the net result determined. This net result, whether a profit or a loss, belongs to the proprietor and must ultimately be shown in his account. It is, therefore, manifest that the Profit and Loss account is _only_ a summary account and should never be used for current entry. It is the means by which the _temporary_ proprietorship accounts are summarized and the medium through which the net result is cleared into some vested proprietorship account or accounts.

=Effect of Closing the Ledger.=--The transfer of net profit to a vested proprietorship account completes the work of closing the ledger, all temporary proprietorship accounts for the _current_ period being closed out. All open balances now shown on the ledger constitute either assets, liabilities, or vested proprietorship. A post-closing trial balance contains only the accounts shown on the corresponding balance sheet. The income and expense accounts, having been cleared of their current record, are prepared to receive the record of the next period. The business cycle for this particular business has been completed and its correct history recorded.

CHAPTER XXIX

TYPES OF ACCOUNTING RECORDS AND THEIR DEVELOPMENT

=Evolution of Analytical Journals.=--Though the only books absolutely necessary for an accounting record under the double-entry method are the journal and the ledger, even the small business finds some subdivision of the journals advantageous, and so makes use of sales, purchases, and cash receipts and cash disbursements journals. As a business grows and its transactions increase in volume and complexity, further subdivision is needed. When the scope of its organization becomes too great for a personal oversight, a method or system must be devised for keeping the proprietor or manager in close touch with the various departments and lines of business endeavor. This is accomplished by means of reports from the accounting department, which exists largely for the purpose of furnishing this kind of information.

=Principle to be Followed in Securing Analysis.=--In an earlier chapter it was laid down as a fundamental principle that the information desired by the management should be furnished from analytical records made at the time of original entry, rather than by analyzing a composite record at the time the information is wanted. Such analytical records make possible a quicker and more up-to-date report to the management, and they save labor in securing the information by making the analysis at the time of record when all the facts related to it are readily available.

=Types of Sales Journals and Methods of Handling.=--The first step in the analysis of business transactions is the subdivision of the general journal into separate journals, and this analysis is carried still further by the use of columnar journal records. Reference has already been made, in Chapter XVIII, to the use of additional columns in the sales and purchase journals. Here a brief sketch will be given of the methods of recording sales in various kinds of sales journals.

1. The earliest type of sales journal, not often used today, consisted of a letter impression book containing the press copy of invoices sent to customers, with columns for the extension of the amounts and sometimes with additional columns for purposes of analysis. Such a journal has the advantage that the original entry is an exact copy of the invoice. Oftentimes, however, the impression is poor and nearly or quite illegible; it takes much room; the detail shown is not often used; and it increases the work of making and handling the record.

2. Another method makes use of a perforated invoice book with a columnized interleaf solid-bound between the perforated invoice sheets. The sales invoice is written on one of the perforated sheets and a carbon underneath gives a duplicate on the interleaf, the latter constituting the formal sales record. The advantages and objections are practically the same as for the impression book method.

3. Another method is to make a separate carbon copy of each invoice and use the duplicate as the source of entry in the sales journal. The journal entry gives only the file number of the duplicate invoice so that in case of need the duplicate can easily be referred to. Such a sales journal may, of course, contain analytical columns with any desired heads.

4. Still another method uses the duplicate invoice for posting to the customer's account, after which it is filed in binders. The latter are usually provided with recapitulation sheets which show the totals and analysis for each day, week, or month as the case may be. Just as above, the invoice file provides the detail in support of the ledger account and the recapitulation sheets constitute the journal from which credits to the various sales accounts are made. Either one of these last two methods eliminates most of the objections and embraces most of the advantages of the other methods mentioned above.

Where several sales ledgers are used, the sales journal is sometimes subdivided on the same basis as an aid in posting and for the purpose of securing controlling figures as explained in following chapters.

=The Sales Returns and Allowances Journal.=--The use of any special form of sales journal, particularly if it provides for an analysis of the sales, requires a similar record of sales returns and allowances. Either a separate book, similar in form to the sales journal, may be employed for recording these items or the pages in the back of the sales journal may be used instead.

=Development of the Purchase Journal.=--The development of the purchase records from the old-time scrapbook for invoices to the modern analytic voucher record resembles the development of the sales journal. The old-fashioned invoice book was usually a big, loose-bound, coarse paper volume in which were pasted the invoices for goods bought. An extension column was provided for the amount of the invoice, and the total of this gave the purchases for a given period. The use of columns for various classes of purchases provided the required analysis, but, as it was a cumbersome, nondescript record, it was bound to give place to something better--the formal purchase journal or register of today.

The purchase journal or register consists of a bound or a loose-leaf book ruled to suit individual needs and purposes. Where sales are analyzed by classes, an exactly similar analysis of purchases must be made in order to secure a gross profit figure for each class. Therefore its form follows very closely that of the sales journal. Entries are made in the purchase journal of the name of the creditor, the amount of his invoice, and the number of the file where the invoice can be found in case of need.

Where a separate purchasing department is maintained, the duplicate purchase orders, corrected if necessary to correspond with the purchase invoice received, may be used as the basis of the purchase journal. In this case recapitulation sheets are inserted just as with the sales journal. The handling of purchases is simplified by the fact that as a rule they are much smaller in number than sales. The same general considerations apply to the handling of returned purchases as to returned sales.

=Handling Expenses through the Purchase Journal.=--It is the practice of some concerns to treat expenses such as labor, rent, salaries, supplies, etc., as purchase transactions. Under this method, instead of postponing the entry until the item is paid, it is made at the time of securing the service or supplies. The basis for the entry may be either: (1) the bill or purchase invoice; (2) a formal purchase memo or voucher made out for each transaction; or (3) the fact that the expense has been incurred may suffice for the entry on the books with no formal paper to vouch for it. The use of such formal papers as the basis for entry is known as the voucher record system. The details of this system are fully explained in the second volume. Discussion is here limited to a brief outline of the method and of the advantages of its use.

When expense invoices are entered and analyzed in the voucher record form of purchase journal, their posting requires debits to the various expense accounts and credits to the individual creditors' accounts in the ledger. If the ledger contains only a controlling account, this account must be credited with the total of the expense and other purchases, while the individual accounts in the

creditors subsidiary ledger must be credited with the details which make up the total. When the bill is paid, entry in the cash book will not be, as usual, to the debit of the expense account in the general ledger, but to the debit of the creditor's account in the subsidiary ledger. The reason for this procedure will be made clear in the discussion of controlling accounts to follow.

The entry of expense invoices in the above manner secures an immediate record of all liabilities as incurred and therefore makes the books show at all times the true state of affairs as regards liabilities. The method, however, necessitates a little more work in making the record, and for this reason many concerns do not enter expenses until paid, making the debit to them through the cash book. In this latter case all unpaid expense bills should be kept in an expense file for reference when information as to the unrecorded liabilities is desired.

=Note Journals.=--As explained previously, note journals are sometimes used instead of the general journal for the record of note transactions, where these are sufficiently numerous. Provision is sometimes made for securing a proper analysis in order to distinguish between notes from customers and notes from other sources. It will be seen later that such an analysis is necessary when controlling accounts are operated.

=Analysis in the Cash Book.=--The cash journals may be ruled to furnish any desired analysis, showing on the debit side (i.e., the cash receipts journal) the sources of receipts, and on the credit side the objects of expenditure. As the sources of cash receipts are usually more limited than the objects of expenditures, they do not require so much analysis. The analysis may be very detailed, the only limit to the number of columns being the width of the page. A minute analysis of expenditures, however, is usually made, not in the cash journal, but in the purchase or voucher record, which thus relieves the cash book of a mass of detail.

The chief advantage of using additional columns in books of original entry lies in the fact that time and labor are saved in posting. The column total is posted in one item, whereas each of the numerous items composing it would have to be posted separately to the account named in the column heading if no analytical column were provided. Hence it would be a waste of space to provide separate columns for items which recur so infrequently as to make their summarization unnecessary. Care should be taken to avoid needless columnization.

It is customary to have the following columns on the debit side of the cash book: General or Sundry, Accounts Receivable, Sales Discount, and Net Cash or Bank; on the credit side: General or Sundry, Accounts Payable, Purchases Discount, and Net Cash or Bank. (See page 282 for illustration.) The proof of the distribution is secured by checking the sum of the net cash and discount columns against the sum of the totals of the other columns. In both receipts and disbursements journals every item must appear in the respective Net Cash columns, and from these distribution is made to the other columns. For example, in the cash receipts journal, receipts from customers are distributed into the Accounts Receivable column for the gross amount of each item, and into Sales Discount for the discount, if any is taken. All other items are carried into the General or Sundry column. Where several sales ledgers are kept, additional columns may be provided so that instead of having one accounts receivable column, there are columns for each ledger. Similar treatment is given to the disbursements.

=Analysis in the General Journal.=--Where the general journal is used for returned goods, allowances, and other adjustments with customers and creditors, use is made of analytic columns with these captions for both the debit and credit: Accounts Receivable, Accounts Payable, and General. Here, however, there is no column in which to enter all items for distribution to the other columns. If a customer's or a creditor's account is affected, entry is made in that column in the first place. All _other_ entries are in the General column. (See page 281 for illustration.)

With regard to analysis columns in the general journal, some accountants maintain, with good reason, that if the number of transactions of a particular kind is sufficiently large to justify their segregation in a separate column, this in itself would be ample justification for the use of a separate journal to record these items. Whenever the analysis of recurring transactions in the general journal is facilitated by the use of separate columns, the advisability of opening a new journal for the record of such items as appear in the general journal most frequently should be considered.

=Subdivision of the Ledgers.=--The next step in the subdivision of the records is made in the ledgers. The general or impersonal accounts of the business are of a more permanent character than the accounts with persons--customers and creditors. Consequently, when once it is determined under what account titles information is desired and those accounts are set up, there is usually little need to change their titles. Personal accounts, however, are constantly changing as some customers are lost and new ones are added, and also because creditors change with purchases in new markets. Hence, when a business outgrows its small beginnings, it is customary to keep these changing accounts in separate books. The basis for the first subdivision of the ledgers,

therefore, is the separation of the accounts into personal and impersonal. The accounts with customers are carried in a separate ledger called variously the sales, customers, or accounts receivable ledger, and those with creditors in a ledger called purchase, creditors, or accounts payable ledger. All other accounts are kept in the main ledger known as the general ledger. One advantage of this subdivision is that several bookkeepers can work on the various ledgers at the same time.

A further subdivision of the customers ledger is frequently made into “city” and “country,” the former containing the accounts with customers located within the city where the business is situated, and the latter the out-of-the-city accounts. Other subdivisions may be made on an alphabetical basis, i.e., customers ledger No. 1, containing all accounts from A to G; customers ledger No. 2, H to M, etc. Sometimes the concern’s sales territory is divided into arbitrary districts and the ledgers are subdivided to correspond with such districts.

[Illustration: Form 29. Standard Ledger--Divided Column]

[Illustration: Form 30. Standard Ledger--Center Column]

[Illustration: Form 31. Balance Ledger Rulings]

[Illustration: Form 32. Balance Ledger Rulings]

=Kinds of Ledgers.=--There are several kinds of ledgers, which may be classified (1) as to their rulings, and (2) as to their bindings.

1. RULINGS. As to their rulings, ledgers are either standard, balance, or progressive. The standard ruling has two duplicate parts, a debit and a credit, and is usually divided in the center of the page, one money column appearing at the extreme right of each part, although sometimes the arrangement is symmetrical with both debit and credit money columns at the center, and the date columns at either side of the page. (See Forms 29 and 30.)

The balance ruling is a three or four-column ledger with the money columns either at the center or at the right-hand margin, or at both the center and the right-hand margin. The extra columns are for the account balances. If the balance is usually either a debit or a credit, only one balance column would be necessary; where it is apt to be a debit at one time and a credit at another, a debit balance column and a credit balance column are advantageous. The balance ruling is used particularly with personal accounts where there is need for an up-to-date balance. Where this kind of ledger is used, entry of new debits or credits should always be on the next blank line as shown in the balance column, so as to allow the extension of the new balance opposite the last entry even though this should leave blank several of the preceding lines on the debit and credit sides. Typical forms of some of these are shown in Forms 31 and 32.

The Boston, progressive, or tabular ledger, as it is variously called, makes provision for a _horizontal_ progress of the account as to sequence of time; the title of the account is written at the left-hand margin, and one or more lines are allowed to each account according to the degree of its activity. The account title is written once at the left margin of the master or main sheet, and is sometimes repeated at the right margin if the sheet is very wide. The page is divided into columns for each day of the period. To effect this, short-margin insert sheets must be bound in to give the desired room for accommodating a whole period’s record. This style of ruling was formerly much used in banks where a daily balance for each depositor’s account was necessary. It is capable of adaptation to other uses, however. One form is shown, Form 33.

[Illustration: Form 33. Boston Ledger Sometimes Used for Depositors]

2. BINDINGS. Ledgers may be classified also as solid-bound, loose-leaf, and card, the titles being self-explanatory. One of the great advantages of the loose-leaf and card ledgers over the solid-bound ledger is their flexibility. They lend themselves easily to any desired grouping of the accounts; they may be numerically arranged where accounts are numbered instead of named; they may be arranged as to classes and each class made self-indexing; or a geographical grouping may be made. Another great advantage of this form of ledger is the ability to discard or file away in other binders all “dead” accounts, thus making for ease and facility in the use of the “live” ledger. Also it is possible for several clerks to work simultaneously, since the leaves or cards are removable and may be distributed among any number of clerks. There is always the danger, however, of failure to return a leaf or card, or of placing it out of regular order when returning it, or of destroying it, if it were desired fraudulently to do away with any particular account. The use of loose-leaf and card ledgers for personal accounts is pretty thoroughly established, notwithstanding the disadvantages just mentioned.

CHAPTER XXX

CONTROLLING ACCOUNTS

=Introductory.=--Reference to controlling accounts has been made several times in preceding chapters. It is purposed now to define them and explain their use. The separation of the various journals on the basis of an analysis of transactions frees the general journal of a vast mass of detail it formerly carried. This separation, however, in no way affects the underlying debit and credit scheme of the whole system. Each journal is an integral part of the whole; every entry therein has its equal debit and credit which are in due course posted to its proper account, thus maintaining the equilibrium of the ledger. The separation of the ledger into three or more special ledgers in the interest of economy of effort and ease of use has also been mentioned. Still, each of these special ledgers is an integral part of the whole ledger and the accounts in the special ledgers must be entered in the trial balance to secure proof of equilibrium.

The customers ledger is usually the most active of the various ledgers, i.e., more postings are made in it because the majority of business transactions involve dealings of various sorts with customers, and more accounts are required to keep the records with customers. It is usually, therefore, the largest part of the whole ledger, but its accounts are all of the same kind, viz., accounts receivable. When taking a trial balance, the total of the balances of the customers ledger accounts is usually set up under the title “Accounts Receivable,” leaving the details to a supplementary list or schedule.

=Advantage of a Controlling Account.=--The advantage of thus condensing the trial balance is apparent and suggests the desirability of obtaining the “accounts receivable” balance independently of the customers ledger. If this is done the bookkeeper in charge of the general ledger can not only draw up his trial balance without reference to the customers ledger, but has also the correct figure for the total of the account balances in the customers ledger. In other words, he has a figure which controls the customers ledger and which therefore furnishes him with a check on the accuracy of the ledger clerk or bookkeeper who keeps that ledger. The most convenient method of recording the accounts receivable figure is evidently by means of a formal account on the general ledger. When such an account is kept, the effect is to make it a summary account whose detail is carried in the customers ledger.

=Controlling Account Necessitates Changed Idea of Ledger Equilibrium.=--By having a customers controlling account (or “Accounts Receivable” as it is commonly called, though other terms are also used) in the general ledger, the customers ledger is no longer used as an integral part of the whole ledger and becomes a “subsidiary” ledger; that is, its function is reduced to that of a supporting schedule or list of detail for the summary controlling account. The equilibrium of the general ledger is now maintained by summary posting to the controlling accounts. Though the customers ledger has ceased to be a “ledger” in the proper sense of the term, it is still a vital part of the system, carrying as it does the detail of the summary controlling account. Moreover, it is linked up to the system by being provable against its summary account. Yet it should be borne in mind that its scheme of debit and credit is now an independent one and is not linked up to the debit and credit equilibrium of the general ledger; that is, the postings in the subsidiary ledger are merely memorandum entries of the detail posted in summary form to the general ledger. Thus the mathematical basis of the controlling account is simply that the whole is exactly equal to all its parts, the balance of the summary account being equal to the total of the balances of all the customers’ accounts of which it is the summary. To illustrate, if we have customers’ accounts whose balances are $1,000, $2,000, $3,000, $4,000, and $5,000 respectively, then the summary account must have a balance of $15,000.

=Debits to the Controlling Account.=--The principle and the purpose of the controlling account having now been explained, the next problem to consider is how best to gather the summary figures for its debits and credits. If every debit to a customer’s account must be posted also to the controlling account and every credit to a customer’s account must be shown as a credit in the controlling account the work involved would be almost doubled and little would be gained by thus duplicating the postings in another ledger. Therefore it is important to secure the figures for entry in the controlling accounts with the least effort, i.e., in the form of debit and credit summaries. Hence, to determine the sources of these debits and credits of the controlling account, analysis must be made of the sources of the debits and credits to the customers’ accounts.

Most of the debits to customers’ accounts are from the sales journal. Additional debits may be from the cash disbursements journal when cash payments are made as a rebate or a refund for overpayment or some other similar transactions; still others from the general journal for adjustments of various kinds. The debits to customers, however, for cash paid them are very few in number, because such adjustments usually are not made by means of cash payments. The sales journal, as usually operated, carries a

column for credit sales, whose total represents in one amount the total of all detailed debits to customers' accounts. The total of the credit sales column, therefore, controls the total debits to all customers on account of charge sales to them. In summarizing the sales journal the summary entry should show that this total is to be posted not only to the credit side of the Sales account but also to the debit of the controlling account in the ledger. This is so because the customers ledger has ceased to be an integral part of the general ledger, the controlling account having taken its place. Accordingly, the general ledger contains no record of either the debits or credits of the entire group of sales transactions until the end of the month, when this group must therefore be brought into the general ledger in summary form, both debit and credit.

Where the total sales in the sales journal include an analysis of sales into cash sales and credit sales, the following summary entry should be made:

Accounts Receivable Cash Sales

The cash debit is set up only to show the equilibrium of the summary entry and is not posted, because it is entered also in the cash book and is posted from there. This debit posting to "Accounts Receivable" in the general ledger secures in one posting a debit amount equal to all individual debit postings to the customers ledger from this source. The controlling account in the general ledger is variously termed "Sales Ledger," "Accounts Receivable," "Trade Debtors," "Customers," etc.

The two other sources of debit posting to customers' accounts are the general journal and the cash book. The debit side of the journal is provided with an Accounts Receivable analysis column in which, as explained in the previous chapter, debits to customers' accounts are entered. At posting time the total of this Accounts Receivable column will therefore give in one figure a debit posting item to the general ledger Accounts Receivable account equal to all individual debit postings from the general journal to customers' accounts in the customers ledger.

Usually it is not necessary to provide an Accounts Receivable column on the credit side of the cash book, since debit postings from there to customers' accounts are very infrequent. Hence no total or controlling figure for entry in the Accounts Receivable account can be obtained. Every item which is posted from this source to the debit of a customer's account must be also posted--item by item--to the debit of Accounts Receivable in the general ledger. This is of course a double debit posting, but one of these debits is to a subsidiary ledger which is no longer a part of the equilibrium scheme and therefore does not throw the general ledger out of balance. Great care must be exercised to make sure that each of these items is posted both to a customer's account and also to the Accounts Receivable account.

=Credits to the Controlling Account.=--An analysis of the credits to customers' accounts shows four main sources:

1. The cash receipts journal for payments made by customers.

2. The sales returns journal, if one is kept, for goods returned by customers.

3. The note journal for notes received in payment.

4. The general journal for various adjustments and also for the purpose of recording notes and returned sales where special journals are not kept for these transactions.

Accordingly, analytic columns for accounts receivable are provided in the cash receipts journal and the general journal. The totals of their columns are posted to the credit of Accounts Receivable, and the detailed amounts to the credit of the various customers' accounts. The credit postings from these sources to the customers ledger accounts and to the general ledger Accounts Receivable account are therefore the same so far as totals are concerned. The sales returns journal is summarized at posting time by means of an entry similar to that in the sales journal, as follows:

Sales Returns Accounts Receivable

In this case the credit posting to the Accounts Receivable account is equal to the detailed credits to customers' accounts.

Similarly, a summary entry for the notes receivable journal secures a controlling figure for Accounts Receivable. If the notes are all received from customers to apply on their accounts, the summary entry is:

Notes Receivable Accounts Receivable

the amount being the total of that journal.

In this way the total of all debits and of all credits to the individual customers' accounts is represented by the summary items entered in the general ledger controlling account, Accounts Receivable. Consequently, the balance of this single account is equal to the balance of the customers ledger. For the trial balance, therefore, one account takes the place of hundreds or even thousands of customers' individual accounts. As a result of this, much time is saved and the possibility of error on the general ledger is greatly reduced.

=Proving the Customers Ledger.=--The use of a controlling account in the general ledger, however, does not eliminate the necessity of proving the accuracy of the customers ledger. It merely makes it possible to take a trial balance without bringing the numerous customers' accounts into it. It is just as much a part of the proof of the work to make a list of customers' accounts balances and check it against the balance of the Accounts Receivable general ledger account, as it is to prove the general ledger by means of a trial balance. If there is a discrepancy between the subsidiary ledger and its controlling account on the general ledger that discrepancy does not necessarily prevent a trial balance of the general ledger, but it does show error in the work which must be searched out and corrected.

=Accounts Payable Account.=--A similar arrangement will make possible a controlling account on the general ledger for the creditors or purchases ledger. This account is variously termed Accounts Payable, Purchase Ledger, Creditors, or Trade Creditors account. Its mechanism is the same as for Accounts Receivable. Analysis of credit postings to creditors' accounts shows the purchase journal as their main source. Other credits come through the general journal and a very few through the cash receipts journal. The summary entry for the purchase journal is:

Purchases Accounts Payable Cash

This shows a debit to the Purchases account for the total amount of the purchases, a credit to Accounts Payable for the liability to creditors, and to Cash for the amount paid on cash purchases. The cash item is not posted. The Accounts Payable column total on the credit side of the journal, and the separate items from the cash receipts journal, furnish the other credits to the Accounts Payable account in the general ledger.

The debits come from the Accounts Payable columns in the cash disbursements journal and in the general journal, and the summaries for the notes payable and purchases returns journals.

=Basic Principle as to Postings to Controlling Accounts.=--In the handling of controlling accounts, the one fundamental requirement is to make sure that every entry in books of original entry which affects any account in the subsidiary ledger is reflected in the postings to the controlling account in the general ledger. This principle resolves itself into the mathematical axiom stated above that a whole is equal to all--not just some--of its parts. Only thus can a true control be established.

=Making the Subsidiary Ledger Self-Balancing.=--Through the use of the two controlling accounts explained above, the trial balance is relieved of a large number of accounts, and the general ledger is made independent of the subsidiary ledgers. On the other hand, the subsidiary ledgers are dependent for their proof on the controlling account balances in the general ledger. In an effort to make every ledger "self-balancing," a further refinement of the controlling account idea is frequently incorporated in each subsidiary ledger. It is accomplished in the following manner: An exact duplicate of the controlling account on the general ledger is set up in the subsidiary ledger, _with this difference_, that the sides of the account are reversed so that the subsidiary ledger account has for its debits the credits of the general ledger account, and for its credits the debits of the general ledger account.

Take the Accounts Receivable controlling account for illustration. On the general ledger its balance is of course a debit balance representing the total outstanding accounts due from customers. Similarly, the schedule or list of customers' accounts taken from the sales ledger will represent debit balances whose total is the same as the controlling account balance. If, then, the controlling account itself is placed on the customers ledger as an additional account, the sides being reversed, the balance of this one account will be a credit equal to the total debit balance of all the other accounts in the customers ledger. Therefore, if the customers ledger is correct, its own balance will be offset exactly by the credit balance of the one additional account, and the ledger then is said to be self-balancing. There is no theory or principle of debit and credit involved in this; the device is simply introduced in order that the ledger may provide an internal proof of its correctness. The title of the balancing account on the subsidiary ledger is "Adjustment" or "Balance" and has no significance other than that mentioned. In a similar manner any subsidiary ledger may be made self-balancing.

CHAPTER XXXI

HANDLING CONTROLLING ACCOUNTS

Chapter XXX concerned itself with the statement and explanation of the principles on which the controlling account rests, the manner of its construction, its advantages, and with the changed application of the fundamental scheme of debit and credit under a system of records operating controlling accounts. The present chapter will be devoted to a consideration of the problems met with in the practical operation of these accounts.

=Introduction of the Controlling Account.=--Upon the installation of a new system or set of books, the controlling account feature may be incorporated from the start. The new system must provide for the separation from the general ledger, of the ledgers over which control is to be established. The method of securing controlling totals for posting to the general ledger controlling accounts was indicated in the preceding chapter.

Where it is desired to introduce controlling accounts into a system which has not formerly used them, certain adjustments must be made, i.e., the accounts to be controlled must be segregated and controlling account columns must be provided for in the books of original entry. With the transfer of these accounts to a separate ledger, together with the introduction of the controlling accounts into the general ledger, the equilibrium of that ledger is maintained. The opening entry in the newly established controlling account is of course the sum of the balances of the transferred accounts.

If it is desired to establish the new controlling account by journal entry, that entry would appear somewhat as shown on page 279, Form 34, with suitable explanation added. All these items should be posted to the general ledger as shown by the entry, and in addition the detailed items should be posted as debits to the accounts in the customers ledger. The effect of these postings would be, first, to close the individual customers' accounts formerly carried in the general ledger and open up in their stead the controlling account; and second, to set up on the subsidiary ledger the detail of the customers' accounts.

=Recording Withdrawals of Stock-in-Trade.=--The original basis for separating the main journal into its subsidiary parts was the analysis of transactions by kinds, such as sales, purchases, cash, etc. The sales journal was presumed to contain only sales of stock-in-trade. Departure from this principle was advisable in the case of goods drawn at cost, for use in the business or by the proprietor or for other purposes. This is done because withdrawals of stock-in-trade, at whatever price and for whatever purpose, can be recorded more conveniently in the sales journal than elsewhere.

It is theoretically incorrect, however, to enter such items in the Sales account because withdrawals at cost do not represent actual sales, and for this reason they should be regarded as deductions from purchases or from inventory. The only proper place for their record, under this view, is the general journal, entry in which would have to be by detailed debit and credit for each item. However, because this requires much more work than entry in the sales journal, this last method is more commonly employed. Usually the volume of such transactions is not large and would not seriously vitiate the use of the Sales account as the basis for estimating percentages of cost of goods sold, gross profit, selling expenses, etc. Moreover, as the total amount of these withdrawals is often fairly constant as between periods their record in the sales journal is countenanced.

=The Problem of the Sales Journal Summary.=--When withdrawals from stock at cost price are recorded in the sales journal, a new problem arises in summarizing the sales journal when operating under a controlling account system. The customers or sales ledger is usually limited absolutely to customers' accounts. Accounts with the proprietors, and with all other titles under which withdrawals for other purposes may be recorded, are almost invariably carried in the general ledger. Therefore, while most of the items entered in the sales journal are posted to the customers ledger, these withdrawal items must be posted in detail to the general ledger. Thus the total of the sales journal does not represent the correct debit to accounts receivable in the general ledger. Evidently an analysis of the content of the sales journal must be made in order to obtain the correct controlling figure.

Such analysis may be made in several ways. Where possible, three columns in addition to the departmental columns should be used. The column titles would be "Sales Ledger," "Cash," and "Sundry." The sum of these three would give the total to check against the total of the other distributive columns, but only the "Sales Ledger" total would be posted to Accounts Receivable, and the individual items in that column would be posted to the customers' accounts in the sales ledger. The items in Sundry column would be posted to their named accounts in the general ledger. This method secures an automatic separation of the controlling account total from other items, and should be used where possible.

If the number of these extraneous items is too small to warrant the use of a separate column, they may be recorded in the Sales Ledger column and indicated by means of an "■" or some other mark. At summary time, the sales journal must be looked over and

these items picked out. Subtraction of their sum from the Sales Ledger column total would give the correct controlling account posting.

Still another method requires a correcting general journal entry at the time the sales journal entry is made. Under this method these special items are included in the Sales Ledger column, thereby causing an overcharge to Accounts Receivable. The correcting general journal entry must therefore credit Accounts Receivable by the amount of the overcharge for each item. For instance, if stock has been drawn by the proprietor, the general journal entry at the time the sales journal entry is made would be:

Proprietor, Personal Accounts Receivable

the debit to proprietor being checked here and posted from the sales journal, or vice versa. This method, however, results in a duplication of work. It would be preferable not to enter these items in the sales journal and to make the record only in the general journal, and so leave the Sales Ledger column total in the sales journal the correct controlling figure.

In a complicated controlling account system, where for current entry a simple bookkeeping routine must be established and all items of whatever kind be handled in the same way, the withdrawals by proprietors are recorded in accounts opened with them in the sales ledger just as with customers. At the end of the period, before closing the books, these proprietors' accounts are transferred by general journal entry to the general ledger, requiring one entry--like the one last shown above--for the drawings of the period.

Cash sales may also be handled without the use of a separate column in the sales journal. Two methods are used for this. Under the one, cash sales are included in the Accounts Receivable debit total of the sales journal, although the individual items are not posted to the subsidiary ledger, and they are also included in the Accounts Receivable credit total of the cash receipts journal. The inflated debit in the general ledger controlling account is thus offset by an equally inflated credit, the balance therefore being the correct amount to control the sales ledger.

Under the other method the postings to the general ledger controlling account are the same as in the first method. The two methods differ, however, in that under the second method an account is opened in the subsidiary ledger entitled "Cash Customers" or "Cash Sales," to the debit of which are posted in detail the cash sales items from the sales journal and to the credit of which are posted in detail the cash sales items from the cash receipts journal. The account is thus only a "wash" or clearing account. This method, however, prevents the inflated debits and credits in the controlling account.

The methods last described for handling proprietors' withdrawals and cash sales are the ones most frequently used in large businesses where simplicity of routine for current entry must be secured.

=The Problem of the Purchase Journal Summary.=--The practice of recording extraneous transactions in the purchase journal brings about at summary time a situation similar to that of the sales journal, when a controlling Accounts Payable account is maintained. The purchase journal is, and should be, the place of record for purchases made for the business. If the proprietor (or other person), for his personal account and use, purchases through the business merchandise which never goes into stock, accurate accounting requires such transactions to be charged direct to the proprietor and not to the Purchases account of the business. Inasmuch as the liability is assumed by the business and the creditor's account will appear in the purchase ledger, the use of the purchase journal total for credit to the Accounts Payable controlling account gives the correct figure. The trouble comes in because this same figure cannot be used as the debit to Purchases. Subtraction of these extraneous items must be made to determine the proper amount chargeable to the Purchases account, thus necessitating an analysis at summary time.

=Accounts Both Receivable and Payable.=--It frequently happens that purchases from, and sales to, the same party are made, i.e., goods are sometimes bought from and sold to a customer. If the account of this debtor-creditor is normally a purchase account, it is set up in the purchase ledger. If a sale is made to this debtor-creditor and charged to his purchase ledger account, such transaction should not be included in the Accounts Receivable controlling figure from the sales journal unless an adjusting entry is made through the general journal. Such entry would affect only the controlling accounts and would be:

Accounts Payable Accounts Receivable

Or the item might be omitted from the sales journal controlling figure and stated separately in the summary entry for the sales journal.

A more satisfactory method is to set up two accounts with such parties--one as a creditor, the other as a customer. Then no adjustment need be made at the time of summarizing the journals, because the two accounts are treated as entirely independent of each other. The settlement of these two accounts may be handled separately or by a payment of the balance between the two. If settled by balance, an adjusting journal entry should be made to show on the books the two separate elements involved. This would of course affect both the controlling accounts and the two individual accounts.

=The Problem of the Note Journals Summaries.=--Of notes receivable the large majority are usually received from customers. The summary entry for such is:

Notes Receivable Accounts Receivable

Where notes are received from other sources, as from officers, partners, or from outside parties to whom loans have been made, it is evident that these must not be included in the credit to Accounts Receivable, and it may be advisable also to eliminate them from Notes Receivable unless they are short-term, current items, as only such should be carried under Notes Receivable. These special notes may be carried in a “Notes Receivable Special” account.

If, as sometimes happens, interest is included in the face of a note, this must be adjusted by the summary entry, as follows:

Notes Receivable Accounts Receivable Interest Income

The considerations stated above as applicable to the notes receivable journal, are of equal importance in handling the notes payable journal. A very careful analysis of the note journals should be made at a summary time, which analysis should be shown by the summary entry.

=Summary Entries for Columnar Books.=--Illustration will now be given of some standard forms for summarizing the columnar journals. Sometimes the summary entries for the various subsidiary journals are made in the general journal. This seems to accomplish no good purpose and is not usually recommended. Theoretically it is desirable to show a formal debit and credit summary for each journal footing posted to the ledger. If, however, the number of columns is small and it is readily seen that the debits and credits are equal, the formal summary is often dispensed with. So also, if there are many distributive columns of the same effect, i.e., debit or credit, as in the large departmental sales journal or the voucher register referred to on page 144, formal summary is not shown, the posting being made from the column totals as illustrated for Petty Cash on page 369.

=The Sales Journal Summary.=--An illustration of the sales journal summary is given in Form 35. The Sundry items should be posted in detail from their column and their total checked in the summary entry. Where a Sundry column is not used and the Sundry items are included in the Sales Ledger column, they must be separated before the summary entry can be made.

[Illustration: Form 34. General Journal]

[Illustration: Form 35. Sales Journal Summary]

Where, also, a Cash column is not carried, as is so often the case, there being just one column for Sales Ledger, Cash, and Sundry items, from which distribution is made, the separation of the Cash items need not be shown in the summary entry, provided those items are entered also in the Sales Ledger column of the cash book. Where, due to the large number of distributive columns, the sales journal can ill afford the room for a Cash column, the above method offers the best solution of the problem.

The purchase journal summary is similar to that of the sales journal, and therefore no separate illustration need be given here.

=The General Journal Summary.=--As shown by the illustration in Form 36, in summarizing the general journal the Accounts Receivable and Accounts Payable columns are formally totaled, ruled off, and their totals brought into the General columns on both debit and credit sides and these columns are totaled and ruled off, thus showing the equilibrium of the journal. This summary entry is posted to the proper accounts in the general ledger. There is no particular advantage, however, in this formal summary entry because the postings could easily be made directly from the column totals.

=The Cash Book Summaries.=--As illustrated in Forms 37 and 38, the formal summary for each side of the cash book shows the equality of the Bank and Discount columns total against the General and Accounts Receivable and Payable columns. To show the correct debit to the bank for the present month, the balance brought forward from last month and entered in both the General and Bank columns on December 1, must now be subtracted from both.

On the disbursements side no explanation of the summary entry is necessary. It will be noted that, to show the balance of the bank account, a restatement of the Bank column total is necessary.

[Illustration: Form 36. General Journal Summary]

[Illustration: Form 37. Cash Summary Book--Receipts Side]

[Illustration: Form 38. Cash Summary Book--Disbursements Side]

=Other Controlling Accounts.=--It is frequently desirable to keep some accounts of the business private, such as those showing partners' investments, drawings, ratios of sharing profits, the adjusting and closing entries, the profit and loss, etc. This can be accomplished through the use of a private ledger supported by a private journal and sometimes a private cash book. For their operation a controlling account of the private ledger is set up in the general ledger, and similarly a controlling account of the general ledger appears in the private ledger. The use of private books is explained in Volume II of this work.

Sometimes subsidiary expense ledgers are used to carry a minute division of each expense group, with corresponding controlling accounts, such as Selling Expense, Office Expense, General Expense, Factory Expense. Similarly, if the consignment sales of a business are large enough to justify a separate record in a consignments ledger, a controlling account is set up in the general ledger. In a manufacturing business, Raw Materials, Goods in Process, and Finished Goods accounts are often controlling accounts for the stores, jobs, and finished stock ledgers. In a corporation the Capital Stock account (or accounts) is a controlling account over the stock ledger.

=Principle Governing Content of Subsidiary Ledgers.=--Before closing this chapter, it should be stated as a fundamental principle that no accounts should be carried in a subsidiary ledger except such as are of the same general kind and can without misrepresentation be carried under the group title of the controlling account.

CHAPTER XXXII

PARTNERSHIP FROM THE BUSINESS VIEWPOINT

=Partnership Defined.=--In Chapter II, reference was made to some of the features of a partnership--the purpose of its formation, advantages, disadvantages, etc. The laws of the state of New York define a partnership as follows: "A partnership, as between the members thereof, is the association, not incorporated, of two or more persons who have agreed to combine their labor, property and skill or some of them for the purpose of engaging in any lawful trade or business, and sharing the profits and losses as such between them."

This definition brings out in a general way the reasons for the formation of the partnership and its essential features. Under this type of organization, where several persons combine their capitals, it is possible to secure a larger fund of capital than under the sole proprietorship. This opens to the partnership avenues of business usually closed to the sole proprietor. The bringing together of the man with a special aptitude or skill, or of a man with a following in the community on account of social standing and acquaintanceship, with another who has money or a plant for the operation of a business, often makes successful an otherwise unpromising undertaking.

=Operating Feature and Working Organization.=--Mutual agency is the essential operating feature of the partnership. By this is meant that any one of the partners can act for the others, and in the eyes of the law all are equally responsible for the management of the business. Except in the case of a limited partnership, to be explained later, each partner has an equal voice in the management and control of affairs. Unlike the corporation where for management purposes the owners' powers are delegated to a controlling board, the essential character of the partnership is that each partner has, regardless of the amount of his investment, an equal right in the direction of its business. As between themselves, for purposes of division of duties and specialization of effort, definite power to exercise control over certain features of the business may be delegated to individual partners. But such delegation means nothing more than a method of dividing the work and is simply the working organization of the firm which may be changed at any time the majority of the partners see fit. Thus, while a partner may be limited in his actions for the firm by agreement among the partners, so that he is not a general agent for the firm, still as to outsiders who know nothing of this internal arrangement, he has power to bind the partnership by his acts, because an outsider has a right to expect that any partner has power to act as an agent for the firm. This is so because such power is of the essence of the partnership form.

=Essential Characteristics of the Partnership.=--Limited life is an essential characteristic of the partnership. The partnership relation is a very personal one. It can be terminated in a number of ways, but the death or retirement of any member automatically works a dissolution of the firm, even though another man takes his place. The legal theory is that the old partnership is dead and a new one, even though bearing the same firm name, has come into existence. Thus a partnership cannot be perpetual. The relationship between the partners is so intimate that the success of the undertaking depends fundamentally on the good faith and honor exercised by each partner towards the others, and therefore any addition to the personnel of a partnership can be made only with the consent of all members of the existing firm.

The partnership being the outgrowth of the sole proprietorship, certain of the aspects of its earlier form still cling to it. For suit at law it is looked upon as a collection of single owners, and action on contract must usually be taken against the individual members of the firm. Suit by or against the partnership cannot as a rule be brought in the firm name. Some states, however, allow this under recent enactments. Title to personalty can be held and transferred under the firm name, but realty must be in the name of the individual members or in the name of one member acting as trustee for the firm. Thus, while in the view of the business community the copartnership is a business entity under a firm name, in the sight of the law it is not an entity but merely a collection of single owners. This legal view accounts also for the full debt liability of every partner--except in a limited partnership. In case the firm assets are insufficient to meet the claims of creditors, any or all the partners' private resources may be levied upon.

Co-ownership of the profits of a business is another feature essential to the copartnership. No sharing in the profits on any other basis than that of co-ownership will constitute a partnership. When the question comes before the courts, the intention of the parties governs, and evidence showing that each acted as principal for himself and as agent for the others, and has shared profits as profits, would be sufficient to constitute the relationship.

=The Partnership Contract.=--A partnership being a contract relationship, all the requirements governing legality of contracts, such as agreement, consideration, lawful object, competency of contracting parties, etc., apply to the copartnership. The contract may be oral or in writing. In case of dispute an oral contract, on account of the difficulty of proof, is of little force in regulating the relations of the partners, and the general law of partnership would usually govern. Inasmuch as there is so great an opportunity for disputes in a relationship of this sort, it is imperative, if efficient working relations are to be maintained, that very carefully drawn articles of copartnership be agreed upon before active business is begun. These articles should contain, at least, the following:

1. The name of the firm and of the partners. 2. The kind and place of business. 3. The duration of the partnership. 4. The method of terminating it. 5. A detailed statement of the relations between the partners, such as duties and powers, capital contributions, withdrawals of capital, salaries, division of profits and losses, interest on capital, and the time of closing the books to secure a definite determination of the partners' interests.

Even when the utmost care is exercised in drafting the articles of partnership, it almost always happens that some portion is not understood alike by all or that some contingency arises not specifically provided for. Nevertheless, it is the only way in which a comparative avoidance of misunderstanding and dispute can be obtained.

=Partnerships Classified.=--As to the scope of their business operations, partnerships are usually classified into general and special. The general class embraces those for the conduct of some general or ordinary lines of business. The special class comprises those formed to undertake a definite task or some particular line of business. Joint ventures would come under this latter class.

As to the liability of their members, partnerships may be classified as general and limited. The general partner has the full liability, referred to above; the limited partner's liability never exceeds the amount of his investment. In a limited partnership one or more, but not all, members may limit their liability. This class of partnership can be formed only under direct authority of statute law. A limited partner is not active in the management of the business, being more in the nature of a lender of money to the firm, who gets his return in profits instead of interest. Should he become active in the firm's management, he will constitute himself an ordinary partner with full liability. The New York statute governing the formation of the limited partnership is as follows:

Two or more persons may form a limited partnership which shall consist of one or more persons of full age, called _general_ partners, and also of one or more persons of full age who contribute in actual cash payments, a special sum as capital, to the common stock--or fund--called _special_ partners, for the transaction within this state of any lawful business, except banking and insurance by making, severally signing and acknowledging and causing to be filed and recorded in the clerk's office in the county where the principal place of business of such partnership is located, a certificate in which is stated:

1. The name or firm under which such partnership is to be conducted and the county wherein the principal place of business is to be located.

2. The general nature of the business intended to be transacted.

3. The names, and whether of full age, of all general and special partners therein, distinguishing which are general and which are special partners, and their places of residence.

4. The amount of capital which each special partner has contributed to the common stock--or fund.

5. The time at which the partnership is to begin and end.

Affidavit of the payment of capital must be made and a notice of the formation of the partnership published in a paper of general circulation. The limited partnership is thus hedged about with safeguards for creditors, bankers, and other interested parties, particularly by the rule that a limited partnership cannot exist unless there are one or more general partners with full liability.

=The Joint-Stock Company.=--The joint-stock company is a partnership or association in which ownership, voice in the management, and profit-sharing ratio are evidenced by transferable shares of stock. Control and management are exercised through a board of directors chosen by the stockholders. If the company becomes bankrupt and the firm assets are insufficient to satisfy creditors, the members are personally liable to the full extent of their private property in the same way as in a general partnership.

The mining partnership is a form of joint-stock company which operates in mining communities. Usually the mining property itself is beyond the scope of such a partnership, only the development of this property by means of a lease being contemplated. Unlike the ordinary partnership, the members of a mining partnership may assign their shares of ownership. Upon their death or bankruptcy, their interests pass to others who take their place in the partnership without the consent of the remaining partners. Thus, the confidential relationship based on the right of selection of its members, characteristic of the ordinary partnership, is largely lacking in the mining partnership.

=Partners Classified.=--Finally, brief mention may be made of the following terms applied to partners to indicate varying degrees of activity within the ordinary partnership:

1. Ostensible partners--those who hold themselves out and are known to be partners.

2. Nominal--those who are known as partners but who have no real interest in the firm.

3. Dormant or silent--those who are not known to outsiders as partners and who take no active part in the management of the firm’s affairs.

4. Secret partners--those who are not known as partners to outsiders but who have an interest and take active part in managing the firm.

For more detailed information as to a partner’s rights, duties, and responsibilities to his copartners and to outsiders, a standard legal text on partnerships or business law should be consulted. The student should also read Chapter II in connection with this chapter and the next.

CHAPTER XXXIII

PARTNERSHIP FROM THE ACCOUNTING VIEWPOINT

From the fact that the law looks upon the partnership as a combination or collection of sole owners, some of the accounting problems arising out of the partnership form of organization are unique, and a partial or full treatment of some of these problems will be given in this chapter.

=Profit-Sharing in the Partnership.=--Of these problems perhaps the one occurring most frequently is that concerning the division of profits. Attention was called in Chapter XXXII to the need of explicit statement on this point in the articles of copartnership under the head of the intrapartnership relations. Since men combine their capitals for the purpose of realizing profits, it would naturally be supposed that all partnership agreements would be specific on that point. Yet it very often happens that many contingencies

relating to the matter of profit-sharing have not been foreseen and as a result disputes arise.

The fundamental principles governing profit distribution may be stated as follows:

1. Where the agreement is silent, the law provides that profits shall be divided equally among the partners regardless of the amounts of their respective investments of capital. Some partners may have made no investments of money or property, setting up their particular skill and aptitude or standing in the community as their share and contribution to the profit-earning capacity of the organization. Unless it is specifically agreed otherwise, these will share equally in any profits.

2. Where profits are to be shared in the same ratio as capital, the agreement should specify whether the basis of division is to be the original investments or the capitals as shown at the beginning of each period, which would be the original investments plus profits left in the business. This latter interpretation would usually result in a changing ratio for succeeding periods, whereas under the former interpretation the ratio of profit-sharing would be always the same.

3. Provision should be made, either in the original articles or at a subsequent time, for a change in the profit-sharing ratio in the event of a partner's withdrawing some portion of his original investment if such withdrawal is allowed. It may be stated here that an agreement between the partners as to any ratio for division of profits can be made at any time and will govern such ratio, but must be on a determinable basis.

4. Where the articles are silent as to the division of losses, the profit-sharing ratio governs. Where a different ratio is desired, specific statement of it must be made. Of course, upon the inception of an undertaking losses are not contemplated, but the experience of others should cause provision to be made for apportionment of losses in order to avoid possible difficulties or disputes.

5. Unless the articles--or subsequent agreements--provide for the payment of salaries to any or all of the partners, none are allowed.

6. The conditions governing the partners' drawings should be explicit as to the amount to be drawn during a given period. It should be stated explicitly whether excess drawings shall be regarded as a charge against capital, or as the basis for an interest charge, or simply as an excess drawing standing in the partner's current account without penalty other than a disallowance of future drawings until lapse of time brings the total amount drawn within the agreed limitations.

7. The manner of handling undrawn profits should be made definite. Are they to be transferred to the capital account and so be made a part of capital, resulting in changing capital ratios; or are they to be carried as open balances in the drawing accounts and thus take on the nature of temporary loans subject to withdrawal at any time?

=Average Investment as a Basis for Profit-Sharing.=--Attention should be called to a basis for profit-sharing sometimes employed for special partnerships, entered into for the performance of a specific contract or for doing any special work. In these cases the capital needed may not be known at the start, or if known may not all be required then but is to be furnished by whichever partner may have available funds at the time of need. In such cases the basis of profit-sharing may be made the amount of capital furnished by each partner and the length of time of its use in the enterprise. Two methods of determining the ratio may be employed.

FIRST METHOD. Each investment may be multiplied by the number of days occurring between the date on which the investment was made and the date of profit determination, giving a result which may be called "day-dollars" of investment in a sense similar to the term foot-pound in physics. From the total day-dollars of investment must be subtracted the day-dollars of withdrawals, arrived at similarly, thus showing net investment in terms of day-dollars. The sum of all the investments in day-dollars becomes the basis on which to prorate profits, each partner's share being the part which his individual net investments bear to this total net investment.

SECOND METHOD. The original investment of each partner may be multiplied by the time it remains unchanged, i.e., until it is added to or some portion is withdrawn. Similarly, this changed capital is multiplied by the time it remains fixed, and so for every change. The total of these items constitutes each partner's net investment, from which the profit-sharing ratio is determinable as above. In the problem given below, for purposes of illustration the dates are so taken that the calculation can be made on a month-dollar instead of a day-dollar basis, thus shortening the operation. The capital accounts of the partners, showing investments and withdrawals, are as follows:

A. B. CARD ========== 19— | 19— Jan. 15 2,500.00 | Jan. 1 10,000.00 Apr. 1 4,500.00 | Mar. 15 7,500.00 June 15 1,500.00 | June 1 5,000.00

D. E. FOLWELL ========== 19— | 19— Feb. 1 3,000.00 | Jan. 1 5,000.00 May 15 2,000.00 | 15 5,000.00 | Apr. 1 5,000.00 | June 15 2,500.00

Profits as on July 1, 19—, were $5,000. Determine each share.

SOLUTION (Using the second method)

Amount Months Month-Dollars A. B. CARD: $10,000 × ½ $ 5,000 7,500 × 2 15,000 15,000 × ½ 7,500 10,500 × 2 21,000 15,500 × ½ 7,750 14,000 × ½ 7,000 ------ ----- ------- 6 $63,250

D. E. FOLWELL: $ 5,000 × ½ $ 2,500 10,000 × ½ 5,000 7,000 × 2 14,000 12,000 × 1½ 18,000 10,000 × 1 10,000 12,500 × ½ 6,250 ----- ------- 6 55,750 -------- Total investment in month-dollars $119,000 -------- 63,250 Card's share of the profit: -------- of $5,000 = $2,657.56 119,000 55,750 Folwell's share: ------- of $5,000 = $2,342.44 119,000

The first method will, of course, give identical results. The second method has the slight advantage that the Investment Months column will always total the same as the length of the fiscal period, provided each partner makes his initial investment at the first of the period—which is not always the case—and acts as a check on the accuracy of that part of the calculation.

=Interest on Partners' Investments.=—A second problem of importance in connection with partnership accounting is the interest on partners' investments. The purpose of allowing such interest is twofold: First, it may serve as an indication of the excess of the profits in this enterprise over the return on the investment of a like amount in the money market, thus dividing the partnership profits into two parts, interest and management earnings; and second, it may serve as a method of distributing profits up to a certain amount on the basis of capital investments, where the agreed-on ratio is different from the capital ratio, thus distributing the period's profits on two different bases or ratios.

This is done sometimes to equalize somewhat the comparatively smaller-ratio profits of the partners who have made the larger investments. This problem, however, will be treated more fully in a later chapter where the methods of booking the interest, its treatment in case of a loss instead of a profit, and the computation of interest on drawings as well as on investments will be discussed and illustrated. Suffice it to say here that disputes frequently occur in connection with these problems and that detailed provision as to their handling should be made in the partnership agreement.

=Valuation and Correct Booking of Original Investments.=—A third matter of importance is the valuation and correct booking of the original investments other than cash. In the case of the sole proprietor this is of comparatively little importance because he will always reap the entire gain and therefore suffer no harm ultimately from present undervaluation of his property investments. In the partnership, however, where separate investment and personal accounts must be kept with each member, the correct valuation of the assets is of importance, inasmuch as the property of the partnership is the joint property of all partners and all will share ultimately in the effect of any under-or over-valuation at the time of investment. The partners' accounts are set up for the purpose of showing their respective interests in the enterprise, and after investments are once brought onto the books these accounts govern the equities of the various partners.

=Distinction between Buying Out an Interest and Making an Investment to Secure an Interest.=—The taking in of a partner by a sole proprietor or his admission as a new member to an existing partnership raises a point about which there must be a very definite understanding. A distinction must be made between purchasing from the owners an interest in the business as it stands at any given time and making an investment in a business to secure such an interest. The first transaction is of a personal nature between the owners and a third party who is a purchaser; in the other transaction the third party, who is an investor, puts in money to acquire an interest and his investment becomes the common property of all the owners of whom he is now one. In the one case the capital of the business is not increased, in the other case it is increased by the amount of the new investment. For example, if a balance sheet shows:

Cash $ 5,000.00 Liabilities $ 6,000.00 Other Assets 15,000.00 A. Jackson, Capital 14,000.00

and Jackson sells a half-interest to B. Killian for a given consideration, the new balance sheet becomes:

Cash $ 5,000.00 Liabilities $ 6,000.00 Other Assets 15,000.00 A. Jackson, Capital 7,000.00 B. Killian, Capital 7,000.00

In this case no new capital has come into the business because the purchase price does not go to the business as such but to A. Jackson as a private individual.

If, however, Killian is admitted as a half-interest partner by making a cash investment equal to the amount of Jackson's interest on the basis of book values, the balance sheet of Jackson and Killian will read:

Cash $19,000.00 Liabilities $ 6,000.00 Other Assets 15,000.00 A. Jackson, Capital 14,000.00 B. Killian, Capital 14,000.00

showing an investment of double the capital in the original Jackson business.

The question of good-will which frequently comes up when an interest in a going business is secured will be treated in Chapter XXXV, where also the manner of closing the books of the old business and opening those of the new firm will be shown.

=Final Considerations.=—From the foregoing discussion it is evident that the partnership relation gives rise to some of the most vexing questions which confront the accountant and the lawyer. It is a truism, therefore, that in drawing up the partnership agreement, all eventualities should be foreseen as nearly as possible and that they should be carefully provided for. As a final safeguard it is well to provide for the submission to arbitrators of disputes subsequently arising, the decision to be binding upon all the partners. This will avoid endless, expensive, and usually unsatisfactory actions at law and will more nearly secure justice to all. As a step in the same direction, it is suggested that provision be made for the drawing up of correct balance sheets and profit and loss statements, that sufficient time be allowed each partner to examine them as to their correctness and, if satisfied, that each be compelled to subscribe to them. This will localize any dissatisfaction within a limited time period and secure its adjustment while all salient points are still fresh in the minds of the interested parties.

CHAPTER XXXIV

CAPITALIZATION OF THE PARTNERSHIP

=Sources of Capital.=—From an accounting viewpoint, the capital of any business enterprise is the excess of its assets over its liabilities. Usually, the main fund of capital is secured by original contribution. In a partnership, the partners' investments provide the common partnership fund. Thereafter, additions to the capital may be secured in several ways:

1. Profits may be left in the business instead of being withdrawn.

2. Specific contributions may be made by the partners, which are either to be considered as additions to their capital investment, or are to be treated as more or less temporary loans to the business.

3. A new partner may be taken in, his contribution increasing the partnership capital.

The present chapter deals with original investments and with the first two types of additional capital mentioned above, while the next chapter discusses the admission of new members and the consolidation of partnerships.

=Original Contributions.=—It sometimes happens that the partnership agreement does not state specifically how much each partner shall invest in the business. For example, the agreement may state that partner A is to contribute certain properties, i.e., place of business and equipment; that B is to contribute a stock of goods, and that the investments of the remaining partners are to consist of cash, the exact amount of which is not stated because it depends upon the valuation to be placed upon the property and merchandise invested by A and B.

After such a valuation has been made and the amounts of the cash contributions have been determined, it may be found that the total investment is more than the business requires; or it may develop that some of the partners do not have sufficient funds available to pay their shares, while others may be able to contribute more than their respective shares. It thus happens that the partnership agreement is not always rigidly enforced, some partners contributing more, and others less, than the agreed amounts. At the time this is looked upon as a temporary arrangement, but it often results in a permanent condition. The partnership agreement should contain provision for such a contingency. If it does not, a later agreement should be made to regulate the relations between the partners.

=Adjustment of Capital Contributions.=—Whenever a partner contributes more than his agreed share, it is customary to allow him interest on the excess amount, and other partners whose investment may be less than the agreed amount are usually charged with

interest. This is obviously an equitable method of meeting the situation.

As a rule, these interest adjustments are handled through the Profit and Loss account, i.e., the partners who invest less than the agreed share are considered to owe interest to the partnership, and those who invest more have an interest claim against the business—not against the other partners individually. The debit or credit balance in the Profit and Loss account resulting from these adjustments is in turn distributed among _all_ the partners in the profit-or-loss-sharing ratios. It should be clearly understood, however, that although these adjustments are made through the Profit and Loss account, there is no element of business profit or expense involved. For this reason, these interest entries should be made direct in the appropriation section of the Profit and Loss, and should never be booked in the regular Interest accounts.

The following illustrations will bring out the different methods of adjustment:

PROBLEM. A, B, and C are equal partners under an agreement to contribute each $15,000. Provision is made that excess contributions are to be credited with interest at 6% and that deficits are to be charged at the same rate. The records show that actual contributions were: A, $18,000; B, $13,000; and C, $11,000.

Three methods of adjustment will be shown.

FIRST METHOD A’s excess is $3,000, interest on which is $180. B’s deficit is $2,000, interest on which is $120. C’s deficit is $4,000, interest on which is $240.

These three interest amounts are brought upon the books by the following journal entries:

Profit and Loss 180.00 A 180.00 B 120.00 C 240.00 Profit and Loss 360.00

The Profit and Loss account then shows a credit balance of $180, which is distributed as follows:

Profit and Loss 180.00 A 60.00 B 60.00 C 60.00

The net effect of these adjustments is a credit to A of $240, and debits to B and C of $60 and $180 respectively.

Note that A is credited with $180 for his excess of $3,000, and Profit and Loss is debited with the same amount, because it is the business that owes him this interest. If this Profit and Loss debit is distributed separately, A’s share of it is $60, so that his real credit on his $3,000 excess is not $180 but $120. On the other hand, the combined debits to B and C result in a credit to Profit and Loss of $360, and if this item is distributed as such, A’s share of it is $120, thus making his total credit on the complete adjustment $240. A similar explanation applies to the adjustments for B and C.

SECOND METHOD. The first method was based on a consideration of the respective excesses or deficits on capital investments, but the same result may be obtained by comparing all contributions with the amount of the smallest investment, viz., $11,000 by C. This would show A’s excess over C as $7,000, and B’s excess over C as $2,000, and these two amounts may be treated as loans to the business. The result is that A is credited with 6% on $7,000, and B with 6% on $2,000, as follows:

Profit and Loss 540.00 A 420.00 B 120.00

The debit to Profit and Loss is charged in equal shares to the three partners as follows:

A 180.00 B 180.00 C 180.00 Profit and Loss 540.00

The final result shows a net credit to A of $240, a net debit of $60 to B, and a net debit of $180 to C, the same as by the first method.

THIRD METHOD. The total capital contributed is $42,000. To be equal partners under the agreement, each should have contributed one-third of the common fund, or $14,000. Actually, A’s investment is $4,000 in excess of this, while B’s is $1,000 less, and C’s $3,000 less. The excess contribution of A, $4,000, may be looked upon as a loan to B and C as individuals, bringing their shares up to the $14,000; viz., $1,000 to B and $3,000 to C. Instead of making the adjustment through the Profit and Loss account as in the first two methods, the interest is now adjusted between the three partners as private persons, the entries affecting only the partners’ personal accounts. This adjustment results in a credit to A and a debit to B for $60, A having loaned B $1,000; and in a credit to A and a debit to C for $180, A having loaned C $3,000. A’s total credit is $240, and B’s and C’s debits are respectively $60 and $180, the same as by the other two methods.

Thus it is seen that any of the three methods employed leads to the same results. It will be observed, however, that in the example given the contemplated investments are to be equal for the three partners ($15,000), and the profit and loss is to be shared on the same basis. The three different methods of adjusting interest lead to the same result only when the profit-sharing ratio is identical with the ratio between the contemplated investments.

=Averaging Investments.=—In temporary partnerships, organized for carrying out a particular undertaking, the amount of capital needed is often not known and may vary at different stages of the undertaking. Here the partners usually contribute as need arises, and withdraw when funds not needed in the business become free. Under such conditions, the partnership agreement should always state the manner in which the partners' interests are to be adjusted. A common method, as explained and illustrated in Chapter XXXIII, is to compute the average investment of each partner and to use these amounts as the basis for profit-sharing. In this way the problem of interest adjustment as such is completely eliminated.

=Accretions of Capital through Profits.=—At the close of the fiscal period, when results are summarized, the net profits are transferred to the partners' accounts. As the amount of profit left in the business usually differs for different partners, it is evident that the partners' capital accounts at the end of the period will show a different ratio from that existing at the beginning. Assume that a given partnership consists of two members, A investing $2,000 and B $1,000, and that profits are to be shared in the same ratio as these original investments, i.e., 2:1; assume further that A withdraws the greater part of his profits while B allows his share to accumulate, and that at the end of a number of years the capital ratios have completely changed, the capitals being, say, $8,000 for A and $24,000 for B. Obviously, under such circumstances it would not be just for A still to receive twice as much profit as B on the basis of the _original_ investment ratio of 2:1.

Whenever it is intended that profits are to be shared on the basis of investments, the profit-sharing ratio should be changed from time to time in order to correspond with actual investments, and this should be plainly stated in the partnership agreement; or increments to capital through the accretion of profits should be treated as temporary loans subject to withdrawals and bearing interest until withdrawn. It should be the policy of the firm to offer an incentive to its members to leave their surplus profits in the business and so prevent the need of borrowing from outside.

Finally, it may be said that in the event of dissolution, accretions through profits constitute claims against the firm ranking before the partners' capitals. Such accretions partake of the nature of loans and for this reason they are sometimes carried in _partners' loan accounts_, to keep them separate from the original capital investments, or are left in the "Personal" accounts which are not then closed into the "Capital" accounts.

=Additional Contributions and Loans.=—When contributions are made by partners there should be a specific understanding as to whether such funds are to be considered as additional capital or as loans to the partnership. In the first case the items should be shown in the capital accounts of the partners, thus requiring a reconsideration of the profit-sharing ratio—although a change is not always made; in the second case they should be entered in the partner's loan accounts with corresponding interest adjustments, as has been explained.

Loans by partners may be evidenced by firm notes signed by all the partners. However, these notes should not be carried in the regular Notes Payable account because that account represents the firm's liability to outsiders, which must ordinarily be met promptly according to the terms of the instrument. At common law a partner may not bring suit against the firm of which he is a member; hence there is an essential difference between these two kinds of notes. For this reason a new account is opened entitled "Partners' Notes Payable," which is credited whenever the firm issues a promissory note to any of its members. Where the loan is not evidenced by a formal note, record should be in the partner's loan account. As stated on page 324, any loans made by partners to the business rank before regular capital claims, and this priority is not changed when such loans are evidenced by promissory notes.

=Partners' Loans in Relation to Firm Credit.=—Loans made by partners to the business may be viewed in two very different ways, depending upon the credit rating of the firm. If there is distrust as to the partners' standing and financial condition, the fact that they themselves, who know the real condition better than any outsider, are willing to put additional capital into the business, is the best evidence that the firm is not so badly off. Consequently, loans made by partners under such conditions help to increase the firm's credit.

On the other hand, if the integrity of any member of the firm is questionable, his loans to the business do not necessarily increase the credit of the firm; for in case of financial trouble he may attempt secretly to withdraw part of the assets from the business and to

conceal the true condition of affairs from the creditors. Being on the inside, he is in a position to do this before outsiders can even scent trouble. Normally, however, the loan of a partner makes a better impression than a loan from an outsider, since in case of insolvency and dissolution the partner's loan ranks _after_ the claims of outside creditors.

It sometimes happens that in a partnership one or more of its members lends the firm comparatively large amounts of money and accepts demand notes as evidence of such loans. If the partner holding such a note is unscrupulous, he may present it for payment at an unfavorable time and, if the business is unable to pay, may demand an "accounting." He may even go so far as to cause its dissolution, repurchase the business at much less than its true value and so "freeze out" his partners.

=Borrowed Capital.=—It may happen that a firm is obliged to borrow funds from outside in order to increase its working capital. For instance, the partners may have no available private funds for further investment and yet may not desire to admit new capital on a profit-and-loss-sharing basis. Such loans usually are on a long-time basis, and should not be included in the Notes Payable account. A special account should be opened, e.g., Notes Payable Special, Mortgage, or some other title plainly indicating the nature of the loan. Sharp distinction should be made between funds borrowed for the purpose of increasing the permanent capital, and money borrowed for current needs. The need for additional current funds usually results from seasonal fluctuations in business, slow collection of customers' accounts, or slow movement of stock, and is met by current borrowing at a bank; while the need for increased capital is caused by the original capital investment being insufficient to meet present conditions.

CHAPTER XXXV

OTHER PARTNERSHIP PROBLEMS

=Admission of a New Partner.=—In Chapter XXXIII a distinction was made between buying out an interest in a business and making an investment in a business. In the former case no new capital is acquired, while in the latter the capital of the firm is increased by the amount of the new partner's contribution.

When a new partner is admitted he usually acquires not merely the right to share in the profits, but he also obtains a share in the net worth (often called "net assets") of the enterprise. For this reason it is necessary that all the partners, including the new member, agree on the value of the net assets, and in this connection any of the following possibilities may arise:

1. Upon admission of the new partner the book accounts may be considered to represent the true status of the business. A balance sheet is drawn up and the new partner is admitted on the basis of the net worth it shows.

2. It may be agreed that the assets are not worth the amount at which they are carried on the books and that a new valuation be placed upon them.

3. The business may be considered to be worth more than the amount shown by the balance sheet.

=First Case.=—In the first case little difficulty is met in making the opening entry admitting the new partner. For instance, if the balance sheet shows a net worth of $30,000, and the new partner wishes to make an investment in order to secure a one-fourth interest in the firm, the amount to be contributed is manifestly $10,000. Assuming that he makes a cash investment of $10,000, the following entry meets all accounting requirements:

Cash 10,000.00 A, Capital 10,000.00

As a result of this cash investment of $10,000, the net worth of the new firm is increased to $40,000 and the one-fourth interest belonging to A is evidenced by his capital account at $10,000. The new firm may now continue the old records and no further adjustments need be made.

=Second Case.=—In the second case it is necessary to place a new valuation upon the assets of the old firm and the accounts of the old partners must be adjusted accordingly. For instance, suppose A and B are equal partners and the financial status of the firm is shown by the following balance sheet:

BALANCE SHEET OF A & B

Cash $ 1,000.00 Notes Payable $ 3,000.00 Accounts Receivable 10,000.00 Accounts Payable 5,000.00 Merchandise 6,000.00 Mortgage on Bldg 4,000.00 Building and Equipment 16,000.00 A, Capital 10,500.00 B, Capital 10,500.00 ---------- ----------

$33,000.00 $33,000.00 ========== ==========

More capital is needed and C is invited to make an investment. Upon investigation he finds that there are included under Accounts Receivable many old items, of which it is estimated $1,000 will be uncollectible; that the merchandise is overvalued to the amount of $500; and that the building and equipment are worth $1,500 less than is shown on the books. He offers to make an investment to secure a one-fourth interest and his offer is accepted.

As a result of the new valuations placed upon the assets, the net worth of the firm is now $18,000, against the old showing of $21,000. Consequently, the capital accounts of A and B are reduced from $10,500 to $9,000 each. The new partner is to invest a certain sum sufficient to acquire a one-fourth interest in the new business. Hence the combined capital of A and B, amounting to $18,000, will represent three-fourths of the new capital, and consequently the amount to be invested by C is $6,000. Thus the new capital of the firm will amount to $24,000, one-fourth of which, or $6,000, is credited to C's capital account.

The balance sheet of the new firm will show:

BALANCE SHEET OF A, B & C

Cash $ 7,000.00 Notes Payable $ 3,000.00 Accounts Rec. $10,000 Accounts Payable 5,000.00 Less—Reserve 1,000 9,000.00 Mortgage on Bldg 4,000.00 ------- A, Capital 9,000.00 Merchandise 5,500.00 B, Capital 9,000.00 Building and Equipment 14,500.00 C, Capital 6,000.00 ---------- ---------- $36,000.00 $36,000.00 ========== ==========

The firm has thus secured $6,000 additional capital, on a basis somewhat unfavorable for the present, but inasmuch as the books now show conservative values, no real injustice results.

=Third Case.=—The third case shows the firm in a position to demand something more than book values as the basis for admission of the new partner. The presumption is that the old firm is favorably known, has an established trade and patronage, built by fair dealing and judicious advertising, by its favorable location, and the numerous other ways in which a substantial business may be developed. Its standing in the community is a factor of value to the firm because it brings trade to its doors. Other conditions being equal, a firm which enjoys a good reputation is worth more than a new venture. Such a reputation is known as "good-will" and constitutes an exceedingly valuable though an intangible asset. The essence of good-will is the ability to produce more than normal profits, i.e., profits above the average in that line. Consequently, whenever the members of a firm consider the admission of a new partner, good-will is regarded as one of the _assets_ of the existing enterprise, thereby increasing its net worth.

The valuation of good-will, however, is a difficult matter and it is a well-established principle that good accounting will not allow the asset good-will to be set up on the books of a concern unless it has come into possession of it by purchase or unless a part of its own good-will is sold to a new partner. In this case the price received for the portion sold represents an outsider's valuation and may therefore become the basis for valuing the whole of it.

The following case will serve as an illustration:

PROBLEM. Assume that X has a one-half interest in a firm, and Y and Z a one-fourth interest each, the balance sheet showing the following summarized facts:

BALANCE SHEET OF X, Y & Z

Cash $ 2,000.00 Liabilities $10,000.00 Other Assets 48,000.00 X, Capital 20,000.00 Y, Capital 10,000.00 Z, Capital 10,000.00 ---------- ---------- $50,000.00 $50,000.00 ========== ==========

An outsider, R, is now to be admitted to a one-fifth interest by making an investment in the business. The relative shares of the others are to remain as before. Hence, after R's admission, X will have two-fifths, and Y, Z, and R one-fifth interest each. It is further assumed that no revaluation of the tangible assets is necessary.

The net worth of the old firm, according to the books, is $40,000, and if this were taken as the basis for admitting R, an investment of $10,000 would be sufficient to acquire a one-fifth interest in the new firm. However the business is considered to be worth $10,000 more than the $40,000 shown in the balance sheet, and for this reason, instead of paying $10,000, R is required to invest $12,500. The excess of $2,500 is paid by R as an offset to the shares of the others in the good-will of the firm.

There are three ways of treating this good-will element, viz.:

FIRST METHOD. Debit the Good-Will account for the amount actually paid for it by R, viz., $2,500, and credit the capital accounts of the old partners in proportion to their shares in the profits:

Good-Will 2,500.00 X, Capital 1,250.00 Y, Capital 625.00 Z, Capital 625.00

As a result of this entry, the capital account of X is $21,250, and those of Y and Z $10,625 each. The capital account of R, however, shows a credit of $12,500. In other words, R's interest in the net assets—although not in the profits—of the business as shown by his account is _larger_ than that of Y and Z, while as a matter of fact he is to have an equal share. For this reason, this method of treating good-will is not satisfactory.

SECOND METHOD. This method regards the matter from a different standpoint. Taking book values as a basis, the share bought by R is worth only $10,000. However, on account of good-will, the real value of this share is considered to be higher and R is required to pay $12,500 for it. Hence, in order that the books may show actual values, the good-will item must be added to the assets of the old firm, at the same time increasing the capital accounts of X, Y, and Z in proportion to their shares in the profits. The entry is:

Good-Will 10,000.00 X, Capital 5,000.00 Y, Capital 2,500.00 Z, Capital 2,500.00

As a result of this adjustment the capital of the old firm is shown as $50,000. R now invests $12,500, and the capital is thereby increased to $62,500. The capital accounts of the four partners now show $25,000, or two-fifths for X, and $12,500 or one-fifth each for Y, Z, and R.

THIRD METHOD. Under this method of handling good-will, the extra $2,500 invested by R is treated as a bonus for distribution among the members of the old firm, their capital interests in the new firm remaining the same as in the old and R's appearing at $10,000. There is no objection to this method if R is satisfied.

Of the three methods, the second usually proves the most satisfactory.

A similar problem involving the handling of good-will is encountered when a member of an existing firm sells out his interest, including a share of the good-will, to one who takes his place in the firm. Here the transaction may be looked upon as a private deal between buyer and seller, in which case the buyer merely succeeds to the seller's interest in the firm, his capital appearing on the books at the same amount as the seller's former capital figure even though the new partner pays more for it; or the good-will may be brought onto the books and the capitals of all the partners be shown at increased figures, as under the second method discussed above.

=Consolidation of Partnerships.=—There are various reasons why the consolidation of partnerships may be of mutual advantage to the individual firms concerned. When two or more firms consolidate, the competition which formerly existed between them is eliminated and co-operation takes its place. Also by uniting their businesses, many of the operations which were formerly performed separately are now amalgamated with resulting savings. Many other advantages may result from such consolidations.

From the standpoint of the accountant, the consolidation of partnerships is essentially the same as the admission of new partners, the same principles applying to both. Before actual consolidation takes place, it is necessary for each of the partnerships to place a new valuation upon its assets and for all concerned to agree upon the new figures. In almost all cases good-will is an important factor. The valuation of good-will requires an investigation of the profits and profit-earning capacity of the member firms. Conditions affecting the profits of the various firms must be equalized as nearly as possible so that the earning capacity of each can be compared on an equitable basis. Such questions as the way in which partners' salaries, interest on capitals, withdrawals, and loans have been handled; the relation of outside sources of income, if any, to the profit of any of the member firms; and whether the consolidation contemplates taking over such source of profits—these and similar questions must be considered and treated equitably for all concerned.

The following illustration is given to indicate the bookkeeping problems incident to consolidations:

PROBLEM. A and B, equal partners in an established business, consolidate with C and D, equal owners of an allied business. A and B are each to have a one-third, and C and D each a one-sixth interest in the new firm. The following balance sheets show their financial positions:

BALANCE SHEET OF A & B Cash $ 2,500.00 Notes Payable $ 5,000.00 Notes Receivable 1,000.00 Accounts Payable 8,000.00 Accounts Receivable 22,000.00 Mortgage on Real Merchandise 10,000.00 Estate 4,000.00 Furniture and Fixtures 2,500.00 A, Capital 16,000.00 Delivery Equipment 1,500.00 B, Capital 16,000.00 Real Estate 9,500.00 ---------- ---------- $49,000.00 $49,000.00 ========== ==========

BALANCE SHEET OF C & D Cash $ 5,000.00 Notes Payable $ 5,000.00 Accounts Receivable 15,000.00 Accounts Payable 7,750.00 Merchandise 8,000.00 C, Capital 9,000.00 Furniture & Fixtures 2,000.00 D, Capital 9,000.00 Horse & Wagon 750.00 ---------- ---------- $30,750.00 $30,750.00 ========== ==========

A careful valuation of the various properties shows the figures of the balance sheet of C & D to be conservatively estimated. In regard to A & B's figures, however, it is decided to allow $2,000 for possible bad debts, and to value their merchandise at $9,000, delivery equipment at $1,000, and real estate at $9,000. Furthermore, it is agreed that C & D's good-will is to be valued at $5,000, and A & B's at $10,000.

After the adjustments the new balance sheets appear as follows:

BALANCE SHEET OF A & B Cash $2,500.00 Notes Payable $5,000.00 Notes Receivable 1,000.00 Accounts Payable 8,000.00 Accounts " $22,000 Mortgage on Real _Less_—Reserve 2,000 20,000.00 Estate 4,000.00 Merchandise 9,000.00 A, Capital 19,000.00 Furniture and Fixtures 2,500.00 B, Capital 19,000.00 Delivery Equipment 1,000.00 Real Estate 9,000.00 Good-Will 10,000.00 $55,000.00 $55,000.00 ========== ==========

BALANCE SHEET OF C & D Cash $ 5,000.00 Notes Payable $ 5,000.00 Accounts Receivable 15,000.00 Accounts Payable 7,750.00 Merchandise 8,000.00 C, Capital 11,500.00 Furniture and Fixtures 2,000.00 D, Capital 11,500.00 Horse and Wagon 750.00 Good-Will 5,000.00 ---------- ---------- $35,750.00 $35,750.00 ========== ==========

It is agreed that C and D's capitals are each to be taken as representing one-sixth of the capitalization of the new firm, and A and B are each to contribute $4,000 in cash to bring their capitals up to the required amounts.

The opening balance sheet of the consolidated firm will then read as follows:

BALANCE SHEET OF A, B, C & D Cash $15,500.00 Notes Payable $10,000.00 Notes Receivable 1,000.00 Accounts Payable 15,750.00 Accounts Mortgage on Real Receivable $37,000 Estate 4,000.00 _Less_—Reserve 2,000 35,000.00 A, Capital 23,000.00 Merchandise ------- 17,000.00 B, Capital 23,000.00 Furniture and Fixtures 4,500.00 C, Capital 11,500.00 Delivery Equipment 1,750.00 D, Capital 11,500.00 Real Estate 9,000.00 Good-Will 15,000.00 ---------- ---------- $98,750.00 $98,750.00 ========== ==========

CHAPTER XXXVI

PARTNERSHIP PROFITS

=Ambiguity of Definition of Profits.=—The term "profits" as applied to business is perhaps used with as little uniformity as any term met with. When a concern speaks of its profits, it is difficult to know exactly what is intended, because the meaning of the term depends very largely on the methods of accounting of that particular concern. The reported profits of different firms are not, therefore, a true basis for judging their relative worths. For instance, although the net profits of a single proprietorship and of a partnership are usually determined in the same manner, there is nevertheless variation in the treatment of some items such as salaries, drawings, interest on capital invested, etc. The partnership form, like the single proprietorship, contemplates an investment on the part of the owners not only of capital but also of time and effort. This is one of the differences in working organization between these forms of business and the corporation. Investment in the corporation is of capital only. If services are employed by the corporation, they are paid for and charged as services, salaries, etc.

=Compensation for Time and Services.=—In the partnership form of organization, the active and direct management of the business is usually vested in the owners. Where this is not the situation, as in a limited partnership, or whenever one or more of the partners does not take an active part in the management of the business, his share of the profit is usually curtailed by the allowance of salaries to the managing partners before any distribution of profits in the agreed ratio is made to the partners. Thus, partnership profits include not only the salaries of the owners but, in general, a recompense for the time and ability of the proprietors. The man who makes an investment in a partnership does so usually because he desires to invest his time as well as his capital. He expects,

therefore, to receive not only a fair rate of interest on his money but also pay for the services he renders.

=Interest on Investment.=—The rate paid for the use of money is dependent both on the money market and on the element of risk involved in the particular investment. In mining ventures, for instance, where there is frequently considerable uncertainty as to the return of the principal, the interest rate is sufficiently high to offset, during the life of the loan, the possible loss of the principal at the end. So an investor in a partnership, because of the greater element of risk in comparison with other and safer investments, requires a higher rate of return in interest than he would ordinarily secure through the investment of his capital in sound securities.

=Partnership Profits Defined.=—Partnership profits, therefore, contain these two elements—interest and recompense for services. If profits are extraordinary or above normal, such excess may be and usually is the measure of the more-than-average ability of the partners, unless it results from the monopolistic character of the business.

In speaking of profits the term is used in a technical accounting sense and has reference to the manner of their showing in the Profit and Loss account and its content. That account or the Profit and Loss statement usually develops a so-called “net profit” which is distributed to the partners. Such profits are more easily defined by stating what should not be considered in their determination, than by attempting to give an itemized list of the income and expense items entering therein.

In accordance with the theory of the law of partnership, the net profit of a partnership is the balance of the Profit and Loss account before interest on owners’ capital investments and the recompense to the partners on account of time and services are taken into account. In the accounting for an ordinary partnership, such items as interest on capital investments, salaries to partners, etc., are not to be considered as expense items to be deducted from profits before the net earnings are determined, but as a part of the net profits to be distributed to the several owners of the business. The payment of salaries and interest on capital is made simply for the purpose of distributing net profits according to certain methods agreed upon by the members of the firm.

=Profit and Loss for Comparative Purposes.=—For the purpose of comparing results between different periods, the Profit and Loss account should have a fairly uniform content from year to year. It should set forth the amount of the net operating profit, in the calculation of which account should be taken of all ordinary income and expenses incurred in the operation of the business. This will provide the basis for comparison, as between periods, of the ordinary normal activities of the business.

In the “Non-Operating” or “Other Income” sections any “outside-the-business” income and expense should be shown, such as income from outside investments, and expenses in connection therewith. Items of extraordinary income and expense, however, such as the profits arising through the sale of good-will, the sale of real estate, extraordinary losses from fire, etc., usually are taken directly into the partners’ accounts so as not to destroy the value (for purposes of comparison) of the results shown by the Profit and Loss account from year to year.

In this way, while the purpose of the Profit and Loss account is to summarize the temporary proprietorship accounts, some proprietorship items may be omitted for the sake of making the summary of greater value to the proprietors. Such a method of handling does not conflict with principles previously laid down, but rests upon the general principle that accounting methods and forms must be flexible in order to conform to the requirements of particular cases; else they fail in fulfilling their full purpose.

=Allowance of Salaries.=—The allowance of salaries to partners is not so much for the purpose of measuring the excess of the profits of the partnership over what the individual owners might have earned by working for others, as it is for the purpose of equalizing or adjusting their interests on an equitable basis. When, on the one hand, men invest their abilities and services in addition to their capitals, and on the other hand, the profit and loss-sharing ratio is determined on the basis of capitals invested, the greater ability of a given partner may be recognized and compensated by a salary. Thus a partner of exceptional ability secures a larger share in the profits by receiving a fixed amount under the head of salary, the remaining part of the net profits being divided among all the partners in the profit and loss-sharing ratio.

=Allowance of Interest.=—As explained in Chapter XXXIII, it is not unusual in partnerships where the profit and loss ratio differs from the capital ratio, to allow interest on capital. The effect of such a provision is to secure a distribution of profits on a dual basis, viz., a part as interest on the capitals in the capital ratio and the remainder in the profit and loss ratio. Thus, two partners, A and B, whose capitals are $10,000 and $15,000 respectively, with a 6% interest allowance on capital and a subsequent half-and-half distribution of profits, share the profits in effect on two different bases. Suppose the profits are $6,000. The interest requirement will give A $600 and B $900, after which $4,500 will be divided equally. Interest on partners’ capitals is thus in no sense an operating expense and should be handled always in the appropriation section of the Profit and Loss.

If the partnership agreement makes specific provision (but not otherwise), interest may be charged on partners' drawings. This is merely an additional device for adjusting the partners' interests, and causes a slight difference in the net shares of profits. Where interest is allowed on capitals and also charged on drawings, the partners' accounts, Personal and Capital, when considered together, comprise virtually an account current, and the interest computations may be made as will be explained in Chapter L in connection with accounts current.

Another method of profit-sharing sometimes introduced in the partnership agreement is the device of an interest allowance for a contribution in excess of the agreed amount and an interest charge on partners' deficiency of capital. This method of equalizing unequal investments, as illustrated in Chapter XXXIV, is a fair arrangement to all concerned.

=Interest on Partners' Loans.=—Careful differentiation must be made between interest on partners' capitals and on partners' loans. If a loan is secured from outside parties, its interest cost is a business expense, to be taken into account before determining net profits. A loan from a partner does not in the least change the manner of showing its cost. Interest on partners' loans is not, therefore, to be handled in the appropriation section of the Profit and Loss account, but should be charged to the regular Interest Cost account, which is cleared in the regular way through Profit and Loss. The credit is to Cash if actually paid, or to the partners' personal accounts if unpaid, although the amount is sometimes credited to the partners' loan accounts in order to secure a compounding of the interest.

=Reserved Profits.=—In rare cases, before the partners' shares in the net profit are determined, a portion of it may be reserved for some specific purpose. The portion so reserved is transferred from Profit and Loss to some specified reserve account, to indicate the retention of the profits in the business. If the profits were transferred to the partners' accounts, they would be subject to withdrawal from the business. Even when shown in the reserve account, however, they belong to the proprietors and are just as much a part of the net worth of the business as if credited to the proprietors' accounts. Such reservation of profits may be for the purpose of providing for the replacement of some fixed asset when it wears out, as buildings, machinery, etc., or for meeting a liability when it comes due, or for some similar purposes. Such reservations, however, are seldom made in partnership accounting and a complete treatment of the subject is reserved for the work of the second year in connection with corporation accounting.

It should be noted that reserves created from profits are not to be confused with valuation accounts, such as reserves for depreciation and doubtful accounts. Valuation accounts in no sense represent a reservation of net profits. They represent the credit side of certain asset accounts. The contra debits—to depreciation or bad debts—of these credit reserves are expenses of the business which must be taken into account before the amount of net profit can be determined.

=Closing Profits to Partners' Accounts.=—The disposition of profits under a partnership does not differ materially from that under the single proprietorship form. When the net profits are determined, they belong to the proprietors and are usually transferred to their accounts. The method of transfer may be either by way of the partners' personal accounts or direct to the capital accounts. The principle involved in either treatment was discussed at the time of closing the books for the single proprietorship and will not be repeated here. Where the partners do not desire to have any change shown in their original capital accounts, the profits may be transferred to the loan accounts of the partners or stand as open balances in their personal accounts.

=The Appropriation Section—Distributing a Deficit.=—The appropriation section of the Profit and Loss account shows the distribution of net profits to the partners' accounts. A thorough understanding of the partnership agreement is necessary before the proper distribution can be made. If the agreement provides for salaries and interest on capitals and drawings, these requirements must first be met, even though the net profits are insufficient to satisfy them. Their purpose, as explained above, is to equalize conditions and interests among the partners preliminary to their sharing in the profit and loss ratio. If this equalization results in a deficit, such deficit will be distributed in the agreed ratio and to that extent nullify some portion of the profits distributed as salaries and interest. If specific provision in the articles of copartnership requires a different handling of the salaries and interest items, that provision of course governs. Otherwise these items should be treated as above.

If any of the partners leave profits in the business, this usually results in a changing ratio of the capital account balances. Where the distribution of profits is based upon the original contributions, it is advisable to transfer the profits left in the business to separate loan accounts for the partners. The partners' capital accounts then always show their original contributions.

=Partners' Withdrawals.=—Partners' withdrawals and salaries are usually handled in a very unsystematic way. The amount of the drawings allowed each partner during a given period—week or month—should be definitely determined by agreement, and regular checks should be issued for these amounts. The payment of partners' personal bills and the handling of any other personal items

should, as a matter of standard practice, be made out of personal funds.

If the partnership agreement provides for salaries these should be credited, when due, to the partners' drawing accounts which will then be charged with all actual drawings, whether for salary or otherwise. The offsetting charge at the time the salary credit is made should be to a "Partners' Salaries" account, which at the close of the fiscal period is closed into the appropriation section of the Profit and Loss account, thereby showing in it the proper distribution of profits as salary.

=Profits Determination upon Admitting a New Partner.=—Particular care should be taken to determine as nearly as possible the correct net profit at the time of any change in the partners' relations. Upon the admission of a new partner, failure to make entry in the old partners' accounts of any profit rightfully belonging to them leads to its being shared with the new partner and consequently results in a loss to the old partners. In like manner the deferring of an expense charge—rightfully belonging to the period before the admission of the new partner—to the period after the admission, results in a wrongful charge to the new partner. Similarly, when a partner is admitted on a changing profit ratio basis (as when, for example, he is to receive a one-fourth share for three years, at the end of which time he is to have a one-third share), an incorrect determination of profits at the end of the three-year period may mean a loss either to him or to the old partners. So long as the same partnership and the same profit and loss-sharing ratios continue, no injustice results through failure to include some such items in their proper periods, as they are cumulative and their effect will be recorded in later periods. However, this is no excuse for the inaccurate determination of profits at any time.

CHAPTER XXXVII

PARTNERSHIP DISSOLUTION

=Temporary Nature of Partnership.=—Because of its personal character, a partnership has necessarily a limited duration. It must look forward to the time when its business will have to be closed up. The chief causes leading to a dissolution are briefly reviewed here.

=Causes of Dissolution=

1. The withdrawal of any partner. Under ordinary circumstances a partner cannot be held to a specific performance of his contract. If he becomes dissatisfied, suspicious, or desires for other reasons to withdraw from his contract before its expiration, he has that power. Such withdrawal cannot be looked upon as a right but only as a power to be exercised under unusual circumstances. If his withdrawal before the agreement terminates results in damage to his copartners, they have a lawful claim against him for the amount of the damage. Under extraordinary conditions, specific performance of the contract might be decreed, i.e., the partner would not be allowed to withdraw.

Withdrawal does not relieve a partner from liability for partnership debts incurred while he was a member of the firm. Any creditors not paid by the firm may hold the withdrawing partner liable for the debts. To be relieved from the liability on debts arising _after_ his withdrawal, personal notice of withdrawal must be given to all the firms with which the partnership has been dealing; a published notice being considered sufficient for the parties not dealing with the firm until after withdrawal.

2. Sale of a partner's interest or admission of a new partner. When a partner, with the consent of his copartners, sells his interest in the firm to another, or when a new member is admitted to the partnership, in the eyes of the law the old partnership has ceased to exist and a new one has taken its place.

3. Limitations in the partnership agreement. The agreement may specify the period for which the partnership is to exist. If it is a special partnership, the object it is to accomplish may be stated and the law considers the firm automatically dissolved as soon as that object is attained.

4. Mutual consent of the partners. Whether or not the partnership period is limited by the agreement, the partners may at any time rescind their contract by mutual consent.

5. Misconduct, insanity, death, assignment, or bankruptcy of a partner. The happening of any of these contingencies effects a dissolution. By misconduct may be understood a member's failure to pay the agreed contribution of capital, failure to perform his duties, his acting in bad faith towards his copartners, etc.

6. Illegal object. A partnership entered into for the pursuit of an object which later becomes illegal is automatically dissolved.

7. War between nations of which partners are citizens. This dissolves the partnership, though such dissolution may be more in the nature of a suspension, inasmuch as the relation may be resumed upon cessation of hostilities.

8. Bankruptcy of the firm. This results in the firm's assets being sold to satisfy the claims of its creditors and the firm as such ceases to exist.

9. Sale or transfer. A firm may sell out to another firm or change its form of organization to that of a corporation. The old firm, therefore, no longer exists.

=Problems Incident to Dissolution.=—It is purposed to consider some of the problems involved in winding up the affairs of a partnership. From the schedule of causes of dissolution given above it will be seen that a firm may be either solvent or insolvent at dissolution. The three statements sometimes set up in the case of insolvency—the Statement of Affairs, the Deficiency Account, and the Realization and Liquidation Statement—will not be explained here but results obtained through them will be taken into account. These statements are seldom met in practice and are not standardized either as to form or content. Their treatment is deferred to the work of the second year.

=Partnership Provisions Covering Liquidation.=—Because of the certainty of final dissolution, it is not unusual for the partnership agreement to make definite regulations concerning the method of liquidation. The appointment of one of the members as liquidating partner, the manner of distributing the proceeds from liquidation whether by instalments or otherwise, the manner of paying the liquidator for his services—all these contingencies should be provided for.

Where dissolution is forced by the death of one of the partners, to determine the interest of his heirs it is necessary to take inventory and make appraisal of the firm's assets. To avoid this inconvenience to the business, provision is sometimes made in the agreement that the remaining partners shall continue the business until the end of the regular fiscal period. The deceased partner's share in the profits for the current period up to the date of his death is determined by prorating the year's profit over the period in which the deceased had an interest. The method of calculating the firm's good-will is usually provided for in the partnership agreement so that the estate of the deceased partner will share in it also. Usually interest is allowed the estate of the deceased partner from the date of his death until the settlement of his share.

=Partners' Rights and Procedure During Liquidation.=—When dissolution is accompanied by liquidation, as happens in many instances, all the partners have an equal right to share in the work of liquidation. Since the work usually does not require the time of all the partners, a customary procedure is to appoint one member—or an outsider—as the liquidator. Notice of the dissolution, in which the name of the liquidator is given, is published in the leading newspapers. If liquidation is necessary because of the death of a partner, great responsibility rests upon the liquidator. He must act in strict good faith and endeavor to realize the best price possible for the assets of the firm in the interest of the deceased partner's estate. A similar responsibility rests upon him when liquidation is carried on in the interest of absent members.

The expenses and losses incident to liquidation must be borne by all in the profit and loss ratio. The liquidator may be paid either by means of a commission on the sums realized or by a salary. If the liquidator is a partner, settlement may take place privately between the partners but usually his commission or salary is charged to the firm's liquidation expenses.

Liquidation may proceed by sale of the assets in regular order and may even permit the purchase of additional goods where necessary to fulfil existing contracts or to complete partly manufactured goods, or where stock on hand can be disposed of to better advantage by the addition of side lines or specialties.

=Distribution of Proceeds.=—Upon the realization of the assets, application of the proceeds must be made in the following order: First, the claims of outside creditors must be met in full or by compromise where not fully recognized. Second, the claims of the partners on account of loans or advances made to the firm must be satisfied. Third, the partners share in the remainder, by first taking out their respective capital contributions and then, if there is a balance, by sharing it in their profit and loss ratios. If there is a loss, this must be shared in the profit and loss ratio before withdrawal of any capital contributions. The remainder, if any, is divided among the partners in the ratio of their capitals as diminished by the loss. Whether the net assets are either more or less than the total amount of the capitals, the difference is shared in the profit and loss ratio, and what remains is shared in the capital ratio. If a careful accounting is made of the profit or loss at the time of the sale of each piece of property and these profits and losses together with the dissolution expenses are summarized and distributed to the partners' capital accounts, those accounts will of course show the claims of the various partners on the net assets of the business after all assets have been converted into cash and all liabilities

paid.

Instead of a complete liquidation of the firm's assets, certain of the assets may, by mutual consent, be taken over by each partner at agreed values and applied toward the satisfaction of his capital and loan interests. Such use of assets is spoken of as a _conversion_ to that particular purpose. It must be distinctly understood that this is not a right which any partner can demand, but only a privilege granted by the mutual agreement of the partners. Any partner can demand that all the assets be sold and that the proceeds be applied in satisfaction of the interests concerned.

=Sharing Losses.=—In the case of insolvency, the partners are compelled to share the losses in the profit and loss ratio, not in capital ratio, and these losses are chargeable against their capital accounts. If the capital account of any of the partners is not large enough to satisfy his share in the losses, a deficit in that partner's interest results, which is represented by the debit balance in his capital account. This shows the amount which he must contribute to the firm in order that all claims may be satisfied. The rule that profits and losses in liquidation cannot be shared in the same ratio as capitals, unless this ratio is also the profit and loss ratio, is responsible for the fact that upon dissolution one or more partners may have to make additional contributions, while others may not be obliged to do so. This duty of contributing to make up a deficit is inherent in the partnership relation and can be enforced by the copartners.

A few illustrations will set forth the main problems in connection with the liquidation of partners' capitals:

=1. Sharing Losses Equally=

BALANCE SHEET OF A, B & C Cash $10,000.00 Liabilities $10,000.00 Other Assets 60,000.00 A, Capital 15,000.00 B, Capital 20,000.00 C, Capital 25,000.00 ---------- ---------- $70,000.00 $70,000.00 ========== ==========

A, B, and C share profits and losses equally.

The above balance sheet shows, in summary form, the condition of the firm previous to liquidation, and also indicates the shares of the partners in the net assets as on that date, i.e., the partners share in the net assets in the ratio 15:20:25 or 3:4:5. Dissolution becomes necessary and in the course of liquidation the expenses and losses incurred amount to $15,000. After the net loss of $15,000 is divided equally among the partners, the capitals will amount to, A $10,000, B $15,000, and C $20,000. The result is that the capital ratio has changed from 3:4:5 to 10:15:20, or 2:3:4, and the net assets of $45,000 are to be shared in this new ratio.

=2. Capital Deficit=

BALANCE SHEET OF JONES & SMITH Cash $10,000.00 Jones, Capital $20,000.00 Losses in Liquidation 15,000.00 Smith, Capital 5,000.00 ---------- ---------- $25,000.00 $25,000.00 ========== ==========

Jones and Smith share profits and losses equally.

The above balance sheet shows the condition of the firm after liquidation. It is necessary, first, to distribute the liquidation losses among the partners, after which they share in the net assets according to capital ratios. Accordingly, each capital account is debited with an equal share in the loss of $15,000, after which Jones' capital is $12,500 and Smith's account shows a debit balance of $2,500. This means that Jones not only gets the entire cash of $10,000, but Smith must contribute $2,500 to the firm and this also goes to Jones.

=3. Personal Insolvency of One Partner=

BALANCE SHEET OF SMITH, JONES & GREEN Cash $16,000.00 Smith, Capital $15,000.00 Jones, Capital 9,000.00 Green, Capital 10,000.00 ---------- ---------- $25,000.00 $25,000.00 ========== ==========

Smith and Jones each have a ■ share and Green a ■ share in profits and losses.

The above balance sheet shows the financial condition of the firm after taking into consideration the losses incident to liquidation. From this it is seen that Jones owes the business $9,000. Assume that he is personally insolvent and cannot contribute the share due from him. The net assets available for distribution consist of $16,000 in cash. Inasmuch as Jones' interest is entirely wiped out and a contribution is due from him which he cannot pay, the amount of that contribution is an additional loss to be borne by the two remaining partners. Their respective shares in this loss are determined by their original profit and loss ratios ■ and ■, so that as between themselves Smith must bear ■ of the loss or $6,000, and Green ■ or $3,000; after which Smith's capital and share in the

net assets is $9,000, and Green's $7,000.

Where a partner, in his private capacity, and the firm of which he is a member are both bankrupt, his personal creditors have first claim on his personal estate and the firm's creditors on the assets of the firm.

=Distribution by Instalments.=—Where the liquidation is of long duration, the partners may desire to receive what is due them by instalments rather than wait to receive their respective shares in one amount. Where the capital ratio differs from the profit and loss ratio, it is difficult to determine the proper ratio in which the instalments should be paid, due to the fact that expenses and losses have not yet been determined. Consequently it is impossible to tell what the ultimate ratios will be in which the partners are to share the net assets. As the payment of instalments on an arbitrary basis might result ultimately in an overpayment of some partners and an underpayment of others, the only safe method of handling the situation is to pay the first instalments to those partners whose capital ratios are in excess of their profit and loss ratios until their capitals are reduced to the point where the capital ratios of all the partners are the same as their profit and loss ratios. As soon as this point is reached, the proceeds of the assets may be distributed to the partners on the basis of their profit and loss ratios, because these are now identical with their capital ratios. A more complete treatment of this problem will be found on pages 650 to 654 of the author's second volume.

=Treatment of Good-Will upon Liquidation by Sale.=—When dissolution is brought about by the sale of the entire business, it may happen that the amount realized on the assets is smaller than their book value, and the difference must be treated as a loss in accordance with the principles previously stated. Similarly, where the assets are sold and the price realized is larger than their book value, the excess constitutes a profit and must be distributed among the partners in profit and loss ratio. Usually such an excess is treated as a receipt on account of good-will, and two standard methods of booking it are employed. When good-will is mentioned in the sale contract and its value has been determined, it is brought on the books as an asset and transferred immediately to the partners' accounts. Thus, if the value is $15,000 and the profit and loss ratio is ■ to A, ■ to B, and ■ to C, the entry is:

Good-Will 15,000.00 A, Capital 6,000.00 B, Capital 6,000.00 C, Capital 3,000.00

Good-will is now shown as an asset, and the entry closing it off is the same as for the sale of the other assets, viz., a debit to Cash and a credit to Good-Will.

On the other hand, when good-will is not specified as such in the sale contract, but the amount realized on the sale of the assets is larger than their book values, this excess may be credited to Good-Will, which is then treated not as an asset account (as in the case given above) but as a profit and loss account. The balance of this account is closed out to the partners' accounts in profit-sharing ratios in the same way as above. The ultimate result is the same in either case; the first method is a little more complete since it shows the value of the asset good-will previous to its sale.

The formal entries by which the sale of any business is recorded on its books, whether single proprietorship, partnership, or corporation, are treated in Chapter XXXIX under corporations.

CHAPTER XXXVIII

THE CORPORATION

=Definition.=—The definition of a corporation, given by former Chief Justice Marshall as "an artificial being, invisible, intangible, and existing only in contemplation of the law," sets forth its fundamental characteristics, viz., artificial personality and creation by the law. Blackstone says, "A corporation is an artificial person created for preserving in perpetual succession certain rights which being conferred on natural persons only would fail in the process of time." Blackstone's definition lays particular emphasis on a characteristic not specifically mentioned by Marshall, that of perpetuity of succession. It is apparent that the corporation within the limits prescribed by statute has most of the attributes and powers of a person—it can sue and be sued, can hold and pass title to property, real and personal, can carry on business in its own name, is responsible to the extent of its entire property for the payment of its debts, etc.

=Growth of the Corporate Form of Organization.=—The corporate form of organization is being increasingly utilized for the conduct of business of almost every kind. It offers a much more attractive field to the investor who desires to place his surplus funds in productive enterprises and share in their profits without having the burdens of active management or the risk of losing his private fortune to satisfy the claims of business creditors should the undertaking prove unsuccessful. Just as the partnership is an advance over the sole proprietorship in point of business organization, efficiency, and ability to cope with larger undertakings, so the

corporation in some of its forms represents an advance over the partnership form of business organization. Its advantages and disadvantages in comparison with the partnership will be reviewed briefly.

=Advantages.=—Some of its advantages are:

1. Limited liability. Only corporation property can be levied on to satisfy the claims of creditors; the private fortunes of the individual stockholders cannot be touched. 2. Continued existence. The death, withdrawal, or bankruptcy of any of its members does not interfere with its existence. Its life may be terminated by voluntary dissolution, insolvency, expiration of charter life, forfeiture of charter to the state for misuse, non-use, or abuse of its privileges. 3. Transferability of its shares, and their use as collateral for private loans without injury to the credit of the corporation. 4. Larger capital. A partnership becomes unwieldy and inefficient if the number of partners becomes too large. The number of stockholders in a corporation is not limited and varies from one to many thousands in the larger corporations. Accordingly much more extensive fields of endeavor are open to the corporation because it can bring together and use advantageously the combined capitals of many persons. 5. Centralized control. Its method of internal organization is such that one man can be made the responsible head instead of the many heads of the partnership.

=Disadvantages.=—The chief disadvantages of the corporation may be summarized thus:

1. Comparative absence of personal interest of the managing officer. This is largely a theoretical drawback, inasmuch as it is usually required that the managing officer be a stockholder.

2. As a creature of the state, the corporation is subject to state legislative control. It is taxable by the state and is required to make periodic reports.

3. Its credit is dependent on the amount of its net assets and not on the fortunes of its individual owners.

4. Corporations are sometimes restricted as to the character of their business. In some states certain lines of business cannot be carried on by corporations.

5. In some states it is illegal for corporations to hold stock in other corporations.

In spite of these and other disadvantages, most of which are not serious, the advantages of the corporate form of organization far surpass those of the sole proprietorship or partnership.

=The Formation of a Corporation.=—Formerly a corporation could be brought into existence only by a special act of the legislature. As this method proved cumbersome and was subject to much abuse, it gave place in all states to general corporation statutes or enabling acts whereby an application in due form and according to statutory provisions is all that is necessary for organizing a corporation. Though the statutes differ for each state, they are uniform in the main points. The method of formation under the New York statute will be explained.

=Certificate of Incorporation—New York State.=—The form of application for a charter to do business as a corporation is known as a “certificate of incorporation.” This document must be prepared by at least three natural persons, two-thirds of which number must be citizens of the United States and at least one of whom must be a citizen of New York State. These persons are called the “incorporators.” Their certificate must be made out in the English language, signed by each incorporator, acknowledged before a notary public, and must contain:

1. The name of the corporation, in the English language. This must be different from the name of any other domestic or foreign corporation doing business in the state and must not contain in its title the words, “bank, trust, insurance, etc.”

2. The purpose or purposes for which it is created. There is practically no limitation as to the lines of endeavor the corporation may declare itself desirous of following, with the exception that banks, trust, transportation, and insurance companies, etc., come under special laws.

3. The amount of capital stock of the corporation, common and preferred if both are to be issued. Preferred stock of various classes may be authorized after incorporation. The minimum amount of capital required by the New York law is $500. One-half of the capital must be paid in within one year from the date of incorporation. The certificate must state also the amount of capital to be paid in before the corporation can commence business and this must not be less than $500. No debts can be contracted before that amount is paid in.

4. The number of shares into which the authorized capital is divided and the par value of each. This must not be less than $5 nor more than $100, although more recently capital stock has been authorized with no named par value.

5. The place in which the principal office is to be located, which must be within the state.

6. The contemplated duration of its life. This may be made perpetual.

7. The number of directors, which must not be less than three.

8. The names and post-office addresses of the directors for the first year. Directors usually are stockholders and at least one-fourth of the directors are subject to election annually.

9. The names and post-office addresses of the subscribers to the certificate of incorporation, and the number of shares in the corporation subscribed by each.

=Filing the Certificate—New York State.=—The certificate of incorporation is usually made out in triplicate. The original must be filed and recorded in the office of the Secretary of State; the duplicate certified by the Secretary must be filed with the clerk of the county in which the principal business office is to be located; and the certified triplicate is retained by the corporation in its own files. The fees for filing the certificate with the Secretary of State are $10, and for recording 15 cents per folio. The county clerk's fees are 6 cents per folio for filing.

=Organization Tax—New York State.=—Before the filing of the certificate, an organization tax of 1/20th of 1% of the authorized capital stock must be paid to the State Treasurer. Record of this payment is forwarded to the Secretary's office.

=Initial Acts of Corporation.=—When the corporation is ready to commence business, its first act is usually to call a meeting of the incorporators and directors for the purpose of adopting a set of by-laws—although this matter may be delegated to the board of directors. This meeting also authorizes the issue of stock at or above par in exchange for cash, labor, or property.

=State Control.=—The outside control of the corporation is vested in the state. The state constitution, the general corporation law, the statutes relating to business organizations in general, and the specific contract between the corporation and state embodied in its charter or certificate of incorporation—these form the basis for state control and the limits within which the corporation may act as an authorized person. If the corporation does an interstate business, it is subject also to the regulations of the Interstate Commerce Commission.

=Working Organization and Management.=—The corporation's owners, that is, the stockholders, are the source of all authority and control. Unlike the partnership where control and voice in the management are equally shared by the partners regardless of any inequality in their investments, the corporation ownership is evidenced by shares of stock and each share is given one vote. Thus each owner's authority and voting power are dependent upon the amount of his ownership of stock. He has, however, the right to delegate this power to another person by "power of attorney," and in this way it frequently happens that one stockholder exercises a power far beyond the amount of shares owned by him. Delegation of voting power frequently occurs when the stock is widely distributed geographically and is owned in small lots. In theory the agent or attorney entrusted with the voting power of others is simply carrying out the will of his principal, the real owner of the stock.

=Annual Election of Directors.=—Because of the number of stockholders and because many of them are engaged in other pursuits, one of the characteristics of the corporate form of management is that the owners frequently do not have direct control of their enterprise. Accordingly, at regular times, usually annually, the stockholders elect directors to whom are delegated the general oversight and control of the business. The board of directors thus elected stands in the place of the stockholders during the period between the annual meetings at which it renders account of its management.

=Officers.=—The board of directors elects officers of the company—usually a president, vice-president, treasurer, and secretary—to undertake the active management of the business; or the directors may appoint a general manager or superintendent on whom rests the active management and who is the executive head of the corporation. Thus the chief characteristic of the working organization of the corporation is the delegation of authority to a responsible head. The accountability of the officers to the board of directors, and of the directors to the stockholders, has so far proved the most efficient method of conducting modern business.

=The Showing of Proprietorship.=—The chief difference, from an accounting viewpoint, between the corporate form and other forms of business organization is in the showing of proprietorship. Vested proprietorship in a sole owner or partnership business is carried under the title of the different owners' capital accounts, and credit is extended by the public to such owners, not on the basis of what the particular business is worth, but on the reputation of the owners and what they are known to be worth outside the business as well as in the business. On the other hand, the law has relieved the owners of a corporation of individual liability for the debts of the corporation. Only the corporate property can be held liable for the satisfaction of creditors' claims. For their protection, the corporation is not allowed to impair its capital stock by the payment of any portion of it in dividends to the owners or to change the amount of its capital stock without special authority. The outstanding capital stock, in theory, represents to the prospective creditor the minimum value of the corporation assets which are supposed to be sufficient to meet in full the claims of creditors. Accordingly, the portion of the capital of a corporation represented by its capital stock is a fixed amount, and the increments or decrements of proprietorship are usually shown in a separate account called Surplus. This account must always be read with the Capital Stock account to ascertain the current or present capital as distinguished from the original.

The Surplus account is sometimes divided and shown under such titles as Profits, Reserves, Undivided Profits, Working Capital, etc. To ascertain full proprietorship or net worth, all such accounts must be included.

RECORDS PECULIAR TO A CORPORATION

=The Subscription Book and Subscription Ledger.=—Upon the proper filing and acceptance of the certificate of incorporation, authority is given the incorporators to secure subscriptions to the capital stock. Subscription books or blanks may then be opened, which usually contain a form of agreement somewhat as follows:

We, the undersigned, do hereby subscribe for and agree to take the number of shares of the capital stock of the Blank Company, par value ..... set opposite our names and pay for the same, ... per centum down, the remainder subject to the call of the board of directors.

Where the number of subscribers is large and especially if record must be made of the payment of calls, a Subscription Ledger or Instalment Book is used. This ledger has no set form but usually carries columns showing when the calls are to be made, when actually made, when paid, and the balance still due. A controlling account called "Subscribers" or "Subscription" is carried on the general ledger, with a special column in the cash book to gather the totals for posting.

=The Stock Certificate Book and Stock Ledger.=—A subscriber is, as such, a stockholder in the corporation even though his stock certificate may not yet have been issued to him. The stock certificate is merely evidence of ownership. It is usually issued from a book with perforated leaves similar to a check book, with stub to carry the essential data of the certificate. Directly from this stub, or through the medium of a stock journal, postings are made to the individual accounts in the stock ledger. This ledger which, in turn, is controlled by the Capital Stock account or accounts on the general ledger, carries the detailed information as to the number of shares issued, shares canceled, and balances held by each owner.

=The Stock Transfer Book.=—In the state of New York a stock transfer book must be kept, showing all the data in connection with transfers of shares, such as old and new stock certificate numbers, names of the parties, etc.

=The Minute Book.=—To preserve a record of the meetings of the directors and stockholders, and the business transacted thereat, use is made of a minute book kept by the secretary. This book, as the source of authority for all the important acts and policies of the corporation, is a most important record. The record should be a complete history of the corporation from its organization through the entire period of its existence.

=Other Records.=—When the stock is sold on the instalment plan, formal receipt of the payment of each instalment is sometimes made by means of an "Instalment Scrip Book," whose certificates or receipts are issued upon payment of each instalment. When full payment has been made, the instalment certificates are exchanged for the regular certificates of stock. A dividend book for recording the payment of dividends is sometimes kept, though the need for such a record has been largely eliminated through the use of dividend checks.

CHAPTER XXXIX

OPENING THE CORPORATION BOOKS

=Corporation Accounting Records.=—The method of recording the ordinary business transactions of a corporation is essentially the same as in the types of business organization previously discussed. The opening and closing of corporation accounts, however, as also the method of making the periodic summarization, call for the special treatment given in this chapter and the next.

=Proprietorship and Capital Stock.=—As stated before, the members of a stock corporation have their ownership evidenced by certificates of stock. The proprietorship or net worth of a corporation, as of the single proprietorship and partnership, is the excess of its assets over its liabilities. This excess is shown in the books by two accounts or two groups of accounts, viz., the Capital Stock account—or accounts—which represents the amount of outstanding shares; and the Surplus account—subdivided and carried under other titles, if desirable—which represents the excess of the proprietorship over the amount of capital stock. Each stockholder's share in the corporation is determined by the number of shares he possesses.

=Common and Preferred Stock.=—There may be various classes of stock. If only one kind is authorized at the beginning, the subsequent creation of other kinds requires an amendment of the charter. The usual classes of stock are common and preferred. As its name indicates, preferred stock has some kind of preference over the common or ordinary stock. This preference may be only in regard to dividends, or it may include preference as to ownership in the net assets in case of dissolution. Preferred stock usually carries a fixed dividend, payable before any dividend can be paid to the common stockholders.

Preferred stock is classified as cumulative and non-cumulative. The terms apply to the dividend liability of the corporation in the event that the continuity of dividend declarations is broken. The dividend on cumulative preferred stock accumulates and becomes a preferred claim for the amount accumulated since the time of the last dividend declaration. That is, the common shareholders are not entitled to receive any dividend until the preferred shareholders have received the amount of the accumulated total. Preferred stock that is non-cumulative does not possess this feature. A dividend once passed on such stock is not a preferred claim to profits as compared with the dividend rights of common stockholders, but lapses completely. Preferred stock is cumulative unless specified to the contrary.

The issue of No-par-value stock is authorized by thirteen different states. Very often in a corporation whose stock carries a stated par value, there is little real relationship between the actual value of the stock as indicated by the net assets of the corporation and its stated par value. The law requires that par-value stock be carried on the books at its stated par. If such stock has been sold or exchanged for assets of a lesser value, there is always the temptation to inflate the value of the assets in order to maintain it at the par of the stock issued for them. This tendency is not met in the use of stock carrying no par value. Such stock appears on the books at exactly the amount of the assets received in exchange for it. A purchaser of such stock, because of the fact that it carries no stated par value, is at once put on notice to investigate the values back of it. No-par-value stock may be either preferred or common. In the former instance, if the preference relates to the assets at the time of dissolution, each such share must state the amount of assets applicable to each share in case of liquidation of the corporation. This constitutes a preference claim, not over the creditors of the corporation, but only over the common stockholders.

Thus it is seen that there may be different classes of ownership of a corporation, the owners of one class having some advantages over the owners of the other classes. It should be understood, of course, that within each class the rights and duties of the owners are the same.

=Opening the Books of a Corporation.=—The opening entries of a corporation have to do with a correct treatment of capital stock, subscriptions, calls and instalments, payments by cash and by property, etc.

The charter to do business, granted a corporation by the state, gives it the right to sell shares of stock. These shares have no value in themselves and are worth only what the corporation can exchange them for, either in cash or other assets. There is, therefore, no reason for making a record on the books of account as distinguished from the corporation's minute book, of the corporation's right to issue stock and of the amount of the stock which it has a right to issue. Until the stock has been paid or subscribed for, no formal entry need be made on the books of account. Of course, full record of all deliberations and resolutions as to procedure and policy up to the time of the actual sale of the stock is carried in the minute book, and a concise narrative statement of the organization of the corporation, its purposes, the authorized capital stock issue, the number of shares, the par value of each share, if par value stock, and so forth, should always precede the formal opening entries in the journal. This record and that in the minute book should give all the information of this sort needed. There is a too prevalent tendency among bookkeepers to make all sorts of memorandum entries on the books of account. A memorandum entry is an entry which has no financial significance and is made merely as a reminder that transactions of financial significance may arise from that source.

Before a corporation can secure its charter it is necessary to make certain expenditures. These usually consist of fees paid to a lawyer for his services in assisting in drawing up the charter; fees for filing the certificate; the organization tax; the cost of the certificates of stock and stock records; and so forth. These expenditures must be met by the incorporators from their private funds but they are reimbursed from the funds received upon sale of the stock. It is, accordingly, customary in opening the books of a corporation to show first the sale of the stock before showing the expenditures for organization.

A number of different methods of opening the books are employed. The first of these does not make use of the memorandum entries referred to above, whereas the other two do use memorandum entries. The three methods will be illustrated by means of the problem given below. The entries are shown in journal form. It will be understood, of course, that those entries which involve cash will appear in the cash book only. All the other entries appear in the general journal.

PROBLEM 1. The Smith-Brown Company is incorporated with an authorized capital stock of $250,000, of which $150,000 is subscribed and paid for at par; the balance remains unissued for the present. The organization expenses are $1,000.

FIRST METHOD

THE SMITH-BROWN COMPANY A corporation organized under the State of New York, with an authorized capital stock of Two Hundred and Fifty Thousand dollars ($250,000), divided into Two Thousand, Five Hundred (2,500) shares of the par value of One Hundred dollars ($100) each, with all powers necessary to carry on the business of manufacturing, selling, and distributing motors of all kinds.

Case 1. Where the subscription and payment are not simultaneous:

(a) Subscribers 150,000.00 Capital Stock Subscriptions 150,000.00 To record subscriptions to the capital stock as follows: A shares B ” C ” Etc. (b) Cash 150,000.00 Subscribers 150,000.00 To credit subscribers for the payment of their subscriptions. (c) Capital Stock Subscriptions 150,000.00 Capital Stock 150,000.00 To record the issue of stock to all subscribers who have paid in full. (d) Organization Expense 1,000.00 Cash 1,000.00 To record the payment of the costs of organizing the corporation.

Entry (a) sets up the claim under subscription contracts against the subscribers as an asset of the corporation, and is offset by the proprietorship account, carried under the title “Capital Stock Subscriptions,” until payment has been made and the certificates of stock actually issued to the stockholders.

Entry (b) is self-explanatory.

Entry (c) shows the issue of the certificates and therefore transfers the proprietorship from Capital Stock Subscriptions to Capital Stock.

Case 2. Where the subscription and payment are simultaneous:

(a) Cash 150,000.00 Capital Stock 150,000.00 (b) Organization Expense 1,000.00 Cash 1,000.00

In a small corporation where a cash investment constitutes the entire original capital, the entries shown in case 1 above are sometimes abbreviated as here indicated. In such a case there is often no formal subscription contract entered into and there is therefore no need to set up accounts with Subscribers and Capital Stock Subscriptions.

SECOND METHOD. This method makes use of the memorandum accounts, Unissued Capital Stock and Capital Stock Authorized. Omitting the narrative statement of organization, the explanatory matter after the various entries, and the organization expense entry, which are common to all methods, the other necessary entries are as follows:

(a) Unissued Capital Stock 250,000.00 Capital Stock Authorized 250,000.00 (b) Subscribers 150,000.00 Capital Stock Subscriptions 150,000.00 (c) Cash 150,000.00 Subscribers 150,000.00 (d) Capital Stock Subscriptions 150,000.00 Capital Stock 150,000.00 (e) Capital Stock Authorized 150,000.00 Unissued Capital Stock 150,000.00

Entry (a) is a memorandum entry recording the amount of capital stock authorized by the corporation’s charter. This entry has little or no financial significance. Not until stock is sold does the corporation have any real assets.

Entry (b) shows that of the stock which was unissued under entry (a), $150,000, has been subscribed for, thus giving the corporation a legally enforcible claim—an asset—for that amount.

Entry (c) is self-explanatory.

Entry (d) shows the issue of the stock when the subscriptions are paid.

Entry (e) adjusts the memorandum entry (a), to show the present amount of authorized stock still unissued, viz., $100,000. Both accounts under (a) continue as memoranda only, and as they exactly offset each other, they will not appear on the balance sheet.

THIRD METHOD. This method also makes use of memorandum accounts before the sale of the stock. The difference between this and the second method should be noted. It will be seen that the credit of entry (a) is here Capital Stock instead of Capital Stock Authorized. This is theoretically incorrect because as yet the corporation has no proprietorship. The best that can be said for it is that the debit represents a contingent asset and the credit a contingent proprietorship item. The other entries are self-explanatory.

(a) Unissued Capital Stock 250,000.00 Capital Stock 250,000.00 (b) Subscribers 150,000.00 Subscriptions 150,000.00 (c) Cash 150,000.00 Subscribers 150,000.00 (d) Subscriptions 150,000.00 Unissued Capital Stock 150,000.00

=Premium or Discount on Stock.=—The law requires that when stock of par value is issued, the Capital Stock account must be carried always at par. When stock is sold at a premium or at a discount, it necessitates, therefore, the use of supplementary proprietorship accounts to make the proper record. In the state of New York, a corporation cannot sell its stock at a discount, but in states where this is allowed the amount of such discounts should be charged to a “Discount on Stock” or some similar account. Sometimes the charge is made to “Organization Expense.” The use of Organization Expense account for this purpose is contrary to the principle that the account title should show the exact nature of the items recorded under it. It is misleading and sometimes reprehensible. A full discussion of this matter is given in Volume II. When stock is sold above par, the amount of the premium is recorded in the account “Premium on Stock,” which as usually handled constitutes a part of the permanent capital of the corporation. Premiums on stock sales should not be credited to Surplus account. The following illustration will show the kind of entries required:

PROBLEM 2. Of the $100,000 unissued stock of Problem 1, we will assume that $50,000 is later subscribed for at 98, and $50,000 at 102.

Entries to make the record according to the first method, Problem 1, are as follows:

(a) Covering stock subscribed for at a discount: Subscribers 49,000.00 Discount on Capital Stock 1,000.00 Capital Stock Subscriptions 50,000.00 (b) For stock subscribed for at 102: Subscribers 51,000.00 Premium on Capital Stock 1,000.00 Capital Stock Subscriptions 50,000.00

Entries for payment of the subscription and issue of the stock follow the method of entry already shown on page 342. It will be observed that the Capital Stock Subscription and the Capital Stock accounts are always shown at par value.

=Capital Stock on the Balance Sheet.=—The net worth section of the balance sheet of a corporation will usually appear somewhat as follows for the capital stock items. Often, however, more detail is shown in connection with the surplus item. The student should note how full information is given concerning the capital stock.

(1) _Net Worth_

Represented by: Capital Stock: Authorized $250,000.00 Unissued 100,000.00 ---------- Issued and Outstanding $150,000.00 Premium on Capital Stock 5,000.00 Surplus 60,000.00 ---------- Total Net Worth $215,000.00 ==========

Where the discount on stock has not been charged off against Surplus either because sufficient profits have not been reserved, or because, although sufficient profits have been reserved, it is deemed desirable to build up a larger balance of Surplus before charging off the discount, the net worth section will appear as follows:

(2) _Net Worth_

Represented by: Capital Stock: Authorized $250,000.00 Unissued 100,000.00 ---------- Issued and Outstanding $150,000.00 Surplus 10,000.00 ---------- $160,000.00 Discount on Capital Stock 15,000.00 ---------- Total Net Worth $145,000.00 ==========

Discount on capital stock should usually be shown as above, although one sometimes finds it listed among the assets on a balance sheet. This is not wholly objectionable unless it is set up under a title which does not indicate its true nature.

=Instalments.=—The subscription contract sometimes provides for payment by instalments. The corporation usually issues to all such subscribers a “call,” i.e., a notice that an instalment payment will come due at a given time. The subscriber is not considered delinquent until the call has been made and he has not responded. The accounts must therefore reflect the difference in status brought about by a “call.” This is accomplished by transferring the claim against the subscriber carried in Subscribers account to a new claim against him carried under Call account. The illustrations below show the accounts required and their handling.

PROBLEM 3. Assume that the $50,000 of stock subscribed for at 102 is to be paid for one-half in cash and the remainder in two equal instalments at the end of successive three-month periods.

For the one-half cash payment the entry is as follows:

Cash 25,500.00 Subscribers 25,500.00

At the end of the first three months, the record is:

Call No. 1 12,750.00 Subscribers 12,750.00 To show the call issued. Cash 12,750.00 Call No. 1 12,750.00 To record payment of the first call.

Similar entries at the end of the second three months are:

Call No. 2. 12,750.00 Subscribers 12,750.00 Cash 12,750.00 Call No. 2 12,750.00

If the call is not paid in full at balance sheet time, the debit balance in the “Call” accounts constitutes an asset, i.e., the amount of unpaid instalments due from subscribers. Upon full payment of all subscriptions, certificates of stock are issued and recorded as shown on pages 341, 342.

=Entries for Common and Preferred Stock.=—Where more than one kind of stock is issued, such as common and one or more kinds of preferred, separate capital stock accounts—and usually other related accounts—should be kept for each class, as illustrated below:

PROBLEM 4. Assume that the stock of a corporation is $200,000 common and $50,000 preferred, and that $100,000 common and $50,000 preferred have been subscribed for. The entries necessary to record the subscription in accordance with the first method explained above, are:

Subscribers—Capital Stock Common 100,000.00 Capital Stock Common, Subscriptions 100,000.00 Subscribers—Capital Stock Preferred 50,000.00 Capital Stock Preferred, Subscriptions 50,000.00

The other entries for payment of subscriptions and issue of stock are essentially the same as explained above, but the record of the transactions affecting common and preferred stock should always be kept distinct and separate.

=Entries for No-Par Stock.=—When a corporation issues no-par stock, the amount of proprietorship resulting from its sale is exactly what the stock brings and is so recorded; there is neither discount nor premium. Booking it is, therefore, simple. The amount of capital so secured, i.e., secured from its sale, should, however, never be mixed with the accretions to capital from reserved profits or other sources. Such items constitute the Surplus just as in the case of stock of par value, and the legal requirement that these amounts be kept separate from the capital stock are just as strict. This is necessary so that the records will clearly show that dividends have not encroached upon the capital. Since the value at which no-par stock is carried on the books bears no relation to the number of shares issued, it is customary to carry on the balance sheet information as to the number of shares outstanding. The net worth section of the balance sheet of a corporation issuing no-par stock should appear as follows:

Net Worth

Represented by: Capital Stock—No Par: Authorized 10,000 shares Unissued 3,000 ” ------ Issued and Outstanding 7,000 ” $369,465.00 Surplus 125,479.00 ---------- Total Net Worth $494,944.00 ==========

=Payment of Subscriptions by Property.=—When payment of subscriptions is by property instead of by cash, the value at which such property shall be brought onto the books is entirely at the discretion of the corporation’s directors, and unless fraud can be shown, their valuations are final. No difficulties are involved in recording such a payment; the paid properties are debited under suitable account titles, and the Subscribers account is credited. The following problem illustrates the change from a partnership to a

corporation, at the same time showing how the payment of subscriptions by property must be treated.

=Change from Partnership to Corporation=

PROBLEM 5. A and B, partners, incorporate as the American Baking Company. The authorized capitalization is $250,000. Each partner subscribes for an amount of stock equal to his interest in the partnership, and C, an outsider, subscribes for the remainder of the stock at par. The corporation purchases the assets and assumes the liabilities of the partnership, paying therefor with stock as above. C pays his subscription in cash. The balance sheet of the partnership on that date was as follows:

BALANCE SHEET OF A & B Cash $ 20,000.00 Accounts Payable $ 45,000.00 Accounts Receivable 150,000.00 Mortgage Payable 80,000.00 Merchandise 50,000.00 A, Capital 125,000.00 Plant 130,000.00 B, Capital 100,000.00 ---------- ---------- $350,000.00 $350,000.00

Make the opening entries for the new corporation and also close the books of the partnership.

1. The entries to open the corporation's books:

(a) Subscribers 250,000.00 Capital Stock Subscriptions 250,000.00 To record subscriptions to the capital stock as follows: A 125,000 B 100,000 C 25,000

(b) Cash 20,000.00 Accounts Receivable 150,000.00 Merchandise 50,000.00 Plant 130,000.00 A & B, Vendors 350,000.00 To record the purchase from A & B of their partnership assets. (c) A & B, Vendors 125,000.00 Accounts Payable 45,000.00 Mortgage Payable 80,000.00 To record partial payment to A & B for their assets by the assumption of their liabilities. (d) A & B, Vendors 225,000.00 Subscribers 225,000.00 To record full payment to A & B for the balance due them, by the cancellation of their subscription indebtedness. (e) Cash 25,000.00 Subscribers 25,000.00 To record payment by C of his subscription contract. (f) Capital Stock Subscriptions 250,000.00 Capital Stock 250,000.00 To record the issue of stock to all subscribers, who have paid in full.

Entries (b), (c), and (d) are sometimes combined in the following compound entry:

Cash 20,000.00 Accounts Receivable 150,000.00 Merchandise 50,000.00 Plant 130,000.00 Accounts Payable 45,000.00 Mortgage Payable 80,000.00 Subscribers 225,000.00

Although this accomplishes the same result so far as the ultimate showing is concerned, it does not present the various steps of the transactions so clearly as the separate entries. The "A & B, Vendors" account in entry (b) indicates the liability of the corporation to A & B, arising from the purchase of their partnership properties. Entries (c) and (d) show the manner in which A and B are paid for this purchase, with consequent cancellation of that liability.

2. The entries to close the books of the partnership of A & B are:

(a) American Baking Company 350,000.00 Cash 20,000.00 Accounts Receivable 150,000.00 Merchandise 50,000.00 Plant 130,000.00 To charge the American Baking Company with the assets purchased under contract of (date). (b) Accounts Payable 45,000.00 Mortgage Payable 80,000.00 American Baking Company 125,000.00 To credit the American Baking Company under their purchase contract for the taking over of the firm's liabilities. (c) American Baking Company Stock 225,000.00 American Baking Company 225,000.00 To credit the American Baking Company for the payment of the balance due by the issue of its stock at par to the firm. (d) A, Capital 125,000.00 B, Capital 100,000.00 American Baking Company Stock 225,000.00 To show the distribution of the stock.

Where the stock is issued to each partner directly (instead of to the firm and then distributed to the vendors), sometimes the issue is not shown on the partnership books, entry (c) above carrying debits to the partner's capital accounts in place of the debit to American Baking Company Stock. Whether the actual transaction follows one course or the other, entries as shown above seem to meet either requirement.

The student should make sure that the effect of the entries under (a) and (b) is thoroughly understood. It may be further noted that if good-will or shrinkage of values enters into the sale of a partnership, the necessary adjustments should be made in the partners' accounts before the sale takes place, after which the closing entries are as shown above.

CHAPTER XL

CURRENT AND CLOSING ENTRIES FOR THE CORPORATION

=Relation between the Corporation and Its Owners.=—It should be noted that the owners of a corporation are on a somewhat different basis in their relationships and activities to the business than are the owners of a partnership or single proprietorship business. The legal theory that the corporation is an entity, a person, separate and apart from its owners, necessitates a change in the status of accounts with owners as compared with similar accounts in the other types of organization. A charge against a stockholder as a customer of the corporation is on the same basis as a charge against any other customer. A stockholder may become a creditor of the corporation in exactly the same way as any other person. In a partnership, on the other hand, charges against a partner and credits to his account are looked upon as charges against and credits to his proprietary interest in the event of liquidation of the firm. This is not true in the case of a corporation, stockholders in such dealings being considered “outside” parties.

=Current Record on Corporation Books.=—After the corporation has been organized and the opening entries made on its books, the record of current transactions proceeds on practically the same basis as in all other types of business organization. Sales, purchases, cash receipts and disbursements, notes receivable and payable, and all the transactions arising out of them, are recorded currently in the same types of books and in the same manner as the similar transactions of a single proprietorship or a partnership.

While the record of current transactions is practically the same for all types of business organizations, there are some kinds of current transactions of a corporation which differ somewhat from those of the other types. They arise out of the nature of the corporation and are recorded under account titles peculiar to the corporate form. Some of these transactions and other accounting records will be discussed briefly.

=Treasury Stock.=—In some classes of enterprise and also under some methods of organizing and financing the corporation, no provision is made for the securing of a fund of working capital, all of the original capital being tied up in fixed assets—as a mine or some other plant. A similar condition is sometimes encountered even after a corporation has been operating for a number of years. Lack of business judgment and financial foresight sometimes brings about a condition in which the company has allowed an undue proportion of its current assets, and therefore its working capital, to become tied up in plant extensions.

In both such cases a frequent method of raising working capital is for the stockholders to donate to the corporation a pro rata portion of their holdings of stock to enable it to secure the needed working capital by selling the stock. When such stock comes back into the company’s treasury, it is termed “treasury stock.” Having once been issued and presumably fully paid for, it has this characteristic which does not attach to the original shares before their issue, viz., that it can be sold at a discount without the purchasers being liable to creditors, in case of bankruptcy, for the amount of the discount. Par-value stock which is originally sold at a discount or which is being sold on the instalment plan and has not therefore been paid for in full is subject to levy for the unpaid amount in the event of bankruptcy of the corporation. Thus, the man who buys a $100 share of original stock for $90, is subject to a $10 levy in the event that the assets of the corporation are not sufficient to pay its debts.

Accordingly, in financing highly speculative ventures such as mining, oil, and other similar companies, it is customary to issue the entire capital stock of the company to the owner or owners of the mining or oil property taken over by the corporation as the basis for its operations. Inasmuch as the value of the properties taken over is not determinable, it is usually impossible to show that the stock issued for them does not represent their true value. Accordingly, such stock is legally fully paid stock and not subject to the liability for additional assessment which attaches to stock sold at a discount. Working capital is provided through the donation of a portion of the capital stock to the treasury of the corporation, which is then in a position to sell to others the stock now fully paid and non-assessable. It is easier to find purchasers for this stock because it can be sold at whatever discount is necessary to dispose of it and carries with it no liability for future assessment.

Treasury stock may arise also through repurchase by the company. It may sometimes be desirable for a company to buy back some of its own stock. This is not allowed in all states but where allowed such stock repurchased becomes treasury stock.

The student should distinguish carefully between treasury stock and unissued stock.

=Accounting for Treasury Stock.=—The record of treasury stock transactions is not complicated. They are discussed under three heads as follows:

1. RECORD AT TIME OF ACQUISITION. Only the acquisition through donation will be explained here. Acquisition through purchase usually involves an adjustment of purchase price to par value and the vexed problem of valuation. This problem will be found discussed on page 18, Volume II.

Assume that a company has issued all its capital stock, $1,000,000 in amount, for the acquisition of a mining property, and that the shareholders donate to the treasury $400,000 of the stock to provide working capital. This stock donation will be recorded on the books as follows:

Treasury Stock 400,000.00 Donated Surplus 400,000.00

Like any other gift, this gift of stock in theory creates additional capital and must therefore be recorded in a proprietorship account. The title “Donated Surplus” is used to indicate the source of this additional capital. Capital arising from this source should never be recorded in the general Surplus account, largely because of its problematical value but also because of the information which it gives concerning the financing of the company by making a separate record.

2. RECORD AT TIME OF SALE. Assume that $250,000 of the treasury stock is sold at 50. Inasmuch as the stock was brought on the books at par, the portion sold must be taken off at the same figure. The 50% discount, instead of being recorded in a Capital Stock Discount account, will be recorded as a charge against the Donated Surplus, thus adjusting a portion of this donated surplus, recorded originally at par value, to its realizable value. The following entry records the sale and adjustment:

Cash 125,000.00 Donated Surplus 125,000.00 Treasury Stock 250,000.00

The student should understand that the customary procedure of opening the subscription books, making the entries with subscribers for treasury stock subscriptions, payment in cash or by instalments, and finally, the issue of the stock, may be the procedure followed in the sale of treasury stock just as in the sale of other stock. The net result will, however, be as shown by the above entry.

3. RECORD OF TREASURY STOCK ON THE BALANCE SHEET. On the balance sheet treasury stock is treated in the same way as unissued stock, namely, as a deduction item in the net worth section of the balance sheet. Using the above figures for illustration, the net worth section will appear as follows:

Net Worth Represented by: Capital Stock: Authorized $1,000,000.00 Treasury Stock 150,000.00 ---------- Issued and Outstanding $850,000.00 Donated Surplus 275,000.00 ---------- Total Net Worth $1,125,000.00

=Bonds Payable.=—Generally, when a corporation borrows money on long-term notes secured by a portion of its fixed assets, chiefly its holdings of real estate, the notes (usually of uniform amounts so as to make them more marketable) are called “bonds.” Thus, such notes or bonds are frequently in $100, $500, and $1,000 denominations, making it possible for one of limited means to take advantage of the mortgage offered as security for the loan. Bond issues are floated in pretty much the same way as capital stock issues, being offered for subscription at a price depending both on the interest rate which the bonds bear and the prevailing interest rate at the time of their offering. Thus, if the bonds bear 5% interest and the market rate for bonds of the same general character is 6%, an investor will naturally not be willing to pay par for them and the company will therefore have to sell them at such a discount as will put the yield to the investor approximately on a 6% basis. The company, by receiving for its bonds an amount less than par value but by being required to pay interest on the par amount, is thus paying higher than the nominal or agreed rate.

There is thus a very definite relationship between the bond discount and the interest rate which the bonds bear.

The accounting record of bond transactions is very similar to that of other liability transactions, and is shown under three heads as follows:

1. SALE OF BONDS PAYABLE. Assume that a $100,000 issue of bonds bearing 5% interest, payable semiannually, and maturing in 20 years, is sold at 90. The record will be:

Cash 90,000.00 Bond Discount 10,000.00 Bonds Payable 100,000.00

Bonds payable are always set up at par, since that represents the liability which must be met at maturity of the issue.

2. BOND INTEREST PAYMENT. At the close of the first six months, 2½% interest, or $2,500, will be paid to the holders of the bonds. Since the corporation will have to redeem its bonds at par, it has been deprived of the use of $10,000, represented by bond

discount, because the issue was brought out at 5%. The $10,000 discount is therefore in the nature of a lump sum interest cost incurred in advance—prepaid—and must be spread equitably over the life of the bonds. Accordingly, at each of the 40 interest payments during the life of the issue, a pro rata share of this prepaid interest should be taken into account as bond interest. The distribution of bond discount over the interest payments made during the life of a bond issue is termed “amortization” of the discount. Scientifically, amortization is worked out on a compound interest basis, discussion and explanation of which are found on page 269, Volume II. Here, all we are concerned with is the principle involved and for the sake of simplicity the amortization is prorated evenly over the 40 interest periods, resulting in an additional interest charge of $250 each period. The record is therefore:

Bond Interest 2,750.00 Bond Discount 250.00 Cash 2,500.00

3. CANCELLATION OR THE BONDS AT MATURITY. When the bonds come due and are paid, the record is the same as the cancellation of any other liability, viz.,

Bonds Payable 100,000.00 Cash 100,000.00

=Bond Premium.=—Bonds are also often sold at a premium. As with discount, the premium is intimately related to the interest rate which the bonds bear. At the time of the sale of bonds, the premium is brought on the books as a credit, which together with the par value at which the bonds are booked, offsets the cash received from their sale. At the regular interest periods the premium is amortized over the life of the bonds and so results in a lessening of the periodic bond interest charge. The student should set up the entries to record the sale of bonds at a premium and the interest payment for such bonds.

=Sinking Fund.=—The sinking fund is a fund of liquid assets created by periodic sums, usually of equal amounts, set aside during the life of a bond issue or other liability to provide ready funds for the cancellation of the liability at maturity. This method is very commonly followed in public finance and is not infrequent in private corporations. It is not purposed here to explain the methods of determining what periodic sum is necessary to be set aside so that these principal sums and their interest accumulations will provide sufficient funds for the cancellation of the liability at maturity. Nor will the complicated problem of sinking fund investments in the hands of a trustee, and the expense and income arising out of it, be discussed here. These and related problems are covered fully in Chapter XXV, Volume II. Only the creation of the fund and its final disposition are treated here, under two heads as follows:

1. CREATION OF THE FUND. Assume that $1,000 cash is set aside at the end of each six months to provide for the retirement of the bonds at maturity. The entry for this, every six months, will be:

Sinking Fund 1,000.00 Cash 1,000.00

2. CANCELLATION OF THE BOND LIABILITY. The student will understand that the cash set aside periodically for the sinking fund will be invested in securities in order to accumulate an income, which usually accrues to the fund. The securities in the fund must be sold just before the maturity of the bond issue, in order to provide cash. It will be assumed that in this instance the securities in the fund have been sold, that the cash in the sinking fund at the time of maturity is $101,500, and that the bond issue to be retired is $100,000. The entries will be:

(a) Bonds Payable 100,000.00 Sinking Fund 100,000.00 (b) Cash 1,500.00 Sinking Fund 1,500.00

Entry (b) returns to the general cash the unused cash in the sinking fund. In case of a deficiency in the sinking fund it will be necessary, of course, to draw on the general cash for the amount of the deficiency.

=Sinking Fund Reserve.=—It is often the policy of a corporation, which has to provide for the redemption of a bond issue, to reserve from the yearly profits a sum equal to the periodic payment into the sinking fund and the accumulations of the fund during that period. Such a policy prevents the distribution by dividends of all the current profits to stockholders, and insures that the increase in the assets represented by these profits will be held in the business and so provide each period an increased amount of assets for use in the business and ultimately, by conversion of the assets into cash, for the use of the sinking fund. The entries crediting the sinking fund reserve and showing its disposition at the maturity of the bonds are as follows:

(a) Surplus (or Profit and Loss) 1,000.00 Sinking Fund Reserve 1,000.00 (b) Sinking Fund Reserve 100,000.00 Capital Surplus (or Surplus) 100,000.00

The first entry shows the periodic reservation of profits. The second entry transfers the total profits so reserved during the life of the bonds, back to surplus—capital surplus if it is desired that these profits be made a part of the permanent capital of the corporation,

or to general surplus in the event that these profits are to be made available for future dividends.

=Closing the Books of the Corporation.=—The results of the period's operations are summarized and the books closed in very much the same way as with the partnership. From what has been said above, it will be understood that there are some types of transactions to be considered at the time of closing the corporation's books that are not found in the partnership and single proprietorship. These concern largely the bond interest, the sinking fund reserve, and the dividend transactions. Bond interest is an expense. The sinking fund reserve is a reserve of net profits. Two methods are employed in showing the appropriation of net profits. Under the one method the total net profit is transferred to Surplus account, which then shows not only the profit for the current year but also the undistributed balance of previous years. The current appropriations of profits for whatever purpose are then booked as a charge against Surplus. Under the other method the current appropriations of profits are shown as charges against the net balance in the Profit and Loss account. Any unappropriated profit remaining is then transferred to the Surplus account.

=Dividends.=—A business is being operated always for the benefit of its owners, to whom the profits belong. In the case of a corporation, before the owners may secure any of the profits, a formal declaration of dividends must be made by the board of directors. During the term of its election the board is supreme in its management of the business. It is intimately in touch with the condition of the business. It knows the needs of the corporation and its obligations and must provide for them. If, after considering all the circumstances, it decides that some or all of the profits should be divided among the shareholders rather than be retained in the business for purposes of expansion, it meets in regular session and passes a formal dividend resolution.

=Ultimate Control of Stockholders.=—Thus it is seen that the board of directors is supreme during the period of its incumbency. Its actions are, however, subject to the review of the stockholders at their periodic meetings, which are usually held annually. If their policies are not favored by the shareholders, a new board, presumably one which will carry out the will of the majority of stockholders, is elected.

=Dividends Out of Profits Only.=—It is forbidden by law to pay dividends out of the capital of the corporation. Such payments would encroach upon the net assets of the organization and thereby weaken the creditors' security for the payment of their claims. Dividends need not be paid out of the profits of the current year, provided the undistributed profits of former periods are still available.

=Distribution of Profits.=—The appropriation of profits in a corporation differs, therefore, from that in a partnership. The entries recording the appropriation of profits cover in the main two kinds: (1) reserves, and (2) dividends. These entries are not necessarily the same for all corporations nor for all periods. No set disposition of profits is prescribed, authority resting with the directors. Their decision, therefore, as recorded in the minutes of their meetings is the basis for this group of entries. Some of the usual entries are illustrated in the following paragraphs.

=Reserves and Dividends.=—As stated above, the two methods for handling the appropriation of profits are: (1) as a charge against Surplus after the net profit for the current period has been transferred to that account; and (2) as a charge against the current Profit and Loss credit balance and a transfer of the remaining balance, if any, to the Surplus account.

A part of the profits may be retained in the business to provide funds for certain future needs, as for the payment of fixed debts, the extension of fixed plant, etc. Such items are transferred to the credit of properly named reserve accounts. Profits for distribution as dividends are similarly transferred to a Dividends Payable account. The dividend is always based on the amount of outstanding stock, not on the unissued or treasury stock. It is reckoned either as a percentage of the par value of each share, as a 6% dividend, or as a stated amount on each share, as a dividend of $4 or 10 cents per share.

The following illustration will show the necessary entries in accordance with the two methods.

PROBLEM. Assume that the net profits of Jackson & Co. are $25,000. The directors declare an 8% dividend on the outstanding capital stock of $100,000, and order $5,000 to be transferred to a reserve for buildings and $7,000 to a reserve for the cancellation of a bond issue.

FIRST METHOD Profit and Loss 25,000.00 Surplus 25,000.00 To transfer net profits to Surplus. Surplus 20,000.00 Dividends Payable 8,000.00 Building Fund Reserve 5,000.00 Sinking Fund Reserve 7,000.00

SECOND METHOD Profit and Loss 20,000.00 Dividends Payable 8,000.00 Building Fund Reserve 5,000.00 Sinking Fund Reserve 7,000.00 To appropriate profits as per resolution of the directors. Profit and Loss 5,000.00 Surplus 5,000.00 To transfer balance to Surplus account.

=Dividend Liability.=—The student should note that the effect of a dividend declaration is to change a portion of the proprietorship into a liability. Surplus is decreased and liabilities are increased. The liability so created ranks with other liabilities, i.e., the assets of the corporation may be used to pay the liability to its stockholders equally with the payment of liabilities to outside creditors. The payment of such dividend is recorded by the cancellation of the dividend liability, as follows:

Dividends Payable 8,000.00 Cash 8,000.00

Where there is more than one class of stock outstanding, it is customary to keep separate dividend accounts with each class.

=Other Methods of Adjusting and Closing the Books.=—It seems desirable at this point, although the material is applicable to any type of business organization, to discuss other methods of adjusting and closing the books than those heretofore explained. In Chapter XXVIII and previous chapters, the methods of handling deferred expense and income, and of summarizing the merchandising transactions were shown. The method given there of adjusting the ledger because of deferred expenses rested upon a classification of the various expense accounts to be adjusted as temporary proprietorship accounts. The method of adjustment effected a transfer out of the current part of the account, the asset portion of the expense, and carried it over into the next period. The balance remaining in the account after this adjustment shows the expense, that is, the amount of service or use, chargeable to the current period.

Another method of handling such items is based on an asset classification of the accounts recording them. Under this hypothesis such account titles as Postage, Stationery, Wrapping Supplies, and even Insurance (that is, unexpired insurance), are classed as asset accounts. At the close of the period when the adjustments are made, it is necessary to transfer from such asset accounts only the portions used or consumed during the current period. The balances left in the accounts represent the unused assets carried over into the next period. The difference between the two methods is indicated by the two sets of adjusting and closing entries given below.

PROBLEM. Assume that $1,000 of insurance has been purchased during the current period and that at its close unexpired insurance is $250.

FIRST METHOD. The adjustment of the Insurance account classified as an expense account is here made by the following entry:

Insurance (Deferred) 250.00 Insurance 250.00

The closing entry would be:

Profit and Loss 750.00 Insurance 750.00

The ledger account would show as follows:

INSURANCE ========== 19— | 19— Jan. 15 500.00 | Dec. 31 Deferred as unexpired 250.00 June 15 500.00 | Profit and Loss 750.00 -------- | -------- 1,000.00 | 1,000.00 ======== | ======== 19— | Jan. 1 250.00 | |

SECOND METHOD. The Insurance account is here looked upon as an asset account. The only adjustment necessary, therefore, is to remove from it the portion used, the portion remaining unused being an asset. This is effected by the following entry:

Profit and Loss 750.00 Insurance 750.00

The ledger account would appear as follows:

INSURANCE ========== 19— | 19— Jan. 15 500.00 | Dec. 31 Profit and Loss 750.00 June 15 500.00 |

In favor of the first method it may be said that it brings out more sharply the difference between asset and expense accounts and the need for separating mixed accounts into their two elements of expense and asset. The second method requires less work.

=The Trading or Selling Account.=—For the purpose of summarizing the merchandising activities a separate account called Trading or Merchandise Trading is sometimes used to effect the partial summarization heretofore explained as being made in the Purchases and Sales accounts respectively. Where so used the Trading account becomes virtually the old Merchandise account with totals in place of details. The following entries will show its content and the method of handling it.

Trading 10,000.00 Merchandise Inventory 10,000.00 To transfer opening inventory. Merchandise Inventory 12,000.00 Trading 12,000.00 To set up new inventory. Trading 100,000.00 Purchases 100,000.00 To transfer purchases for the period. Trading 3,000.00 In-Freight and Cartage 3,000.00 To transfer in-freight and cartage expense. Purchase Returns and Allowances 5,000.00 Trading 5,000.00 To transfer. Sales 150,000.00 Trading 150,000.00 To transfer. Trading 6,000.00 Sales Returns and Allowances 6,000.00 Trading 48,000.00 Profit and Loss 48,000.00 To transfer the gross profit on sales.

The Trading account is thus used as a means of separating the net sales into its two elements: (1) income, or gross profits; and (2) decrease of assets, or the cost of goods sold. This method makes the Profit and Loss account a purely summary account of income and expenses. Its chief disadvantage, however, is that a picture of the entire operations for the period is not presented in one account. One seldom finds the Trading account used in actual practice. It does serve, however, as an efficient teaching device to bring out clearly the way in which the merchandise accounts are adjusted and summarized in order to effect a separation of the income and decrease in asset elements.

CHAPTER XLI

HANDLING THE CASH

=General Considerations.=—In keeping record of the various properties of a concern, the greatest care is usually exercised in accounting for the asset cash. This is done because of the difficulty in tracing money that is lost or stolen and the ease with which the thief may get rid of it, due to its universal use as a medium of exchange, and due also to its great value in comparison with its small bulk. Merchandise, supplies, and the like, may be purloined or misappropriated, but not so easily and profitably. Oftentimes, however, unless care is exercised in safe-keeping it, large losses occur also in merchandise. Absolute prevention of losses cannot be expected even with the employment of all possible precautions, but experience shows that certain general safeguards may be placed about both cash and merchandise. In the ultimate analysis the best safeguard is the integrity of the employee; still the employer should not tempt the employee by making the abstraction of his cash an easy performance.

=Principle of the Double Record.=—A fundamental principle in the handling of cash is to secure a double—not a duplicate—record of its receipt and disbursement. The practice of depositing in a bank all cash receipts and making disbursements only by check should be followed invariably, because it secures this double record—the bank's record and the cashier's record. Any discrepancy is detected whenever comparison of the two records is made. When the bank's record is compared with the cash book record, the balances shown by each are seldom in agreement, chiefly because of the outstanding checks which have not yet been presented to the bank for payment. This requires a reconciliation of the two balances before proof of correctness is secured, which is usually accomplished by subtracting from the bank balance the amount of the outstanding checks. Other adjustments are sometimes necessary. These are explained and a form of reconciliation statement is shown on page 475.

Most concerns object, however, to issuing checks for small amounts, and set therefore a minimum below which they do not issue them. For the purpose of paying smaller amounts, a petty cash fund is provided from which disbursements are made in cash. This fund is established, in the first instance, by a check on the general cash and is from time to time replenished in the same way. In this manner the double record is maintained.

=Handling the Petty Cash.=—There are two general methods of handling the petty cash. Under the one, entry of the check creating the fund is made as an immediate charge to some expense account and no further accounting is required. This method is based on the theory that the cash is to be used for petty expenses anyway, and might as well be so charged now as later. Subsequent amounts for replenishment of the petty cash are treated in the same way. The objection to this method, from the accounting viewpoint, is that it results in an inaccurate record of expense distribution and a misstatement of the facts in that it charges to expense an item which at the time of the charge is still a part of the general cash fund. The second and chief objection is that it encourages in the petty cashier loose methods in handling and accounting for the fund, as usually no strict reckoning is required.

The second method, known as the "imprest method," is in more general favor. This charges the original check creating the fund to an account called "Petty Cash." The petty cashier is required to secure a receipted bill, sales ticket, or other voucher for every petty

cash item of expenditure, so that at all times the amount of cash in his possession added to the receipted bills and vouchers must equal the original amount in the fund. Usually the fund is a fixed amount, its size depending upon the needs of the business for these small expenditures. When the cash in the fund becomes low, the petty cashier turns over his receipted bills to the general cashier, who issues a check for their exact total to replenish the petty cash by the amount of its depletion, thus restoring it to its original fixed amount.

The expenditures as shown by the receipted bills and vouchers are classified and entered by either of the following two methods: (1) as a charge to the several accounts through the general cash book, offsetting the petty cash replenishing check; in this case no charge appears in the “Petty Cash” account except the item covering the original check; or (2) by an entry through the journal debiting the various expenses and other items and crediting Petty Cash. This latter method necessitates charging in the general cash book the replenishing check to Petty Cash as an offset to the journal credit of the same amount. Most accountants consider the postings to the Petty Cash unnecessary—except the original—and so check both in cash book and journal. If, however, posting to the Petty Cash account in the general ledger is made whenever the fund is replenished, this will serve to indicate the activity of the fund on the face of the ledger account—information which could just as easily be obtained from the petty cash book. The imprest method thus effects a careful accounting of the petty expenditures.

=The Petty Cash Book.=—The petty cash book is usually a columnar record with the amount columns to the right of the explanation space. The first column is the receipts column, the second the disbursements column, and the others show under appropriate titles the distribution of disbursements. One form of the book is shown in Form 39, with typical entries and balancing.

[Illustration: Form 39. Petty Cash Book]

Sometimes the classified summary which is made the basis of the general cash book or journal entry referred to above, is shown in the petty cash book, the account titles being written in the explanation column, with the amounts opposite in the credit column underneath the $100 total. The items of this summary are then posted to the ledger, and the debit of the replenishing check to Petty Cash on the general cash book is “checked” in the ledger folio column. Or if the distributive column titles give sufficiently analyzed account titles, their totals may be posted without formal summarization, posting being shown by the small-figure ledger page in each column, as in the illustration. Where the petty cash book is used as a posting medium, of course no summarization of it is made either in the journal or the general cash book.

=Keeping the Bank Account.=—Several different methods of keeping the bank account are in use. Sometimes the check stub is the only record kept; in Chapter XXIII reference was made to the two methods of keeping the account for the entry of deposits—either on the face or the back of the stub. When the entry is made on the face, each check is usually subtracted from the previous balance and the new balance is shown. When deposits are recorded on the back of the stub—or on a special deposit interleaf—check totals and deposit totals may be carried forward from leaf to leaf without showing any balance.

A better method is to use the stub only as a memo from which to make formal entry in the cash book columns—one for deposits on the debit side and one for checks on the credit side. These bank columns may be used, first, for the purpose of keeping the bank account, by showing the totals of deposits—but not the items composing each deposit—and the totals of the checks that have been drawn; and second, for the purpose of furnishing weekly or monthly totals for posting to a ledger account kept with the bank, thus making the ledger self-balancing without having to bring in the cash book balance.

If, however, the principle of double record (explained earlier in the chapter) is followed, there is no need of a _special_ bank deposits column, since the total of the Net Cash column gives the amount of each day’s deposits, and similarly the Net Cash column on the credit side shows the checks drawn against the bank. Thus the policy of depositing in the bank all receipts and disbursing only by check has an added advantage in that it simplifies the keeping of the record of cash as well as proving it. Under this method, the cash journals may be summarized, just as the other journals, and posted to a Cash account in the ledger. Detailed instructions for the handling of the entries, balancing, and closing under this method are given in Chapter XXXI.

Another and rather unusual method of keeping the cash book is to carry a Currency column on each side, supplemented by Bank columns for deposits and checks on the debit and credit sides respectively. In the debit Currency column are entered all receipts of money in regular course. When the bank deposit is made up, its amount is entered as a charge to the bank in the credit Currency column and also, as a memo, in the debit Bank column. As checks are drawn they are entered in the credit Bank column. Thus the balance of the Currency columns should show the actual amount of cash in the cash drawer at any time, and the difference between the Bank columns should show the balance in the bank. Though somewhat complicated, the method has its advantages

under conditions where currency accumulates before being deposited in the bank.

Of course, under all methods of keeping the cash record, the requirement that all cash received be deposited and payment be made only by check should be strictly adhered to.

=Entering Checks on the Cash Book.=—When all disbursements are by check, every check drawn must be entered on the cash book and accounted for. Entry should be made in numerical sequence with suitable explanation of any spoiled checks. The amount of the spoiled check may be left blank or entered as usual, but in the latter case the spoiled check must also be included in the day's deposits, and the bank's cancellation stamp must be secured. Neither the deposit nor disbursement is posted, each entry being marked "contra" by way of explanation. This effects an inflation of the total receipts and disbursements, but inasmuch as the bank's record also shows the inflation, an adequate safeguard is secured. The new check replacing the one spoiled is entered in regular order.

The method just discussed is perhaps the best way of recording the exchange of checks for cash. Sometimes a concern is asked to exchange its check for currency, the party making the request desiring to send the check through the mails or for some other purpose. The entry is best made on both the debit and the credit side of the cash book with reference "contra" in each case, but neither entry need be posted. This makes the cash book record check against the bank record and shows the full history of the transaction. When a check is cashed in currency, or when a check of larger amount is received in payment of a debt and the difference is returned in cash, no record need be made of the check, as only the nature—not the amount—of the deposit for the day is changed and no disbursement is made which affects the bank account. When, however, a check is issued for "change" in lieu of currency, record should be made, debit and credit, as shown above.

=Branch Cash—The Working Fund.=—Frequently cash working funds must be provided for the current expenses of branches or of a factory located at a distance from the main office. When the branch or factory keeps a separate set of books, it must be charged with the advances of the working fund and a careful audit of the way the fund is handled must be made periodically, just as would be done with an independent concern.

Such cash transfers may also be handled by the imprest method as explained above. The original advance is charged to "Factory" or "Branch Cash," and is deposited in the branch's local bank to the credit of the head office, the branch having the privilege of using it. The branch may draw checks against the fund, sending the canceled checks to the head office as supporting vouchers for its disbursements. These canceled checks become the basis for the replenishing checks and also for the charges for branch expenditures made on the head office books.

If the branch is a selling agency making sales for cash and on account, a modification of the system is necessary. Daily reports should be required from the branch. Its cash receipts should be deposited daily and a duplicate deposit ticket should be forwarded to the head office by the bank. The bank should be asked also to forward all canceled checks. All collections on customers' accounts should be made from the head office. This does not prevent the abstraction of cash before deposit, but it at least places control or oversight of the bank cash account in the hands of the head office and secures a careful accounting of it.

=Safeguarding Cash—General Principles.=—Proper safeguards for the cash should always be provided. The method of the double record—the bank's and the owner's cash book—is good so far as it goes and acts as a check on cash transactions _after_ the record is made, but does not insure that the cash book record will be made correctly in the first place. There are ways in which cash received may get into the cashier's or salesmen's pockets instead of the cash book. No system or method has yet been devised to prevent this entirely. Every system must rest at some point upon the integrity of the human agent, and will fail of its full efficiency and intended results if the agent fails in the trust reposed in him. Every effort should be made to prevent both petty thievery—the abstraction of small sums at every opportunity—and systematic robbery mapped out and planned with infinite care and detail. Only everlasting vigilance and a system of "checks" will secure satisfactory results, as occasionally it is the _trusted_ employee who is not true to the trust placed in him.

=Internal Check.=—By internal check is meant the method by which employees check each other's records, control not resting entirely in any one clerk. Thus a system of record-making which combines the work of the cashier and bookkeeper under one clerk or which gives the cashier access to the ledgers is one which invites dishonesty.

Where the cashier has entire control of the cash, and besides opens the incoming mail, makes up his daily deposits, has his pass-books balanced periodically, and files the canceled checks, he has every opportunity to abstract cash and falsify his records.

But where he must make detailed daily reports of the cash to the manager, treasurer, or some other officer; where he is denied access to the records—except his own cash record—and where his record is subject to periodic proof; where the mail is opened first and receipts listed by an independent clerk; where a careful system of proving receipts from cash sales and of allowing no unauthorized deliveries over the counter is employed; where every member of the office force is required to take a vacation during which his work and records are cared for by other employees—there is a very satisfactory system of internal safeguards and checks.

All these devices and systems are applicable in full only in large concerns where minute division of duties is possible. In smaller concerns where many duties have to be combined under one person, the problem of safeguarding the cash and providing other measures to prevent fraud of various sorts is more difficult. In such a concern, at least the cash received through the mail should be listed first by someone other than the cashier or bookkeeper, and the daily deposit slip should be compared with this list to see that all the cash items are included. The cash received from cash sales should also be proved daily against the sales tickets.

=Statement of Receipts and Disbursements.=—A periodic report of cash is usually made by means of a statement of receipts and disbursements. This statement is an abstract or summary of the cash book, showing the total receipts from various sources and the causes of the disbursements and their totals. A simple form is given below:

[Illustration: Form 40. Weekly Statement of Receipts and Disbursements]

To assist in checking past deposits, an itemized record of daily cash receipts is often kept, analyzed as to gold, silver, currency, notes and checks. To be of value this record should be filed with the daily deposit tickets and should be later available for purposes of comparison.

CHAPTER XLII

NOTES RECEIVABLE AND PAYABLE

=Conditions Precedent to the Present Use of Notes and Bills.=—During the twelfth and thirteenth centuries there was much bad money in circulation in Europe because of the widespread practice of coin-shaving and the entire lack of standards of purity of the coins. If a monarch needed funds for war or government purposes, his easiest way of getting them was to increase the amount of base alloy in the coins of the country or to increase the rate of seigniorage. As the former method might be resorted to several times during the reign of one sovereign, the weight and relative purity of metallic coins had no relation to the denominated value of the coins, and they fell under general suspicion. Consequently, only the money dealers, who could determine the actual value of coins by assaying them, were willing to trade for coins. These men gradually became the custodians of moneys for merchants, who were given receipts showing the assay value of the coins deposited. Because the receipt represented tested and proven value, it was a more acceptable medium of exchange than the coins themselves.

Medieval trade was subject to many perils, chief of which was that from robbers. Any safeguards placed about the transportation of money from one place to another, or any method devised for settling debts without the transportation of coin and bullion, were more than welcome. Out of these conditions arose the method of settling debts by means of drafts. The draft, not countenanced by law at first, had standing, however, under the “law merchant,” the code of rules recognized by merchants as governing commercial relations. This code was later incorporated by statute into the law of the country.

These two kinds of paper, the one a receipt for coin which was in the nature of a demand promise to pay, the other a counterpart of the modern draft, were the forerunners of our promissory notes and bills of exchange of the present day. The law with regard to the bill or draft became settled as the result of the practice of merchants sooner than that relating to notes.

=The Titles “Notes” and “Bills.”=—In this way, the word “bill” became an established term. The titles “bills receivable” and “bills payable” still cling to both classes of items. Inasmuch as the accepted bill is practically identical with the promissory note, and the title “bill” is so often used interchangeably with the word “invoice,” it is advisable to use the terms _notes receivable_ and _notes payable_ instead of bills receivable and bills payable. Some advocate the use of the title “acceptances” in order to distinguish accepted bills from promissory notes. Unless these two classes of paper are large enough in volume to justify it, little advantage is secured by this separation of their bookkeeping record. However, in the case of trade acceptances, i.e., acceptances based on particular sales of goods and therefore evidencing bona fide commercial transactions as the basis for the extension of credit, it is advisable, because of their superior rating in the money markets, to segregate this class of acceptances from notes and other

acceptances.

=Relation of the Note to the Open Account.=—In the preliminary discussion of the relation of the note to the open account in Chapter XXI, it was pointed out that both the note and account are claims against the person liable for payment; and that the one is carried under a class title “notes receivable,” because the number of such notes is usually small, while each account receivable is carried under a separate title which designates the person liable for payment. The essential difference between the two kinds of claims is that the note is an acknowledgment of the justice of the claim and the correctness of the amount, whereas the claim under the open account may be disputed and in case of dispute requires outside proof; besides, the open account may always be offset by counterclaims and sometimes by a return of all or a part of the goods bought.

Any defenses of value under the contract for which the note was given are good defenses as between the original parties to a note; but not so as between the maker and a third party who is an innocent purchaser for value. To him the maker is liable according to the exact terms and tenor of the note. Only so could the element of negotiability be insured and the note pass from hand to hand as money. In no other sense is the note a preferred claim over the open account.

In case of bankruptcy a claim against the bankrupt under an open account and a claim under a promissory note or an acceptance made by the bankrupt before his insolvency, rank alike, both sharing pro rata in the net assets available for the satisfaction of the total claim of unsecured creditors.

=Relative Liquidity of the Note and Open Account.=—Compared with the liquidity of open accounts, promissory notes have a slight advantage in that they can more readily be turned into cash and at a better rate. Although an assignment of open accounts is possible by hypothecating them with a third party, the cost of such assignment is almost prohibitive and is resorted to only where the customary sources of credit are not available.

The legitimacy and the low cost of discounting notes greatly increase their liquidity. Oftentimes the question of risk, i.e., the degree of certainty of their payment when due, enters into the determination of the relative liquidity as between open accounts and promissory notes, but from this standpoint there is little, if any, difference between the two claims. Occasionally a firm, which refuses to pay its debts on open account, will meet its notes and acceptances in an effort to bolster its credit at the local banks. This phase of the question does not usually enter into the discounting operation, where the credit of the discounter is the determining factor in raising money. Of course, this may be only a temporary expedient if the note is dishonored and charged back to the bank. In some lines of business it is very common practice to secure notes for overdue accounts. If the Notes Receivable account contains many such items, its liquidity is seriously to be doubted. However, the note is usually classed as a more liquid asset than the open account.

=Method of Recording Notes.=—As to the accounting phase, a record is made of each note received or given, entry being to Notes Receivable or Payable, as the case may be. If the note transactions are few in number, the general journal is used for their record. Ample explanation must be given as to the essential facts of date, maker, for what received, rate of interest, due date, etc. Notes receivable must be watched carefully, as failure to present them when due releases all indorsers. There is nothing unusual in the entry when made in the general journal, its debit and credit being determined as indicated in Chapter XI.

=The Note Journals.=—Because the general journal does not lend itself to an easy record of the essential data pertaining to note transactions, a separate book is oftentimes kept for this purpose. This special book may be used merely as a memorandum record for carrying the detailed explanation of the Journal entry; or it may become a special journal that is used as an integral part of the accounting system, and, when so used, posting to the ledgers is made direct therefrom. The use of this special journal is always advisable when note transactions are numerous. A bills or notes receivable journal may be ruled as shown on Form 41. The notes payable journal differs but slightly from the notes receivable journal.

[Illustration: Form 41. Notes Receivable Journal (left and right hand pages)]

If the bill book is for memorandum use only, the “Amounts Credited” columns may be omitted. If it is a real note _journal_, its debit and credit equilibrium is shown through summary entry at posting time. The total debit is to Notes Receivable for the amount of that column’s total. If it were not for the fact that sometimes notes are received in whose face amount is included not only the credit to the customer but an interest item as well, there would be no need of credit columns. The note journal would then be operated just as is any simple special journal, with a debit to Notes Receivable and the same amount credited to the customer; but when interest is included, the note is best recorded in an additional column, separating the credit to Customers from that to Interest. If notes are

numerous, a distributive column in the cash book should be used for receipts from notes, in order to secure a total posting to the credit of Notes Receivable account.

Referring to the left-hand page of the illustrated ruling (Form 41), the face amount of the note receivable is entered in the Notes Receivable column, and the due date in one of the narrow columns headed “When Due,” each of these columns representing a separate month. In this way it is easy to find the total of all the notes due in a given month and the amount of cash to be expected from their payment. For this purpose, however, it is best to use a note journal arranged by _months of maturity_ on the principle of a “tickler.” In such a journal one page is reserved for each month, and the notes are entered, not on the page for the month when received, but on that for the month when due. Thus a note received in January and due in March should be entered on the March page. To secure a summary of all notes received during each month for posting to Notes Receivable account at the end of each month, the various month pages are totaled and “recapped” on a special page. On this “recap” page, at the end of January, say, will be entered the total of the January page, giving the notes received in and maturing during January; the total of the February page, giving the notes received in January but maturing in February; etc., for each month during the year. The grand total is the amount to be posted to the general ledger, representing all notes received during January.

This type of journal gives easy control over maturities, and forecasts for a given month the amount of cash receipts from notes.

=Notes Entered at Face Value Always.=—Some notes are interest-bearing from their date of issue; others only after their due date when not paid. Even on non-interest-bearing notes, the law allows the charging of interest for their overdue period. From the standpoint of strict accuracy, a note payable at a future time is not worth its face value at the time of entry, unless it is interest-bearing from date at approximately as high a rate as the current discount rate. Its present value is such an amount as when placed on interest will equal the face at its due date. That value increases day by day until it reaches par or face on the due date. Because of the practical difficulties encountered in the numerous adjustments necessary under any other method of entry, universal practice countenances the bringing of the note onto the books at a slightly inflated value, i.e., face value, at the time of entry. Face value is the amount of the credit to the customer’s account; it shows the amount to be collected on account of the note; and if interest-bearing, the amount on which the interest is based. Accordingly, the note transaction is entered at its face value. Where the note is interest-bearing and the face plus the interest is paid at maturity, credit is in two items, one to Notes Receivable for the face, and the other to Interest Income for the amount received as interest.

Occasionally, the interest for the period the note is to run is added to the amount of the debt, and the sum is made the face of a non-interest-bearing note. The purpose of such procedure is to secure a compounding of interest for the first period if the note is not paid at maturity. The entry of the note on the books is a debit to Notes Receivable for its face, and credits to the customer for the amount of the debt and to Interest Income for the amount of the interest. Only a credit to Notes Receivable is made when the note is paid. The credit to Interest Income, before the interest is actually earned and received, is necessitated by its pre-estimate and inclusion in the face of the note. Were a balance sheet drawn up on that date, the entire amount of this interest would be shown as deferred income.

=The Interest Accounts.=—As explained in Chapter XV, when interest items are numerous two interest accounts are usually carried on the ledger, one for Interest Income and one for Interest Cost. Sometimes, however, only the one account, Interest and Discount, is carried, and if it is desirable to separate the two classes of interest, it may be done by entering the debit and credit totals of the Interest and Discount account—instead of simply the balance—when the trial balance is taken. Needless to say, bank discount—interest paid in advance—is the only kind of discount recorded under this account title; it must not be confused with discounts on sales and purchases, which receive different accounting treatment.

CHAPTER XLIII

PROBLEMS ENCOUNTERED IN RECORDING NOTES RECEIVABLE AND PAYABLE

=Entries in the Account.=—The elementary discussion of entries to the note accounts in Chapter XIV will be reviewed and amplified here.

Where the Notes Receivable account in the ledger shows each note separately rather than the totals of the items, good practice countenances the recording of the _credits_ in this account in non-chronologic order. Thus, when a customer settles his promissory note and the document is returned to him, the credit to Notes Receivable should be entered directly opposite the original debit item. This brings each complete note transaction on a single line and shows at a glance which notes are outstanding, as evidenced by

the blank lines on the credit side of the account.

When, however, the credit items are entered in chronological order, the same purpose may be accomplished by the use of an index figure for the original debit and the corresponding credit item.

What has been said above applies equally to notes payable.

=The Discounted Note.=—In the booking of notes receivable discounted and accepted drafts, a problem arises because of the legal right accorded the holders of notes, in case of non-payment by the maker, to look for payment to any or all of the indorsers, provided certain formal requirements are complied with. Whenever a business house transfers a note by any method of indorsement (except the qualified), it incurs a _contingent liability_, which may become a _real liability_ if the maker of the note fails to meet the obligation at maturity. Since it is the function of good accounting to present _all_ the financial facts bearing on the business, it is evident that whenever a contingent liability is incurred, it should be entered in the books of account. Very frequently, however, this liability is ignored, with the result that it is eventually lost sight of altogether.

The usual, though incorrect, method of journalizing a note discounted transaction is as follows:

Cash Interest Cost Notes Receivable

Usually when an asset is sold, a credit to the account of the asset sold is correct, but not so in the case of notes sold, i.e., of notes discounted. For the purpose of showing the complete facts, the entry at the time of discount should be made as follows:

Cash Interest Cost Notes Receivable Discounted

and at maturity when the note is paid by the maker:

Notes Receivable Discounted Notes Receivable

The effect of the first entry is to set up a suspense account, Notes Receivable Discounted, representing the contingent liability on the discounted note. The effect of the second entry is, first, to cancel the _credit_ of the Notes Receivable Discounted account, because upon payment of the note by the maker the contingent liability ceases; and second, to cancel the original _debit_ to the Notes Receivable account which was made at the time the promissory note was received but which remained _unchanged_ when the note was discounted, because it was still needed to record the contingent asset which would become a real asset in case the contingent liability became a real liability.

It has been argued that the above treatment of discounted notes stretches the theory of debit and credit nearly to the breaking point. It must be observed, however, that unless accounting records are so kept as to give the necessary information, they are not serving the purpose which justifies their existence. Any theory which prevents the proper functioning of the records must be changed; there is no place for it.

It would be incorrect, however, to regard Notes Receivable Discounted as an independent liability account, because it only represents a contingent liability. The two accounts, Notes Receivable and Notes Receivable Discounted, must be considered together, the latter account being set up merely for the purpose of keeping notes discounted under review until their final status is determined. The purpose of the Notes Receivable Discounted account is in a way similar to that of the valuation accounts of depreciating assets. The asset account is held at its original figure, and in order to determine the present value of the asset, the valuation account must be referred to. Similarly, the asset account, Notes Receivable, is held at its original figure, even though some or all of the notes are discounted, and in order to know the amount of notes receivable actually on hand, the credit of the Notes Discounted account must be subtracted from the debit of the Notes Receivable account. In the balance sheet, Notes Receivable Discounted is not shown as a liability item, but appears as a deduction from Notes Receivable, only the difference, representing the amount of notes actually in possession, being extended among the assets. It should be noted, however, that this contingent liability is oftentimes shown on the liability side of the balance sheet, the corresponding asset, Notes Receivable, then being separated into two items, “Notes on Hand,” and “Notes under Discount per contra.” Banks uniformly follow this practice in showing these and similar items.

At maturity of the note the final entry (Notes Receivable Discounted debit and Notes Receivable credit) is placed upon the books as illustrated above. Usually no formal notice is received by the indorser that the note has been paid by the maker. In case the note is dishonored, prompt notice would be sent, and failure to receive such notice implies that the note has been duly paid.

What has been said above concerning notes applies equally to accepted drafts, the legal character of which is identical with that of notes, the status of the drawer of an accepted draft being the same as that of the first indorser of a promissory note. The contingent liability arising from the transfer of all negotiable instruments should usually be shown.

In some instances, however, there may be good practical reasons for not adhering to the above principle. When, for instance, a large number of notes and acceptances are handled and the experience of the business shows that few of them are ever dishonored, or if the matter is under constant review by the financial manager, it might be considered an unnecessary requirement to make use of a separate Notes Receivable Discounted account. It must be left to the judgment of the accountant to decide which method is preferable in connection with the needs of the business. However, if no current account is kept to show the contingent liability, at the end of the period the balance sheet must be made to show the amount of discounted notes still outstanding as of the closing date of the period.

=The Dishonored Note.=—A note is dishonored either when the maker refuses payment upon its legal presentation at maturity or when there is sufficient evidence that he intends to refuse. When a note is dishonored, a formal protest is required in order to hold the indorsers. The payee appears before a notary public or some other officer with notarial powers, and makes oath that legal presentment of the note has been made and that the payment was refused. The notary then takes the note and personally presents it for payment to the maker. If payment is still refused, the notary makes a certificate of protest and mails notices of the protest to all indorsers desired to be held. Such notice is sufficient basis for action to recover from the party or parties thus notified.

In making the accounting record of a dishonored note, a number of problems may arise. These problems deal with these two situations: (1) when the note is dishonored in the hands of the named payee; and (2) when the note has been discounted by him and is charged back on account of dishonor. To illustrate the entries required, take the following two cases:

PROBLEM. Case 1. Promissory note made by P. Canning for $100. Payee, D. Johnson. Due December 15. At maturity Johnson presents the note for payment, but payment is refused.

Case 2. Promissory note for $250 made by P. Canning. Payee, D. Johnson. Due December 15. Note was discounted by Johnson. Final holder is A. Andrews who presents the note for payment on December 15, but payment is refused.

The questions arising in connection with these two cases may be stated as follows: What record should be made on December 15—

(a) By D. Johnson in case 1. (b) By A. Andrews in case 2. (c) By D. Johnson in case 2.

(a) D. Johnson, at the time he received the note from Canning, made the following entry:

Notes Receivable 100.00 P. Canning 100.00

and on December 15, in order to show that the note is dishonored, he may make either of the following two entries:

(1) P. Canning 100.00 Notes Receivable 100.00

or

(2) Notes Receivable Dishonored 100.00 Notes Receivable 100.00

Entry (1) takes the charge out of the note account and sets it up again as a claim on Canning’s open account. Entry (2) transfers the charge to a Notes Receivable Dishonored account. Entry (2) is theoretically a better entry than entry (1), because from the latter it might be inferred that the nature of the claim has changed from a note claim to an open account claim. Such change has not taken place, however; Johnson’s claim against Canning is still on the note. Therefore, entry (1) is not true to the facts.

On the other hand, entry (1) has an important advantage over entry (2), because by posting entry (1) Canning’s personal account in the ledger is made to show the fact that one of his promissory notes was dishonored. This is a matter of very great importance, especially if Canning should again apply for an extension of credit.

If the second method is adopted, it is clear that the posting of the entry will not show the dishonor of the note on Canning’s account. It is essential, therefore, that the bookkeeper should make a special memo of the fact in that account. If the bookkeeper could be depended upon to make such memorandum entry, the desired purpose of making Canning’s account show a complete record of all dealings with him would be accomplished. Any treatment consistent with accounting principles and securing a complete history in

one place of all dealings with the same individual satisfies all requirements.

(b) A. Andrews, who is the last indorsee of the note, should make the following entry at the time the note is dishonored:

Notes Receivable Dishonored 250.00 Notes Receivable 250.00

The Notes Receivable Dishonored account represents Andrews' claim against any or all the indorsers whom he wishes to hold responsible. Instead of this, an entry might be made corresponding to entry (1) discussed above.

(c) In case the note should be charged back to Johnson, either by Andrews or by one of the other indorsers, he should make the following entries:

Notes Receivable Discounted 250.00 Cash 250.00 P. Canning (or Notes Receivable Dishonored) 250.00 Notes Receivable 250.00

It will be noticed that these two entries completely reverse the two original entries made by Johnson, viz.:

Notes Receivable 250.00 P. Canning 250.00

at the time he received the promissory note from Canning, and

Cash 250.00 Notes Receivable Discounted 250.00

when he transferred the note by indorsement.

It is to be understood that all expenses in connection with the dishonored note should be charged either to the personal account of the maker or to the Notes Receivable Dishonored account, as the case may be.

Where the Notes Receivable Dishonored account is used, it secures a good analysis of the claims against customers from the standpoint of probable realization and gives a relatively better basis for the bad debts estimate than that offered by the other manner of treatment. Of course, the use of such an account is limited to the ledger; it never appears as such on the balance sheet, being included there in the customers' accounts with ample reserve for uncollectible items.

=The Classification of Notes.=—The Notes Receivable account should carry only the short-time notes of customers, and thus be a truly current asset. Long-time notes and those secured by mortgage should be booked under separate account titles. For a similar reason, the notes receivable given by officers, employees, or stockholders of the corporation should have separate booking, as these notes are given for the purpose of making formal record and acknowledgment of indebtedness, usually without regard to time of payment. Such notes do not constitute easily convertible assets, and therefore should not be recorded under the same account with short-time customers' notes.

=Notes Receivable Out as Collateral.=—Notes receivable are sometimes given as collateral security for a loan. When they are so used, no bookkeeping problem is involved—though a memorandum to show their use as such should appear in the note account, and in case a balance sheet is drawn up, a cross-reference or a footnote should indicate the liability secured by the notes. However, the sale of the notes to satisfy the loan constitutes a regular business transaction, which should be recorded in the proper manner.

=Note Renewals and Partial Payments.=—The renewal of notes and partial payments are other features met in the accounting for notes. The renewal of a note is rather a question of business policy than of accounting procedure. When a note is renewed, it is usually better to deliver up the old note and secure a new one in its stead. The accounts should reflect the transaction by showing cancellation of the old and receipt of the new note. If the old note is extended, a memorandum of that fact should be entered in the ledger account.

From the financial standpoint, if neither note is interest-bearing, the amount of the renewal note should be larger than that of the old note, to cover the cost of deferring payment to a future date. For example, if the old note amounts to $1,000 and is renewed two months later, the amount of the new note should be fixed at $1,000 plus 1% interest, or $1,010.

In accounting for partial payments, no new accounting principle is involved. When such payments are numerous, additional space in the note journal and in the ledger should be provided for the purpose of facilitating the actual work of making the book record.

CHAPTER XLIV

DISCOUNTS

=Definition and Kinds.=—A discount is a deduction from a listed or named figure. The manufacturer or wholesaler in making up his catalogue for the trade usually enters his products at certain prices—called “list prices”—which are not selling prices but only nominal amounts on which the actual sale prices are based. For reasons to be explained later, he offers buyers a deduction from list prices which is called “trade discount.” The usual quotation of sale prices is at so many per cent below the list prices.

Among practically all merchants it is a very common practice to bill goods to customers with settlement allowed on an optional basis. The goods may be billed “net,” i.e., the full amount shown in the invoice must be paid. Since there is a relationship between the time allowed for payment and the amount to be paid, most concerns have an established credit term, at the end of which they expect full settlement of the account, but, as an inducement for earlier payment, they offer a reduction in the amount to be paid. This is stated usually at so much per cent below the billed price, and is generally called “cash discount.” The practice had its origin in conditions prevailing at the close of the Civil War when business failures were numerous and the risk on open accounts even for short credit terms was very great.

Bankers when making loans usually deduct from the face of the loan the interest charge for the use of the money. This deduction is called “bank discount.”

Merchants usually allow a deduction for the prepayment of a customer’s note, and this is called “commercial discount,” to distinguish it from bank discount, although the two kinds of discount are essentially identical; the only difference being that in the one case a bank buys a merchant’s note, while in the other case it is a transaction between two commercial houses, the one buying back its own note before it is legally due.

Trade discounts are very seldom recorded on the books, the actual selling price and not the list price being entered. Cash discounts are invariably recorded. If the merchant knew at the time of the sale which optional basis of settlement the buyer would choose, he could record the transaction at a net figure on that basis without entering the discount portion. This would, of course, result in a varying figure at which sales were booked. Accordingly, the almost invariable practice is to record sales at the gross amount and show by means of the Sales Discount account the acceptance of any lesser sum in settlement in accordance with the sales contract. Bank discount has to be booked in order to show the cost of the loan which is the difference between the asset received, cash, and the asset parted with, notes. The matter of bank discount has been treated in some detail in Chapter XLII.

=The Method and Purpose of Trade Discount.=—Trade discounts are so universally met with in business that an extended discussion of them will be of value to the student. As has been stated, a trade discount is a deduction from the list price and it serves two purposes. It is apparent that the prices listed in the catalogue cannot be changed until a new catalogue is printed and that it would not be practicable to print a new catalogue to make a change in selling prices. Therefore, instead of reprinting the catalogue whenever market prices fluctuate and a change in the list prices must be made, sheets containing the discounts allowed from list prices are published, the expense of which is much less than that of a new catalogue.

The other purpose served by the trade discount is in partly concealing the real quotation. Without the rate of discount allowed from that list, the catalogue tells nothing of the real price. In this way a concern in publishing its catalogue does not lay itself open to the risk of being underbid by competitors publishing later catalogues.

Prices may be quoted at a single discount or by means of a series of discounts, each taking as its base the net amount left after deducting the next preceding discount. Examples will illustrate:

1. Goods listed at $250 are quoted at 20% off. The sale price here is $200. 2. Goods listed at $500 are quoted at 50% and 20% off. 50% off $500 leaves $250. 20% ” $250 ” $200—the same real sale price as in No. 1. 3. Goods listed at $750 are priced at 50%, 33■%, and 20% off. 50% off $750 leaves $375. 33■% ” $375 ” $250. 20% ” $250 ” $200—the same as in Nos. 1 and 2.

It is apparent that the _list_ prices without the trade discounts tell nothing as to the _real_ prices.

=Methods of Calculation.=—Short methods for calculating trade discounts when given in a series are often employed. For a series of only two discounts, a single rate equivalent to the two may be found by subtracting their product from their sum—always treating them as decimals. Thus a series of 20 and 20 is equivalent to a single rate of 36,

(.20 + .20 = .40; .20 × .20 = .04; .40 - .04 = .36).

Another method of calculating trade discounts, and one applicable to a series of any number of discounts, is to treat the discount off as equivalent to one-minus-the-discount on. Thus a discount of 15% is equivalent to 85% of the list. An additional discount of 10% is equivalent to 90% of the new base, or 90% of 85% of the original list, or 76.5%. Thus a continued multiplication of the "percentages on" gives the single sale price multiplier to be applied to the list price. If the single discount rate is desired, it is secured by subtracting the multiplier from 1, or 100%. Take the series 60, 20, 10, and 10 off. This is equivalent to 40, 80, 90, and 90 on, or 25.92% on

(.40 × .80 × .90 ×. 90 = .2592).

The single discount rate equivalent to the series is, therefore, 74.08% (100%-25.92% = 74.08%).

The _order_ in which the discounts of a series are used is immaterial, as the order of the factors does not affect the product.

The method just illustrated develops the reason for the first special rule given above for a series of two discounts. Let the discounts be "_a_"% and "_b_"%. The "percentages on" are, therefore, (1 -_a_)% and (1-_b_)% whose product, algebraically, is 1- [(_a_ + _b_)-_ab_], which is the single "percentage on"; from which it is readily seen that the single rate discount is _a_ + _b_-_ab_, i.e., the sum of the two rates minus their product. Similar rules can be developed for longer series, but they are too complicated for easy application.

There is now available a "discolog" table, an ingenious reference table, which is operated somewhat like a logarithmic table. It gives quickly and easily the single discount rate equivalent to any series of discounts.

The chief value of the single rate equivalent to the discount series is in its use for comparative purposes, as it indicates which of two discount series is the more favorable. When a large number of selling prices must be computed, all having the same discount series, the single rate method of calculation also has a great advantage over the long method, which makes use of the series. This is true especially when the work is done with the use of a calculating machine.

=The Nature of Cash Discount—Its Basic Elements.=—Where goods are sold on credit with a cash discount offering, four main factors of cost, not incurred when goods are sold for cash, must be provided for. These are:

1. Credit investigation and collection expense. 2. Bookkeeping and billing expense. 3. Loss from uncollectible accounts. 4. Interest for the use of the money—credit.

The cash discount is offered to free the vendor especially from costs (3) and (4), which are the heaviest of the four.

There is a direct relation between the credit period and the loss from bad debts. Thus, if a credit period of 30 days results in a given volume of such losses an extension of the credit term to 60 days would undoubtedly result in increased losses, assuming that all factors, such as investigation of the risk, credit supervision, collection effort, etc., remain the same. Inasmuch as the sale price must be sufficiently high to provide for loss from bad debts, the credit term enters into the determination of the price.

The other of the two main factors of cost, the interest charge on the cash sale price, represents the cost of being deprived of the use of the capital tied up in outstanding accounts.

Thus, when a discount is offered for early settlement, under normal conditions the controlling factors are the risk or cost of insurance against loss from bad debts and the interest cost. Special circumstances, however, may make it expedient to offer more or less favorable terms of settlement. Normally, terms of 2% off if paid within 10 days, the billed price being on a 30-day credit period (2/10, n/30), measures two things: (1) the saving secured by receipt of the money 20 days earlier; and (2) the saving in the item of bad debts expense brought about by shortening the term for which credit is extended from 30 to 10 days. How much of the cash discount is for interest and how much for bad debts can be seen by comparing the current interest rate, say 6%, with the discount rate reduced to a yearly basis. A discount of 2% which effects the collection of a debt at the end of 10 days, when the net credit term is 30 days, secures the use of the money by the vendor 20 days earlier than the full credit term would effect. 2% for 20 days is equivalent to 36% on a yearly basis.

=Showing Cash Discount in the Trading Section.=—Opinions differ among accountants as to the proper treatment of cash discounts in the profit and loss summary at the close of a period. Some maintain that the discount is a trading or selling item, and show it, therefore, in the trading section of the statement. Their theory is that discounts on sales partake somewhat of the nature of trade discounts, that the real selling price is, after all, what is received for a particular bill of goods. According to this theory, if goods

are billed at $1,000, and $980 is accepted as full settlement, the sale should be shown only at $980 on the books. At the time of offering an optional basis for settlement, however, the merchant does not know which basis the customer will accept, and he therefore enters the sale on his books at the highest offer. Later, if the customer settles on the more favorable option, the discount he takes is logically a deduction from sales.

On the other hand, if the discount is explained as a bait offered to secure customers, it should be treated as a selling cost. Consequently, on either of these two theories, cash discount would have to be shown in the trading section of the profit and loss statement, in the one case as a direct deduction from sales, in the other as a selling cost.

=Correct Method of Showing Cash Discount.=—Other accountants maintain that cash discount is a financial management item; that a manager, in order to secure ready funds with which to take advantage of the discounts offered him on his own purchases, extends to his customers sufficient inducement to secure the early and prompt payment of their bills. The difference between the saving on purchases payments and the cost of securing early payment on sales, is the measure of the efficiency of such financial policy.

While this explanation of cash discount on sales as a cost of securing funds may have some foundation, it does not give a fully satisfactory explanation of the practice. If cash discount has been correctly analyzed as being composed of the two factors, interest and bad debts expense, there can be no question as to the place of its showing. Both factors are financial items and they should therefore be placed in that section of the profit and loss statement. In this work cash discounts will be treated as a financial management item.

=Account Titles for Cash Discounts.=—In booking cash discounts, two accounts are used—one for the discounts on sales, and the other for the discounts on purchases. Self-descriptive titles are Sales Discount and Purchases Discount, which seem better than Discounts Allowed and Discounts Received and other similar titles sometimes met with.

=Methods of Booking Cash Discount.=—In booking cash discounts, any one of four methods may be used. In Chapter XIX, “The Cash Journals,” two of these methods were shown and the explanations will not be repeated here. Explanations of the other two methods follow.

1. Entry is made only in the cash book through the use of a non-cash-discount column on the receipts side. This was also fully explained and illustrated in Chapter XIX. In the illustration given there, this discount column was not used in finding the cash balance, because net cash columns were employed, thus making unnecessary the use of any other column to find the cash balance.

2. Entry is made as in method 1 above, but the discount column is used in finding the cash balance. Where, as sometimes happens, the net cash column is omitted, the true receipts can be found only by _subtracting_ the amount of the discount from the other column totals.

The closing summary for the columnar cash book, explained in Chapter XIX, shows one method of handling the discount column total. While all other summary entries for the cash receipts are _credits_, the discount summary is a _debit_. Because of this fact, the discount total is sometimes shown on the disbursements side of the cash book among the summary entries of the other columns, in which case the word “contra” is written after the words “Sales Discount,” showing that the amount has come from the discount column on the opposite page. Similarly for the Purchases Discount.

The only advantage of this method is to bring all summary debit postings on one side of the cash book and all credits on the other. Where the cash book is operated according to method 2, the closing summaries are made as shown in Form 42, using columns on the debit side for Customers, Sales Discount, and Sundry; and on the credit side for Creditors, Purchases Discount, and Sundry. As there is no net cash column, the totals for Customers and Creditors are not all cash. To clear them of their non-cash elements, the discounts can be subtracted from their respective Customers’ and Creditors’ totals, and only the net brought over into the Sundry columns; or the subtraction can be effected by adding the discounts to the opposite side. The use of a Net Cash column simplifies the summarization of the cash book and should always be employed. Treatment 2 is shown only because it is sometimes met with in practice.

=Securing Information as to Neglected Discounts.=—Some accountants have pointed out the desirability of bringing before a manager or proprietor the cost of his failure to take advantage of discounts offered him. To show this cost the following method of entering a purchase has been suggested:

Purchases 100.00 Purchases Discount 5.00 Vendor 105.00

The _net_ amount of the bill is thus charged to Purchases, the discount offered to Purchases Discount, and the Vendor is credited with the billed amount. When payment is made on any of the optional bases offered, entry is made as follows:

(1) Vendor 105.00 Cash 105.00

or

(2) Vendor 105.00 Cash 103.00 Purchases Discount 2.00

[Illustration: Form 42. Discount Columns Used for Cash Balance (Method No. 2)]

In the case of entry (1), the net result of the whole purchase transaction is a loss or expense of the amount in Purchases Discount, because of failure to take the discount. In entry (2), if the best option is taken, viz., the entire 5%, Purchases Discount shows no balance; any less favorable option, say 2%, results in a debit balance in Purchases Discount of 3%, measuring the expense incurred through failure to take the best option. Unquestionably, the information given a manager by this Purchases Discount debit balance will claim his notice and immediate attention.

A sales transaction handled on a similar basis results in a Sales Discount credit balance representing the excess of the offering of discounts over the amount taken by customers and has to be treated as income additional to the booked sales income.

Inasmuch as the sale or purchase, under this method, must be booked on a cash option basis, this treatment seems to result in a departure from true cost or in the mistake of booking only _some_ of the elements which enter into the cost of merchandise. The price at which a merchant can sell his product must include all direct and indirect costs and provide a margin for profit. The sales discount offered is simply one of these indirect costs. It cannot be more accurately estimated than can the salesman's salary which is a part of the sale price. It is inconsistent practice to separate the invoice price into two elements and term one _real_ selling price and the other sales discount cost when the _real_ selling price is still a composite item. Rather, the sale should be booked at its full invoiced price and actual costs recorded as they accrue, to be closed out against Sales Income at the end of the fiscal period.

After all, the sales policy of each concern enters largely into the determination of its normal selling price. A concern with a normal credit term of 30 days fixes its sale price on that basis; one with a 60-day credit term will, in determining its sale price, take into account the risk and interest costs of the longer credit period; and one doing a cash business will determine its sale price accordingly. However, as a means of furnishing the information necessary for guidance under a particular sales policy, sales should be recorded on the basis of the normal credit term.

To secure the information sought as to neglected discounts, it is suggested that memorandum accounts be opened for that purpose and entry be made of the expense only when incurred. Thus failure to take a purchase discount would be recorded under these or similar captions:

Neglected Purchase Discounts Reserve for Neglected Purchase Discounts

At the time the books are closed these memorandum accounts would be closed against each other, having served their purpose of giving the desired information through their inclusion in the trial balance submitted to the manager or owner.

=Trade Acceptances and Cash Discounts.=—Brief mention should perhaps be made of some recent discussions of the probable effect of the extended use of trade acceptances on the practice of allowing cash discounts. Some sellers, to whom the cash discount practice is troublesome and unsatisfactory, welcome the use of trade acceptances as an avenue of escape from the practice. Others have gone so far as to say that the trade acceptance will eventually do away with cash discounts. It should be said that the use of trade acceptances, while attractive from the seller's standpoint, has not as yet made a strong appeal to buyers, largely because of the fact that it offers little that the open account method does not secure for them and it may, on the other hand, interfere somewhat with the taking of cash discounts.

CHAPTER XLV

BALANCE SHEET VALUATION

=The Two Problems of the Balance Sheet.=—There are two major problems connected with the balance sheet: (1) the problem of form, and (2) the problem of content. The form of the balance sheet, which was discussed rather fully in Chapter III, has to do with the arrangement of the items for the purpose of intelligent reading. It deals with the principles in accordance with which the asset, liability, and net worth items are to be marshaled and set up in groups and arranged within the group with a view to facilitating the comparisons between groups and the calculations made in judging the financial condition of the concern.

The second problem of the balance sheet, that of content, which was also mentioned in Chapter III, concerns itself mainly with the valuation of the items in the balance sheet, assuming of course that all the assets and liabilities are included in the statement. A balance sheet may be correct in form but, unless its content is reliable, it has little or no value when judged from the standpoint of its chief purpose, namely, that of showing the financial condition of the concern. The problem of the form of the balance sheet has to do with the technical or mechanical side of accounting, while the problem of its content or the valuation of its items has to do with the questions of the concern's financial administration, for the solution of which the accounting department must furnish in proper form the necessary information.

=Kinds of Value.=—It is first necessary to state the limitations within which the principles of valuation to be laid down are applicable to the commercial balance sheet. In business many different kinds of value are found and used. Thus we have the terms, sale or liquidation value, cost value, and replacement value. By the term "sale value," when applied to a going business, is meant the value which a willing buyer offers to a willing seller. "Liquidation value" means the value or price offered for a commodity or an entire business when the concern is winding up its affairs and going out of business. Liquidation is, therefore, forced value. There is thus a marked difference between sale value and liquidation value. The term "cost value" is understood to mean the price paid for a purchased article. From the discussion of the principles of debit and credit as applied to merchandise and to fixed assets, it has been shown that the price paid should include not alone the invoice cost but the other expenditures needed to put the article purchased in such a position that it can be used by the business in the customary way. Replacement value means the cost to replace an article. It differs from first cost mainly in that the price level may have changed between the date of the original purchase and the present time. Thus, because of the changes in prices, an article, costing $1,000 in 1914, might have had a replacement cost of $1,800 in 1917, and $1,400 in 1922.

Manifestly, before the principles to be followed in valuing balance sheet items can be laid down, there must be some understanding as to what kind of value is under discussion. The kind of value used in the ordinary commercial balance sheet is termed "going concern value." By this is meant the value which is applied to a going business—a business which expects to continue in operation, not one which expects to sell out to other owners nor one which expects to discontinue operations.

=Source of Data as to Values.=—In a going concern the information as to value is found chiefly in the books of account. The data in the accounting records are, of course, supported by the original documents evidencing the purchases and sales. It is a necessary corollary that if the books of account are to give reliable information as to values, a correct analysis must be made of all transactions previous to their entry. Mention was made in an earlier chapter of the necessity of a clear differentiation between capital and revenue charges and the effect of failure to make such differentiation. If at the time of an expenditure a correct classification of accounts has been made, particularly of the broad classes of assets, liabilities, and proprietorship, the accounts should reflect the true values as of the various dates of record. For purposes of detailed information it is equally necessary that a correct classification be made of the accounts affected by an entry within any of these main groups. It has been seen that because of practical difficulties no effort is made to have the accounts reflect day by day the correct value of the various items. It is considered sufficient to bring the book record into agreement with the facts in respect to value once each fiscal period, namely, at its close. The true financial condition and correct operating results are then determined.

It will thus be seen that a correct analysis of every transaction recorded in the accounts is an absolute prerequisite to the use of the accounts for determining correct values. It is very vital that a clear line of demarcation be maintained between capital and revenue expenditures—that great care be exercised that no cost is charged into the asset group of accounts unless such cost really enhances the worth of an asset. A cost incurred for the purpose of maintaining the value of the asset is an expense charge, and repairs and maintenance charges must be very carefully distinguished from replacements. _Maintenance_ has to do with those costs which maintain an asset in good operating condition; _repairs_ have to do with those costs necessary to put an asset in operating condition after a condition of inefficiency has been reached which the maintenance costs have not been able to prevent; a _replacement_ cost is incurred when it becomes necessary to replace some part or the whole of an asset, neither maintenance cost nor repair costs having been able to maintain the asset in efficient operating condition. Where only a part of an asset is to be replaced, it is often spoken of as a _renewal_ of parts. When so used, the term "replacement" is limited to the renewal or the

replacement of the whole asset.

When a renewal or replacement is made, it becomes necessary to determine whether the cost of the renewal or replacement is more than the cost of the part or the whole replaced. For example, if an asset costing originally $1,000 is replaced by one costing $1,200, there has manifestly been an addition of $200 to the value of the asset. The new asset may be an exact duplicate of the old but if prices have risen so that the new actually costs more than the old, the books must record the asset at its new cost value. The amount by which a new asset or part of an asset exceeds the cost of the old asset or old part is called a _betterment_. A betterment is always an asset.

The student will readily see that at times it must be difficult to draw the line between repairs and replacements. In practice the line is usually drawn only when the expenditure exceeds a certain amount. This amount is not uniform and is determined by each individual business. For example, when the cost of placing the asset in efficient condition for operation is less than, say, $100, it is charged as repair cost and therefore does not increase the book value of the asset. If the cost exceeds $100, an analysis is made to determine what portion of it, if any, increases the value of the asset. The amount of the betterment is of course a charge to the asset account, while the rest of it is a charge to some expense account.

=Treatment of Special Items.=—In the determination of the classification of charges, some kinds of items require special consideration:

ORGANIZATION EXPENSE. The group of expenditures explained in Chapter XXXVIII, as incident to the organization of a corporation, is recorded under the title “Organization Expenses” and is classified for purposes of the balance sheet as an asset. It is a kind of asset, however, which has no tangible value and most businesses desire to consider it more in the nature of a deferred charge to operations. It is recognized that frequently intangible assets add no strength to the business. While, therefore, in strict theory organization expenses are assets, in practice it is best to write them off against income during a period of from three to five years.

COST-CUTTING CHANGES. Another similar class of charges is met in costs incurred in making changes in the arrangement of building and other facilities which will tend to bring about a more economical handling of some phases of the business; for example, a rearrangement of a receiving and packing room in order to facilitate the receipt and delivery of goods. Where these costs are inconsiderable it is best to charge them against the income of the period in which they are incurred. Where, however, a big expenditure is necessary, it seems best to set the costs up under a suitable descriptive title and spread them over several periods. In other words, at the date of their incurrence the costs are treated as an asset whose value is to be written down at the end of successive fiscal periods until finally it has all been charged against the operations of the business.

INTEREST DURING CONSTRUCTION PERIOD. Where a business builds its own home, all costs incurred during the period of construction are proper charges to the costs of the construction. Thus, if a mortgage or bond issue is used as a means of partially financing construction of the building, the interest paid to the mortgagee or bondholders during the period of construction is a proper charge to the building account. Costs of this kind follow the general principle laid down previously, that all costs up to the point of placing the asset in condition ready for use are proper charges to the asset.

=Basic Rules for Valuation of Balance Sheet Groups.=—We may now consider the principles applicable to the valuation of the various groups on the balance sheet. In the standard form of balance sheet the assets are divided into the three groups: (1) Current, (2) Deferred Charges, and (3) Fixed.

It has been seen that the assets of the current group are used for purposes of settling debts, the payment of expenses, and the purchase of merchandise. In judging the sufficiency of these assets for this purpose, it is absolutely essential to know that the values at which they are carried will be realized when they are converted into cash. From the standpoint of conservative business management an understatement of realizable value may be made, but never an overstatement. Accordingly, the fundamental principle of valuation applicable to this group is that these assets are to be valued at cost or market, whichever is the lower. When so valued, the figures at which they are carried in the balance sheet will usually represent an amount slightly less than the amount which it is expected will be realized from their conversion into cash.

The function of the deferred charges group of assets is to secure an equitable distribution of expense charges between the current and the following period. It is only because certain expenditures have been made during the current period which will benefit the succeeding period, that it is necessary to set up this group of assets. Here the problem of valuation is, therefore, simply the

problem of dividing the cost of the expenditures between the current and the next period on the basis of the benefits accruing to each. In some cases the basis of division is one of time, as where an insurance policy is purchased for a definite term. The portion of the policy which has expired during the current period is the portion of its cost to be charged to the current period, the balance being deferred to succeeding periods and therefore carried as an asset. In other cases a physical inventory is necessary to determine the distribution of the cost of expenditures, as when supplies of fuel have been purchased and not entirely consumed during the current period. The basis of the value carried over to the next period is of course a fair portion of the original cost. Market or replacement cost does not have any effect on the valuation of the deferred portion.

Fixed assets are acquired as more or less permanent equipment without which it is impossible to operate the business. The time during which an asset continues in use is the customary basis for a classification of its cost as between expenses and fixed assets. Thus, an asset acquired for purposes of business operation which, however, will be used up completely during the current period is charged immediately to some expense account, whereas an asset which will continue in use over several periods is charged to an asset account. Fixed asset purchases are never for purposes of resale. It is expected that they will continue in use until they are discarded because of failure to perform the service for which they were acquired. Neither the sale value nor the replacement cost value of such assets has, therefore, any influence on their value to the business. That value is the full cost adjusted periodically by an equitable distribution of that cost over the operations of the periods benefited by the services rendered by the asset. This principle of valuation is usually expressed by the formula, cost less depreciation.

=Valuation of Assets=

CASH. Cash as carried on the balance sheet is the asset which is used, without conversion, for payment of the liabilities of the business. There should, therefore, ordinarily be no problem of valuation. However, because of the practice of including checks, drafts and notes due and in course of collection, cash balances held abroad and therefore subject to the fluctuations of exchange, and other similar items in the account Cash, it is oftentimes necessary to examine all these items carefully and arrive at a figure which represents the amount expected to be realized from them.

NOTES AND ACCOUNTS RECEIVABLE. The claims against customers, both on note and open accounts, constitute an intermediate step in the conversion of merchandise into cash. At the time credit is extended to a customer it is expected that he will pay the amount due. The experience of every business man shows, however, that during each period there is a shrinkage in these claims due to some customers failing to pay the amounts they owe. In valuing these claims it is therefore necessary to take cognizance of the amount of the shrinkage. This amount is different in different businesses, depending on the length of the credit term, the policy as to investigation of credit risks, and on the rigor of the collections policy. On the basis of the experience within a given business, it is therefore necessary to make an estimate of the loss from uncollectible accounts.

The manner of making the record of estimated bad debts has already been explained. The reason for placing the amount by which the asset is estimated to shrink as a credit in the Reserve for Doubtful Accounts account rather than in the Accounts Receivable account has also been explained. The custom of estimating the amount of loss on the basis of the sales for the period rather than on the amount of claims outstanding at the close of the fiscal period has been referred to. Here it is desired to explain the manner of handling the reserve at the time claims are definitely determined uncollectible. Until a claim is determined uncollectible it is carried as a part of the assets, Notes or Accounts Receivable. The amount of the estimated shrinkage in these assets due to failure to collect claims is indicated by the Reserve for Doubtful Accounts account. This amount cannot be applied directly to particular notes and accounts until it is definitely known that such notes and accounts cannot be collected. When that is learned, it is necessary to transfer from the reserve account the amount needed to cancel from the books the uncollectible notes and accounts receivable. This is done by the following entry:

Reserve for Doubtful Accounts Notes (and Accounts) Receivable

PROBLEM. Assume that the accounts receivable amount to $75,000, of which it is estimated that $5,000 will not be collectible. During the succeeding period a customer owing $500 becomes bankrupt and nothing is realized on his account.

The accounts will then appear as follows:

ACCOUNTS RECEIVABLE ========== Dec. 31 75,000.00 | Feb. 28 500.00

RESERVE FOR DOUBTFUL ACCOUNTS ========== Feb. 28 500.00 | Dec. 31 5,000.00

It will thus be seen that the decrease in value of the accounts receivable as estimated by the amount in the Reserve for Doubtful Accounts can never be applied to the asset until it is definitely determined what particular customer's account included in the Accounts Receivable account is bad and must therefore be written off the books. Inasmuch as the Bad Debts account set up at the close of each fiscal period to indicate the loss or expense due to uncollectible accounts, has been charged as an expense of operating for that period, it would manifestly be duplicating the expense charge if a debt that proved bad were charged to the Bad Debts account rather than to the Reserve for Doubtful Accounts. Only during the first period of operation of a business are debts, if determined bad during that period, charged to the Bad Debts account. Even here, if it is expected at the close of the first period to base the estimate of uncollectible accounts on the sales for the period rather than on the amount of outstanding accounts at the end of the period, it would be necessary to charge the debts becoming bad during the period against the Reserve for Doubtful Accounts account—even though at the time of the charge it contained no credit entries—and not to the Bad Debts account. The desirability of establishing a standard routine for the handling of all items should be kept in mind. Best practice, therefore, demands that all debts shall be charged against the Reserve for Doubtful Accounts whenever they are determined to be bad, regardless of the amount held in reserve in that account. If such practice creates a debit balance in the Reserve for Doubtful Accounts, it is an indication that the estimate of uncollectible accounts made in previous periods has not, as a matter of fact, been sufficient and a larger estimate must be made for future periods.

MERCHANDISE. Merchandise is purchased for the purpose of resale at a profit. Sale price is dependent, in a free market, on the force of demand and supply and not at any given time on cost. Until the goods are sold no profit, as a matter of fact, has been secured. Conservatism, therefore, demands that sale price should not ordinarily be used as the basis for the inventory valuation. Unless there has been a decided change in prices, it is the confident expectation of the management that at least the cost price of the merchandise will be realized when the goods are sold. Ordinarily, therefore, merchandise will be priced in the balance sheet at cost. When, however, there has been a change in price levels, particularly when the indication is that there is a generally declining market and not simply a temporary fluctuation in prices, it is the part of conservatism to value the merchandise at its replacement cost, or even at a lower figure, if stocks are large and market conditions are such that customers are withholding their purchases until price levels have dropped still further. The basic principle for valuing all current assets requires that they be valued as nearly as possible at the realization figure. Therefore, the amount expected to be realized governs or influences the valuation basis. The valuation formula or rule-of-thumb method, in accordance with which merchandise inventory is usually valued, is expressed as cost or market, whichever is the lower. As indicated above, there are times when exception is taken to this basis.

INVESTMENTS. Stocks and bonds representing the investment of temporary surpluses of cash are valued on a realization basis. Inasmuch as the tying up of cash in these securities is only temporary and it is expected that they will be converted again into cash as needed, the amount which can be realized from their sale on the date of the balance sheet is the amount to be considered when judging the financial condition on that date. A large amount of discretion must be used in valuing these securities, because of the violent fluctuations to which quotations on the various stock exchanges are subject. Here also conservatism does not usually authorize value at the market if the market is higher than the cost. Accordingly, the valuation formula is cost or market, whichever is the lower.

ACCRUED INCOME. The income accrued on the date of the balance sheet is determined on the basis of a fair distribution between the periods during which the income accrues. Thus, the income from money loaned during the current period but not due until a succeeding period must be distributed over two or more periods. Where the income is dependent on time, the portion applicable to the current period is determined on a time basis. Where the income is dependent on some other basis, such as sales or units of work done, the portion applicable to the current period is determined by the ratio of the whole to the amount completed during the present period. Thus, in the case of a contract entered into to sell goods on a commission basis, the commission income accrued during the current period will usually be based on the amount of sales made during that period.

DEFERRED CHARGES. The valuation principle for deferred charges has been stated above in connection with the principles of valuation to be applied to the various groups of accounts on the balance sheet.

FIXED ASSETS. Fixed assets may usually be divided into two classes: (1) assets not subject to depreciation, and (2) assets subject to depreciation. The usual example of assets not subject to depreciation is the land on which a building stands. Land used for growing crops may easily be subject to depreciation. Land subject to the exploitation of the natural resources under its surface is

similarly subject to depreciation. To distinguish the decrease in value of such natural resources because of the fact that they enter into and become a part of the commodity dealt in, the term “depletion” is used. Thus, a coal mine or oil well decreases in value with every unit of product taken therefrom. It is not purposed hero to discuss the principles of valuation applicable in such cases, the assets under discussion being limited in meaning to those of a mercantile business. (See Volume II, page 312, for a discussion of depletion.)

The valuation formula for assets not subject to depreciation is cost. Increase in value due to changed market conditions is not usually to be taken account of.

The second group of assets, those subject to depreciation, are to be valued on the basis of original cost less the amount of depreciation accrued to the date of the balance sheet. The valuation of such assets, therefore, requires the determination of the amount of depreciation.

Depreciation arises from several causes, the chief of which are:

1. Wear and tear, due to use. 2. Decrepitude or age, due to lapse of time. 3. Obsolescence, due to a changed demand for the article or to an advance in the arts which makes the continued use of the asset uneconomical. 4. Inadequacy, brought about by several causes, one of which may be the change in the market which renders the asset inadequate for furnishing the product or service in the amount required.

Obsolescence and inadequacy, because of their very nature, are usually difficult of determination and frequently cannot therefore be considered in determining the amount of depreciation accrued at a given time. Where measurable they should, of course, be taken into account. Depreciation due to lapse of time is calculable on a time basis. Depreciation due to wear and tear is calculable on the basis of the use to which the asset has been subjected. It is in practice difficult to separate these two types of depreciation. The estimate for depreciation is in the majority of cases made on a time basis. In manufacturing establishments, oftentimes a use or output basis proves more satisfactory. These more difficult problems met in the determination of depreciation are discussed in Volume II. Here only the most usual method of depreciation estimate on a time basis, known as the straight-line method, will be explained.

For determining the periodic amount of depreciation of any asset it is necessary to know: (1) the original cost of the asset; (2) its scrap value, that is, the estimated value as scrap on the day it is junked; and (3) the estimated life of the asset in years or fiscal periods. The following symbols will be used in working out the formula:

_V■_ = Original value. _V■_ = Scrap value at the end of _n_ years, its estimated life. _n_ = The estimated number of years in the life of the asset. _D_ = The amount of depreciation during a period. _r_ = The rate to be applied to _V■_ in order to determine _D_.

It is apparent that _V■_-_V■_ is the amount to be depreciated over the life of the asset. The amount to be charged off periodically as depreciation is, therefore:

(_V■_ - _V■_) ---------- _n_

Accordingly

_V■_ - _V■_ _D_ = ---------- (1) _n_

The amount to be written off each year is thus seen to be constant. The percentage to be applied to the original cost in order to determine the periodic depreciation _D_ is, therefore, found by dividing _D_ by _V■_. Hence the formula:

_D_ _r_ = ---- (2) _V■_

Having determined by careful estimate the method of calculating the periodic amount of depreciation, the problem of valuation of the asset at any given time during its life is ordinarily simple. In the case of renewal of any parts, the question of betterment comes in and requires careful handling. In unusual cases it may often be necessary to revise the rate of depreciation in order to write off the betterment during the remaining life of the asset. Depreciation is at the best but an estimate and unless there are major betterment items it is not usually necessary because of them to revise the estimate of depreciation. When a renewal takes place it is theoretically necessary to determine the value of the replaced part at the time of its replacement. The excess of the cost of the new part over this value is the amount of the betterment, when only the values of the old and new parts are considered. In such cases, however, the new part will not usually have value apart from the asset to which it is attached. In practice, therefore, the

amount of the betterment recorded is the difference between original—not present—value of the old part and the cost of the new part. An example will illustrate the problems involved and the accounting treatment.

PROBLEM. Assume that an asset—office equipment—costing $1,000 has an estimated life of ten years and no scrap value. After six years of this life it becomes necessary to replace a part of the asset, estimated to have cost originally $100, the cost of the new part being $150. At the time of the replacement the depreciation reserve carries an amount of $600.

The first step in booking the transaction is to transfer from the reserve account to the asset account the original cost of the part replaced. Just as in the case of bad debts, now that a part of the asset has been discarded and the amount of the decrease in value of the asset is definitely known, this amount held in suspense until the present time in the reserve account must be applied as a definite reduction in the carrying value of the asset. The entry to effect the transfer is:

Depreciation Reserve, Office Appliances 100.00 Office Appliances 100.00

The next step is to set up the cost of the new part which replaces that discarded. This follows the usual entry at the time of purchase of any equipment. The entry needed is:

Office Appliances 150.00 Cash 150.00

The student will note that the office appliances account now carries a value of $1,050, of which the $50 represents the value of the betterment.

It might appear that since the renewal occurs at the end of six years there has been accumulated in the reserve by that time only $60 covering this specific part, and that therefore only $60 should be transferred from the reserve account, the other $40 being charged to a proprietorship account to represent the additional expense or loss not yet provided for by the depreciation charges during the past six years. That is not the situation, however, for if the periodic depreciation has been correctly estimated, the entire amount, $100, has already been charged off and is therefore included in the reserve. When the asset was originally installed and the length of its life estimated for the purpose of determining the periodic depreciation charge, the policy as to repairs and renewal of parts was taken into consideration. Such estimates cannot, of course, be absolutely accurate. However, until such time as a definite basis is given on which to check the amount of the over-or under-estimate, it is the standard practice to charge against the reserve the original value of the renewed part. Always at the time of discard of the entire asset—and sometimes sooner—such a definite basis is given and adjustment must be made in accordance with the facts then ascertained. A problem will illustrate the considerations involved.

Continuing the foregoing example, assume that the office appliance, now valued at $1,050 with a reserve of $500, is discarded after ten and a half years' service.

At the end of the tenth year the annual depreciation charge of $105 will have brought the reserve account to a total of $920. Six months later, at the time of discard of the asset, there will be accrued depreciation, not yet booked, amounting to $52.50. It is, accordingly, necessary to book this amount by means of the following entry:

Depreciation 52.50 Depreciation Reserve Office Appliances 52.50

This entry charges the current period with its share of the consumed value of the asset. The next step is to transfer the reserve account to the asset account, to show in that account the amount of the inaccuracy in the depreciation estimate—the amount by which the actual depreciation differs from the estimate. The entry is:

Depreciation Reserve Office Appliances 972.50 Office Appliances 972.50

The office appliance account now shows a debit balance of $77.50, which indicates the value or amount of the asset which has been consumed but which has not been charged against the income of the periods during which the asset was used. It is manifestly inequitable to charge this amount against the income of the six months of the current period, and it is impossible to go back and spread it over the previous periods because their records have been closed. The charge must therefore be made direct to the Surplus account in the case of a corporation, or to a final section for extraordinary profits and losses of the regular Profit and Loss account in other cases. It may be handled by this latter method also in the case of a corporation. The entry needed is, therefore:

Surplus 77.50 Office Appliances 77.50

In case the reserve is more than the value of the asset at the time of discard, it means that more than the cost of the asset has been charged as expense. Accordingly, the excess represents real profit and must be transferred to surplus. The necessary entry is:

Office Appliances Surplus

GOOD-WILL. Good-will is an intangible asset depending for its value upon the ability of a business to make more than normal profits. It is not usual for a business to show an asset of good-will unless it has purchased another business and has paid for the latter's good-will. In other words, good-will is not brought on to the books until a purchase determines its market value. Where good-will is purchased, it is customary to carry it at its cost value. Depreciation is not taken into account. Because of the intangible nature of good-will and its more or less speculative value, some businesses prefer not to show it. In such cases it may be written off against surplus at any time and in any amount until it has all disappeared from the books. While, therefore, good-will is not subject to depreciation, it is subject to this writing off process, which usually bears little or no relationship to time. It should not be charged against the profit of any period or several periods, but when written off should be charged direct against surplus.

=Liabilities.=—The problem of valuation of liabilities is simple. From the standpoint of a going concern, its liabilities decrease only when they are paid off, and increase only because of services or assets purchased and not paid for. The main problem in connection with balance sheet liabilities is the determination of the fact that all liabilities are shown on the balance sheet. This oftentimes involves the consideration of contingent liabilities. The amount of a liability may sometimes be in dispute, in which case a careful and conservative estimate of the probable amount must be made and shown.

=Proprietorship.=—Since proprietorship is always the difference between assets and liabilities, the problems of valuation of proprietorship are solved almost automatically if the valuation of assets and liabilities have been handled properly. There may sometimes be problems in connection with the various items in the proprietorship group. These concern surplus, undivided profits, and various reserves. The problems here are largely those of determining whether a company has lived up to its contract or other agreements in the maintenance of the proper values in the various proprietorship accounts.

=Conclusion.=—The problems of valuation are vital to any business and intimately concern its financial integrity. In order to maintain at least the original capital investment in a business, it is necessary to make provision for the decrease in asset values due to different causes. The financial management of the business must watch this feature closely, else capital will be dissipated and the business rendered incapable of performing the functions for which it was organized.

CHAPTER XLVI

BUYING AND STOCK CONTROL

=Importance of Buying.=—Buying as a major function in a mercantile concern is intimately related to, and dependent on, the other functions of the business. Buying must always have regard to the sales activities. To buy without reference to the ability to sell is suicidal. Both overbuying—buying more than can be disposed of at a profit—and underbuying—buying less than is needed to meet the sales demand—are conditions to be avoided. Underbuying means a loss of sales. Unless their needs are met promptly in accordance with their orders, customers will go elsewhere. Overbuying means the unnecessary tying up of capital in a stock of goods which increases the possibilities of loss resulting from changes in fashions and the level of prices. The relation of the rate of turnover to profits in merchandising was discussed in Chapter VII. Manifestly the ideal situation, so far as the amount of stock carried is concerned, is one in which the least amount of capital is used to provide an adequate stock for meeting the requirements of customers and in which the loss from unsalable stock is reduced to the lowest level.

Many business houses fail to realize the wastes resulting from slow turnovers. The Chamber of Commerce of the United States has called attention to these losses and has analyzed them under the following heads:

1. The unnecessary use of capital in merchandise that could be more profitably employed in other productive sources.

2. The increased cost of borrowed capital, the carrying of larger stocks and their slow turnover, necessitating the borrowing of larger amounts of capital for longer periods.

3. The marking down of the sale price due to the fact that the goods will not move at the higher sale price.

4. An increase in overhead expenses due to the larger storage and display equipment needed for goods and to the costs incident to handling the larger stock, and re-marking the stock when it is necessary to lower sale prices.

5. The loss of prestige and reputation from carrying unstylish and shopworn goods.

=Relation between Buying and Finance.=—From what has already been said, it is evident that there is a very necessary relation between the buying policy of a business and its ability to finance purchases. Even though it may be possible to increase sales, unless the business is in a position to finance not only the additional credits extended to customers but also the additional purchases needed to take care of the increased sales, it will not be feasible to pursue a policy of sales expansion and therefore of increased buying. Hence, buying cannot be considered as a business activity by itself, but as one dependent upon the sales activities and the financial resources of the business.

=Organization for Buying.=—In large merchandising businesses the duties and authority of the buying department are not uniform. In some, this department is organized entirely distinct from the selling department; in others (and this is particularly true of the large department stores), the buyer is head merchandise man with control over the selling activities of the business. It is also quite usual for the buyer to be in charge of a given department and his success or failure to be judged by the profits he makes in that department. A profit quota is sometimes assigned to each department, for which the buyer is responsible. In other words, in the management of the buying and selling activities and therefore in the control of his merchandise stock the buyer is supreme, subject to the general limitations placed by the financial resources at his disposal. Under the control of the buyer, therefore, will be stock clerks, the clerks which mark and re-mark the merchandise, and the sales force. Above and in control of all the departmental buyers is usually an executive or high official of the company whose chief function is to correlate the activities of the buyers with the concern's general buying, selling, and financial policy.

=Characteristics of the Buyer.=—To perform his functions properly, the buyer must be a man of broad experience, with a keen sense of values and the marketing possibilities of merchandise. On the buying side he must have complete information as to the available sources of the merchandise he desires to secure, both in staple and in novelty lines. On the selling side he must know the demands of his customers and the possibility of creating new demands. The best index of the buying power of his customers is the volume of sales made in previous years. Past performance, considered in connection with general trade conditions and plans for the further development of the business, is the only basis for judging the sales possibilities of the future. He must know the quality of merchandise and the reliability of the people from whom he buys. He must be a keen judge of prices. He must know the financial resources of his own store and strive to secure the best possible credit and discount terms.

=Buying Procedure.=—In Chapter XXII, where the goods invoice was discussed, a typical purchasing procedure was set forth. Here only the chief points in that procedure will be mentioned. In a large establishment the buying requisition should be the basis of all purchase orders. This is particularly true when the buyer does the buying for several departments. The requisition should be made out in triplicate by the department head, two copies going to the buyer and one being retained in the department. Upon the issuance of the buying order, the second copy of the requisition is returned to the department as evidence that the goods have been ordered.

The purchase orders are made in manifold, the original going to the vendor, one copy to the treasurer to notify him of the future need for funds, one to the controller or accounting department, and one being retained by the buyer as a basis for follow-up. Upon receipt of the invoice, which usually precedes the goods, the buyer compares it with the order and if it is found correct, he passes it to the accounting department, where it is held until the receiving slip, showing the receipt of goods, is received from the receiving room. If the three documents now in possession of the accounting department, namely, the copy of the original order, the invoice, and the receiving slip, agree, the invoice is passed for entry on the books and is filed for payment in accordance with the financial policy of the business. After payment, the invoice with its supporting documents is filed. Great care must be exercised to make sure that an invoice is not put through more than once for payment and that every invoice represents goods properly ordered and actually received.

=Requirements of Successful Buying.=—Successful buying rests on a knowledge of two things: (1) when to buy, and (2) what to buy. The timeliness of buying has regard rather to the sales requirements than the market possibilities. Goods are bought for the purpose of satisfying needs of customers. A knowledge of the trend of the market is necessary but buying wholly in accordance with market trends too often leads to speculation in merchandise, due weight not being given to the sales requirements. A knowledge of the specific commodities needed to satisfy the requirements of customers is equally important. The regular use of the

“want slips” of customers calling for goods not in stock is one source of information. The records of the paid “shoppers” as to the commodities and prices of competitors is also some indication.

In answering both these questions, when to buy and what to buy, the records of the business itself should furnish the fundamental information needed to secure a proper control of the movement of merchandise. Some system of perpetual inventory is almost indispensable. In a small business where the buyer, usually the owner, is in intimate contact with all departments, a fairly satisfactory control of merchandise can be secured without a perpetual inventory. In a business of some size, however, the perpetual inventory is an almost absolute essential if movement of stock is to be kept under control.

=Control of Merchandise Movement.=—The beginning of merchandise control is the fixing of the sales quota, that is, the making of an estimate of sales for the next period. Without a definite goal to be aimed at control is impossible. Buying and finance are dependent on it. A knowledge of the stock on hand at any time is needed to determine the buying requirements. Even in a small business the inventory can at least be estimated on the basis of past performance as to percentage of gross profit and therefore the percentage of cost of goods sold. The application of this figure of percentage of cost of goods sold to the sales for the period gives the cost of goods sold, which, subtracted from the opening inventory plus goods purchased, gives an estimate of the goods in stock. A perpetual inventory kept by quantities rather than by values serves the purpose in many establishments. What is known as the “retail system,” by means of which the value of the stock on hand can be estimated at any time, is used in many large retail establishments. In addition to, and in conjunction with such a system, the use of commodity control cards, as illustrated in Form 43, gives a sure index of the condition of stock and the movement of merchandise at any time.

=The Retail Method of Inventory.=—The retail system of inventory is based on the carrying of all goods purchased at a retail sale price as well as at cost price. In the financial records purchases are, of course, always booked at cost. A stock record is kept, however, which carries purchases at retail sale price as well as at cost price. The principle of the perpetual inventory under this method is shown by the fundamental formula:

Opening Inventory + Purchases - Cost of Goods Sold = Final Inventory

It is apparent that if all the values on the left side of the equation are retail sale values, the right side of the equation represents the final inventory valued at the retail sale price. Thus, if the opening inventory for use in the stock record is set up at the marked sale price, and purchases are similarly set up, the subtraction of the sales to date from the sum of the opening inventory and purchases gives the amount of stock on hand valued at the sale price.

In order to reduce an inventory, valued at retail sale price, to a cost basis, the per cent of mark-on of the cost price to give the original sale price must be applied. This per cent is based on the sale price and not the cost price, being determined by dividing the difference between sale and cost price (that is, the gross profit figure) by the sale price. Thus, a commodity, costing $60 and marked to sell at $100, will, if sold, yield a gross profit of $40, which, given in terms of the sale price, is a 40% gross profit. This 40% is spoken of as the “mark-on per cent.” The cost is, therefore, the difference between 100% and the per cent of mark-on, in this case 60%. That is, 60% of the sale price gives the cost price.

Accordingly, to reduce the inventory value at selling price to a cost price basis, it must be multiplied by 100% minus the per cent of mark-on.

The use of the retail method is thus seen to require a stock record from which the goods on hand as valued at selling price can be determined almost instantly and from which the per cent of mark-on can also be determined. In principle the method is simple. In practice it must be operated very carefully, else unreliable results will be secured. It seldom happens that merchandise will always move at the marked sale price. Adjustments are necessary. On an upward market, perhaps, a higher price can be secured than the marked price. On a downward market or in order to move certain colors and styles, it is necessary to mark down from the original sale price. The fluctuations arising from mark-ups and mark-downs are treated in Chapter XI of Volume III and will not be discussed here. Some applications of the retail method will be explained, however.

=Some Buying Records and Their Use.=—The chief purpose of the main records kept in business is the securing of control over the activities of the business. The control over merchandise must always be based on records. The first step in securing the necessary control is a proper departmentization of stock. Analysis of purchases and sales by departments is fundamental. In addition, a knowledge of what others in the same line are doing serves as a criterion by which to judge one’s own results. Trade associations and research bureaus are giving invaluable information by furnishing standards for judging results.

Three major problems from the buyer's standpoint are always met. They are not independent problems but, as indicated above, are intimately related to selling and financial policies. These problems are: (1) the determination of the average stock to be carried; (2) the determination of the buying quota for a given period; and (3) the determination of the "open-to-buy" amount at a given time. Too often these matters are decided in a haphazard fashion. Only by means of a careful analysis of all the factors and the results obtained in the various departments as compared with average or standard results can a sound basis of stock control be secured.

=Average Stock to be Carried.=—Stock control rests, in the first place, on estimated requirements for the future. Estimates for the future must always be based on past performance, as modified by present market conditions and contemplated changes in basic merchandising policies. In estimating the amount of stock to be carried, the volume of expected sales must be taken into account. The other factor is the rate at which the merchandise should turn during the period. Thus, if estimates are made for a period of six months, the estimated sales for the period divided by the number of times the stock is expected to turn during the six months will give the average amount of stock to be kept on hand. Seasonal fluctuations must be taken cognizance of in determining the changes from average stocks to be carried at particular times during the period. Thus, if the estimated sales in a given department are $50,000 for the next six months and the merchandise turns twice during that time, manifestly a stock of $25,000, as priced at retail, must be carried. If the mark-on is 40%, the cost of the average stock will be 60% of $25,000, or $15,000, representing the average capital to be tied up in stock for that department.

=The Buying Quota.=—The determination of a buying quota for a given period must take cognizance of the stock on hand at the beginning of the period, the stock which it is planned to have on hand at the end of the period, and the estimated sales for the period. If, from the sum of the stock planned to be on hand at the end of the period and the sales estimate for the period is subtracted the stock on hand at the beginning of the period, the buying quota for the period is determined. This buying quota is, of course, at retail price and must be reduced by use of the mark-on percentage to a cost basis. An illustration will show the method:

Stock planned to be on hand at end of period $25,000 Estimated sales for period 50,000 ------- $75,000 Stock on hand at beginning of period 23,000 ------- Buying quota at retail price $52,000 ------- Mark-on is 40%, i.e., cost is 60% of selling price. Therefore $31,200 = buying quota at cost

=The "Open-to-Buy" Estimate.=—The buying quota is estimated at the beginning of the period. At various times throughout the period, if stock is to be properly controlled, it is necessary to know how much of the buying quota is available. Furthermore, because estimates made at the beginning of the period never quite coincide with the facts of actual performance, it is necessary to take cognizance of these data of performance in determining the amount of stock to be bought at a given time. The difference between the estimated sales for the period and the actual sales to date is the estimated sales to be made during the remainder of the period. If from the stock on hand at a given date is subtracted the estimated sales for the rest of the period, the difference will be the estimated stock remaining on hand at the end of the period, providing no more purchases are made. If this amount is less than the amount of stock planned to be on hand at the end of the period, the department is "open-to-buy" to the amount of the difference. If the estimated amount on hand at the end of the period is more than the planned inventory for the end of the period, no additional stock should be purchased, except of course to replenish certain stocks which have become depleted and which it is necessary to have on hand to meet the needs of customers. In calculating the stock on hand at a given time, cognizance must be taken of stock in the warehouse, in transit, and on order. A typical open-to-buy calculation is shown below:

Stock on hand today $ 40,000.00 Stock in warehouse 15,000.00 Stock in transit 10,000.00 Stock ordered (to be received before end of period) 25,000.00 ---------- Total available stock $90,000.00

Sales planned for period $175,000.00 Sales made to date 105,000.00 ---------- Estimated sales for balance of the period 70,000.00 ---------- Estimated stock at end of the period $20,000.00 Planned stock at end of the period 30,000.00 ---------- Open-to-buy amount $10,000.00 ==========

This open-to-buy figure should be amended in the light of experience with regard to the way in which actual sales are running as compared with the estimated sales. If it is apparent that the sales are running ahead of the estimate, the sales quota should be enlarged accordingly, which will in turn increase the open-to-buy balance. A similar adjustment should be made in the event that actual sales are not keeping pace with the estimated quota.

=The Stock Control Card.=—The problem of stock control is not solved solely by a maintenance of buying quotas and limits. The movement of individual commodities must be watched very closely. The tying up of funds in large stocks of slow moving commodities may soon use up the buying quota needed for faster moving commodities. To maintain control over the movement of

individual commodities, a record called the “stock control card,” which is similar to the stock book, is of great value in some lines. To other lines it will not be found adaptable. It is not the purpose of this chapter to attempt to lay down specific methods adaptable to all situations but only to discuss basic principles and to illustrate them by methods found applicable to certain situations. The control card illustrated in Form 43 is one used in a retail shoe store.

On the form shown as Form 43, Style, Bought From, Description, and Material, are self-explanatory. On the line below, cost is shown in the first column, size in the next, and the month with days along the rest of the line follows. Horizontally are entered on the dates shown the quantities of stock received (Rec’d), on hand (O. H.), sold (Sold), and on order (O. O.).

According to the form, on August 1 there were on hand 19 pairs of shoes, size 9, and 11 pairs of size 9½. During that week, on consecutive days, 3, 4, 3, 6, 2 pairs of size 9 shoes were sold, of which 2 pairs (circled) were returned on the 4th and 5th; and 2, 2, 1, 3, 4 pairs of size 9½ shoes were sold, of which 1 pair was returned but again sold on the 5th.

On the first day of the following week 24 pairs of each size which had been ordered on the 2d of August were received. Upon their receipt the O. O. (on order) figures were inclosed in circles. On that day also the O. H. (on hand) figure was placed in its proper place in the size 9 group. All of size 9½ had been sold during the first week of August and there was of course no figure to be entered there.

The record is continued by daily postings of sales and by a weekly posting or entering of the stock on hand. Orders are entered on the day they are placed.

[Illustration: Form 43. Stock Control Card

Taken from Bulletin issued by the United States Chamber of Commerce]

With such a stock record a perpetual inventory is maintained and control over the movement of merchandise is secured.

=Problems Connected with the Merchandise Inventory.=—Proper accounting for merchandise at the time of inventory-taking and the close of the fiscal period requires a consideration of the following points:

GOODS IN TRANSIT. It may happen that certain goods have been ordered during the period, and that the invoice has been received but that the goods themselves are still in transit. The question whether or not such goods shall be included in the inventory may be viewed from different angles, as follows:

1. If the goods have been paid for in advance, they have undoubtedly been entered on the books as a charge to Purchases. If this is the case, the goods in transit must of course be included in the inventory as if actually received.

2. If the goods are still in transit but have not been paid for, it is customary not to charge them to Purchases until they arrive. If not charged to Purchases, or other similar account, they must not be included in the inventory. However, theoretically, this method is incorrect. The fact that the goods have been ordered and are now in transit makes the business liable for their purchase price, and although not actually received, in reality they form a part of the asset merchandise. It is true that until the goods are received, inspected, and accepted, the purchaser has the privilege of refusing them if they are not as ordered, but this privilege is exercised only in exceptional cases. Generally speaking, therefore, it is better to consider such goods as a completed purchase, include them in the inventory and credit the vendor for the amount of his invoice. Instead of being charged to Purchases account, such goods may be charged to Purchase Commitments which will better indicate their status.

GOODS RECEIVED BUT NOT YET BOOKED. In concerns where a separate shipping and receiving department is maintained, it may happen that the goods received by this department are not immediately transferred to stock or storage, in which case they may not have been taken up on the books. At the end of the period it is important to see that all such goods are properly recorded as purchased and are included in the inventory.

GOODS IN OR OUT ON CONSIGNMENT. Still another problem in connection with the inventory has to do with goods which do not belong to the business because they have been consigned to it for sale on account of their owner. Inward consigned goods must not be included in the inventory, if taken into stock, it is very important that they be so marked as easily to distinguish them from the regular stock.

Similarly, if goods are out on consignment to another market, they still belong to the business and must not be overlooked at inventory time. If the proper record is made at the time the goods are shipped, as will be explained in Chapter XLVIII, the

memorandum accounts on the ledger will call attention to them. In some concerns all such goods are entered as sales at the time of shipment. If at the end of the period part of these consigned goods are still unsold and in the hands of agents, they should be deducted from the sales for the period and included in the inventory at full cost.

GOODS FOR FUTURE DELIVERY. Goods sold for future delivery are best handled at inventory time in the manner suggested in Chapter XLVII, even if they are set aside ready for delivery.

GOODS READY FOR CURRENT DELIVERY. Finally, goods sold for current shipment but delayed in delivery on account of congestion in the service or for some other cause are best treated as sales and excluded from the inventory.

CHAPTER XLVII

SALES

=Importance of the Sales Department.=—Of the major departments into which business activities are commonly classified, the selling department ranks first in point of relative importance. Regardless of the efficiency secured in the other branches, regardless of the economy in buying and the excellence of administration, the life of a business largely depends upon the results obtained by the selling division. Since the sales department plays such an important part in the development of the business, it is evident that the accounting and financial problems connected with sales should be given careful attention and should be handled by the most scientific and up-to-date methods.

As before stated, one of the most important principles of modern accounting is that the system by which the records are to be kept must be planned in advance. The modern accountant must first know the kind of information that is desired and he then can classify the accounts so that the information may be obtained from the ledger or other records at any time, with the least possible effort.

=Basis for Sales Classification.=—The majority of enterprises at the present time deal in a number of commodities, the kind, quality, and grades of which are of such variety that careful classification is imperative. Formerly all goods sold were classed together under a single title “Merchandise,” with the result that no detailed information concerning the sale of particular goods, qualities, and grades was available and the manager or proprietor was unable to study the movement of specific classes of commodities.

Applying the principle of classification to sales, the basis for classification depends on the character of the business and the nature of the goods sold. Where the commodities dealt in are of such variety that it is impracticable to have a separate account for each kind, a more general grouping by classes may be necessary. Where the concern manufactures some of its commodities and buys the remainder in the open market, an analysis of sales on the basis of “own” product and “other” product may be wanted. Sales may be classified also on the basis of the sales contract, as cash, credit, instalment, sales to branches, consignment sales, approval sales, etc. Accounting problems in connection with these various types of classification will be treated in the present chapter.

=Principles Governing Analysis in Books of Original Entry.=—It is evident that the kind of classification shown in the ledger determines the journal analysis. That is to say, the analysis in books of original entry, and therefore their columnar ruling, always depends upon the way in which the accounts are classified and grouped in the ledger.

The various types of analyses, both in journals and in ledgers, make use of either (or both) horizontal or vertical distribution. In most forms or records, except in banking and allied institutions, the generally accepted practice is to reserve vertical distribution for showing chronological sequence, and horizontal distribution for any other kind of classification. The reason for this lies in the fact that the time basis requires practically unlimited space and the requirement can be met only by vertical distribution, consecutive pages being considered as the continuation of preceding pages. Horizontal distribution, on the other hand, is limited to the width of the page.

By reference to Chapter XLI, “Handling the Cash,” it will be noted that for the purpose of horizontal classification the sheet contains a number of money columns, each headed by an individual class title, and that each item is first entered in the general column and then extended to one of the subsidiary columns. This serves as a check against error, since it is evident that the total of the general column must be equal to the sum of the totals of the other columns, thus furnishing a fair though not complete proof that the extensions have been made correctly. All books where analytical processes are involved should provide some kind of internal

check. The student should refer to Chapters XVIII, XIX and XX, where form of analytic journals and explanation of them were given.

=Use of the Sales Ticket in Analysis.=—Since the sales invoice or ticket is the basis for entry and analysis in the sales journal, it must give on its face the information necessary for making the analysis. In accordance with the basis of classification used, it should show the department number, the kind of goods sold, whether for cash or credit, etc. The use of invoices with printed department numbers and of different colors for cash, charge, and C.O.D. sales, aid in making the record effective.

In a business of any size, the entry on the main sales journal only shows the total for the day's sales. The sales tickets lend themselves easily to grouping, and therefore a day's sales may be analyzed by sorting and grouping the sales tickets. Under any method of this sort, of course, each ticket must be used for the record of only one class of goods. Thus the totals of each of these sorted groups may be entered in the sales journal at the end of the day. Besides furnishing the totals for each group of sales, the individual tickets are used also for the purpose of posting the sales to the accounts of the particular customers.

After use in these various ways the tickets are filed away in binders for reference. Thus, the main books are freed of a mass of comparatively unimportant detail, to which it is necessary to refer only in rare cases.

=Analyzing Sales Returns.=—Attention should be called to the necessity of analyzing returned sales, allowances, and rebates, on the same basis as sales. Provision should also be made for a separate sales returns journal since the ordinary journal does not lend itself economically to an analyzed record of that kind.

=Purchases and Returned Purchases.=—It has been pointed out that the basis of classification of sales in the ledger determines the analysis in the sales journal. The same classification should also be applied to purchases, returned purchases, and inventories, because only in this way is it possible to determine the profit from the different classes of merchandise.

Similarly, all inward costs, such as duty, freight, insurance, handling, etc., which enter into the cost of goods sold must be analyzed on the same basis and apportioned to each group on some equitable basis. Because of practical difficulties, however, this analysis or apportionment usually is not made upon the first entry of these items on the records, but a distribution on a more or less arbitrary basis is made at the close of the period. In a large concern where very detailed information as to results is desired, an analysis of many other expenses and costs applicable to each sales group is made. Such a distribution of expense, however, leads into the field of cost accounting which is beyond the scope of the present discussion.

=The Handling of Cash Sales.=—Where an analysis by kind of commodity is unnecessary, a simple method of booking cash sales is by entry in a "Sales" column provided in the cash book, the total of which is posted to the credit of "Sales" in the ledger. Under this method, cash sales need not be entered in the sales journal. In previous chapters where the functions of the subsidiary journals were discussed, the practice of entering a cash sale in both cash book and sales journal was advised, so that the summaries of each may show true totals for those groups of business activities. However, this principle is often departed from and the method just described for booking cash sales is followed. Where an analysis of the sales is desired, the practical difficulty of providing analysis columns in the cash book for the cash sales in addition to analysis columns in the sales journal for the sales on account gives added weight to the principle stated.

It is sometimes desirable to distinguish between cash and charge sales, thus requiring two accounts, the "Sales on Account" and the "Cash Sales," to show the total sales for the period. This is easily accomplished by the use in the sales journal of the "On Account" and "Cash" columns whose totals furnish the amounts for posting to the two ledger accounts. Even were it desired to have two sales accounts, the cash and charge, for each department, the necessary information can be secured by providing in the sales journal two columns, a cash and a charge for each department and posting their totals to the two sales accounts carried for each.

A more complicated problem arises when it is desired to keep an account to show the total cash sales of _all_ departments and at the same time to keep one sales account for each department, in which will be recorded both cash and charge sales. The information can be placed on the ledger, but not without destroying the usual meaning of the Cash Sales account. The purpose is accomplished by providing the sales journal with two total or general columns—in addition to the departmental columns—one for charge and one for cash sales, and by carrying a Cash Sales column in the cash book. The items in the Cash Sales column in the sales journal are distributed to the proper analytic columns for classification. At the end of the period the totals of these analytic columns (which include both cash and charge sales items) are posted to the credit of the proper departmental accounts in the ledger. The total of the Cash Sales column in the sales journal, however, is posted to the _debit_ of Cash Sales in the ledger, which will be offset by a corresponding credit item from the Cash Sales column in the cash book. These two totals should agree provided

the books are completely posted.

=Sales to Branches.=—Sales to branches are made on different bases in different concerns. Sometimes such sales are charged to the branch office at cost, sometimes at full selling price, and sometimes at a fictitious figure. The first method is theoretically the best, but is not always desirable because head offices frequently prefer to keep their branches ignorant of cost prices. For this reason such sales are frequently charged to the branch office at the regular selling price. By this method, however, the books of the head office record the goods as if actually sold, while in reality they have been merely transferred to a branch office. Consequently, the books show a profit which is not yet earned. In order to correct this, it is necessary at the end of the period to make an adjustment entry covering all goods still in the possession of the branch office unsold at that time. By billing the goods at a fictitious figure the branch is also kept in ignorance as to real profits, but proper adjustment should be made at the close of the period for the reason explained just above.

Whichever method is followed, sales to branches should always be kept separate from the regular sales accounts. Where shipments of goods to branches are frequent and a matter of regular routine, a branch shipments journal similar to the sales journal should be provided; otherwise a special column in the sales journal will suffice. The total of such sales should be credited to a Branch Shipments, Branch Consignments, or some similar account, so as not to confuse these transactions with regular sales. The subject of accounting for both domestic and foreign branches is treated in Volume II.

=Consignment Sales.=—Consignment sales—which in some respects resemble branch sales—should also be recorded separately from regular sales. This is so because the title to goods out on consignment is still vested in the consignor and no element of profit appears in the transaction until an actual sale is made. However, in the case of an _occasional_ consignee as distinguished from a factor who deals regularly in consigned goods, it has usually been held that the title has passed to the consignee so far as the consignee's dealings with all except the consignor are concerned. Only in this way can the interests of innocent third parties be adequately protected.

The accounting for consignments is treated in Chapter XLVIII.

=Instalment Sales.=—The instalment sale should be treated in a different manner from regular sales because of certain special features connected with it. The chief characteristic of the instalment sale is the probability of the goods coming back into the seller's possession through forfeiture because of non-payment of instalments, the profit on the transaction of course being affected thereby.

The sale of goods with the privilege of payment in instalments is a well-recognized custom in certain lines, particularly in the furniture, piano, book subscription, and similar businesses. To protect the seller, the sale contract almost invariably contains a clause to the effect that title to the goods shall remain in the seller until final payment has been made, that failure to pay any instalment when due shall result in the cancellation of the contract, and that in such case the goods shall be returned to the seller. Experience with this class of sales shows that a large number of contracts are forfeited with or without return of the goods. Where the goods are returned, there is frequently a large loss through depreciation, the returned goods having to be treated as second-hand. In some instances, to enforce return of the goods migh

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Accounting theory and practice, Volume 2 (of 3)

Roy B. Kester

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ACCOUNTING THEORY AND PRACTICE

A TEXT-BOOK FOR COLLEGES AND SCHOOLS OF BUSINESS ADMINISTRATION

BY ROY B. KESTER, Ph.D., C. P. A.

PROFESSOR OF ACCOUNTING, SCHOOL OF BUSINESS, COLUMBIA UNIVERSITY

VOLUME II (SECOND YEAR)

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To Nancy

AS A TRIBUTE OF LOVE AND TENDER MEMORY TO HER MOTHER

PREFACE

A knowledge of the subject matter of Volume I is a prerequisite to the profitable study of the present work. Therefore, it may be well to review briefly the contents of the latter as an introduction to this book. In Volume I the attempt was made to formulate and illustrate the basic principles upon which the practice of accounting is founded. The principles of debit and credit were developed and their application explained—as related ultimately to the balance sheet and statement of profit and loss. The chief books of original entry (the voucher register excepted) and the various ledgers were described and illustrated. Columnar books, controlling accounts, methods and devices for preventing and detecting errors, methods for the proper handling of purchases, sales, cash, and trade discounts, and some phases of proportion and interest were discussed in detail.

Some special applications of accounting principles, as viewed in relation to the accounting problems involved therein, were also explained and illustrated under such heads as: notes receivable discounted and dishonored; consignments and approval sales; single and joint venture accounts; accounts current, their reconciliation and adjustment; instalment sales; sales for future delivery; single entry, its methods and the results attainable under it; etc.

From the standpoint of business organization, the accounting problems peculiar to the single proprietorship and the partnership were given full treatment. The advantages and disadvantages of the various types of organization, the rights and duties of owners among themselves and to outsiders, the accounting procedure necessary under different conditions for changing from one form of organization to another, and other like items were set forth. Underlying the entire treatment of the subject was the guiding principle that accounting is never an end in itself, that its right to existence depends solely on the service it can render from the standpoint of administrative and financial management.

In content, the present volume is primarily a study of the corporation, its accounting and financial problems, although most of the material, in so far as it consists of a statement of general principles, is equally applicable to other types of organization. The

emphasis of the volume is laid upon the problem of valuation as met in the commercial balance sheet. Chapters IV to XXVII inclusive comprise this portion of the subject matter. The other chapters treat miscellaneous matters, a knowledge of which is essential to the student of accounting. These latter form parts of the work of the second year as mapped out in the author's scheme of instruction, whereby the whole field of accounting is covered by a well-graded three-year course of study. In this scheme cost accounting should be studied concurrently and as a parallel course with the work of this second volume. Only a bare outline of some of the problems and methods of cost accounting is presented in this volume.

As to the division of the text and its use in the general scheme, it is suggested that the first twenty-seven chapters should comprise the text material for the first semester, leaving the remainder for the second semester in which the chief emphasis should be placed on the solution of problems rather than on the formal classroom lecture. Hence the text material is lessened for this semester's work, and the student's main effort is directed towards the application to the problems of business of the principles already established.

Instead of following the plan of the first volume in placing the practice work for the student at the end of each chapter of text, this material is presented separately in three appendices. It is believed that this will be found a more convenient arrangement.

The author desires to emphasize the need of ample practice work and at the same time to take a stand against the method of teaching accounting exclusively by the so-called laboratory or case method. A happy combination of text containing a statement of principles and showing methods of application, together with practice material intelligently made up so as to require a knowledge of principles before solution, is the desideratum in any course of instruction. Principles, theory, without application are barren and soon slip away, even if seemingly understood at the time. Practice without a thorough grounding in fundamental theory can never be sure of itself. An equitable division of the student's time between theory and practice portions should be aimed at. In the present volume, while the time required for the practice assignments may at times seem heavy, an attempt has been made to keep it to the minimum deemed essential for adequate training either for general or professional use. It cannot be too emphatically stated that accounting as a profession ranks as to subject matter and the need for its services with the other professions. If it is to enjoy equal honor, dignity, and professional standing, teachers and practitioners must condemn without qualification the idea prevalent among many that a few months' training suffices to turn out a finished product. Too often has such a course given point to the witticism that an accountant is a bookkeeper without a job. As stated in the preface of Volume I, a course of at least three years' _professional_ study is now quite generally recognized as essential. Accounting is so broad in its many ramifications that less than that gives inadequate training.

The reception accorded the first volume and the report of results achieved in the classroom, through its use leads the author to hope that this second volume may have a courteous hearing and trial. Criticisms and suggestions will be much appreciated. The author hopes to be able to offer in the not too remote future the third and concluding volume in this series on general accounting.

The author is indebted for much assistance and counsel. Acknowledgment is due Miss Nina Miller of the Columbia staff and Eric Bodine for help in gathering and preparing much of the material for Chapters XXVIII to XXXIII; to H. A. Inghram of the University of Georgia, for preparation of a large part of Appendix D; to Leo Greendlinger and David E. Boyce for the use of problems prepared by them; and to his good friend, Joseph Gill, for help in reading the proof. To S. B. Koopman and James F. Hughes of the Columbia staff in second year accounting, the author is under special obligation for many suggestions. Mr. Koopman has furnished most of the problems for Appendix B, and has collected those for Appendix C.

As with Volume I, so in shaping the content of the present volume the author has had the good counsel and ever ready help of his chief, Robert H. Montgomery, and desires again to offer goodly acknowledgment, for his debt is large.

R. B. KESTER. Columbia University, New York City, August 5, 1918.

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CHAPTER I

THE CORPORATION

The Corporation

In Volume I, Chapters XLVIII and XLIX, the fundamental characteristics of the corporation were explained and discussed briefly and some of its peculiar accounting features were set forth. Here these matters will be gone into more fully and additional aspects of this type of organization will be treated. In Volume I were explained the advantages and disadvantages of the corporate form, the procedure incident to the formation of a corporation, its charter, officers, working organization and management, the records peculiar to a corporation, the showing of proprietorship, opening the corporation's books, booking premium and discount on stock, change from partnership to corporation, the distribution of profits, dividends, etc. Only so much of the information already presented will now be repeated as may be necessary to make the treatment here complete.

Classification and Definitions

As instruments for the transaction of business, corporations may be classified in a number of ways. First, all corporations are either public or private. Public corporations are the governmental organizations set up to transact the collective business of a city, a county, a township, or school district.

Private corporations are divided into two subclasses, stock and non-stock. Under stock corporations are included all those organized to carry on business for a profit. Under non-stock corporations are included all those organized to carry on non-profit-making enterprises, such as libraries, hospitals, religious organizations, eleemosynary undertakings, etc.

Under the head of stock corporations we may have the following subclasses: (a) industrial or manufacturing, (b) commercial or trading, (c) public utility or quasi-public, and (d) financial, i.e., banks, trust companies, insurance companies, etc.

From the standpoint of the sovereignty to which allegiance is due, corporations are either domestic or foreign. A corporation is domestic in the state in which it is organized; foreign in any other state or country. Thus corporations chartered in New York are domestic in New York and foreign in New Jersey and Canada. A foreign corporation may be at a distinct disadvantage with a domestic corporation. To obviate this, one occasionally sees a separate incorporation in every state in which a concern intends to do business. Very infrequently is a domestic corporation subject to more stringent supervision and regulation than a foreign.

From the standpoint of the fact of incorporation, corporations may be classed as (1) de jure and (2) de facto, the former comprising those which have met fully all legal requirements for incorporation, the latter comprising those which have not met fully all legal requirements but are to all intents and purposes corporations in fact.

Method of Ownership

Business corporations are sometimes spoken of as “open” or “close.” An open corporation is one in which ownership of the stock is not held closely but is being passed about, traded in, or transferred from one owner to a new. A close corporation is one in which the stock is held very closely in order to retain control and keep profits and trade secrets within a small compass of ownership. Thus some corporations are strictly family affairs; others are held by a few families or a small group.

What is known as a corporation “sole,” while little known now, virtually exists in some close corporations, as where one man holds all but two shares of stock. The incorporation of a single individual is not legally possible in this country.

The corporation, because of its peculiar advantages over other forms of business organization, has become the accepted form for most large enterprises. The gathering together of large capital funds, the ease and efficiency of management and control, continuous life, the facility of transfer of ownership, and the limited liability of the stockholders, make the corporate form attractive to the investor and absolutely necessary to the large businesses carried on today. In some states encouragement is given the small business to incorporate; in the State of New York, for example, the minimum limit of capitalization is only $500. In a few other states the old-time fear of the corporate form is still expressed in their general corporation laws in which the minimum limit for corporate capitalization is set as high as $10,000.

Working Organization

The peculiar features of the stock corporation are the method of ownership and working organization. This latter is effected through a board of directors who are responsible directly to the owners at periodic intervals. Within the board are its officers and committees to whom duties are assigned by by-laws, custom, common consent or action of the board. Under these official heads are the rank and file of the organization—department heads, clerks, employees, etc. It is not necessary to treat here this phase of the organization further.

Different Classes of Stock

The collective capital of a corporation is divided into shares of equal value. Ownership of a share or shares in a corporation is evidenced by formal certificates of stock. Each share carries with it the same privileges, powers, and duties of ownership as every other share of the same class. It represents a pro rata share of the total interest of its class. There may be several different kinds or classes of ownership within the corporation, these classes will have different privileges, and there may be other points of differentiation. The reason for setting up these different classes is almost always to secure additional capital from outside sources by making the investment as attractive as possible. Upon a reorganization, an adjustment of the various interests concerned may require a grading of ownership, a differentiation by classes in order equitably to satisfy the claims of all interested parties. These

various classes of stock ownership will be discussed under the following heads:

1. Common 2. Preferred 3. Guaranteed 4. Founders' 5. Debenture

Common Stock

Common or ordinary stock is that which is evidence of ordinary ownership in the corporation. The share of ownership of the original organizers of the corporation is usually in the common stock. The common stockholder is a sort of remainderman, a residuary legatee. Upon dissolution, after the special claims and privileges of the other classes of owners have been satisfied, the common stockholders come in for their share. After the satisfaction of the claims of preferred owners, the common stockholders have a right to all that is left, their rights being simply residuary. They are subsequent to those of the other classes and to that extent inferior to them, though they may be more valuable.

Preferred Stock

Preferred stock has some kind of preference over the common. Such stocks differ among themselves, there being no standardized features applicable in every way to all kinds of preferred stocks. The basic purpose of the various preferences is to make the stock attractive from an investment standpoint. Common to all preferred stocks, however, is a preference as to dividends. Whenever profits have been made and have been set aside for dividend purposes, the preferred stockholders receive their dividends ahead of the common stockholders. If only sufficient profits are available to meet the requirements of the preferred stockholders and are appropriated for that purpose, the common owners receive nothing. Stock may be preferred as to assets as well as to profits. By this is meant that in case of dissolution the net assets remaining after payment of all outside claims are applied first to satisfy the interests of the owners of preferred stock and any remainder then goes to the common stockholders.

Cumulative and Non-Cumulative. Preferred stock carries with it a definitely stated minimum rate of dividend. The preferred claim to the profits may be cumulative or non-cumulative. In the one case, if profits are insufficient at any time to meet the preferred dividend requirements or are not appropriated for that purpose, the claims of the preferred owners _accumulate_ from period to period until satisfied in full. This satisfaction must take place before the ordinary owners can have any share in the profits. The rate of accumulation is the specified minimum and usually interest on unpaid dividends is allowed when the company finally settles these preferred claims. Of course, since dividends can be declared only out of profits, no claim for preferred dividends or any other kind can exist unless sufficient profits have been made. Non-cumulative stock is stock on which the dividend claim does not, if unsatisfied at any time, accumulate from period to period. Preferred stock is cumulative unless otherwise specified.

Dividends on cumulative stock do not have to be paid just because sufficient profits have been made. Declaration of dividends rests entirely with the board of directors who may see fit to appropriate profits to other purposes. A holder of non-cumulative stock may be very unjustly discriminated against in favor of the common stockholder by the withholding of all profits for a number of periods until a large amount has been accumulated. This is then disbursed as a dividend to the common owners after the deduction of as much as may be necessary to satisfy the preferred owner for the _current period_. On this account a non-cumulative stock is not attractive to investors.

Participating and Non-Participating. Preferred stock may be participating or non-participating. It is said to be participating when the terms under which it is issued provide that it shall share in any dividend in excess of its own specified minimum. Thus, if it is 6% preferred, after the preferred receives its 6% the common stock receives a like dividend, and then the preferred and common may share alike or in any agreed ratio in any further dividends declared in that year. Both participating and non-participating stock is either cumulative or non-cumulative. Preferred stock is non-participating when it is limited to the rate of dividend specified in the terms of its issue.

Redeemable and Convertible. Other features met in some preferred stocks are redeemability and convertibility. Preferred stock may be issued under a contract to redeem it, after a certain length of time, at a named figure—frequently par plus one year's dividend. Redemption may be either at the option of the holder or the company. Redemption may be serial, i.e., a certain amount called at stated intervals for redemption. Preferred stock is convertible when under the contract in the terms of its issue it may be converted into some other form of ownership or obligation. Thus, provision may be made that after a certain time has elapsed, preferred shares may be converted into common according to specified rates of conversion; or conversion into bonds of the company is sometimes provided for. Many nice adjustments may become necessary from an accounting viewpoint, when redemption or conversion take place at any ratio other than book values.

Guaranteed Stock

Stock which is issued under a guarantee to pay a specified dividend is said to be guaranteed stock. Inasmuch as dividends can be declared only out of profits, a company cannot guarantee its own stock—or rather a guarantee on the company's own issue must always be dependent or contingent upon the earning of profits sufficient for that purpose. Stock issued by one company and guaranteed by another may with strict propriety be called guaranteed stock. Thus, a large company may enter into a contract of lease with a smaller concern whereby the compensation shall be, let us say, an 8% dividend guaranteed to all holders of the stock of the smaller concern. Such a guarantee is not contingent but becomes a lien or claim on the guarantor company, regardless of the amount of its earnings.

Founders' Stock

In England there is issued what is known as "founders'" stock, a stock preferred as to its _share_ of dividends. Thus, a comparatively small portion of the common stock authorized might be set aside as founders' or promoters' shares with the stipulation that these founders' shares shall receive a dividend out of proportion to the ratio which they bear to the total common stock. The provision might be that these shares shall receive one-half or one-third—or any other specified share—more dividends than shall be given to the common owners. Instead of being preferred stock with specified dividend rate, it is preferred over the rest of the shares of the group from which it was originally set aside but its share of dividends is dependent upon the dividends given the rest of the shares. The par value of the founders' shares might represent only one-twentieth of the value of the rest of the group, while their share of the dividends would be, say, one-fourth as much as that of the other shares. This preference as to amount of dividends may give founders' shares a much higher market value than the other shares. Provision is sometimes made for their redemption, as usually there is such a marked difference between their amount ratio and their dividend ratio as compared with the other shares, that dissatisfaction among the owners results. Outstanding founders' shares may then interfere seriously with the marketability of the other shares.

Debenture Stock

The term debenture stock is applied to a class of liabilities rather than to proprietorship items. In England debentures of various kinds are frequently used. A recent book[1] thus describes them: "In Great Britain the term 'debenture stock' is used to designate an unsecured loan issued in _irregular_ amounts. If the amounts were fixed and equal, the issue would be called 'debenture bonds' or simply 'debentures.' Debenture stock is a debt of the corporation and does not resemble stock as used in this country." Debenture stock has not proven popular in this country, although used to some extent in Canada. The Public Service Commission of the State of New York defines debenture stocks as "those issued under contract to pay absolutely thereon at specified intervals a specified return." These stocks, while usually of limited life like bonds, are sometimes "perpetual and give the holders no right to demand the repayment of their capital, and the company no right to repay it."[2] When issued as perpetual, they somewhat resemble capital stock, as the term stock is used in this country. Because of the fixed and absolute charge for interest—or dividends as it is sometimes called—which these stocks carry, they are much more of the nature of bonds than of a stock indicating _proprietorship_. Debenture stocks are therefore to be classed as liabilities.

[1] "Business Finance" by Lough.

[2] "Stocks and Shares" by Hartley Withers.

Stock of No Par Value

A characteristic of most stock is that it bears a specified par value which must be uniform for all the shares within a class. The par value of the different classes may differ, however. In most states no regulation is made of the amount of par value. A par value of $100 is customary for industrial and commercial concerns, and of $1 for mining companies. Between those limits, and even beyond them, one finds stocks of almost any par value.

In the State of New York the issuance of stock of no par value is allowed. Both preferred and common classes may be issued without par value, but if the preferred shares have preference as to assets, the certificates for preferred shares shall state "the amount which the holders of each of such preferred shares shall be entitled to receive on account of principal from the surplus assets of the corporation in preference to the holders of other shares." With this exception, none of the certificates may express any nominal or par value and this statement of the amount of preference is regarded as an expression of par value for this purpose.

Each share is equal to every other share within its class.

Every certificate of such stock must bear plainly on its face the number of shares which it represents and the number of shares the corporation is authorized to issue. Regardless of the price paid for a share of such stock, all shares issued by the corporation shall be “deemed fully paid and non-assessable and the holder of such shares shall not be liable to the corporation or its creditors in respect thereof.”

To the heedless a named value on a certificate of stock is sometimes misleading as to the real value of the stock. The no-par-value stock overcomes this in that a prospective purchaser is at once put on his guard to find out the worth of the stock. Another advantageous feature is that the questionable practices sometimes indulged in of booking stocks sold at a discount have no place here because the stocks, having no par value, cannot be sold at a discount and the record of their sale will carry therefore the price at which they were sold. Some points in connection with booking this stock will be discussed later.

Watered Stock

So-called watered stock is stock which has a higher nominal value than the true value of the properties for which it has been issued. Thus, if $1,000,000 worth—par value—of stock is issued for the purchase of property which has a marketable value of only $750,000, the stock is said to be watered to the extent of $250,000. The bookkeeping equation requires that an equality be shown between the properties purchased and the par value of the stock, and this is usually done by inflating the value of the properties when they are brought onto the books.

Treasury Stock

Treasury stock, when the term is used properly, is stock which has been once issued as fully paid and which through purchase or gift comes back into possession of the issuing company. Stock which has never been issued should not be called treasury stock. The distinction between the two lies in the liability (or freedom from it) to further contribution, in case of need to meet the claims of creditors, on the part of stockholders who have bought their shares at less than par value.

In some states the sale of stock at less than par is forbidden. In those states where the practice is allowed, the purchaser of a previously unissued share at less than par is liable to the creditors (if the assets are insufficient to satisfy their claims) for a further contribution equal to the difference between par value and the price paid for the stock. If, though he pays less than par, the stock is issued to him by the corporation as fully paid and non-assessable, he is not liable to the corporation for any further payment to entitle him to all the rights and privileges of a shareholder; but he may be liable in case of need to outside creditors who have a right to expect always that assets of equal value to the stock issued therefor have come into possession of the corporation. As mentioned above, this trouble is obviated in the case of no-par-value stock. However, after stock has once been paid for in full, all future purchasers may hold it without liability for further contribution regardless of the price they pay for it. Because of its freedom from this liability, treasury stock has a readier marketability than unissued stock.

In some enterprises, particularly those of a speculative character where it is extremely difficult if not impossible to place a true valuation on the property to be used or exploited, the practice is very prevalent of issuing the entire authorized capital stock in payment for the properties to be acquired. The stock so issued thus becomes fully paid and its owners liable to no further contribution. To provide working capital, some portion of the stock is usually donated to the company for resale. This is sometimes called donated stock and is, of course, true treasury stock. In states where a corporation is permitted to buy its own stock, treasury stock may be acquired by purchase. Theoretically, stock which has been issued under a contract providing for redemption becomes treasury stock when redeemed and may be reissued until it has been canceled through charter provision to reduce the capital authorized. (See also pages 15, 16.)

Forfeited Stock

Stock is said to be forfeited through failure to make the agreed purchase payments on it. The laws of the different states vary with regard to the conditions under which stock may be declared forfeited. In some states the instalments paid on the stock—or all but a small amount to cover the cost of handling the transaction, or a specified portion of the amount paid in—must be returned to the purchaser. In others, the entire amount paid in may be declared forfeited. In the State of New York the provision in the law is as follows: “If default shall be made in the payment of any instalment ... the board may declare the stock and all previous payments thereon forfeited for the use of the corporation, after the expiration of sixty days from the service on the defaulting stockholder,

personally or by mail directed to him at his last-known post-office address, of a written notice requiring him to make payment within sixty days from the service of the notice at a place specified therein, and stating that, in case of failure to do so, his stock and all previous payments thereon will be forfeited for the use of the corporation. Such stock, if forfeited, may be reissued or subscriptions therefor may be received as in the case of stock not issued or subscribed for. If not sold for its par value or subscribed for within six months after such forfeiture, it shall be canceled and deducted from the amount of the capital stock." The provisions are very specific and must be carefully followed. The method of accounting is given on page =19=.

Bonus Stocks or Bonds

Bonus stocks or bonds are stocks or bonds given as a bonus upon the purchase of other stocks or bonds. Thus, upon the purchase of a share of preferred stock, one share of common may be given as a bonus.

ACCOUNTING FOR STOCKS

Accounting for the original issue of stock has been treated in Volume I. There several different methods of opening the records of the corporation were given and the manner of treating premiums and discount and instalment subscriptions was shown. Here some additional problems peculiar to corporation accounting will be discussed.

Discount on Stock

In the State of New York the stock of a corporation cannot be sold below par. Where sale below par is allowed, the proper booking of the discount requires consideration. The Interstate Commerce Commission requires that discounts or premiums be shown on the books under those titles, i.e., Discount on Capital Stock and Premium on Capital Stock. This method is to be commended as being true to fact and presenting a full and sufficient record of the facts. In the case of other concerns over whose accounting practices there is no regulation, that method is honored more in the breach than in the observance. A prevalent feeling is that the appearance on a balance sheet of such an item as discount on stock is a serious reflection on the standing of the corporation and is to be avoided in any way possible. Discount on stock is not an attractive item on a balance sheet, but there is little justification for such sentiment in those states where the sale of stock at a discount is a perfectly legitimate transaction. The balance sheet ought to represent facts as they are until they change; then the new conditions should be shown. So long as the discount on stock remains a fact it should be so shown. When the discount has ceased to exist through its absorption against premium on stock or the general surplus, it should no longer be reported because it is then a matter of ancient history with which the present is not concerned.

A favorite method of charging the discount on stock to organization expense is not approved, not because it is a misnomer, for discount may well be looked upon as one of the expenses of organization, but because it is an item of sufficient importance and interest to require separate record. Charging the discount to some asset account, when payment of stock is made by property instead of by cash, is to be severely condemned. Inflation of asset values to cover up such an item cannot be justified.

Premium on Stock

The premium on stock sold above par is best recorded in a premium account which should remain on the books as a part of the permanent capital and not therefore be transferred to surplus and returned as a dividend to the shareholder. It may be legitimately used to cancel any discounts.

In the State of New York a corporation cannot issue its stock "except for money, labor done, or property actually received for the use and lawful purposes of such corporation." A broad interpretation has been given the word labor so that under the law it may comprise both manual and mental labor and services of almost any kind legitimately received at the time of organization of the corporation or at any subsequent time. Stock may thus be used to pay for organization expense, promoters' fees, etc.

Property Exchanged for Stock

Where stock is issued for property, no more is supposed to be issued than has a par value equal to a fair market value of the property received therefor. In valuing the property the judgment of the directors is conclusive, unless fraud can be shown. Any stock issued for property becomes full-paid and the owner is neither subject to further call by the corporation nor liable to contribution for the benefit of creditors. In all statements and reports required by law to be published, stock issued for property purchased must be so reported.

Treasury Stock Donated

When treasury stock comes into the possession of the company by donation, the entries needed to show the transactions are somewhat as indicated below, some variations from the form shown being sometimes met with. Practice varies as to the value at which treasury stock shall be brought onto the books, some concerns booking it at an arbitrary value based on an estimate as to what it will probably bring when sold; others booking it always at par. Practice varies also as to the manner of showing treasury stock on the balance sheet, some listing it among the assets at the value at which it was brought on the books; others treating it as a deduction from authorized capital, a sort of valuation account for the capital stock. These points are discussed in Chapter XXI and will not be treated here except to state a conclusion on which the booking of the transactions depends. Manifestly, if treasury stock is to be treated as a deduction from capital stock, it will have to be brought onto the books at par. Such treatment usually results in an inflated showing of the surplus arising from the donation until that has been adjusted to the values realized from its sale—an adjustment which cannot be completed with accuracy until all treasury stock has been disposed of. If treasury stock is to be shown among the assets on the balance sheet, it is perhaps best booked at an estimated realizable price, a method which will show the donated surplus also at an estimated realizable figure. While authorities differ on these points, the weight of opinion seems to favor booking treasury stock at par and showing it as a valuation account on the balance sheet.

For the sake of illustration assume that the stockholders donated $100,000 par value of common stock to the corporation and that $50,000 of it is sold at 60 cents on the dollar. The entries to record the transactions would be:

(1) Treasury Stock, Common $100,000.00 Donated Surplus $100,000.00 (With suitable explanation.)

(2) Cash 30,000.00 Discount on Treasury Stock, Common 20,000.00 Treasury Stock, Common 50,000.00

Other titles for Donated Surplus are “Donated Working Capital,” “Donation Account,” etc. The account “Discount on Treasury Stock, Common” will ultimately be closed against Donated Surplus, and there is no objection to making the charge for discount directly to Donated Surplus instead of as shown above, although the method shown perhaps makes more easily available the information as to the discounts allowed on sales of various portions of the treasury stock. If it is sold at one price, the charge for the discount should be direct to Donated Surplus. A balance sheet drawn up at an intermediate period, i.e., before Discount on Treasury Stock is closed, should show Donated Surplus at its adjusted figure, viz., book value less discount. After all treasury stock has been sold, the Donated Surplus account, as adjusted, will show the true surplus arising out of the donation transactions. The proper disposition of this—as to whether it should be maintained as a permanent increase in capital, be transferred to general surplus and so be made available for dividends, or be treated as a deduction from plant values on the theory that they have been overstated as originally booked—is discussed in detail in Chapter XXI.

Bonus Stock

Bonus stock is usually treasury stock for the very good reason that, if it carried a liability for contribution in amount up to its par value, recipients of such stock might not be overly appreciative of the gift. Instead of being an incentive to purchase the securities which it accompanies as a bonus, it might act as a deterrent. Bonus stock is a gift on the part of the corporation and is therefore an expense. While custom favors recording the expense under the title “Bonus”—or even including it with organization expenses—and treating it as a deferred expense for a number of periods, a correct analysis of a bonus stock transaction may dictate other method of record. If the bonus stock is given with an issue of bonds which could by themselves be disposed of only at a discount, the difference between the market value of the bonds alone and their par value should be charged to Bond Discount, and the rest of the loss on the transaction may be charged either to Bonus account or Discount on Treasury Stock. This distinction is important, as will be seen in Chapter XX where the true nature of bond discount is discussed. When data are available for making the separation it should always be done. Thus, if a $1,000 par bond has a market price of $950 but when sold with one share ($100) of treasury stock as a bonus brings $1,000, the record should be:

(3) Cash $1,000.00 Bond Discount 50.00 Bonus (or Discount on Treasury Stock) 50.00 Bonds Payable $1,000.00 Treasury Stock 100.00

The customary method of showing, as in entry (4) below, is theoretically incorrect, though it may be necessary to use it when the data needed for the other entry, i.e., (3) above, are not available.

(4) Cash $1,000.00 Bonus 100.00 Bonds Payable $1,000.00 Treasury Stock 100.00

If a bonus of treasury stock is given with the sale of preferred stock, similar treatment would make possible a showing of the portion which is really discount on stock and the portion, if any, which is true bonus. Inasmuch as discount on stock and bonus are very similar in kind and in manner of treatment on the books, nothing of real value is perhaps gained in making the separation. The ultimate disposition of the Bonus account is, as indicated above, to treat it as a deferred expense, charging it against profits as rapidly as conditions warrant. It is an undesirable item on the balance sheet or ledger and should be expunged as soon as possible.

Treasury Stock Purchased

Treasury stock which is created by purchase by the issuing company requires consideration. If the price paid is less than par, carrying the treasury stock on the books at par requires an offsetting credit account similar to the Donated Surplus account used above when the stock is created by donation. This credit account simply represents a book surplus and should not usually be made the basis for a dividend. This account may be called “Treasury Stock Surplus,” “Contingent Profit on Treasury Stock Bought,” or other title indicating the true nature of the item. When the treasury stock is resold and the discount or premium on it is charged against this surplus or credited to it, as the case may be, the balance of the Treasury Stock Surplus account will then show the realized profit or loss on the completed treasury stock transactions and may be disposed of as indicated above for Donated Surplus.

On the other hand, if the price paid by the company in the purchase of its own stock is more than par, the premium paid must be charged against general surplus because there is usually no other place for the charge unless there is still open on the books a Premium on Stock account arising out of a previous sale of stock at a premium. Purchase of stock at a premium may represent simply the payment to the owner of the stock of his share in the general surplus of the company, in which case the premium paid must be shown as a reduction of that surplus.

Redemption of Preferred Stock

Handling redemption of a preferred stock issue is exactly the same as handling treasury stock by purchase. If by contract agreement at the time the preferred stock was issued it can only be redeemed at a premium, the premium must be charged, as indicated above, to an open premium account or to general surplus. The effect is similar to the payment of a special or extra dividend at the time redemption is made.

Forfeited Stock

Payments made on stock which is declared forfeited constitute an item of surplus but of a permanent nature, i.e., not a surplus applicable to the declaration of dividends, though there may be no legal inhibition to that use. If the stock is resold any discount on the resale is properly charged against the surplus arising from the forfeiture. By way of illustration, assume that $1,000 worth of stock has been subscribed for and payments amounting to $400 have been made when the stock is forfeited for failure to pay further instalments. The stock is offered again for subscription and is sold for $900 and payment has been received in full. The entries necessary to show the above are:

(5) Subscribers $1,000.00 Capital Stock Subscriptions $1,000.00 (6) Cash 400.00 Subscribers 400.00 (7) Subscribers 400.00 Surplus from Forfeited Stock. 400.00 To transfer the forfeited payments to Surplus. (8) Capital Stock Subscriptions $1,000.00 Subscribers $1,000.00 To reverse. (9) Subscribers 900.00 Surplus from Forfeited Stock 100.00 Capital Stock Subscriptions 1,000.00 (10) Cash 900.00 Subscribers 900.00 (11) Capital Stock Subscriptions 1,000.00 Capital Stock 1,000.00

Stock of No Par Value

Booking capital stock of no par value presents no new principles. Inasmuch as the stock has no fixed par value, its sale is recorded for what it fetches. There can be neither discount nor premium. Payment of the subscription may be made, just as in any other case, by means of cash, property, or services, and the same care must be exercised in placing proper valuations on the property taken over. Here there is not the danger of inflating property values to show them equivalent to the par value of the stock issued therefor. Rather, subscription for the stock is made at the figure of the fair value of the property to be turned over in payment of the subscription. In the case of no-par-value stock even greater care must be exercised to see that the contributed capital shall never be encroached upon in the declaration of dividends, and careful supervision is somewhat more difficult because the _number_ of shares issued bears no relation to the _amount_ of the capital stock.

Distinctive Records

The accounting and other records peculiar to a corporation are explained in Volume I, Chapter XLVIII. These records are the subscription book and subscription ledger or instalment book, the stock certificate book and stock ledger, the stock transfer book, the minute book, sometimes a dividend book, in large companies a register of transfers (which classifies the information as to transfers given in the stock transfer book, and so may serve as a convenient posting medium for the stock ledger), and a stock register (a record kept by the officially appointed registrar of the corporation, whose duty it is to see that there are no irregularities in the issue of stock and that there is no overissue). The stock register should show the amount of stock authorized and the amount issued at any given time, the balance being the stock not yet issued. A form for the stock transfer book and several forms for stock ledgers as prescribed by the Comptroller of the State of New York are shown below.[3] The two latter forms of the stock ledger are applicable only to the State of New York.

Ledger Folio 27 Transfer No. 556 ALLIANCE AUTOMOBILE COMPANY

For value Received, I hereby sell, assign and transfer unto John H. Lansing, of Newark, New Jersey, Seventy-six Shares of the Capital Stock of the above-mentioned Company, now standing in my name on the Company books and represented by surrendered Certificates Nos. 32, 37, and 44.

Witness my hand and seal this 28th day of September, 1918. GEORGE B. GOLDMAN [L. S.] By GEORGE GALE, _Attorney_.

New Certificate No. 224 Issued to John H. Lansing Ledger Folio 84

Stock Transfer Book

[3] From “Corporate Organization and Management,” by Thomas Conyngton.

JOHN H. KIRCHER, 230 Broadway, New York

==========+==========+========================+======= | | CERTIFICATE | | | NUMBERS | | +----------+----------+ DATE OF | TO WHOM | | | NUMBER TRANSFER | SHARES ARE | | | OF | TRANSFERRED | SURRENDERED | REISSUED | SHARES ----------+----------+----------+----------+------- 1917 | | | | March 13 | W. K. Howard | 15 | 70 | 10 July 15 | Robert Moyer | 70 | 145 | 40 July 31 | Harold McKain | 145 | | 40 December 3 | James McNeil | 85 | 175 | 20 December 16 | James Archer | {175} | 231 | 105 | | {165} | | December 31 | Balance | | | 180 | | | +------- | | | | 395 | | | +======= ==========+==========+==========+==========+======= DATE OF | FROM WHOM | AMOUNT |CERTIFICATE| NUMBER TRANSFER | SHARES WERE | PAID ON | NUMBERS | OF | TRANSFERRED | SHARES | | SHARES ----------+----------+----------+----------+------- 1917 | | | | January 10 | Original Issue | Full-Paid | 15 | 90 March 25 | George Holmes | ” | 85 | 75 August 1 | Harvey Cornell | ” | 150 | 35 August 15 | Howard Gaines | ” | 160 | 50 September 2 | John Woodwell | ” | 165 | 100 | | | | October 5 | Henry Simpson | ” | 42 | 45 | | | +------- | | | | 395 | | | +======= 1918 | | | | January 3 | | | | 180 ----------+----------+----------+----------+-------

Stock Book or Stock Ledger

[Illustration: _Stock Book to be Kept by Brokers (New York Form Prescribed by Comptroller)_]

[Illustration: _Stock Book to be Kept by Corporations and Transfer Agents (New York Form Prescribed by Comptroller)_]

Stock Ledger

The stock ledger is a subsidiary ledger controlled by the Capital Stock account or accounts on the general ledger. It may, of course, be made self-balancing just as any other subsidiary ledger. There has been some controversy as to whether the stock ledger is normally a credit or a debit balance ledger. In some concerns the stockholder is debited with the shares owned, and in others he is credited. Theoretically, in accordance with the principle of all other controlling accounts, the subsidiary ledger—in this case, the stock ledger—merely carries the detail of the controlling account. If, then, the controlling account is a credit balance account, the accounts on the subsidiary ledger must similarly have credit balances. Accordingly, the stockholder should be credited with his net holdings. Practically it makes little or no difference because the subsidiary ledger is no integral part of the debit and credit scheme of the general ledger. Of course, unless practical difficulties prevent, practice should always follow the theoretically correct method. No difficulty need be experienced, however, in accommodating oneself to either method of record on a subsidiary ledger. In the

stock ledger the record of holdings is kept in terms of the number of shares owned rather than by the par value of the holdings.

Minute Book

Before leaving the subject of the records peculiar to a corporation, it is desired again to call attention to the keeping of a careful record in the minute book. This book should contain first a copy or duplicate of the corporation's charter. Following this should be the by-laws of the corporation. Sufficient blank space should be left at the end of each of these documents to make record of any amendments to charter or by-laws. There should follow a complete record of the deliberations and authorizations of the board of directors as affecting the management and control of the corporation's policy. The minute book is often the source of authority for many of the most important entries made on the books of account, and great care must be used to make the record full, complete, and accurate. Such matters as leases, purchase and sale of properties, bond issues, dividends, and other similar items should have very careful record.

Conclusion

Other features of the corporation from the accounting point of view are treated under their respective heads in later chapters. These include such items as bond issues, sinking and other funds, reserves and surplus, scrip and stock dividends and other dividend considerations.

It is proposed in the next two chapters to discuss the corporation from the manufacturing viewpoint, types of accounting records sometimes used therefor, and the elements of manufacturing costs. After that the problem of the balance sheet and the principles of valuation applicable to it will claim attention.

CHAPTER II

THE VOUCHER SYSTEM

Purchasing for the Manufacturing Business

Accounting for the business which manufactures its own product is a much larger problem than that for the concern which limits its activity to purchase and sale of a stock-in-trade. To the activities of a trading concern the manufacturing business adds those of the factory. Not only must more property, and a larger variety, be kept account of and handled so as to get the most efficient return therefrom, but also in the handling and operation of this property a somewhat distinct type of expenses is incurred. The problems of financial and factory management and control are different and more complicated than those of the trading business. The period between the expenditure of funds for the purchase of materials and the payment of expenses and the receipt of money from the sale of the finished product is much longer. More working capital must therefore be provided and its rate of turnover is less. A larger element of risk enters in. Raw materials must be worked and fashioned, machinery must be employed, a different class of labor must usually be handled, perhaps will have to be trained—these are problems calling for a special type of management for the manufacturing end of the business.

The accounting department must be organized to serve these additional demands and complexities of management and to give the needed information. The amount and cost of the materials consumed in making the product, the labor cost expended on it, and the various items of factory expense incurred, during one period as compared with the same items for previous periods—all must be kept under constant review if successful operation is to be secured.

Expansion of the Purchase Journal

To make this information available as soon as the transactions giving rise to it are entered into, a different method of gathering the information becomes necessary. Because of the fact that the purchase journal is limited to the record of purchases of stock-in-trade, and that information in regard to expenses incurred is not usually brought on the books until payment of them is made, not only do the books fail to give the service which a management has a right to expect of them but they fail to reflect many liabilities at the time they are assumed. Thus a new type of record is needed.

This has led to an extension or expansion of the purchase journal. The way in which this journal can be used so as to analyze purchases of stock-in-trade on a departmental basis has been explained and illustrated in Volume I. This new use of the purchase journal is merely an extension of the principle of analysis there developed. Instead of limiting it to a record of transactions involving

purchases of stock-in-trade, every purchase transaction, whether of assets, supplies, or of service of any kind, finds this its place of first record. By introducing sufficient columns, as detailed an analysis of all the purchasing activities of the business can be secured as may be desirable. Furthermore, entry here being made at the time of the purchase rather than at the time of payment for the purchase, the books make available a mass of valuable data needed for purposes of management much sooner than it becomes available under the former restricted use of the purchase journal.

Development of Voucher System

Had the evolution of this record stopped here, the resulting gain would have been secured at high cost. The entry of all expense purchases in the purchase journal creates the necessity of opening accounts on the ledger with numerous creditors for small purchases, as well as the more important items, both to show the liability incurred and to provide a means of canceling it when payment is made. In large corporations, where oftentimes the policy of securing bids on all purchases is followed, resulting in a constant changing of firms from whom purchases are made and no regularly established trade with any of them, the burden of handling the creditors ledger becomes an increasingly heavy one with little or no gain in desirable information furnished by it. Accordingly, a further development took place which eliminated the necessity of opening regular accounts with every creditor, but instead made every transaction, whether one or many were entered into with the same individual, independent of all others. This makes possible the showing of the settlement of that transaction in the place where its original record was made, without opening up a ledger account for it. This use of the purchase journal with some slight additions has given rise to the so-called “voucher system” of handling purchases.

Definition and Description of Voucher

In a broad sense, a voucher is a statement which certifies, i.e., vouches for, the correctness of a transaction. As used in the restricted sense to which it is limited under the voucher system, it is a more or less formal document which shows a receipt for a particular bill of items. As distinguished from a receipt in general, this latter term is applied to all acknowledgments of money paid whether or not for a particular bill; whereas the essence of voucher accounting requires receipts for particular bills. At law a voucher has no more weight than an ordinary receipt, and a signed receipt is only prima facie evidence, capable of refutation, though the burden of proof of non-payment is placed on the complainant.

A formal voucher must therefore provide for a statement of the bill of which payment is being made and a place for acknowledgment of receipt of payment by the payee. Usually provision is made also for: (1) certification of the correctness of the bill by properly authorized house employee and its approval for payment; and (2) a proper distribution on the accounting records of the payments authorized, i.e., an official determination of the debit and credit entries to be made on the books.

A form of voucher is shown on pages 30, 31. On the face of the form provision is made for (1) detailed statement of bill; (2) house approval of same; and (3) receipt form to be signed by payee. On the reverse side of the voucher the distribution of the charges is provided for. This is the bookkeeper’s authorization for making the indicated entries on his books. The form is so devised that, when doubled, it is of a convenient size for filing in a vertical file.

Operation of Voucher System

When the invoice covering any purchase is received, it is held till the commodities bought arrive. After inspection and acceptance of the goods, a voucher is made out in duplicate on which is written a copy of the invoice, with the cash discount, if any, shown deducted. Vouchers are given consecutive numbering just like checks. If immediate payment is to be made, the voucher will be “approved” and check drawn for the amount. The voucher with check attached is sent to the creditor with a request that he receipt the voucher and return it. A creditor is not usually particularly interested in helping another concern keep its books and the result is that a large number of vouchers find their way into the creditor’s waste basket. It is here that the duplicate copy retained in the files serves to keep the file of vouchers complete, though it does not, of course, constitute a receipt for the payment.

Sometimes before sending the original voucher, the distribution of the charges is made on it, and it is used as the basis of the bookkeeper’s entries. An objection to this method is frequently made that the creditor is thus given some insight into the business and perhaps a more intimate view of it than may be desirable. Where such is the case, only the office copy of the voucher shows the distribution and the book entries are made from it. Both may be filed together when the original is returned, or the one may be filed numerically according to voucher numbers, the other alphabetically according to creditors’ names and so serve as an index to the numerical file.

[Illustration: _Voucher (face)_]

[Illustration: _Voucher (reverse)_]

In some concerns the canceled checks when returned by the bank are filed with their respective vouchers; in others, they are filed separately in their own sequence. Inasmuch as each voucher also carries its check number, cross-reference is easy.

Voucher Check

The difficulty referred to above in securing prompt return of receipted vouchers has led to the introduction of a combined voucher and check called a “voucher check.” The indorsement on the check, which is necessary for its collection, serves at the same time as a receipt of the bill. All vouchers thus ultimately find their way back through the bank. The legality of the indorsement serving also as an acceptance of the check in payment of the stated invoice has been thoroughly established, particularly when on the blank space for indorsement attention is drawn to the fact that such indorsement will constitute a receipt for the bill; or where the face of the check states that it is full payment for the invoices covered by it.

Two forms of voucher check are in use, the folded check and the single. Below are given illustrations of both. If such checks are not unduly large, banks do not object to handling them.

Because of lack of room on the voucher check, provision is not always made for showing the distribution of the charges. The single form of check can be used when a detailed statement of invoices is not desirable or when invoices carry but few items. Such a voucher check, but differing somewhat from the one shown, is frequently used for the payment of dividends to stockholders and does away with the need of a formal receipt or of signature in the dividend book.

[Illustration: _Voucher Check—Double (face)_]

[Illustration: _Voucher Check—Double (reverse)_]

[Illustration: _Voucher Check—Single_]

Form of Voucher Register

The “Voucher Register,” or the “Accounts Payable Register,” as it is sometimes called, is the book of original entry in which the voucher and its distribution are recorded. This register is a journal so far as its scheme of debit and credit is concerned, but its record is not usually supplemented by a formal subsidiary ledger—though it may be—posting of it being limited to the general ledger. The register must provide columns for date, voucher number, name of creditor, explanation, amount, distribution, and payment. There are many different forms and rulings, the information desired never being quite the same in any two businesses, but a typical form of voucher register is shown on page 35.

Distribution of Vouchers

As soon as a purchase invoice has been approved, a voucher—sometimes called a voucher jacket where the original invoice itself is attached to it—is made for it, the distribution of the charges is authorized, and entry is made in the voucher register. All vouchers are numbered consecutively and entered in numerical sequence, which is usually also chronological sequence. The amount of the voucher is entered in the total column, Vouchers Payable or Accounts Payable, whatever the account title is on the general ledger. The next column, Purchase Discount, may or may not be merely a memorandum column, depending on the use made of it, as will be explained later.

[Illustration: _Voucher Register (left-hand page)_]

[Illustration: _Voucher Register (right-hand page)_]

From the Vouchers Payable column, distribution on the same line is made into the columns for the various accounts to be charged. To secure a complete distribution without waste of space, a Sundry Charges column is provided for entry in detail of all items of infrequent occurrence, each account to be charged being named in the explanation space to the right of this column. Following this comes the record of date and manner of payment, with a final column in which to extend at the end of the month all unpaid vouchers and so indicate the detail of the total outstanding liability. The voucher record is capable of almost indefinite expansion through the use of short-margin insert sheets. Provision can in this way be made for a large number of columns for analysis.

Posting of Summary Totals

At the end of the month, or oftener if desired, the voucher register is summarized and posted. Inasmuch as usually no subsidiary ledger is kept when the voucher system is in use, there is no day-to-day record on the ledger of the purchasing activities of the business. Accordingly, a complete double entry must be made by way of periodic summary. It was at one time thought desirable to make this summary entry through the general journal or, at any rate, by setting up a formal journal entry on the face of the voucher register. As the degree of analysis increased, the futility of such a procedure became apparent and now posting to the ledger accounts is made directly from column totals as shown in the illustration. The Sundry Charges column is posted in detail to the named accounts as indicated. Proof of distribution should always be secured by checking the total of the distributive column totals against the total of the Vouchers Payable column. In posting, the total of the Voucher Payable column is credited to its account, while the totals of the distributive columns are debited to their respective accounts.

Effect on Cash Book and Bank Account

The advantage of this periodic posting of expense column totals as compared with the detailed posting of such items from the cash book as required under the old method is apparent. The cash book is in this way relieved of all need of naming the account to be charged for each detailed entry, the proper charge having been made from the voucher register. If every transaction which will ultimately give rise to a disbursement of cash is vouchered and therefore recorded through the voucher register, there is really no need of a detailed entry of the checks on the cash book, for only their total is posted. It is perhaps more usual, however, to enter them in detail on the cash book. Entry here is, as always, chronologic, by date of payment.

Sometimes, to facilitate reconciliation with the bank account, the voucher checks are given a new series of numbers known as treasurer's numbers when issued in payment of invoices. Where this is done, the cash book shows entry of all checks in the numerical sequence of treasurer's numbers, just as entry in the voucher record is in the sequence of voucher numbers. Some checks are held before issue longer than others, due to different lengths of credit term, etc.; hence the need for this new series of numbers.

Payment of Vouchers

After a voucher has been made up and entered in the register, if payment is to be made immediately, it is passed for payment by the treasurer or other fiscal officer and the check is drawn and issued. Any cash discount offered is shown deducted on the face of the invoice and the check carries the net amount. Where payment is not immediate, but observance of the terms of credit is necessary to secure the discount, the voucher should be filed away in a tickler file which will automatically bring it up for attention at the proper time. The original invoice is placed in a temporary file, arranged alphabetically, until paid, when it may be removed and filed permanently with the paid voucher. Upon payment of the voucher, the check is entered among the cash disbursements and a notation is made in the payment column of the voucher register as to the date and manner of payment.

Voucher Index of Creditors

It has been stated that one of the essential features of the voucher system, as it is usually operated, is the dispensing with the formal creditors ledger. This is accomplished by treating every transaction as an independent unit, numbering it, and providing a place in the voucher register to indicate its payment, so that there is no need of a separate ledger to keep track of the cancellation of the liability. The voucher system fails, however, to give a record of volume of business done with each creditor. Furthermore, it is often desirable to make reference to past transactions with creditors. This would be very difficult without a definite knowledge of the voucher numbers under which account has been kept of the transactions with a particular creditor.

Accordingly, for the proper operation of the system an alphabetic index of creditors must be made up on which should be shown the voucher numbers relating to transactions with each creditor. This is usually of the card index type, each creditor being provided with a card on which is noted a list of the vouchers recording the business done with him. This voucher index, while not a ledger in the accepted sense, yet when operated in connection with the Payment column in the voucher register serves all the essential purposes of a creditors ledger, and the use of the "Unpaid Vouchers" column, as explained above, secures at the end of the month the detail of the summary account, Vouchers Payable, carried on the general ledger.

Control of Vouchers Payable

With the elimination of the detailed ledger record which served as a check on its controlling account on the general ledger, particular care must be exercised to see that the control account, Vouchers Payable, reflects the correct summary of all detailed liabilities. This is readily accomplished when every item that leads to a disbursement of cash is vouchered. Then the only postings to “Vouchers Payable” come, for their credits, from the total of Vouchers Payable column of the voucher register, and for their debits, from the total of Vouchers Payable column in the cash book.

Introduction of System

Some of the problems encountered in the operation of a voucher system will now be discussed, the first of which is the introduction of the system in a business where the old method of handling purchases is in use. The requirement here is the closing of the open accounts on the purchase ledger and their transfer to the voucher register. This may be accomplished in two ways—one of which requires a change in the controlling account, and the other of which does not. Under the first plan without formality, the accounts in the purchase ledger are balanced and closed by indicating in their explanation columns the transfer of the balance to the voucher register. As these accounts are entered on the voucher register, each of the _items_ comprising the balance of an account should be given separate vouchers rather than entered under one voucher for the whole amount. This is particularly true where the different items are subject to different discount and credit terms, rendering it undesirable to pay them all at the same time. After entry on the voucher register, the amounts may be distributed to the Sundry column and charged to the controlling account, Accounts or Vouchers Payable, as the case may be. The register should now be totaled, i.e., the Vouchers Payable and Sundry columns should be added and the register ruled off. These totals, being to the credit and debit of the same account, may or may not be posted, as the balance of the controlling account is not affected. Under the second plan the register is left open, i.e., not totaled. In this way the credit to the Vouchers Payable account is included with the total to be posted at the end of the current month when the register is first summarized. This, of course, necessitates posting the corresponding debit of the amounts distributed to the Sundry column as explained above.

The new voucher system is now ready for use and current entries will be made as previously explained.

Purchase Returns and Allowances

The handling of purchase returns and allowances is awkward under the voucher system. If the goods can be inspected and accepted or adjustment secured when necessary, before the voucher for the transaction is made up, then the amount to be paid is always the amount of the voucher and no change need be made in the amounts entered and distributed on the register. Where this is done a Purchase Returns and Allowances Account is not required. This procedure, however, is not always possible, for a first inspection does not always show the true condition of goods. Adjustment of the general ledger accounts could be made by entry of the return or allowance through the general journal. That would not, however, leave any indication in the voucher register record of the fact that cancellation of the liability there shown was made by payment of a lesser amount than the one entered, and it is desirable that these two amounts be the same.

To accomplish this, entry of the allowance should be made, in small red ink figures on the upper part of the line just below the vouchers affected, entering in red the voucher number—the same as the voucher to which it applies—and the amount of the allowance, both in the Vouchers Payable column and the distributive columns affected by the allowance. These red ink items are, of course, deductions, the summary amounts of the various columns being net totals, i.e., the totals of regular items less the red figures; or two totals may be shown, one above the other, the regular and the red. Where both black and red totals are shown, both must be posted, the red as contras or offsets to their corresponding black postings. If desired, separate Purchase Returns and Allowances accounts may be opened.

An alternative method, requiring more work but handling the difficulty somewhat more neatly, cancels the original voucher by marking it paid and its check void, and issues in its stead a new one for the correct amount. The new voucher is handled regularly in the cash book, but in the register distribution is made to the Sundry column and charged to Vouchers Payable, as the purchase has already been charged from the original voucher. This charge to Vouchers Payable cancels the credit from the journal and allows the liability for the new amount to be shown in the total of the Vouchers Payable column of the register. The cancellation is best evidenced by entry in the general journal somewhat as follows:

Vouchers Payable $2,150.40 Vouchers Payable $2,101.59 Purchase Returns and Allowances 48.81 To cancel Vo. #2158 and authorize its reissue in Vo. #3245, account of return of defective goods.

Under this method postings to the Vouchers Payable account, instead of being limited in their origin to voucher register and cash book, will be made also from the general journal.

Partial Payments

A similarly awkward situation is met when it becomes necessary to make partial payments on a voucher. The whole system is built on the idea that each voucher is the unit according to which the record is kept. It, therefore, presupposes settlement in full of each voucher; otherwise, the efficient operation of the system is interfered with. Settlement in full is not always possible, however. Since provision is made in the register for but one line on which to show payment of the voucher, it is not possible to indicate partial payments in the allotted space, nor would such practice be desirable.

Hence, where partial payments are to be made, the original voucher must be canceled in full and two new vouchers issued in place of it—the one for the amount of the partial payment, which will thus cancel it, and the other for the unpaid balance, which will remain open until paid in full or till other partial payment is made. In the latter case the same procedure of cancellation and issuance in its stead of two vouchers must be repeated. This process of cancellation by the reissue of two new vouchers may be effected directly on the face of the voucher register by a full cross-reference between the old and the new, usually shown in the Manner of Payment column; or it may be done by formal entry on the general journal, which will then constitute the authority for the transaction. At the best, it is an awkward situation and where financial arrangements cannot be made so as to make partial payments unnecessary in large measure, the voucher system itself should be discarded as not adapted to the conditions of the business.

Handling of Notes Payable

Practice differs, under the voucher system, in the handling of notes payable. If a note is given or a draft accepted upon the purchase of goods, the liability for it will appear on the books only as a note liability, provided the purchase is recorded through some other medium than the voucher register. This medium might be the general journal or the notes payable journal. If, however, original entry of the purchase is made in the voucher register, liability for it is thereby created under the account title, Vouchers Payable. This must be shown canceled by the creation of a note liability in its place, by entry in general or notes payable journals. If the voucher check system is used, the check on the original voucher must be canceled by marking it “Void” or by running it through the bank with the day’s deposits. In either case for the sake of a complete record of check numbers, it should be entered among the cash disbursements. From all this it is evident that less work is entailed and just as complete a record made by entering the purchase originally in general or notes payable journal as suggested above.

In order to maintain proper control over the cash, when the note becomes due a check should be drawn for it rather than allow its payment to rest merely on the bank’s memo of charge against the account, where the note is made payable at the bank. If a voucher check system is in use, payment by check results in a momentary transfer of the liability from its status as a note liability to a vouchers payable—an open account—liability. Cancellation of the note is made by distribution of the voucher to the Sundry column of the register as a charge to Notes Payable; the voucher not being made or entered until the note falls due. Simultaneous entry of the check in the cash book cancels the voucher payable liability and completes the transaction.

If the note is given in cancellation of the open account which had been set up by previous entry in the voucher register, then the same procedure must be gone through, as was explained above in connection with the practice of invariably entering every purchase on the voucher register. If the note transactions are many, it would prove much less laborious to accept the bank’s memo of charge as adequate evidence of payment, this memo being given a treasurer’s number in proper sequence, where treasurer’s numbers are given to establish order of entry on the cash book. Cancellation of the notes payable liability is then posted from the cash book entry.

Cash Discount on Purchases

A final problem in connection with the voucher system concerns the treatment of cash discount on purchases. As discussed in Volume I, Chapter XXXVI, a cash discount is usually treated as a financial management item, though it is sometimes looked upon as a purchase department item. The handling of the voucher register so as to record properly the purchase discount will depend somewhat upon which theory of cash discount is adhered to. It is customary to carry a Purchase Discount column in the voucher register, although this is unnecessary if one is carried in the cash book. Where both cash book and voucher register are provided with discount columns, one is usually merely a memorandum carried for the sake of easy reference.

As regards the amount at which the liability under Vouchers Payable is carried on the books, we find two methods of making up the voucher and entering it on the register. This is in turn closely related to the financial policy as to the taking of discount. If it is an invariable rule of policy always to maintain a sufficient cash balance to take advantage of all discount offerings, there is nothing seriously wrong with the practice of making up the voucher and entering it for the net amount in the Vouchers Payable column; for if the policy is adhered to, no understatement of liabilities will result. If the policy is not strictly adhered to, constant adjustment will be necessary to make the books reflect the true liability.

A voucher entered net should have the discount shown in the Discount column and the gross amount in the distributive columns. Mathematical proof of the voucher register is secured by checking the sum of Vouchers Payable and Discount columns against the sum of the distributive columns. Here it is best to treat the Purchase Discount column total as an item to be posted, and the Discount column in the cash book as a memo. As regards the income from purchase discount, the effect of entering the voucher net is to bring onto the books the purchase discount income as soon as the voucher is entered. Purchase discount is not usually looked upon as earned until payment of the bill is made and thus the right to the discount established. This method then necessitates at the close of the fiscal period an adjustment of the difference between the Discount columns in voucher register and cash book, in order to defer to the next period the discount not yet earned on all vouchers unpaid at the close of the period. This may be accomplished by the usual method of deferring income, or by the following entry, on the theory that it is better for Vouchers Payable to carry the gross amount of liability, at the _end_ of the period, at all events.

Purchase Discount $..... Vouchers Payable $.....

The entry must, of course, be reversed immediately at the opening of the new period—a procedure which makes this method of adjustment of doubtful value.

If there is any failure to take the discount, after the voucher has been entered net, it becomes necessary to make up and enter a supplementary voucher for the discount, with cross-reference between the original and the supplementary vouchers. The new voucher must be distributed to Sundry column as a charge to Purchase Discount. One of the few advantages of this method is that it makes possible reconciliation with the bank account by checking the canceled checks against the voucher register, which thus carries in its Vouchers Payable column the exact amount of the check and its entries are in the sequence of voucher numbers; whereas on the cash book voucher number sequence cannot be followed. Accordingly it is unnecessary to use treasurer’s numbers on the checks in order to secure sequence of numbers in the cash book.

The customary method, and one which usually proves most satisfactory, is to make up and enter the voucher for the gross amount, using the Discount column in the voucher register merely as a memo or not at all, posting the discounts, as earned, from the cash book and using a separate series of treasurer’s numbers when the checks are entered on the cash book.

Strict adherence to the theory of cash discount as a purchase department item would require making and entering the voucher net and distributing it net. The Discount column in the register might well be changed to a “Neglected Purchase Discounts” column into which would be distributed the supplementary voucher required when discounts are not taken. Under this theory, also, the voucher may be made up and entered gross, with the discount handled as a regular purchase discount item, and the net amount distributed to the other columns. The student should work out the manner of handling all the discount contingencies under this method.

Modifications of System

A regular purchase ledger is sometimes used with the voucher system. In such cases the voucher register becomes merely an analytic purchase journal and much of the advantage of numbering every transaction is lost. Accounts may also be set up merely as memos to indicate volume of business. The voucher index, as explained above, accomplishes this in a limited way.

A hybrid voucher system is sometimes met, a sort of half-hearted affair, which gives good results but does away with the essential idea of the voucher as being a receipted bill. Under it, a house voucher—so called because it never leaves the house—is made up and used as the basis of entry. The bill is paid by independent check, which when canceled is filed with the voucher. In all respects, except that the voucher is not sent with the check to be receipted, the system is operated as a regular voucher system. An advantage claimed is that in this way all information as to distribution of the charge or use of the purchased materials or services is kept strictly within the business itself. This is done at the sacrifice of securing a receipted bill.

Summary of Operation and Advantages

By way of summary, it may be stated that a fully efficient operation of the voucher system is comprised under the following routine:

1. A verification of invoices. 2. Making up and entering the vouchers. 3. Filing vouchers previous to payment. 4. Paying vouchers. 5. Filing paid vouchers. 6. Indexing vouchers.

Some of the advantages claimed for the voucher system are:

1. It gives a detailed analysis of all purchases. 2. It saves labor by doing away with the purchase ledger. 3. It secures an up-to-date entry of all liabilities. 4. It localizes responsibility by showing authority for the auditing, payment, and entry of the items. 5. It secures a receipted bill for all disbursements of cash.

The chief disadvantages are:

1. Clumsy provision for returns and allowances, partial payments on bills, and notes payable. 2. Inadequate showing of volume of business with each creditor. 3. The giving out of information about the business which should be kept private.

It should always be borne in mind that any satisfactory method of account-keeping must be adapted to individual conditions. If efficient results are expected, a business man should beware of ready-to-wear accounting systems. There are conditions in which the voucher system gives excellent results. There are also conditions to which it is entirely unadaptable and inadequate.

CHAPTER III

FACTORY COSTS

Difference between Factory and Financial Accounting

As was stated in Chapter II, the accounting records of a concern making its own product are much more complex than those of a concern which limits its activities to the buying and selling of stock-in-trade. A much larger mass of detailed information is needed for the proper conduct of the business. In this chapter it is purposed to study in a broad way the fundamental principles involved in factory accounting and to examine some of its distinctive problems. Factory accounting does not differ in the real fundamentals of account-keeping from any other kind of accounting. Its principles of debit and credit are the same; it employs the same or similar kinds of accounting records; and the same general use is made of the records, viz., to serve as a guide in the proper management and control of the business. Its distinctive features are seen in the application of certain principles to secure special information. To understand the problems peculiar to factory accounting, it will be necessary to consider the nature of this information.

Definitions of Terms

Three elements enter into the manufacture of a product. These are material, labor, and expense. The problems of factory accounting are therefore those connected with the accounting for the costs of material, labor, and expense. Some terms used in this connection will need explanation. A standard terminology for cost-keeping is becoming fairly well established. Direct and indirect costs, prime cost, factory burden, or overhead expenses, factory cost, full cost or cost to make and sell—these are some of the terms needing definition. Direct costs are those which can be allocated directly to a specific product. They are items which can be separated from all other cost items and applied solely to a particular product. Indirect costs are those which are shared in common by the various products and so must be distributed over them on some equitable basis. Direct costs are sometimes called prime costs. The cost elements which can almost invariably be applied directly to the product are material and labor. The sum of these two items constitute, therefore, the prime or first cost of the product. The other items of cost which are incurred _in the factory_ or with which the factory is chargeable are variously called factory expense, overhead, or burden. These indirect costs cannot be charged directly to any specific product, and so they are shared by the entire factory output.

The sum of prime cost plus factory expense constitutes factory cost, i.e., the entire cost of manufacture up to the point at which the product is turned over to the selling department for sale. This is sometimes called total manufacturing cost.

Full cost is the price at which the manufactured article can be made and sold. In other words, to the factory cost of the article must be added its equitable share of all the other costs of conducting the business and also a margin of profit in order to arrive at a selling price. These definitions indicate some of the purposes of cost-keeping. Other purposes are given below.

Special Purposes of Cost Records

To maintain adequate control over production, careful records as to consumption of material and labor must be kept, so that the cause of any marked fluctuations of the costs of the current period from those of former periods can be investigated. The determination of factory cost makes possible a comparison of the policy of manufacturing with that of buying the manufactured article on the open market. This sometimes shows that manufacture is being carried at a loss. Again, the fixing of a sale price on the article, which while covering all expenses, shall at the same time leave a margin of profit, is a prime essential in every business. To be of the greatest advantage and usefulness, cost records should not only determine factory cost but they should accumulate the data needed to _predetermine_ the selling price with accuracy.

Nature of Raw Materials and Supplies

Materials or raw materials constitute the crude commodities or semi-manufactured articles which are to be worked upon and fashioned into a new product. It is seldom that any factory takes its material in the raw form in which it comes from nature. The product of the mines goes through many degrees and stages of refinement and at each stage of the process some of it becomes the “raw material” for another class of industry. The term is therefore relative; that which is the finished output of one factory becomes the raw material of another factory, to be worked upon and given new forms.

Auxiliary material and supplies are also made use of. Thus, certain parts such as screws, bolts, hinges, casters, fastenings, trimmings, and the like, are incorporated into the finished product without change of form or the application of any labor thereto. These also constitute a part of the raw material of the factory, their value as finished product being due to place utility rather than form utility.

Supplies are to be distinguished from raw materials. This also is a relative term. In general, material which does not directly form a part of the finished product is carried under the head of supplies. Materials used in getting ready or seasoning the raw material, i.e., auxiliary material, such as paint, putty, etc., the quantity of which used on each piece of product cannot be measured with exactitude and must therefore be spread over the entire product—these and similar items constitute manufacturing supplies. They are usually treated as a part of factory expense rather than as belonging to prime cost.

There are also factory operating supplies. These comprise the materials used in the operation of the factory. Repairs material, brooms, oil, waste, packing, nails, fuel, etc., are examples of this kind of supplies. These, of course, are classed with factory expense, also.

The raw material which enters into _prime_ cost is thus seen to be only that which can be charged directly to the particular product. All other material is overhead or expense.

Accounting for Material Cost

The problem of applying the cost of the material directly to the job is largely a problem of systematizing which requires the careful oversight and accounting for all materials bought and used in manufacture. Two general methods are employed. Under the one, the old method of keeping record of all purchases and taking the inventory periodically to determine how much material must have been used in the processes of manufacture, is deemed sufficient. In a small factory making just one product—or a few simple products—where the conditions are such that the manager has an intimate knowledge of all processes and can exercise personal control over them, fairly satisfactory results may accrue under this method, though the amount and therefore the cost of the material consumed in the product can never be known accurately until the inventory has been taken.

The other method requires almost as accurate accounting for material as for cash. A stores room or department must be established and a stores ledger installed. As materials are purchased and come into stores, they are classified in whatever detail is desirable and charged to their respective class accounts kept in the stores ledger. As material is needed for manufacture it is drawn by properly authorized order on the stores-keeper. These orders are called “requisitions” and indicate the material needed and the job or product to which it is to be charged. The requisitions constitute the source of the credit entries to the various stores ledger accounts as well as the charges to the job or product. The balances on the stores ledger accounts thus show the amount of each class of material which should be on hand in the stores room.

This method of keeping track of materials is known as the perpetual inventory system. By its use, it is possible to know without the taking of a physical inventory how much material is being used in manufacture and the cost of it. In this way much better control is secured over materials than under the physical inventory method. In keeping track of material values, of course, inward freight,

cartage, handling and stores room cost must be loaded onto the invoice cost of the materials to arrive at the full cost at which they are issued for manufacture.

Direct and Indirect Labor

The second element of prime cost is labor. In factory accounting, labor is divided into two classes, direct and indirect. These are sometimes called productive and non-productive, terms doubtless carried over from the old economics which looked upon some labor as productive and some non-productive—necessary, it is true, but rather of the nature of a necessary evil. Direct labor is a direct cost as explained above. That is, it is the labor of the workmen who apply themselves directly to the manufactured product as distinguished from the labor of those employees who plan, lay out, and supervise the work of others. Direct labor can be definitely allocated to specific product or jobs, because it is applied directly to them. Indirect labor cannot usually be allocated to a definite product because it is applied to all the product, not being employed long enough or definitely enough on any specific product to justify keeping track of the time and charging it to specific product. Direct labor is a prime cost; indirect a factory expense. It is with direct labor that our present discussion is concerned.

The problem to be solved in accounting for labor is not the determination of the total cost of labor used, as is part of the problem of accounting for materials, but the distribution of that cost over the product. Determination of labor cost, except that accrued at any time, is a comparatively simple matter because the workmen have to be paid at regular intervals. Distribution of the labor cost over the product is more difficult. This necessitates keeping a record of the amount of time spent by each workman on specific product. In that way the labor costs can be figured quickly and distributed to the various products worked upon.

Time-Keeping Records

To keep track of the workman’s time spent on each unit of product, record must be kept by means of time cards, timekeepers, time clocks, or other similar device which will show the time at which work was commenced and the time at which it was finished or when the working force is transferred to other work. The time card is arranged with space for number or name of the jobs or products worked on and the time spent on each. Use of the hour or day rate of wages paid the workman gives the labor charge to each particular product worked upon. This time card, or its equivalent, may be kept by department foreman, a special timekeeper, or by the workman himself. At the end of the week or other period, these time cards are turned into the office and they serve as the basis for making up the past week’s pay-roll or as a check against the pay-roll where some other source for the make-up of the pay-roll is used.

Pay-Roll

The pay-roll is merely a list of the names or numbers, or both, of the workmen, showing the time employed during the past period, and the rate of wages. A column to carry total amount due each workman is provided, as well as in some cases a place for the signature of the workman’s name to acknowledge receipt of payment. Provision may be made for other information, also, such as distribution of the labor cost to the specific product, but this is not usual. When the time cards of the workmen are turned in, they are checked against foremen’s reports or sick notices. The total time spent by each workman multiplied by the rate of wages gives the amount earned by each man. From this may be deducted any claims, such as insurance, rent, store charges, hospital and sick benefit, giving the net amount due the workman.

Safeguarding the Pay-Roll

Since the pay-roll is such a frequent source of error and fraud, all possible safeguards, chiefly of an internal sort, should be made use of. Where possible, workmen should be employed through an employment department to which requests for men needed should be sent. Some form of card record should be kept for office files of all men taken on—and perhaps of all men interviewed. Additions of names to the pay-roll should not be allowed without authorization, and the payment of the men should not be made by the same clerks who make up the pay-roll. The pay-roll should be checked as to mathematical correctness and, where possible, as to the content of the roster, both before and after making payment. Too often has the total of the pay-roll been changed after its correctness has been proven but before it has been presented to the treasurer to provide the funds needed, the thief pocketing the difference between the amount needed for payment of labor and the raised amount of the pay-roll. Checking before and after payment will prevent this.

If payment is by check, the total amount of the pay-roll should be transferred by check to a special bank account on which the individual checks are drawn. If payment is in currency, this will be secured by check on the bank and the pay envelopes made up from it. Before drawing the currency, the individual amounts should be analyzed to determine the denominations of the coins and currency needed for filling each envelope.

Methods of Pay-Roll Payment. On each pay envelope should be marked the name and the amount. One pay-roll clerk should count out the amounts, the other clerk verifying them and filling the envelopes. A very ingenious pay-roll machine can be used for filling envelopes with the proper amount. The total amount of the pay-roll is placed in a coin rack operated by a keyboard. As the amounts of the individual envelopes are set up on the keyboard, the coin rack delivers the correct amount into a chute which carries it to the envelope. At the same time the amount delivered is listed, making it easy, in case of error, to locate the envelope containing the wrong amount. When the envelopes are delivered to the workmen, each man should identify himself in the presence of his foreman and give receipt for his pay. This is usually done by signing the pay-roll. The clerks making payment and the witnessing foremen should sign the pay-roll. Any unclaimed envelopes are returned to the treasurer to be held a certain length of time for claiming, after which time they may be diverted to other uses, though the liability for them must still be shown.

Distribution of Labor Charges

Distribution of the labor charges may be made in several ways. The precise method must depend largely on local conditions. In a small factory making only a few products, or where cost by departments is the desideratum, the voucher register may be provided with sufficient distributive columns to meet the requirements. At the time the pay-roll check is entered, it is distributed according to the labor cost in the various departments or on the various batches of product. This dispenses with a general pay-roll or labor account on the ledger. In a larger concern or one in which a more detailed distribution is desirable in order to secure definite and accurate costs on a diversified product, distribution on the face of the voucher register might not be feasible. Here, the pay-roll check will be run through the register as a charge to pay-roll. When the desired analysis is made in accordance with workmen's time cards or other sources of information, a general or cost journal entry is made, charging the proper accounts and crediting Pay-Roll. Or, and usually better, a "Pay-Roll Distribution Book" may be used. This book is a recapitulation of the time cards distribution sheets. Each time card must be analyzed according to jobs, product, or departments, and these distributions as summarized should as a matter of permanent record be entered in a recapitulation book. This, by being made a posting medium, becomes the pay-roll distribution book. Charges to the proper accounts are made from this book, offset by a credit of the total of the book to Pay-Roll account. Sometimes the pay-roll book itself carries distributive columns and can therefore be made to serve as a pay-roll distribution record.

Accrued Wages. Distribution of wages accrued at the end of the fiscal period is perhaps best made through the general journal, although it can without much difficulty be run through the distribution book by making two recapitulations of the last week or pay-roll period at the end of the fiscal period, the portion of the week belonging to the last fiscal period being summarized separately from the portion belonging to the next period. Both summaries, however, should be run through on the regular pay-roll voucher for that week's wages.

Expense

The third item or element which goes into the cost of manufacture is factory expense. Under this head are included all the costs of manufacture excepting the prime cost elements of materials and direct labor. Indirect labor, factory supplies, light, heat, power, repairs and maintenance to factory buildings and equipment, depreciation on factory buildings and equipment, rent, insurance, etc., constitute the main items under this category. These are the indirect costs of manufacture because, while just as necessary as the prime cost elements, it is impossible to allocate them directly to the product. How much of the cost of light, how much of repairs cost, how much of the cost of factory supplies, etc., shall be charged to each unit of several different kinds of product constitute a problem on the solution of which depends the whole structure of accurate costing. Accurate distribution of materials and labor costs may be complex, but presents no real difficulties. It requires little more than careful and painstaking work. On the other hand, to secure an equitable basis for the distribution of factory expenses, and one which is at the same time a workable basis, is in some cases well nigh impossible.

One common basis of distribution for all the factory expenses will not usually give satisfactory results. Each item of overhead must be considered separately and will often require a distinct basis of distribution. Thus, indirect labor is sometimes distributed over product on the basis of the cost of the direct labor item in the product, on the theory that the cost of supervision is a cost of

supervising the direct labor and so closely related and dependent on that cost. Under some conditions, the number of direct labor hours is used instead of the _cost_ of direct labor. Again, the time the product is worked on in a given _department_ is taken as the most equitable basis for distributing indirect labor costs. Power, where metered to a machine, may be charged to the product on the meter basis. Where not metered, it may be charged on the basis of the time the machine is operated. So, every item of expense must be analyzed and effort made to secure an equitable basis of distribution.

Summary of Manufacturing Cost

Each unit of product, therefore, as it comes from the factory must carry its burden of cost composed of materials, labor, and factory expense costs. The sum total of all of these costs for all products—the entire output of the factory—will be the record of manufacture on the general books, the detailed record being carried in subsidiary books. At the close of the fiscal period when the temporary proprietorship activities of the business must be summarized, an entirely distinct group or section will be devoted to the activities of the factory because these costs must be shown separately from the others. For this purpose, the first section of the profit and loss statement and account is treated as the “Manufacturing” section, and under it are summarized in two groups the prime cost elements of materials and direct labor and the factory expenses. The total of this manufacturing section gives the cost at which the manufactured product is charged to the sales department of the business, and there this item takes the place of the cost of purchases in a business which buys its stock-in-trade. A detailed explanation of the manufacturing section as a part of the profit and loss summary is given in Chapter XXVII. The principles of cost accounting cannot here be developed further than this mere statement of the ends sought.

CHAPTER IV

THE BALANCE SHEET

Business Methods under the Microscope

The balance sheet is occupying an increasingly large place in all affairs of business and even of state, because the state is taking cognizance of business as never before. All phases of commercial activity are under the microscope. In these war times the government is tapping every available source of revenue. Kinds of property, property values, profits, rates of profit on capital invested—all are under investigation and the publicity resulting therefrom should make for a better conduct of future business. All this is forcing home to the manufacturer and trader some very obvious but long disregarded principles of business conduct necessary to secure health and long life. And these timely lessons will be of even greater use in the struggle for world markets that is imminent. As an interested party to any condition of business, labor also is claiming the right to be heard. The public in its direct dependence on certain classes of corporations for many of its necessities and most of its conveniences is also interested in the proper conduct of those businesses. As a factor in this increasing interest and scrutiny over business enterprises, exercised both from the inside and from external sources, banks are exerting a large and beneficent influence. The extension of credit, both bank and commercial, is no longer done by haphazard rule-of-the-thumb methods as in days gone by. Every applicant for credit must prove his right to it, must show cause why he deserves it, must present evidence of financial condition and standing on the basis of which the banker, the money lender, or the seller will be justified in extending all or some portion of the credit asked.

The Reading of the Balance Sheet

Because, in these and many other ways, the balance sheet offers the readiest means of securing the necessary information, it becomes an increasingly prominent statement. Before a proper understanding of the balance sheet can be had, and therefore before it can serve the various purposes to which it can be adapted, certain principles governing its make-up, both as to form and content, should be established. A proper reading of the balance sheet cannot be made without a thorough grasp of these principles.

The knowledge necessary for this is broadly of two kinds, viz.: (1) a knowledge of accounts, their technique, construction, and meaning; and (2) a knowledge of the principles of valuation as applied to business enterprises. The latter is not a domain of knowledge pre-empted by the accountant nor limited exclusively to his use. It touches more or less intimately all related fields of business endeavor. That is why the modern accountant needs a broad training and something more than a cursory knowledge of business practices and conditions. He should have a close acquaintance with the fundamental currents of business life, its organization and finance, and its basis in law, if he hopes to measure up to present-day requirements.

Thus not only is the accountant interested in the form and content of the balance sheet, but a proper understanding of it is valuable and increasingly necessary to all business men. In this chapter and those which follow, it is purposed to study these two problems of form and content, first establishing the broad basic principles and then showing in detail how these apply to various conditions and particular data. This chapter will concern itself with the problem of the make-up of the balance sheet so far as it relates to form.

Definition

George Lisle[4] defines a balance sheet as “a concise statement compiled from the books of a concern which have been kept by double entry, showing on the one side all the liabilities and on the other side all the assets of the concern at a particular moment of time.” Another writer says, “It is a cross-section of the business at a given instant”; and another, it is a “screen picture of the financial position of a going business at a certain moment.” As indicated by the first definition, an attempt is sometimes made to limit the term balance sheet to a statement made up from a double-entry set of books. With equal propriety it may be applied to any statement, whether made up from single- or double-entry books, or from any formal records, or from no records at all, which shows the assets and liabilities of a concern and the difference between them, i.e., the balance, as the item of net worth.

[4] In “Accounting in Theory and Practice.”

To distinguish this latter statement from the balance sheet when used in the restricted sense above referred to, the title, “statement of assets and liabilities” is sometimes used but there seems little reason for the distinction. Here the terms will be used as synonyms. The balance sheet then is a statement of financial condition as distinguished from a statement showing the operations of the business, and it is true only for a given moment of time. Theoretically the wheels of business are stopped momentarily, all operations cease, and a summary of the assets and liabilities then existing with their balance shown as net worth constitutes at that moment the balance sheet—the financial statement.

Relation between Balance Sheet and Trial Balance

A balance sheet when made up from a double-entry set of books bears a close resemblance to the trial balance. The trial balance is simply a list of ledger balances. Due to practical considerations in making the record from day to day, the ledger seldom reflects the true condition of the business, as there is no distinct separation of assets, liabilities, expenses, and income. Some accounts take on a mixed character, making necessary the periodic separation of their elements. This separation is effected by the adjusting entries explained in Volume I. A trial balance of the ledger after the adjusting entries are made contains the data for both the financial statement and the operating statement. After the operating data, i.e., the income and expenses, have been summarized through the Profit and Loss account and its balance has been transferred to some vested proprietorship account, the records left on the books relate only to assets, liabilities, and vested proprietorship. A trial balance now taken—a post-closing trial balance—contains only balance sheet items and to all intents and purposes is a balance sheet. While, as we shall see, the form in which the data of the balance sheet are presented is a matter of serious importance, any showing of assets, liabilities, and net worth constitutes a balance sheet.

Form of Balance Sheet

A balance sheet is not an account, nor is it the statement of an account. It is simply a statement of assets, liabilities, and proprietorship, arranged in whatever form best suits the purpose. Where set up in parallel columns, it is frequently called the account form; when shown vertically on the page, assets followed by liabilities and the difference indicated as net worth, it is called the report form. A balance sheet therefore being only a statement cannot properly be said to have either a debit or a credit side. It is not a complete system for the record of the transactions of a business set up in debit and credit form for the sake of proof, although on its statement of fundamental equality may rest the whole scheme of debit and credit. While usually made up from a system of double-entry books and so often spoken of as the goal of record-keeping, it may be made up from sources entirely extraneous to the books.

Purpose and Uses

The purpose of the balance sheet is, as indicated, to show financial condition. It may be made also to show the amount of profit for the period by elaborating the information given in the net worth section. If there has been during the period neither a withdrawal of any funds nor an additional investment, a comparison of net worths as at the beginning and at the end of the period will bring out the increase or decrease in net worth and therefore establish the _amount_ of profit or loss, though telling little or nothing as to its

source. If there has been withdrawal or investment or both during the period, adjustment must be made on account of these before the amount of profit or loss for the period can be determined from the balance sheet. The balance sheet may thus be made to show profit, though that is an incidental rather than an essential purpose of the statement.

As a statement of financial condition the balance sheet should make possible the determination of several facts. It may be used as the basis for short-time credit. If so, its purpose then is to show facts as to solvency. It may be used as the basis for floating a bond issue. If so, other groups of data in addition to the solvency facts must be held under view. It may be used for determining the advisability of an investment in the business. If so, its data must be examined from still another angle. In all of these cases the balance sheet must set forth clearly the relationship of the interests of the various parties in the business. The assets of a corporation are listed usually so as to show the total properties to which all the parties may look for the satisfaction of their claims. Of the claimants there are first, then, those whose claims are redeemable within a short time. Failure to meet these claims may mean insolvency. There are those also whose claims are not necessarily of immediate urgency, though they may be. Inability to meet these claims may mean bankruptcy and dissolution. Finally, the owners themselves have a proprietor's right only to any residue of assets left after the claims of all outsiders have been satisfied or are capable of being satisfied. Thus the balance sheet may serve many purposes.

Types of Balance Sheet

As the balance sheet must serve, or can be made to serve, several definite purposes, the best way to accomplish the end in view must receive careful consideration. It is here that the question of form enters. The various problems in connection therewith will next be discussed.

As to types of form there are in the main two, the English and the Continental or American, both of them well standardized, although many variations from the types are found. The chief difference between the two types lies in the showing of assets on the right side and liabilities and capital on the left under the English form, and a reversal of the sides under the Continental form. So much useless controversy has been carried on with such a waste of effort and words over the relative merits of the two types, that a writer now scarcely dares venture into the subject. As a matter of historical interest and information to the student, an effort will be made to summarize briefly the two positions.

Origin of English Form of Balance Sheet

In the development of record-keeping a stage was passed through in which every account on the ledger was closed. Not only were the temporary proprietorship accounts cleared through the Profit and Loss account, but all the remaining asset, liability, and vested proprietorship accounts were in like manner closed into a Balance account opened on the ledger for this purpose. The Balance account, after transfer of the various accounts into it, became virtually a balance sheet and so was itself in balance. In this way the whole ledger was closed. The Balance account at this stage, so the controversialists maintain, represents, and was later adopted as, the Continental form of balance sheet. The ledger could not, of course, remain closed; it had to be reopened for the record-keeping of the next fiscal period. This was accomplished by credit entries to transfer the assets, and by debit entries to take out the liabilities and vested proprietorship. These reopening entries as appearing in the Balance account represent the English form of balance sheet.

This explanation of the origin of the two forms is ingenious and even plausible, although not synchronizing historically with the lapse of use of the Balance account. Others have attempted an explanation on purely logical grounds. These hold to the theory of the personality of accounts, which looks upon the business always as an entity distinct from its owners. Here, the English form of balance sheet is said to be the statement of account rendered by the business to its owners, whereas the Continental is the account given by the owners to the business. A. Lowes Dickinson,[5] in discussing the two forms, says: "The balance of argument would seem to favor the latter (English) on the theory that a balance sheet is intended to set forth the position of the owner of the property, who should therefore be credited with what he possesses and charged with what he owes."

[5] In "Accounting Practice and Procedure."

Quite opposed to this view is the position taken by an English authority, George Lisle,[6] He says: "Why ... the assets which are on the debit side (of the ledger)[7] and the liabilities which are on the credit side, as according to the principles of accounting they ought to be, should change places (in the balance sheet),[8] it is impossible to justify. The custom seems to have arisen through the influence of the forms given in Acts of Parliament, chiefly The Companies Act, 1862, which must have been prepared by those

unacquainted with the theory of accounts. The Profit and Loss account is taken from the ledger, and the sides are not transposed, and there is no logical reason why the sides in the balance sheet should be reversed.... The form of balance sheet in which the assets appear upon the left side is both theoretically the correct form and in practice is the most convenient form to use.... Prior to about the passing of The Companies Act, 1862, it was the form chiefly adopted in England, but is so no longer."

[6] In "Accounting in Theory and Practice."

[7] Material in parentheses is author's.

[8] Material in parentheses is author's.

R. H. Montgomery[9] proposes a psychological explanation. He says: "The only sound reason the author can think of for the custom is that a conservative Englishman looks for his liabilities first and then looks to see if he has enough assets to discharge, them ... that the average American looks for his assets first and subsequently glances at his liabilities in order to assure himself that his excess of assets is as much as he believes it to be." Regardless of the origin of the two types and their respective merits, a balance sheet is everywhere used to show assets, liabilities, and net worth, and less and less regard is being paid to debit and credit or left and right sides, technical form giving place to an elasticity in the method of showing adapted to accomplish definite purposes.

[9] In "Auditing, Theory and Practice."

Variation of English Form

A variation of the English form of balance sheet is seen in the make-up of the balance sheet for British public service companies. These companies are authorized by special act of Parliament to raise money for designated purposes. The act, therefore, requires as a part of the statement of financial condition the rendering of an accounting of the receipts from sale of stock and bonds. Accompanying the financial statement, or rather as a part of it, is the statement, "Receipts and Expenditures on Capital Account," comprising the fixed asset and liability sections of the ordinary balance sheet. Illogical as it may appear in view of the usual English practice, this account is _credited_ with the capital stock and bonds issued to establish the undertaking, and is _debited_ with the fixed assets in which the capital funds have been invested, the intent of the law being that the capital funds raised should be applied to purchase of fixed equipment with which to earn revenue and that all other expenditures should be made from revenue. If the fixed assets exceed at any time the fixed liabilities and capital, it means that the excess has been supplied out of revenue. If the reverse is true, it means that capital receipts are being used as working capital. Any balance is carried down to the second part of the financial statement known as "General Balance Sheet," in which arrangement of the two sides is made according to English custom. The act authorizing this double-account form of balance sheet allows the valuation of the fixed assets always at cost, on the theory that their maintenance in a state of constant good repair and efficient working condition constitutes a charge against revenue and hence that depreciation need not be considered.

It has been suggested that the double-account form of balance sheet, or rather the law on which it rests, has been responsible for the decisions in the cases of Lee v. Neuchatel Asphalte Co. and Verner v. The General and Commercial Investment Trust, Ltd., reference to which is made later in Chapter XXII, "Profits," and Chapter XXIV, "Dividends." Here the decisions rested on the distinction between fixed and circulating assets and declared in favor of the maintenance of the capital funds invested in circulating assets but not necessarily of those invested in fixed assets. The following illustrates the double-account form:

THE EAST AND WEST RAILWAY COMPANY RECEIPTS AND EXPENDITURES ON CAPITAL ACCOUNT
========== | Railroads, Franchises | Capital Stock: and Other | Common $200,000.00 Properties $410,000.00 | Preferred 75,000.00 Current Expenditures | Debenture 50,000.00 for Construction | Funded Debt: and | General Mortgage Equipment 65,000.00 | Bonds 150,000.00 Investments in Other | Equipment Trust Companies 50,000.00 | Bonds 100,000.00 Securities in Hands | of Trustee 15,000.00 | Balance carried to | General Balance | Sheet 35,000.00 | ---------- | ---------- $575,000.00 | $575,000.00 ========== | ==========

GENERAL BALANCE SHEET, DECEMBER 31, 1918
========== | Capital Account, | Securities $50,000.00 credit balance $35,000.00 | Prepaid Expenses 750.00 Special Betterment | Accrued Income 1,250.00 Fund 15,000.00 | Accounts Receivable 25,000.00 Accrued Expenses 1,500.00 | Materials and Supplies 10,000.00 Dividends Payable 17,500.00 | Accounts Payable 25,000.00 | Cash 7,000.00 ---------- | ---------- $94,000.00 | $94,000.00 ========== | ==========

It will be noted that the sides of the capital account follow the debit and credit order of the ledger, whereas the general balance sheet reverses that order—an inconsistency for which even the English do not attempt explanation.

Balance Sheet Titles

The title of the balance sheet is fairly well standardized. Other titles are sometimes met, such as Financial Statement; Statement of Assets and Liabilities; Statement of Resources and Liabilities; Statement of Assets, Liabilities, and Capital; Statement of Financial Condition; etc. The title “Balance Sheet” seems best. Though not so fully descriptive as some of the other titles, it is generally understood and has not the objection of inadequate descriptiveness and unwieldiness often raised against the other titles. There is a similar variation in the titles used for the three main groups of items shown in the balance sheet, viz., assets, liabilities, and net worth. Obviously, portions of some of the general titles cited apply here with equal appropriateness. In addition, we find in use or suggested as appropriate, Property and Assets, Active and Passive, Debit and Credit, Positive and Negative, Proprietorship, Capital and Surplus, Capital, etc. None of these suggested titles have met with favor in practice, but they have served the worthy purpose, perhaps, of providing fuel for academic controversy. The titles, Assets or Resources, Liabilities, and Net Worth or Capital, seem thoroughly established and seem to cover the need.

Grouping and Classification

In the matter of classification and arrangement of the items under these main groups there is room for greater diversity both in practice and in theory. The need and purpose of classification and arrangement is obvious. While any statement, list, or schedule which shows assets, liabilities, and net worth may properly be called a balance sheet, only by a careful grouping and formulation of the items can their mutual interrelations and proper dependence be shown. Not only does the bringing of similar items into groups put them in proper perspective, but the arrangement of the groups to show their relations to one another makes for a more intelligent interpretation of the balance sheet. The controlling principle underlying classification of the items into groups is, in the main, their relative degrees of liquidity. Sometimes other factors, such as emphasis, perspicacity, publicity, and so on, bring about groupings which differ somewhat from those based solely on degree of liquidity. Thus it may be desirable to call particular attention to, say, the permanent investments of a concern, to the condition of its sinking and other funds, to the amount of new construction and betterments for the current period, or to the values tied up in intangible assets. No hard and fast rule can therefore be followed; elasticity, flexibility to the desired purpose are working rules which must underlie any scheme of classification.

As to titles for the various groups, one finds many. The current assets are variously styled Quick, Floating, Liquid, Circulating. As a sub-group under Current or as a separate group we find Working and Trading assets. Other groups are Fixed or Capital, Investments, Sinking and Reserve Fund Assets, Deferred Charges to Operation, Deferred Assets, Deferred Debits, Suspense Debits, with similar titles for corresponding credit items, Contingent Liabilities—in short almost any title which seems best to fit the needs of the particular case. Some of these may need some explanation.

The distinction between current and working assets is a somewhat fine-drawn one, although well taken under certain circumstances. Where the two groups are used, current assets include the cash, receivables, and temporary investments, and the working assets group (or working and trading assets as it is sometimes captioned) includes the stock-in-trade (finished goods, goods in process, and raw materials), supplies of all sorts used in preparing the goods for sale or in making the sale, office supplies, working funds in the hands of branches and agents, and the like. The line of demarcation between the two groups is not always clearly drawn, some placing the stock-in-trade among the current assets, others putting finished stocks in the current group and process materials in the working group. There is apt to be an overlapping also between the working and the deferred charges groups, supplies of various sorts often being treated as deferred charges to operation. Capital assets are fixed assets—the plant and those assets in which the capital must first be invested before revenue can accrue. When the group of capital liabilities is shown it usually includes both the long-term obligations incurred for raising capital as well as the capital stock. This unfortunately does not recognize a distinct section for the net worth items.

Arrangement of Groups

The arrangement of the groups among themselves, while showing variations, offers few important matters for consideration. Here, also, the principle of degree of liquidity controls. The arrangement is sometimes from fixed to liquid but rather more frequently from liquid to fixed. If the chief interest in the balance sheet is as to the amounts of capital invested in properties and the growth of such investments, it is claimed that the fixed asset group should be shown first. This might be the case with railways, steel corporations,

and other large concerns wherein the ratio of the fixed assets to the current is large. In other concerns—and these constitute the larger number—chief interest centers in the current group. Here, the ability to pay dividends, to extend a sales market through carrying larger stocks of merchandise, to secure credit, are the items of chief moment. It is contended that in these cases, the order of the groups should be from current to fixed.

Whatever grouping is made for the assets, a similar arrangement of groups must be insisted upon for the liabilities; it is the placing in juxtaposition or the same relative positions of similar groups among the assets and liabilities which makes for an easily intelligent reading of the statement. After all, the order of the groups, as from fixed to current or vice versa, is of small importance in comparison with the similar arrangement of both assets and liabilities and with the surety of the proper content of each group. The thing to be sought is the arrangement which will facilitate comparison of similar groups. A rather serious objection to the “fixed to current” arrangement is that it almost invariably necessitates the separation of the net worth elements. Thus, capital stock and long-term bonds are grouped together at the top for comparison with the fixed assets; the remainder of the net worth—surplus and reserved profits—must be shown at the end. The group of all net worth items together compels a general scheme of logical grouping from current to fixed.

A difference as to order is also found in the placing of deferred charges to operation. Regardless of the scheme of general grouping, one frequently finds the deferred charges placed as the last group. This also seems illogical. Only items of prepaid operating expenses should be included in that group. Such prepayments, while made in the one period, are properly chargeable to the next. Their effect, therefore, is to bring about a saving of the cash and other current assets for other uses during the next period. They are thus nearly related to the current group and could without any serious violation of principle be included thereunder. For the sake of emphasis and a more open showing, they are best shown in a group by themselves immediately following the current assets.

The intangible assets, good-will, franchises, patents, etc., are usually included among the fixed assets. Where so shown they should be given unmistakable titles and are best set up at the end of the group so as not to be covered and lost among the other items. A suggested scheme of grouping which will make an intelligent showing for most purposes follows:

========== | _Assets_: | _Liabilities_: 1. Current Assets | 1. Current Liabilities 2. Deferred Charges to | 2. Deferred Income Operation | 3. Fixed Liabilities 3. Investment of Reserves | 4. Permanent Investments | _Net Worth_: 5. Fixed Assets | | 1. Capital Stock | 2. Reserves of Profits | 3. Surplus |

The content of these groups and any further explanations necessary are treated in the chapters which follow, where the detailed application of principles is discussed.

As stated above, the important desideratum is a like arrangement of groups to facilitate comparison and care to secure the proper content of each group. Within the group itself, while the arrangement of the items is not so important, the principle of degree of liquidity should govern here too. Whatever the order of general arrangement of the groups, the same order may well be observed for the items within the group.

Report and Account Forms

Something should be said with regard to the merits of the two methods of arranging the three main classes of items, i.e., assets, liabilities, and net worth, on the balance sheet. As previously stated, the method known as the report form makes a vertical showing of the classes, while the account form shows the items in parallel columns. The one lists the assets and from their total shows the subtraction of the total liabilities which are in a subjoined list. This difference, representing net worth, is explained in detail as to the portion represented by capital stock, surplus, etc. The account form method lists the assets in one column and the liabilities and net worth in a parallel column, bringing about a balancing of the two columns.

For the report form, it may be said that this method follows the reasoning of the average business man, particularly the man unacquainted with accounts, who subtracts his liabilities from his assets to find how much his present net worth is. The account form rests on the fundamental desire, deep-rooted in the system of double-entry bookkeeping, to show the two sides in balance. It may be looked upon as the technical form and therefore well adapted for publication purposes. It secures also a convenient juxtaposition of groups for purposes of comparison. The one may be regarded as non-technical, easily within the intelligent grasp of the layman; the other as technical and addressed to those trained to read that form of statement. As previously stated, any method of showing which fails to list separately the three distinct classes of assets, liabilities, and net worth is not usually to be justified; a

mixture of net worth and liabilities is bad. Omitting detail, the two following type forms meet the conditions laid down above:

REPORT FORM OF BALANCE SHEET _Assets_ Current Assets: Cash $..... Receivables ..... Stock-in-Trade ..... $..... -------- Deferred Charges to Operation: (See Schedules) ..... Investment of Reserves: Sinking and Other Funds Permanent Investments: (Held for purposes of control) ..... Fixed Assets: Plant $..... Equipment ..... Good-Will, etc. .... -------- -------- Total Assets $.....

Liabilities Current Liabilities: Notes Payable $..... Trade Creditors ..... Accrued Expenses ..... $..... -------- Deferred Income: (See Schedules) ..... Fixed Liabilities: Bonds $..... Long-Term Notes .... -------- -------- Total Liabilities ..... -------- $..... _Net Worth_

Represented by: Capital Stock $..... Reserves of Profits ..... Surplus ..... -------- Total Net Worth $..... ========

ACCOUNT FORM OF BALANCE SHEET ==========+========== | _Assets_ | _Liabilities and Capital_ | Current Assets: | Current Liabilities: Cash $.... | Notes Payable $.... Receivables .... | Trade Creditors .... Stock-in-Trade .... $.... | Accrued Expenses .... $.... ---- | ---- Deferred Charges to Operation: | Deferred Income: (See Schedules) .... | (See Schedules) .... | Fixed Liabilities: Investment of Reserves: | Bonds $.... Sinking and Other Funds .... | Long-Term Notes .... | ---- ---- Permanent Investments .... | Total Liabilities $.... Fixed Assets: | Plant $.... | Net Worth represented by: Equipment .... | Capital Stock $.... Good-Will, etc. .... | Reserves of Profit .... ----- ----- | Surplus .... | ---- | ---- Total Assets $.... | Total Liabilities ==== | and Capital $.... | ====

Valuation Accounts

Nothing has been said thus far concerning the showing of valuation accounts on the balance sheet. Two different practices are met with. Sometimes such accounts are listed with the liabilities, and there is a sense in which they may be regarded as liabilities. Rather, however, they should be looked upon as credits to asset accounts, held temporarily in suspense until they can be definitely allocated to their assets. They are offsets to show the _appraised_ values of the various properties. As such, therefore, they are best shown as deductions from their corresponding assets with the appraised value full-extended. This applies to both the debit and the credit valuation accounts. A full discussion of these and other reserves is given in Chapter XXIII.

Statutory Requirements as to Frequency of Balance Sheets

Excepting in the case of corporations, there are few, if any, compulsory regulations governing the frequency of balance sheets. Some of our tax laws have brought about an increasing regularity with regard to the issuance of formal statements, both balance sheet and profit and loss. England, France, and Germany require a formal statement from corporations once a year. In this country, most states require some form of statement but oftentimes the requirement is so indefinite or so inadequately or half-heartedly enforced that the statement submitted is of little value. On the other hand, some classes of financial and public service corporations are required to present full and adequate reports periodically, at least once a year. In the case of national banks five reports are asked for; in the case of savings banks in some states two reports are required.

Condensation of Information in the Balance Sheet

The relation of the formal balance sheet to the post-closing trial balance needs further consideration. It has been stated that a post-closing trial balance is essentially a balance sheet. As the purpose of the latter is to present a bird’s-eye view of financial conditions, much of the detailed information shown in the post-closing trial balance must be condensed and consolidated with similar items, so that only totals are shown on the balance sheet. Just as the purpose of the ledger is by a process of analysis to secure detailed information for use in the current control of the business, so the balance sheet by losing sight of the detail and by setting forth the fundamental currents of business life and health, provides the data for the larger aspects of control. How far this process of condensation should be carried depends largely upon the use to which the balance sheet is to be put. A statement of financial condition to be issued to the public—stockholders and outsiders—can well omit data which would be required for internal use. Care must always be taken in condensed statements to avoid consolidation of detail in such a way as to render the statement misleading. The English Companies Act of 1862 provided that the “auditors’ report should state whether in their opinion the balance sheet was a ‘full and fair balance sheet’ containing the particulars required by the company’s Articles and ‘properly drawn up so as to exhibit a true and correct view of the company’s affairs.’” This represents the proper attitude for every accountant to assume in the making of statements. This is not meant to require the publication of information which is the private property of the business.

The phrase, “full and fair,” must be interpreted to mean sufficiently full, and only so much so that it will be fair to both parties. The company is entitled to withhold legitimate information the publication of which would be detrimental to it, and not to do so would be unfaithful to the proper guardianship and protection of its interests, and this in turn would bring about dissatisfaction with the management and oftentimes ill-feeling among the owners.

Use of Supporting Schedules

By means of supporting schedules, as illustrated and discussed briefly on pages 411 and 412 of Volume I, it is possible to carry condensation to almost any desired degree and still have available all necessary detail in the accompanying schedules. What items in the balance sheet should be supported by schedules and what should not, must be determined by the conditions peculiar to each case. Here again, the determination rests largely upon the use the statement is to serve. The informational content is therefore largely dependent upon the purpose for which the statement is drawn.

Balance sheets may serve any one of the following purposes:

1. Internal use by proprietor or manager. 2. Formal report to stockholders. 3. As a basis for application for credit. 4. For publication or report to regulating or supervising commissions. 5. For annual report to the state. 6. For advertising purposes to float new issues of bonds, preferred stock, etc.

When used for some of these purposes, oftentimes condensation is made a convenient method of bringing about a misrepresentation of true condition. Of course, no justification can be found for this.

Emphasis has already been placed on the necessity of choosing titles and captions which shall indicate clearly the nature and content of the transactions or data recorded thereunder. Statements of condition which are misleading, whether with intent or by chance, are to be condemned. As H. R. Hatfield[10] so well summarizes, the lack of clearness and consequent misunderstanding of the balance sheet are due in the main to three causes: (1) vagueness of terminology; (2) purposeful misrepresentation; and (3) the very nature of accounting itself which so largely rests on estimates rather than on facts of definite determination. Some of these troubles have their origin in the form of the balance sheet, the manner of showing the items; while the others inhere in its content. It is to a study of the content of the balance sheet from the standpoint of the statement of values, with the emphasis on quantitative analysis, that we now turn.

[10] In “Modern Accounting.”

CHAPTER V

GENERAL PRINCIPLES OF VALUATION

Content of the Balance Sheet

The problems of content and valuation strike at the very heart of the balance sheet. Form, framework, and method of presentation are important and their usefulness should not be discounted. Particularly is this seen to be true from the standpoint of availability of the information presented and facility in its interpretation; but the meat of the balance sheet is its content. In connection with this, two points demand consideration, viz.: (1) what items shall be admitted to a place in the balance sheet; and (2) on what basis shall they be admitted, this latter being the problem of valuation.

The first question can be answered without much trouble. All properties owned and all liabilities incurred must find a place in the balance sheet. The properties belonging to a business include both the tangibles and intangibles, rights and claims. Most of these have cost value, some may have been gifts. All the assets must, therefore, be listed. Similarly, the liabilities, all those things which represent debts owed by the business or established claims against it, must be given place in the balance sheet. Neither from the assets nor the liabilities must there be allowed omission. As stated in Chapter IV, as to content, the balance sheet must be “full and fair.” Some classes of items, known as _contingent_ assets and _contingent_ liabilities, will be discussed and their place determined as they are met. The net worth items, in whatever detail desirable, must also be included.

Valuations for Rate Regulation

The second problem as to the basis on which items shall be valued for the balance sheet is our chief problem. The general question of valuation may be viewed from so many points that definition of its meaning here is necessary. Principles that are

applicable to valuations for one purpose frequently cannot be made to serve another purpose. Because of the agitation in recent years relative thereto, when the problem of valuation is mentioned it is associated almost invariably with public service corporations. Most of the so-called valuation work has been done in connection with railroads, water companies, gas and light companies, etc. Here the issue of regulation is involved. Regulation of rates is price regulation and therefore regulation of profits. The purpose of valuation in connection with public utilities is the determination of the amount of investment on which rates must be so regulated as to secure a return based on fairness and equity to all parties.

Where such valuations have been made they have not proven entirely satisfactory and it is placing too great faith in human kind to expect the satisfaction of all parties with the results of any valuation. Where the properties involved have not been exceedingly complex and have been fairly well localized, results have seemed to justify the effort; but in the case of a large and complex plant covering widely separated areas and serving many and different communities, as is the situation with railroads, in the minds of many the results obtained in such instances are of doubtful value when compared with the effort and cost expended. Though much can be learned from such valuations, the principles underlying them differ at many points from those which must control in valuations as applied to commercial balance sheets. It is in connection with public service valuations that very valuable studies of the depreciation problem have been made.

Valuation for Sale and Purchase

Again, valuations and appraisals are often made in cases of prospective sale and purchase negotiations. While most of the determining principles are the same, not all apply to our problem of going concern valuation. Thus, the plant to be purchased may not be continued in its present use but must be adapted to other uses. Results secured towards controlling the market by means of this purchase may make the plant much more valuable than its physical worth. Elements of “going concern” and good-will call for valuation in the case of a purchase and sale transaction and are frequently not present in commercial balance sheet valuations. These last questions touch closely our problem and will receive careful consideration in their proper places.

Other Kinds of Valuations

There are several other kinds of valuations, all more or less closely related to commercial balance sheet valuations but differing from them in some respects because of their differing purposes and ends sought. The chief of these are: (1) valuations for purposes of fire loss adjustments; (2) valuations for purposes of liquidation to satisfy creditors and determine the owners’ equities, as in bankruptcy and voluntary dissolutions; and (3) valuations for purposes of taxation. In all of these cases, many points of similarity to, and of some differences from, our present problem are found. In the first and third kinds enumerated, there is marked similarity, but the problem in the case of the income tax is not so broad. In the second kind, the problem is entirely different, as values have to be determined on the basis of forced sale.

Going Concern Valuation

The kind of valuation to be treated here may be called “going concern” valuation. By that will be meant the values at which the various items shall appear in the balance sheet when viewed from the standpoint of a concern which expects to continue operations—a going concern as contrasted with one which is facing dissolution, reorganization, sale, or other eventuality. As stated above, the principles of going concern valuation are not distinct and separate, except in a few instances, from those governing the other types of valuation referred to. Oftentimes they are the same principles applied in the same way because the purpose is practically the same; again they are the same principles but applied differently in order to serve different purposes; and finally they are sometimes entirely distinct principles because the purpose to be served is entirely different.

It is not purposed in this treatment of valuation to set forth the points of variance and sameness with the other types; that is beyond the scope of the present volume. Endeavor will be made to set forth clearly underlying principles and their detailed application to the chief items met in the average balance sheet as viewed from the standpoint of a going concern. Elsewhere, notably in Chapter XXXV, some principles of another type of valuation will be discussed.

In any consideration of valuation, it is necessary to seek out the sources and kinds of value to determine in the one case its basis, and in the other to establish the type of value applicable to the given conditions. Value is not of spontaneous origin; it cannot be created out of nothing. Here it is not intended to search for causes of value or to inquire into the forces back of them. The author is content to leave that to the economist.

Kinds of Value

Various kinds of value are established facts of the world of business and by their sources, as the term is used here, is meant the information which vouches for or establishes the fact of value, rather than a search for the cause of it. Thus we find, among others, the following kinds of value:

1. Cost value 2. Market value 3. Sales price value 4. Reproduction cost value 5. Scrap, salvage, junk, or break-up value 6. Service value 7. Present or depreciated value 8. Tangible or physical value 9. Intangible value 10. Taxable value 11. Earning value or earnings-capitalized value 12. Liquidation or forced-sale value, etc.

It is to be understood that these various kinds are in no sense mutually exclusive and separate; they are met in the common vocabulary of men of affairs, are construed loosely in most cases, but have quite technical connotations in some places. Any of the terms employed here will, whenever necessary, be defined. Thus, in accounting, by cost value is usually meant full cost of a product or other asset in position ready for its intended use.

Source of Data as to Values

The sources of data as to values are several. Where double-entry books are kept, the original cost of the various assets can usually be secured from the books of account, barring errors of principle and omission in making the record. If not found there (as is often the case where single-entry books are kept), the original purchase invoice gives the chief item of cost, but does not usually show any inward-carrying or placement costs. Where there is a formally established market, this may give the information as to value when no book entries are available. Quoted prices in trade catalogues or lists as of the date of purchase, offer another means of procuring the information. Sometimes, even the memory must be relied upon.

Present values of properties purchased formerly may be determined on the basis of original cost adjusted to take cognizance of depreciation and, sometimes, of appreciation. This adjustment is made in the light of the best available experience. The amount of the adjustment is sometimes called an “experience figure.” Stated otherwise it is an _estimate_ made on the basis of past experience with some regard to future contingencies. This estimate may be made by some one within the organization—manager, owner, etc.—or by regular appraisal companies who specialize on this kind of work. Usually, however, the appraisal company bases its value on present cost less depreciation—a reproduction cost value.

Again, for some purposes the statement of earnings as giving the amount to be capitalized becomes the source of values. As has been seen, however, earnings themselves contain many elements which rest on estimated values. In almost all instances there is an element of speculation—an estimate—in the determination of values.

Cost Value the Usual Basis

The values which are, for the most part, shown in the commercial balance sheet are cost value or adjusted cost value. Occasionally, values which bear only an indirect relation to cost must be taken into account. The determination of cost value is sometimes a comparatively simple matter, as where the source is a purchase invoice, but more often it involves numerous other costs in addition to those shown by the purchase invoice, both definite and indefinite, i.e., estimates. It is in connection with the determination of cost that the proper segregation of the so-called capital and revenue charges is of vital importance. An effort will be made to formulate the distinction between them so as to give a working rule for their determination under most circumstances.

Definition of Capital and Revenue Expenditures

Capital expenditures may be defined as expenditures of funds or other assets on capital account. In accounting language, they may be said to be those expenditures which result in charges to some asset account. They may sometimes ultimately result in a charge to a liability account by the conversion of the asset to the decrease of the liability. Expenditures of capital may be made on account of expenses. This can occur only when revenues are insufficient to meet all expenses. Such expenditures of capital bring about an impairment of capital. As the term is generally used, however, capital expenditures have the meaning first given.

Revenue expenditures may be defined similarly as expenditures of funds or other assets on revenue account. That is, such expenditures must be booked as charges to expense accounts. They represent the expenses incurred in the earning of the revenue, and measure its cost. Just as the original capital fund, through its expenditure, must provide the plant and equipment with which to work, so the other expenditures necessary to prepare and market the product must provide the revenue out of which to

meet these expenditures and secure a margin of profit; else there is encroachment upon the original capital funds.

A few other terms need definition by way of differentiation from these. The term “capital receipts” is used to differentiate receipts of funds from the sale of capital stock or the sale of capital or fixed assets, from funds or other assets received from revenue or profits sources. Thus, upon the sale of any asset which was originally purchased out of capital, the receipts therefor must first be applied to take the place of the capital expended for the asset, and any balance not used for the first purpose is then a receipt of revenue.

The term “capital expense” is sometimes used to indicate the group of expenses incurred in providing the capital needs of the business. They are the financial management expenses as the term is used in Volume I. Opposed to capital expenses are the capital income or revenue items. These are the receipts or income from portions of the capital employed otherwise than in the purchase and sale of commodities; or the income which represents savings effected through the handling of the funds of the business as distinguished from income derived from the handling of stock-in-trade. They are _deductions_ from the financial management expenses.

Capital and revenue expenditures are thus easily differentiated on paper. It is in the application of the definition to situations as they develop in practice that difficulty is encountered. Some of these situations will be examined with the purpose of determining the application to them of the distinction between revenue and capital expenditure.

Organization Expenses

Upon the organization of a new enterprise the distinction between capital and revenue expenditures can usually be made without much difficulty. All costs incurred to put the concern in a position to earn revenue are properly treated as capital expenditures. Sufficient capital must be provided to put the undertaking on an earning basis, as otherwise it fails. These costs will include many items which upon their _second_ incurrence must be treated as expense charges because the revenue must provide for keeping the plant in a state of efficient repair. One group of capital expenditures, usually carried on the books under the title “Organization Expense,” is often treated as a revenue expenditure as soon as sufficient revenues have accumulated to care for them conveniently. This is discussed in detail in Chapter XVIII on intangible assets. It is sufficient to say here that upon their incurrence organization expenses constitute capital expenditures, for no other funds are available for the purpose.

Definition of Replacements, Renewals, Maintenance, etc.

Only after the concern becomes a revenue-producer is the chief difficulty encountered in determining the proper record as between capital and revenue. In all cases of new construction and additions to the existing plant or equipment, no question arises as to the legitimacy of such capital charges. But when replacement, renewal, or betterment of existing properties take place, difficulty is met in determining the portion chargeable to the asset and the portion to be charged against revenue. The dividing line between renewals and repairs, maintenance, and up-keep is a closely drawn one, and usually an arbitrary working rule suitable to conditions must be adopted by each concern. R. P. Bolton[11] gives for some of these terms very suggestive definitions which the author quotes in full:

[11] In “Power for Profit.”

“Maintenance is a process of continuous attention to, and supply of, operating necessaries, including solicitous observation of the condition of the object cared for, corresponding to the protecting shelter, clothing and food supplies to living beings, in order to maintain their functions in operating condition. It includes supplies which form part of the food of the appliance. Part of the labor in attendance on machinery is involved in this element of its care.

“Up-keep is a course of partial recreation, involving the expenditure of time and money in anticipating causes of decay, of failure, or of possible injury to the object under care, corresponding to hygienic and recreative methods, often involving considerable expenditures without apparent direct results, which are or should be followed in safeguarding the general health and strength of human beings. Thus, welfare and recreation of employees is a justifiable expense of an industry. It is part of the cost of the human machine.

“Repair is the course of partial reconstruction, replacement, or renewal of worn or of injured portions, after the necessity therefor becomes apparent, and, unless brought about by accident, the need for the process is brought about by the failure or inability of maintenance, and also of up-keep, wholly to arrest the progress of decay by age or continued use. Provisions to preclude accident or to cover the cost of its results are part of the cost of repair. Health insurance of employees is a repair cost paid in advance.”

While these definitions were not intended for accounting purposes and are not fully applicable thereto, they call attention to the basic ideas of the terms. The distinctions are in some cases too finely drawn. For accounting purposes the title “maintenance and repairs” usually gives sufficiently detailed information. Repairs is a part of the process of maintenance, as is also renewals. Maintenance, from an accounting standpoint, may be defined as “the act of keeping a property in condition to perform adequately and efficiently the service for which it is used.” A. Lowes Dickinson[12] defines repairs and renewals as follows:

[12] In “Accounting Practice and Procedure.”

“Repairs. This should include all current expenditures recurring from day to day and from month to month on the general up-keep of the existing property without the renewal of any substantial part thereof, and generally all periodic repairs which are necessarily undertaken within, say, one year.

“(This caption will, of course, include certain renewals of small parts, etc., such as would be necessary to continue the useful life of any unit of building, plant, or machinery over the estimated period of its life.)

“Renewals. This should include all expenditures incurred in renewing, in whole or in part, any unit of building, plant or machinery, which tend to extend its useful life beyond the average term. These expenditures would in general be those which would only occur at long intervals of two or three years, and whose effect would last for a number of years afterwards.”

As distinguished from renewals, a replacement may be defined as “the act of replacing a plant unit which is going out of service, with a _substitute_ which may be either identical with the unit replaced or different from it.” In accounting terminology the terms “renewals” and “replacements” are for the most part used synonymously and will be so used here.

Treatment of Renewal of Parts

In the maintenance of a property in efficient condition, repairs and renewals are constantly taking place. When for an old part or plant unit a new one is substituted, the question of betterment immediately arises. If an old machine with book value of $500 is replaced by one costing $750, the excess of $250 is classed as a betterment and is properly a charge to capital. A renewal of machine _parts_ cannot be handled so easily. The parts of a machine are subject to diminution in value due to wear, tear, and obsolescence, along with the machine as a whole. The machine was purchased for a lump sum. What portion of the cost is applicable to each individual part is difficult to determine and must usually rest on estimate or guess. Similarly, the book value, i.e., the present depreciated value of a part, is not accurately known. Accordingly, the amount of betterment, if any, in the replacing of an old part by a new part is difficult to determine. It is here that working rules must be adopted for each concern.

Thus, it has been suggested that only when the renewal involves an expenditure of $5 or more should there be any attempt to determine the amount of betterment, every expenditure under $5 to be charged to expense. In an establishment of any size this is altogether too small an amount. The Chicago Traction System through its board of supervising engineers has established $200 as the minimum charge to capital or renewals. All transactions involving even a true betterment, if the amount is less than $200, are to be recorded as maintenance charges. As a means of simplifying the accounting, a working rule, with a minimum capital charge adapted to the conditions of each concern, serves a practical and useful purpose.

Treatment of Cost-Cutting Changes

Other kinds of expenditures which cause trouble as to their proper place of record are those incurred for the purpose of facilitating the handling of the work. They may result in an increase of capacity to earn revenue through a speeding up of production, or the result may be simply a lessening of the expense of turning out the various units of product. A test frequently applied in such cases is that of increased earning capacity. It is argued that even though nothing tangible which did not exist before has been added to the plant, there has been a rearrangement of the factors of production with a resulting co-ordination of effort, and this has increased the capacity of the plant, thus making it more valuable. Inasmuch as this value is measured by earnings, the cost incurred in securing the increase is a very proper and legitimate charge to capital. Against this argument, it may be said that plant or structural changes are always made to improve operation. To make increased earning capacity the sole test is virtually to capitalize all expenditures of this kind—a policy which would soon lead to an unconscionable inflation of assets. Only by a policy of very liberal depreciation can such values if capitalized be kept within reasonable bounds. The impropriety of charging such expenditures to the current profit and loss account is generally acknowledged.

The best practice is to handle items of this kind as deferred charges under suitable descriptive caption, instead of as charges direct to the asset account where the nature of the items is soon lost from view and the need of a high depreciation rate to write them off is soon forgotten. Thus, a rearrangement of the machinery in a plant may bring about a more economical routing of the product, or the introduction of a new machine may entail an entirely changed disposition of existing machines—all for the purpose of, and actually accomplishing, a saving in costs. Rather than a charge of the costs incurred to the asset account Machinery, a setting of them up under the title “Rearrangement Costs of Machinery,” or other similar title, shows their exact status and makes possible an intelligent writing down of them periodically in accordance with the estimated life or continuance of the savings effected. Practically this amounts to treating the costs as capital expenditures if the saving effected is judged applicable to more than the current period. The chief difference is that booking such items as deferred charges calls for specific attention to the need of a speedy writing off.

Asset Subject to Depreciation a Deferred Charge to Operations

In this connection it may be pointed out that the cost of all assets subject to depreciation may well be looked upon as deferred charges to operation, some portion of that cost being charged off at the close of each fiscal period. “So we see that capital expenditures, as distinguished from expenses, are at last an arbitrary conception. It begins with the idea that certain expenditures have an efficiency which reaches over many earning periods extending indefinitely into the future. But nothing physical would last so long, and its earning power might have even less permanence. To meet this condition we arbitrarily designate certain expenditures whose effect indefinitely outlasts the immediate earning period as ‘capital,’ and then in the same arbitrary way, through all subsequent vicissitudes, we hold them to their first value by maintenance, renewal, and depreciation charges which are borne by other expenses.”[13]

[13] “Handbook of Railroad Expenses,” by J. S. Eaton.

Authorization for Booking Capital Expenditures

As regards a suitable method for handling transactions which involve a separation into capital and revenue charges or a determination of the status of the transaction as between capital and revenue, proper authority should be secured for making the expenditure. Where possible, before its incurrence, authorization as to its proper booking should be given, even to the amounts where feasible, and this order becomes thus the voucher supporting the entries on the books.

Repairs on Second-Hand Plant

In one situation repair charges which are ordinarily an expense must be capitalized. Where a company takes over a plant which is badly run down and out of repair, the expenditures necessary to bring it to a state of efficient operation are capital expenditures. Such a plant resembles a partially completed plant, and the purchase price is supposed to take that fact into consideration. It is expected that additional capital will have to be sunk to rehabilitate the property and put it in a condition of repair necessary to earn revenue. Accordingly the expenditures necessary to do this are rightly treated as capital charges.

Construction Costs

A final consideration in the distinction between capital and revenue expenditures has to do with certain costs incurred during the period of original construction. We may cover the situation by a general statement to the effect that all costs necessary to produce a complete plant in condition ready to earn revenue are proper charges against capital. Thus, interest on moneys borrowed for construction purposes is a proper charge to capital, and in England it has been held that dividends in the form of interest are allowable to _shareholders_ during the construction period. Also, such items as engineering and superintendence, law expenditures, injuries, taxes, etc., both preliminary to the construction period and during it, are to be capitalized. On the other hand, profits on own construction work are never to be counted as costs. To do so reveals a misunderstanding of the difference between a profit and a saving. The matter is discussed more at length elsewhere.

As to whether any portion of the overhead expenses has a rightful place among the assets must be determined by the conditions in each case. In original construction work, before operations begin, all overhead charges constitute a part of the cost of the assets. For betterment work and additions carried on concurrently with operation, the case is not so clear. A safe principle is to treat as capital charges all increases in overhead above what would normally have been incurred for operation only. To free operation of any portion of the _regular_ overhead just because betterments are in progress is not recognized as a sound or conservative policy.

Distinction between Capital and Revenue Expenditures often Based on Opinion

Thus it is seen that many phases of the problem of capital and revenue expenditures are extremely difficult of determination and in their final analysis rest on estimates and opinions rather than definitely established facts. Too often it is feared that decision in matters of this kind is “influenced by unsuspected individual caprice and by considerations of the financial convenience of the moment”; for the allocation of such items may sometimes represent the margin between a profit or a loss for the current period. As is said to be true of geometry, so here there is no royal highway to the solution of these problems.

Main Groups of Asset Items

If, therefore, it can be determined what items are to be included in the balance sheet and the proper basis for their valuation can be established, the problem as to its content is well on the way to solution. Having discussed the elements and factors entering into a determination of cost value, we are in a position to state the principles of valuation applicable to the main groups of items as set up in the balance sheet. These may be listed, for the purpose of this generalization, under three heads, viz.: (1) current assets, (2) deferred charges to operation, and (3) fixed assets.

1. For the current assets, the principle of valuation may be stated as valuation on the basis of cost or market, whichever is the lower. Since speedy realization of the current assets by conversion into cash for its equivalent is the aim and expectation of every business—for on such conversion depends the ability to meet the current liabilities and so have working capital available for another cycle of purchase and sale (another turnover)—it would seem that the realization price as given by the market should govern. In the interest of conservatism and as producing certain other desirable results which will be brought out as each asset is examined in detail, cost price, if lower than market, is deemed the desirable basis for the valuation of this group. By way of explanation, it should be said that working capital as used here is the difference between current assets and current liabilities and so represents the portion free to be put to the further pursuit of business.

2. The principle of valuation involved in deferred charges to operation is simply the principle of equitable prorating between periods on the basis of a going concern. Here, not sale value, cash surrender value, or forced sale value govern, but their value to a concern which expects to continue operations.

3. For the fixed assets, the principle of valuation generally applicable may be stated as valuation on the basis of cost less depreciation. This group of assets represents the properties held for operating and without which operation could not continue. They are the very essence of the enterprise. Disposal of them would mean abandonment of the undertaking. Hence they are not held for realization and conversion into cash, and in a going concern market value has no effect on them. To a going concern they are worth at any time what they cost less the portion used up in operations to date. Therefore valuation at cost less depreciation is the proper basis for showing the fixed assets in the balance sheet.

Valuation of Liability Items

To the liability items of the balance sheet, principles of valuation are not directly applicable as such, except so far as content or inclusion and measure of quantity or amount may be said to embody considerations of valuation.

Over- and Under-Valuation

The need for correct valuations requires no comment and can best be appreciated as compared with the effects of over- and undervaluations. Particularly bad and harmful is overvaluation of the assets and undervaluation of the liabilities. The use of the balance sheet as an index of financial condition makes apparent the harm of wrongful content or valuation of the items entering into it.

The Balance Sheet an Expression of Opinion

It is thus seen that the main problem in connection with the presentation of a true balance sheet is a problem in valuation and content rather than form. From what has been said it will be evident that valuation in the vast majority of cases is not an exact science—a process of definite determination. Rather, from the nature of the data to be handled and the principles of valuation given as applicable to the various groups of data, valuation must almost always be an estimate. The determination of the value of the elements of cost, the proper differentiation between capital and revenue charges, and finally the calculation of the amount of

depreciation necessary to the valuation of fixed assets—all are estimates. It is true, they are estimates based on experience, but, from their nature and the influence of local conditions in a given case, no universally applicable law of experience can be formulated. It is safe to say that two men would seldom, if ever, arrive at the same estimate of the values of given assets. Accordingly the conclusion is reached that a balance sheet is not a statement of fact but always an expression of opinion. If estimates are carefully made in the light of all available facts applicable thereto, the expression of opinion in the balance sheet will approximate as nearly as may be to a statement of fact.

Because depreciation plays so important a part in making these estimates, it seems necessary, before setting forth the detailed application of the principles of valuation to the various assets, to devote several chapters to a full discussion of the subject, chiefly as it is related to the problem of valuation but also in some of its correlated aspects.

CHAPTER VI

DEPRECIATION—ASPECTS AND DEFINITIONS OF TERMS

Aspects of Depreciation

Depreciation is intimately related to practically all problems of valuation. The engineering profession has made many valuable investigations and contributions to the literature of the subject and constant reference to them and use of some of their findings will here be made. Most of their studies relate to the vexed and still unsettled question of the valuation of public utility properties for the sake of its bearing on the problem of fair and equitable rates to the user or consumer. Accordingly much of this material is not applicable to the accounting phases of the subject. It is purposed here to treat the question from the standpoint of accounting rather than that of engineering.

Depreciation may be considered from many viewpoints. It is involved in the problem of rate-making referred to above; it must be considered in the valuation of fire insurance adjustments; it is bound up with most questions of taxation, with all transactions involving the purchase and sale of enterprises, with negotiations for the procuring of loans, for the determination of the limitation of capitalization; and in all studies of commercial balance sheets depreciation is found to affect the value of going concerns. As stated in Chapter V, these are not always separate and distinct problems of valuation; they may and often do overlap, one basis for valuation sometimes serving several of the purposes or classes named above. The treatment of the subject will be limited in this book to the latter phase of the subject, i.e., going concern valuation, with the object of establishing certain norms and differentiating this phase of depreciation clearly from its other relations.

Definitions

A clear-cut definition of depreciation is desirable. The word in a general sense means a lessening, a decrease in value; decretion; deterioration. Various specific definitions are given, among them being: “the loss, arising from years of service, in the value of the investment in perishable property”; “expired capital outlay.” These and many other similar definitions are met with.

The term “depreciation” is frequently used when the term “amortization” would be more appropriate. R. P. Bolton[14] says: “The subject of depreciation has been greatly misrepresented, because depreciation, which is a financial result, has been confused with obsolescence, which is an economic process, and with deterioration, which is a physical condition. Either of the latter brings about depreciation, and the physical process rarely happens to be more rapid than the economic.

“An illustration of the processes involved is that of the physical deterioration and obsolescence of a work horse, the capacity of which is definitely connected with its condition, and the value of the labor of which is discounted by its up-keep and the cost of its supplies and feed. Its age is productive of reduction of capacity, but this process may be, and often is, anticipated for commercial reasons by its supersession by some other form of apparatus. The horse may be in ever so good a condition at the time when the motor displaces it, but its financial depreciation then is complete, for it could be maintained only at a loss. All the elements which come into consideration in connection with machinery will be better understood if considered in relation to such an animal, the life of which may readily extend beyond the point at which its commercial value has terminated.”

[14] In “Power for Profit.”

Authoritative Opinions

The special committee appointed by the American Society of Civil Engineers for the purpose of formulating principles and methods for the valuation of railroad property and other public utilities, after a study of the question covering a five-year period, presented its report at the annual meeting of the society, January 17, 1917. The question of depreciation receives full and serious consideration in this report, which although treated mainly from the rate-making standpoint offers many suggestions for the valuation of commercial balance sheets. Their statement reads:

“Perhaps there is no single subject in connection with valuation that has caused more trouble than depreciation. This has been due to various causes, perhaps not the least of which has been confusion in the use of the term. Depreciation is sometimes used to mean decretion, which is loss of service life; sometimes to mean the money allowance made in the bookkeeping to offset accruing loss of service life; and sometimes the loss of value existing at any time due to the loss of service life or any other cause. The committee will use it only as meaning the loss of value or worth of property units which are parts of going concerns. Although this may be due to many causes, the general discussion will include consideration only of those effects which, like wear and tear, age, use, and obsolescence or inadequacy, bring a physical property unit gradually to the end of its service life.”

Earl A. Saliers[15] says: “This loss of value, whether tangible or intangible in form, resulting from physical decay, or from obsolescence or inadequacy, which indicate functional decay, is known as depreciation. It necessitates repairs, renewals, and replacements. Did it not occur, every outlay on plant would add to the investment. It does not result from one cause but from many causes, and this sometimes leads to the belief that it cannot be scientifically handled. But some adequate method of handling it is not merely desirable, but necessary, to a solution of the problems arising in the valuation of public utility properties, and in the management of industrial enterprises generally.”

Henry Floy[16] says: “It (depreciation) is used broadly to mean a reduction in utility value, expressed as a percentage but more usually in dollars, due to any deterioration in physical plant by reason of: (a) normal wear and tear, (b) age or physical decay, (c) inadequacy, (d) obsolescence, (e) deferred maintenance. The term depreciation, always used in connection with a reduction in value, has, however, four distinct and separate shades of meaning, so that the term must be qualified when used in order to distinguish which one of the following meanings is intended:

[15] In “Principles of Depreciation.”

[16] In “Value for Rate-Making.”

“First. The annual amount, expressed as a percentage or in dollars, that should be laid aside to renew or replace the article in question at the time of its abandonment.

“Second. The annual amount, expressed as a percentage or in dollars, that should be laid aside to renew or replace the article in question at the time of its abandonment, plus the annual expense of maintenance and repair expended in removing such part of depreciation as is practicable and good economy.

“Third. The total amount—usually that estimated as necessary to be expended to put the physical property in perfect operating condition—determined by the inspection and observation of an experienced engineer, expressed in a percentage or in dollars, which must be deducted from the ‘original cost’ or the ‘cost to reproduce new,’ in order to determine the absolute, actual, present value.

“Fourth. The total amount—it may be the sum of several years of depreciation—computed from ‘expectancy of life’ tables, more or less authoritative, expressed in a percentage or in dollars, that must be deducted from the ‘original cost’ or the ‘cost to reproduce new,’ in order to obtain the theoretical, present, depreciated value. This value may be increased or reduced by the condition of the property, as determined from inspection.”

The foregoing quotations from authoritative sources not only show the efforts made to define the term accurately, but also indicate the various elements included by different writers under the term, and suggest the need of further effort toward the standardization of its meaning.

Why the Depreciation Factor Arises

The distinction made in Chapter V between capital and revenue charges draws attention to the fact that the depreciation factor arises only because the fiscal or other period when information concerning values and costs, i.e., financial condition, is desired, does not coincide with the expiration of service life of the properties used in production. If the information just referred to were not

desired at intermediate periods between the date of acquisition of the asset and the date of its discard or obsolescence, its cost should be treated solely as an expense of operation to be charged to the whole period in the same way that the fuel consumed, the raw materials used, etc., are regarded as revenue charges, or costs of manufacture. Practically, therefore, depreciation must be considered because a statement of financial condition is needed at regular stages of the life of the enterprise; and furthermore because the life of the various assets used in an undertaking is not uniform in length and their life histories in consequence overlap. Some assets wear out and have to be replaced, while others have still many years of useful service in them.

Actual or Absolute Depreciation

Before considering the various elements of depreciation, an explanation of some related terms will be given. A distinction is sometimes made between “absolute or actual” and “theoretical” depreciation. Absolute depreciation is the decrease in value of an asset from its state when new, to its present condition _as viewed either from the standpoint of the amount it could be sold for_ or from the standpoint of its serviceability. In the first place, therefore, absolute depreciation is not applicable to going concern valuations. A machine after only a short term of service becomes, from the standpoint of its salability, a second-hand article and suffers a large decrease in _market_ value. A water-pipe or an underground telephone cable immediately after its installation and even before it is brought into service depreciates materially from the standpoint of its salability as a disconnected unit. But from the standpoint of service and operations, i.e., adaptability to its intended use, such an asset may really be more valuable than before or immediately after installation. Again, an asset because of the excellent state of repair in which it is maintained may, so far as the serviceability required of it is concerned, be practically as good as new from the date of its installation until well along towards the end of its life-term. Its actual or absolute decrease in value is very slight during the early years of its life but increases rapidly just before it is discarded. This fact is illustrated by the example of the water-pipe. Slight repairs, the replacement of parts and small units, keep it for a long period 100% efficient, but the time comes when it is completely worn out and repairs are no longer economically advisable. These two examples illustrate absolute or actual depreciation.

Theoretical Depreciation

Theoretical depreciation is based upon, and has reference to, _all_ the factors which must be considered in taking account of depreciation. As so considered the subject is viewed from the standpoint of financing the item of depreciation (sometimes called “accounting depreciation”) rather than from that of its serviceability. The engineer attempts to determine the actual, present serviceability of the asset in comparison with its serviceability when new, and so he leaves out of account its expectancy of life due to whatever causes.

Comparison of Actual and Theoretical Depreciation

The following chart adapted from Henry Floy’s “Value for Rate-Making” admirably illustrates the difference between actual and theoretical depreciation.

[Illustration: _Chart Showing Actual and Theoretical Depreciation_]

Curves 1, 2, and 6 representing actual depreciation have been sufficiently exemplified in the foregoing explanation of actual depreciation. Curves 1 and 2 may well represent the actual depreciation of two assets as viewed from the standpoint of salability; whereas curve 6 represents the actual depreciation of an asset viewed from the standpoint of serviceability, assuming that maintenance has kept the asset practically 100% efficient during most of its life-term. Curves 3, 4, and 5 are illustrations of _theoretical_ depreciation, the different curves representing different bases for calculating the annual amount of the decrease in value, as will be explained in Chapter IX, “Depreciation—Methods of Calculating.” To quote from Mr. Floy’s work at length:

“The curves 3, 4, and 5 indicate several classes of ‘theoretical’ depreciation which have been quite widely used in some cases for estimating present values, but more often for determining the yearly theoretical deterioration for purposes of establishing depreciation funds, which, however, is quite a different subject. Making a theoretical estimate of the probable, future, average, annually accruing deterioration of certain property to provide an item in bookkeeping accounts of operating expense has nothing whatever to do, in making an appraisal, with fixing the definite amount of absolute, actual, or accrued depreciation which depends upon the present condition of physical property, determinable from inspection and not upon historical documents, depreciation funds, or disputed theoretical conclusions.”

In an opinion filed March 8, 1916, by the Public Service Commission of Maryland in the matter of the Chesapeake and Potomac Telephone Company of Baltimore City, an interesting commentary on the relative merits of actual versus theoretical depreciation is made. While the opinion concerns primarily depreciation from the rate-making point of view, it shows well the interrelation between the two kinds and answers so conclusively the objection often raised to accounting depreciation that it is here quoted. The statement is:

“Any theory for ascertaining existing depreciation in the plant of a public utility which confines such depreciation solely to the actual, visible, physical, demonstrable deterioration which can be seen by the human eye and measured by the human hand, must of necessity ignore that other species of deterioration which the experience of the past has demonstrated beyond peradventure exists in the property of every telephone company, although it cannot always be seen by the human eye or measured by the human hand. We refer to that tendency upon the part of all such property to become inadequate or obsolete with the lapse of time.”

“Accounting” and “Fair” Depreciation

Another distinction is sometimes made between “accounting” depreciation, previously mentioned, and “fair” depreciation or depreciation of valuation. Accounting depreciation signifies the depreciation, determined by whatever method, which has been taken into the accounts, i.e., the depreciation as shown on the books. This is approximately the same as theoretical depreciation defined above. Its point of view is that of financing the loss of value caused by depreciation so as to cover the entire loss by the time the asset is retired from active service rather than that of establishing a true actual value of the asset at intermediate periods. On the other hand, fair depreciation or depreciation of valuation is the “sum that should be deducted from original cost to date (or from estimated cost of reproduction new)[17] as a step in finding that which the courts have called ‘fair value.’” Here the point of view is essentially that of showing the true value of the asset at a given date. Determination of this is fundamentally an engineering problem in the solution of which cognizance must be taken of:

[17] Material in parentheses is the author’s.

1. Accounting depreciation. 2. The managerial policy as to repairs, maintenance, and renewals. 3. The past performance and expected future performance of the asset. 4. All other factors locally present which may affect the determination of the _present_, existing values in the asset.

Under certain conditions fair depreciation corresponds roughly with actual or absolute depreciation as defined above.

Complete and Incomplete Depreciation

Depreciation is sometimes classed as “complete” and “incomplete.” Complete depreciation refers to those assets or properties which have been discarded because no longer capable of economical service. When their cycle comes to an end, depreciation is complete. Incomplete depreciation refers to the amount of the decrement in value of assets which are still in service. The accounting for complete depreciation requires little consideration except so far as _rates_ of depreciation are concerned. This class of depreciation represents the accomplished fact and therefore furnishes data and statistics by which the _expected_ depreciation of similar new assets can be calculated. The accountant, therefore, is concerned with it purely as an experimental means of forecasting the future.

Individual and Composite Depreciation

Again, depreciation is classed as “individual or unit” and “composite.” Unit depreciation is the amount of the decrease in value of the individual parts which compose the whole of a property; composite depreciation is the amount of the decrease in value of the plant or property as a whole. Its amount in dollars is the sum of all unit depreciations similarly expressed. Expressed as a percentage it represents the effect of all unit depreciations weighted by the ratio of the value of each to the whole. Thus a plant as a whole may be depreciated 20%, but the numerous units of that plant may have a range of depreciation of from 0% to 100%. Some items may be ready to be discarded and others will probably have just been newly installed.

In connection with composite depreciation the term “normal” or “average” value is used. The normal value of a plant is the average value at which it must be maintained to give efficient service. Any drop below that point results in increased cost per unit of service rendered, and is consequently evidence of poor management. Normal value may sometimes be expressed in percentage as the difference between 100%, original cost, and composite depreciation. In the case cited above, where composite depreciation is 20% the normal value would be 80%, under a proper policy of management.

Physical and Functional Depreciation

Finally depreciation is classed as “physical” and “functional,” definition of which are deferred for treatment in Chapter VII, “Depreciation—Its Causes.”

Deferred Maintenance and Accrued Depreciation

Other terms needing definition are: “deferred maintenance” and “accrued depreciation.” The former refers to repairs which at any given time are needed for the proper up-keep but which for one reason or another have not yet been made. So long as an asset is giving reasonably satisfactory service, repairs are usually deferred to a convenient time—such as when work is slack, or until similar repairs may have accrued elsewhere, or until weather conditions have changed, or in general until the repairs can be most economically done. Similarly, accrued depreciation refers to the depreciation which has taken place between the last time an item was brought on the books and the present time. The inevitable forces causing depreciation are constantly at work bringing about the decretion of the asset day by day, but it is impracticable to reflect such condition daily. Only at the close of each fiscal period is it deemed necessary to adjust the books so that they reflect the depreciation which has taken place during the period just closed.

Attitude of the Law

Before studying the factors of depreciation it is interesting to note the attitude of the courts towards depreciation. Accountants and engineers recognized the necessity of taking account of depreciation considerably in advance of its recognition by the courts of this country. H. R. Hatfield[18] says: “France, Belgium, Switzerland, Germany, Austria all prescribe in their statutes that depreciation must be reckoned before showing profits.” The French Joint-Stock Company Law specifically requires the reservation of some portion of the company’s surplus for taking care of the depreciation of the assets. While the method may not be scientific, the principle involved is recognized as correct. But in an early English case, Lee v. Neuchatel Company, it was held, in the case of a company operating inherently wasting assets “that even depreciation by waste is not necessarily a revenue charge.”

[18] In “Modern Accounting.”

Early decisions in this country likewise fail to sustain the propriety of depreciation charges. The cases usually cited are The Union Pacific R. R. Co. v. United States, 99 U. S. 402, and United States v. Kansas Pacific Ry. Co., 99 U. S. 455 (1878), the first not passing specifically on the question of depreciation but showing a lack of appreciation of the distinction between capital and revenue charges, and the latter stating that “only such expenditures as are actually made can with any propriety be claimed as a deduction from earnings.” The Supreme Court of California in San Diego Water Co. v. San Diego, 118 Cal. 556 (1897), and in Redlands, etc., Water Co. v. Redlands, 212 Cal. 312 (1898), refused all allowances for depreciation except necessary amounts for “maintenance and repairs during the year.” However, in Pioneer Tele, and Tele. Co. v. Westenhaver, 118 Pac. 354, the language of the court is not uncertain: “A sufficient sum should be allowed from the earnings of a utility to make good the depreciation of the plant and replace the deteriorated portions thereof, when they become so impaired that they can no longer be made useful by repair.”

Decision of Supreme Court

The United States Supreme Court recognizes the necessity for an allowance for depreciation in Mayor and Aldermen of the City of Knoxville, Appt., v. Knoxville Water Co., 212 U. S. 14 (1909), which forms the basis of judicial attitude towards the question at the present time. The decision of the court which has been supported and reaffirmed in all subsequent decisions, reads, in excerpts:

“A water plant with all its additions begins to depreciate in value from the moment of its use. Before coming to the question of profits at all the company is entitled to earn a sufficient sum annually to provide not only for current repairs, but for making good the depreciation and replacing the parts of the property when they come to the end of their life. The company is not bound to see its property gradually waste, without making provision out of earnings for its replacement. It is entitled to see that from _earnings_ the value of the property invested is kept unimpaired, so that, at the end of any given term of years, the original investment remains as it was at the beginning. It is not only the right of the company to make such a provision, but it is its duty to its bond- and stockholders, and in the case of a public service corporation, at least its plain duty to the public. If a different course were pursued, the only method of providing for replacement of property which has ceased to be useful would be the investment of new capital and the issue of new bonds and stock. This course would lead to a constantly increasing variance between present value and bond and stock capitalization—a tendency which would inevitably lead to disaster either to the stockholders or the public, or both.”

Recognition of the Depreciation Factor

Following this decision the rules and regulations of the public service commissions of practically all the states now require that provision for depreciation be made. In the case of some of the smaller public service companies the failure to make this provision is overlooked but the practice is generally recognized as absolutely necessary. The Interstate Commerce Commission has led in this respect, although its early rulings relative thereto were strenuously objected to in some quarters. Private concerns in their contact with the government now almost invariably see the value, or at any rate the self-interest, of a deduction for depreciation. In the case of the Special Excise Tax, a Treasury decision on account of Internal Revenue provides that “deduction on account of depreciation of property must be based on lifetime of property, its cost, value, and use, and _must be evidenced by a ledger entry_ and a like reduction in the plant and property account with respect to which depreciation is claimed.”

Similarly, the present Federal Income Tax Law recognizes allowances for depreciation, but perhaps errs in placing too stringent safeguards on the amounts to be deducted therefor, whereas the Federal Trade Commission realizes the need of liberal provision. The law reads: “That in computing net income in the case of a citizen or resident of the United States, for the purpose of the tax there shall be allowed as deduction a reasonable allowance for the exhaustion, wear and tear of property arising out of its use or employment in the business or trade. No deduction shall be allowed for any amount paid out for new buildings, permanent improvements, or betterments, made to increase the value of any property or estate, and no deduction shall be made for any amount of expense of restoring property or making good the exhaustion thereof for which an allowance is or has been made.” The depreciation allowed as a deduction from income must have actually been charged off the books. Many interesting rulings—some almost absurd if carried to their logical conclusions—have been made by inspectors and the Treasury Department on points raised as to the application of the above law to particular cases. A perusal of these decisions will well repay the student who is interested in the subject.

Distinction between Repairs and Renewals

At this point attention is called again to the need of a careful distinction between repairs (up-keep and maintenance charges) and renewals (replacements and betterments). Only a clear definition of the terms and a strict adherence to an adopted policy can prevent endless confusion and absolutely misleading results. Such a policy is necessary because in the practical handling of such items on the books the theoretical aspect of the distinction between repairs and renewals must always be modified by reason. The student is referred to the preceding chapter where more detailed treatment of this point is given.

Depreciation and Plant Efficiency

The relation of depreciation to the efficiency of a plant or an asset will now be considered. The amount of depreciation is not based on the degree of efficiency of the service rendered by the asset. In other words, a depreciation reserve is not in any sense an inverse measure of the productive efficiency of the asset to which it relates, nor does the sum of all depreciation reserves either indicate or measure the degree of efficiency of the whole plant. A comparison of present with normal value (as defined above) affords some index of productive efficiency, but there is no direct ratio between the two. In any well-maintained plant, however, the normal value is the value below which the plant cannot be allowed to fall if the standard of efficiency is to be maintained; and good management requires nothing less than this. It has been variously estimated that normal value ranges from 75% to 90% of the original cost, and in some instances runs as low as 50%. The composite depreciation of from 10% to 50% represents the limit beyond which the decrease in value cannot pass if efficient service is to be given by the plant. Usually the sum of the depreciation reserves for all the assets of the plant remains fairly constant because the large reserves against assets that are almost ready to be scrapped are offset by the smaller reserves of the assets just replaced.

Unit Efficiency

The efficiency of the _unit_, however, has a somewhat different relation to depreciation. Units, i.e., individual assets comprising the plant, are constantly wearing out and being replaced. The plant, aside from exceptional cases, never reaches the point where it must be discarded in its entirety and replaced as a whole. The depreciation of each unit continues until the point of inefficiency is reached, when it is scrapped and replaced. The unit frequently is allowed to drop below its margin of efficient service before being scrapped, and it may be made to render service much longer than is customary, by means of heavy repairs and a relatively high up-keep expense. When to scrap a particular unit involves a nice calculation. The heavy cost of repairs necessary to secure good service from the old unit and the possible loss through failure to accumulate a sufficient reserve must be weighed against the cost

of a new unit and its up-keep and running expense. Usually the efficiency of the individual unit is very like the parson's one-hoss shay which "ran a hundred years to a day and then of a sudden it went to pieces all at once."

The following chart illustrates accurately the relation of efficiency to uniform depreciation, the XCY line being the efficiency curve and XY the depreciation curve. Also curve 6 of the chart on page 105 gives a good illustration of the same point. Inasmuch as the depreciation reserve must provide for the loss of the entire asset by the time it goes out of service, it is readily seen that in judging an asset from its bookkeeping record of cost and reserve there is no measure of efficiency shown therein, since a normal efficiency must be maintained by repairs at all times. The record is, however, a good index of the _time_ when the point of inefficiency will be reached.

[Illustration: From "Principles of Depreciation," by Earl A. Saliers.

Chart Showing Progress of Uniform Depreciation and of Diminishing Efficiency]

Engineers hold the opinion that machinery as a rule cannot suffer more than 25% to 50% _actual_ depreciation and give efficient service. A depreciation reserve of anything more than that does not mean that the point of inefficiency has been reached, for the reserve is usually estimated and applied on the basis of _theoretical_ depreciation and so takes cognizance of all its factors. It has sometimes been stated that inefficiency is a factor of depreciation distinct from wear and tear, obsolescence, and supersession. It seems a better statement of the relation to say that the point of inefficient service is the limit beyond which the three factors named cannot be allowed to operate or have effect. The need of judging the efficiency of some kinds of assets is not so apparent as of others. Thus in the case of poles, wires, conduits, and the like, efficient service is secured until they are worn out, with very little expense for up-keep. That is, such assets are normally efficient throughout their whole term of life, and the application of repairs will not appreciably extend their life nor will it affect their efficiency. In the case of other assets, such as machinery, telephone switchboards, motors, etc., the item of up-keep is a very vital one in the determination of the point or margin between efficient and inefficient service, and that in turn is an important factor in the determination of the length of service life of the asset. Thus, although efficiency and depreciation are intimately related, the degree of depreciation at a given time is not by any means an inverse measure of the efficiency of the service being rendered by an asset.

Depreciation and Fluctuations in Market Value

The relation of depreciation to fluctuation in value, due to whatever causes affect the market, also deserves consideration. Depreciation primarily refers to a decrease in value from a definite cost figure, such decrease being due to certain well-recognized causes, of which change in market value is not one. Thus, while it may be correct, through a loose use of the term, to use the expressions, "depreciation of securities," "depreciation of real estate," and similar phrases, and there may be no likelihood of any misunderstanding, that is not the sense in which the term depreciation is used here. Unfortunately, market fluctuations are sometimes allowed to influence depreciation charges.

Such influence may come about in three ways: (1) In valuation proceedings for the determination of rates for a public utility company, a basis frequently used is that of the cost of reproduction or renewal less depreciation. The theory is that under existing views of private property such a company has the right to the enjoyment of all increments in its own properties and therefore has a right to such rates as will earn a fair income on the present value of those properties. Depreciation based on the present reproduction cost is in this way influenced by fluctuations in market value, and the oftener a physical appraisal is made and its determined values brought upon the books, the greater will be the disturbance of the basis for the depreciation charge. (2) Occasionally the practice is met with of basing the present depreciation charge upon the estimated cost to replace the old asset. This is discussed later and is mentioned here merely to show a possible relationship between fluctuations and depreciation. (3) Finally, in the _periodic adjustment_ of depreciation rates and charges, the estimated scrap value of the asset does affect the amount of the periodic charge. Changes in market value of scrap, which may be considered as due to causes which will continue in force rather than to the ups and downs of the market, may _legitimately_ be reflected in the depreciation charge for the remaining life-term of the asset and must be so reflected in the interests of accuracy in any statement of true values.

Distinction between Depreciation and Depletion

Inasmuch as depreciation is not here used to apply to current assets (with one exception noted below), and fluctuations in the market value of any asset subject to depreciation need not be considered, it may be well to state the class of assets to which it does apply. In general the value of all fixed or capital assets is affected by depreciation. The term frequently used in this connection

is “wasting” assets. Under this nomenclature is included any asset which wastes away or is used up. For the sake of clarity the author desires to limit the term depreciation to those assets which are clearly affected by any of the causes of depreciation as discussed in the following chapter. For those assets which are used up without any possibility of their being replaced, and the life of which cannot be prolonged by repairs and renewals, the term depletion will be used. Accordingly the term “depreciation” will be applied to mine buildings and machinery; “depletion,” to the mine. Both are wasting assets, but their waste is due to somewhat different, although vitally related, causes. No better definition of wasting assets has been formulated than that by P. D. Leake[19] who says that they “consist of all forms of exchangeable value which inevitably diminish while applied to the purpose of seeking profits, increase, or advantage otherwise than by purchase and sale.”

[19] In “Depreciation and Wasting Assets.”

Effect on Different Kinds of Business

Some types of undertakings are more subject to the effects of wasting assets than others. Concerns dealing in investments, insurance of all kinds, brokerage and commission, manufacturers’ agents, banking and financial houses, professional firms, and the like, only a small portion of whose capital is tied up in fixed assets, are comparatively unaffected by the charge for depreciation. Practically all other concerns are subject to it in marked degree—manufacturers, mines, transportation companies, light, heat, and power concerns, the telephone, telegraph, and cable, construction companies, agricultural, etc. Those engaged in extracting raw materials from the ground are, with few exceptions, subject to a charge for depletion. Those with an investment in any kind of terminating rights, such as leases, patents, copyrights, non-renewable franchises for a fixed term of years, and so on, are also subject to it. Opinions differ as to whether good-will and trade-marks may properly be considered as subject to depreciation. They will not be so considered here for reasons which will be stated when the principles of their valuation are discussed.

It will be noted that thus far all examples given have been those of fixed assets. The exception already referred to is made in the case of the current asset, merchandise or stock-in-trade. The term depreciation can perhaps correctly be used in connection with merchandise, which, however, is not to be classed as a wasting asset. Due to some of the causes discussed in the next chapter, the stock-in-trade of an undertaking does truly depreciate in value. The method of accounting for such depreciation differs entirely from that used for wasting assets. Hence, the treatment of depreciation of merchandise will be considered at the same time that its valuation is discussed (see Chapter XIII.)

Having cleared the ground with this definition of terms and the general statement of what the depreciation problem is, attention will now be directed to a consideration of the causes of depreciation, to be followed by the method of accounting for depreciation and a treatment of some points growing out of the general discussion.

CHAPTER VII

DEPRECIATION—ITS CAUSES

Analysis of Causes

Most definitions of the term depreciation set the boundaries or limits of its meaning by naming the causes. These are normally: (1) wear and tear, or physical factors; (2) inadequacy and obsolescence, or functional factors; and (3) accidents or contingent causes. This statement of causes applies specifically only to physical or tangible properties. In the case of intangible property, consisting for the most part of rights of various sorts, the controlling cause is usually merely lapse of time. The chart on the following page analyzes the various causes and shows their detailed ramifications.

Age as a Cause of Depreciation

The physical depreciation of tangible properties arises from two main causes, viz., the wear and tear from operation and the use of the asset and the wear and tear of age, known as decrepitude. Immediately upon the installation of an asset the forces of time and the elements begin their ravages even before operations begin. As H. R. Hatfield[20] trenchantly puts it, “all machinery is on an irresistible march to the junk heap,” and the statement is equally applicable to all other forms of wasting assets. The ties placed on the roadbed of a railway, conduits put in place for carrying water, gas, steam, electric current, or oil, rolling stock, poles for telephone and telegraph lines, buildings, even interior installations of various types—all are subject to the normal ravages of time and the elements, and nothing which man has been able to devise can do more than retard the inevitable. Thus, all assets

decrease in value through the inevitable lapse of time. Attention should be here directed to the fact that decrepitude depends on the _normal_ action of time and the elements, whereas accidents due to action of the elements (listed in the chart on page 121, under III, 1, b) are of an _abnormal_ character and cannot usually be taken into full account at the time of the installation of any particular piece of property.

CAUSES OF DEPRECIATION[21]

{ { 1. Wear and Tear from Operation { I.Physical { (a) Maintenance Policy { { 2. Decrepitude { { (a) Action of Time and the Elements { { II.Funct- { 1. Inadequacy or Supersession { ional { 2. Obsolescence { { { (a) Negligence { { { { Fire { { { { Lightning { { 1. Accidents { (b) Elements { Wind A. Tangible { { { { Water Property { { { { Temperature { { { (c) Structural Defects { { { { { (a) Parasites { III.Contin-{ { (b) Pollution of Water { gent { { { Mineral { { 2. Diseases { (c) Growths in { Vegetable { { { Water-Mains{ Animal { { { (d) Electrolysis { { { (e) Crystallization { { { { 3. Diminution in Supply { (a) Natural Gas { { { (b) Water

B. Intangible Property—Rights { 1. Limited in Time { 2. Abandoned

[20] In “Modern Accounting.”

[21] Chart adapted from “Regulation, Valuation and Depreciation,” by S. S. Wyer.

Wear and Tear of Use

The wear and tear due to use or operation usually has a much more potent effect on the service life of an asset than that due to decrepitude. The established policy as to repairs and maintenance has an important effect on this kind of depreciation. Sooner or later every machine becomes unfit for service, due to the friction of its parts, the strains to which it is subject under normal load, those of much greater effect under abnormal load, the method of applying its power, etc. It must then either be withdrawn from service and completely depreciated, or it must be repaired in an effort to lengthen its life. It should be kept in mind that the determining factor here is efficiency. The serviceability of the machine must be kept up to a recognized standard through adequate expenditures for repairs and up-keep until the cost of up-keep is disproportionate to the service rendered, or until the machine becomes so decrepid as to make its operation hazardous.

The application of theoretical depreciation to operating wear and tear must proceed with great care. This is so because of the varying factor of maintenance. If the cost of maintenance Could be standardized, experience under such standard would give a reliable basis for the calculation of the depreciation charge. Since adherence to such a standard is difficult or impossible under the conditions that are constantly arising in a given establishment, the depreciation policy must of necessity be based on actual observation and inspection by experts. The expenditure necessary to restore an asset to a state of operating efficiency is called “deferred” or “accrued” maintenance, and it is the amount of this at a given time, estimated by expert inspection, which compared with normal maintenance forms the basis for an estimate of the depreciation charge.

Functional Depreciation

Tangible property is subject also to “functional” depreciation. This means a lessening in worth or service value due to causes, other than those already treated, which interfere with and operate against the proper functioning of the asset, making it impossible to render effectively and economically the _full_ requirements of service expected of it. This inability to fulfil its proper function may result either from inadequacy or obsolescence. “Thus the structure may suffer total depreciation and be thrown out of service, not only because through wear and tear it has reached a condition where further expenditures for repairs or attempts to make it suitable for the required service would not be economical or expedient, but also because recent improvements, or new inventions, new developments and radical changes in service, or the demands of one kind or another involving sweeping changes in the existing plant, make abandonment necessary.”[22]

[22] Leonard Metcalf paper on “Water-works Valuation and Fair Rates” before the American Society of Civil Engineers, Vol. LXIV, 1909, page 16.

Inadequacy as a Factor

Inadequacy is a condition in which the asset is found unable to meet the demands made upon it, due usually to growth of business or to some rearrangement made necessary by changed policy before the asset has reached the end of This condition is also called

“supersession.” For economical operation the asset must be discarded and superseded by a larger unit. As an example, dynamos and motors of a capacity sufficient to meet all demands on them at the date of their installation may, through growth of business, prove entirely inadequate after a few years to meet the service expected of them. Inadequacy as a factor of depreciation will have no appreciable effect in cases where the demand is fairly constant and the market does not permit of much expansion. Where there is a growing community and (or) a growing appreciation of the commodity manufactured, demand may increase to a point where original judgment and expectation will be shown to have been in error and the equipment will have to be superseded if advantage is to be taken of the expanding market.

Two main factors or compelling forces may bring about inadequacy, viz., those of internal origin and those of external origin. Those of internal origin may become effective because of: (1) abandonment of original financial policy, (2) considerations of engineering economy, and (3) unforeseen development.

Inadequacy through Change of Policy

Perhaps the best illustration of the first type is that of a plant built to supply a certain commodity to the local community. A change in ownership brings about an abandonment of the original policy and a determination to provide neighboring communities with the commodity also. This change in policy frequently comes about when several smaller plants are merged under one control and the original units are found to be entirely inadequate to meet the demand. Again, when through a change in financial policy it is decided to lower the rates of a public service commodity, the original equipment may prove inadequate to meet the increased demand. It is not contended here that this type of inadequacy is to be taken into account in estimating the depreciation charge. Usually it cannot be foreseen and should therefore be provided against under the head of a general contingent reserve or appropriation of profit. If it can be foreseen intelligently, it should be taken into account in the estimate of depreciation.

Inadequacy through Motives of Economy

The second type of inadequacy may be a foreseen and calculated inadequacy. In a new community or in the case of a new commodity whose virtues are little known, it may be the part of economy and business sagacity to install originally only such equipment as will be adequate to meet the requirements during the development stage and then when the commodity is introduced and established to discard the old and install larger and more adequate structures. Although it may be foreseen with reasonable certitude that a power plant generating a thousand horse-power will be entirely inadequate in ten years, yet it may be the better business economy to scrap it at the end of ten years rather than incur the up-keep and depreciation charges on a larger plant which would give longer service. Whichever policy, according to best engineering economy, results in the lowest unit cost of product is usually the determining factor. If with all the facts and reasonable expectations under view the smaller plant is decided upon, then assuredly the depreciation due to inadequacy must be taken into consideration.

Inadequacy Due to Unforeseen Development

The third type of inadequacy, unforeseen development, has been shown to be due to an _unexpected_ expansion of the market. This may be brought about by growth in population of the present market, growth in appreciation of the commodity manufactured, or sometimes by a lowering of transportation rates whereby new markets are opened. The very fact that this kind of inadequacy is _unexpected_ and _unforeseen_ makes impossible its inclusion in the current depreciation charge. This kind of inadequacy is revealed by a post-mortem determination of causes of which there were no symptoms leading to a correct diagnosis during life. The loss to be incurred through the scrapping of the property before its expected termination of service is a loss which must be borne by the future and not by the past. It is in the nature of a development cost which must be incurred if the opportunities of the new market are to be seized, and which must enter into a consideration of the advisability of making a bid for the new business.

Business policy might or might not dictate that these costs be charged against reserves of profits from the past. Theoretically they should be spread somewhat evenly over the future but in neither case can they have any place in present depreciation charges. It should be thoroughly understood that depreciation is a charge which relates always to the past, never to the future. There is no contradiction here in that a consideration of the future must help to determine the amount of waste which has taken place in the past. P. D. Leake[23] says: “It is a misconception to describe the annual provision for depreciation as a provision for future renewals, as though it has reference to the future. The annual provision for depreciation has nothing to do with the future but relates solely to the past. It is a replacement of capital in respect to past capital outlay expired in the process of carrying on the business.”

[23] In “Depreciation and Wasting Assets.”

Inadequacy Imposed from Without

Inadequacy may be imposed by external forces or authority. In public service utilities this has often proved a source of expense. In the interests of a supposedly enlightened opinion—oftentimes a badly mistaken opinion—present equipment is found inadequate to meet the new demands. This type of inadequacy merges imperceptibly into obsolescence. Again, a municipality at the time of repaving the streets may require that the utility company discard present equipment and install a larger and heavier type; it may require that overhead wires be carried in underground conduits; and prudence on the part of the company may lead to the installation of larger carriers than the old. These losses—and there is almost invariably a loss to the utility company—must be charged against the future. So also, the passage of laws and ordinances in the interests of sanitation and fire protection frequently compels the private owner to discard equipment and devices before their service life has passed and install more adequate equipment.

Obsolescence as a Cause

The second factor of functional depreciation is obsolescence. By this we mean that lessening in worth which is brought about by the development of something new whereby production becomes more economical or is changed to meet new ideas, fads, or fancies of the consumer. Obsolescence may be imposed by outside forces through the exercise of the police power under circumstances analogous to those mentioned under the discussion of inadequacy brought about by external means. Municipalities and regulating commissions have speeded up the “irresistible march to the junk heap” in numberless instances. Cotton-spinning and shoe machinery, lasts and patterns of all sorts, electrical devices in particular—all have been subject to obsolescence charges. The horse car gave place to the cable car, which in its turn was displaced by steam locomotion, and today this has given way to electrically propelled street cars. The old wooden rail gave way to the rail of wood capped with a strip of steel, the light “T” steel rail, and the present heavy steel rails—changes all necessitated by changes and developments in the art and a demand for better service by the public. The stick used by the Indian to turn the ground and plant his corn has been displaced successively by hand tools of iron and steel, horse-driven plows, and the big steam and gas tractors of the present day. No industry has escaped the seemingly inevitable trend towards the displacement of the old and antiquated but not worn-out equipment, by newer, more up-to-date, and more economical equipment. Obviously the last word has not yet been spoken or the last refinement been made in the development or application of art and science to any industrial enterprise. Life means development; dry rot and retrogression are the fate of any art, any industry, any people which has reached the limit of its development.

Since, therefore, obsolescence is so common an occurrence, so absolutely a fact of general experience, it would be folly to ignore it. Many writers and some authorities have said that while obsolescence is as certain and ever present as the forces of nature, it seldom is more possible of measurement than are they. However, engineers tell us that in most cases it is possible for qualified experts to foretell with _reasonable_ certainty the effect of obsolescence. “Those most familiar with the art know the units which will be able to serve their entire physical life, and what classes are so uneconomical or otherwise defective that some improvement must be expected.”

Treatment of Obsolescence

As to the effect of obsolescence, attention should be called to the fact that it is seldom operative to its full extent. The decision as to the exact time of discarding the old and installing the new rests on a nice balancing of many factors. Thus, the safety devices operated by hand on railroads are not displaced in a wholesale manner by those which operate automatically. In a large telephone company old switchboards are not discarded for new over the entire system at the same time. Much of the old is oftentimes allowed to serve out its life-term, and obsolescence has no effect. Under the circumstances stated above, and many similar and more complicated conditions, it requires a nice calculation to determine the actual effect of the factor of obsolescence in depreciation. Many inaccuracies, even many ridiculous conclusions, in estimates made by experts are met with, times without number. The novice thus fears even to guess as to the amount of the depreciation due to this factor. That is perhaps as it should be; there is no place here for the novice. Inasmuch, however, as the trend is to estimate the depreciation due to obsolescence, and such practice has the unqualified approval of many public service boards and at least the silent approval of our courts, it would seem that an attempt should be made to include it in the depreciation charge. As to its sufficiency or insufficiency, an amount can be estimated with as much accuracy under the head of depreciation as under that of a contingent reserve, and the former course is to be preferred in that an inevitable fact of experience in almost every industry is thereby recognized. The past, and not the future, is thus

burdened with the accomplished waste. There doubtless will be instances where depreciation due to obsolescence palpably cannot be foreseen. For such there is but one of two courses, viz.: either to charge it against profits reserved out of the past, or burden the future with its cost.

Relative to the inclusion of obsolescence in the depreciation charge, the Illinois Public Service Commission says in the case of the City of Springfield v. Springfield Gas and Electric Company, March, 1916: “In view of all the facts in this case, the Commission finds that it is but reasonable, proper, and equitable to make deductions from cost new to cover accrued depreciation, both physical and functional....” The statement of the Maryland Public Service Commission in the case of the Chesapeake and Potomac Telephone Company of Baltimore City has already been cited on page 106. Quoting from the report of the Valuation Committee of the American Society of Civil Engineers: “A limited search ... indicated that inadequacy and obsolescence were included either in ascertaining the amount of depreciation to be included in cost, or to be deducted from earnings ... by the commissions of the following states: Arizona, California, Colorado, Illinois, Maryland, Massachusetts, New York, Oregon, South Dakota, Wisconsin.”

Covering this feature, i.e., the depreciation feature, in making returns to the government under the Federal Income Tax of 1916, the Commissioner ruled as follows: “The deduction for depreciation should be the estimated amount of the loss, accrued during the year to which the return relates, in the value of the property in respect of which such deduction is claimed, that arises from exhaustion, wear and tear, or obsolescence out of the uses to which the property is put.... The depreciation allowance, to be deductible, must be, as nearly as possible, the measure of the loss due to wear and tear, exhaustion, and obsolescence.”

Although not specifically mentioned, functional depreciation may be said to have the sanction of the United States Supreme Court in its decisions covering the Knoxville and Minnesota rate cases. In the case of the Des Moines Water Company v. City of Des Moines, 192 Fed. 193, September 16, 1911, the court allows both “functional and physical depreciation.”

It would seem, then, that the legality of the practice is pretty well established and the ability to compute the amount has been recognized. It is not often the case in matters of business policy and prudence such as this that the courts lead where business men and some professional men are reluctant to follow.

Contingent Depreciation

A third factor in depreciation is given in the chart on page 121 as contingent. The term would seem to indicate on the face of things that it is not a factor of sufficient definiteness and certainty to make possible its prevision and therefore the calculation of its effect. Hence it might seem that provision could be made for it only by means of a general reserve. In many individual cases and as to its application as a universally operative factor in the same sense that are use and wear and tear, the position is undoubtedly well taken. The term contingent, as here used, is meant to cover not only things which have happened and _may_ happen again, but also things which in given localities and under known or knowable conditions are more or less inevitable. Hence while not found present in all cases, where conditions are favorable to the happening of any of the contingencies, from the standpoint of prudence and an equitable distribution of the burden of costs, provision should be made for them as one of the items comprising depreciation. Contingent depreciation may comprise three classes of contingencies, viz., (1) accidents, (2) diseases, and (3) diminution in supply.

Accidents. With regard to the first class, M. E. Cooley, in the Milwaukee Three-cent Fare Case, says: “An engine or a boiler may be wrecked and with it other machinery. This might, and probably would, involve a considerable expense for repairs or replacement, besides possibly crippling the plant in part. Cars may collide or a car may drop through a bridge. A bridge itself may fall or be carried away by floods. A storm, as a cyclone, may work havoc, entailing costs in excess of those proper to be charged to ordinary maintenance of property.” Accidents may happen either as a result of negligence or as a so-called “act of God,” i.e., the elements, or a hidden defect in the structure. With regard to depreciation from accidents it may be quoted, “There is always a certain amount of loss by accident which seems to be inseparable from the business. Usually it can be counted on in advance, and no amount of care and precaution will entirely eliminate it.”[24] The Railway Library for 1910 says that of 899 railroad accidents the various causes were:

Malicious acts 30 accidents Elements 104 ” Structural defects 117 ” Various forms of negligence 648 ”

[24] Spring Valley Water Co. v. San Francisco, 165 Fed. Rep. 703.

In a large concern where past experience may serve as a guide to the future, depreciation of this sort can be rather accurately estimated. In the case of the rolling stock of a railroad, statistics make available the yearly loss due to accidents from whatever

cause. It is argued that such losses are fairly uniform from year to year in a large system of that sort, and each year's operation carries the burden simply by charging all repairs incident thereto against the revenues of that period. This is, of course, true in the main and may give sufficiently accurate results. The same treatment may also be applied to replacements, and if the units are sufficiently small in value in comparison with their number, practically no inequity as between periods will result. However, the Interstate Commerce Commission has ordered that depreciation reserves shall be set up for the proper handling of such accidents and this seems the better method. Statistics are available as to how frequently explosions in powder factories are apt to occur and the losses due to them, so that a manager can calculate the provision to be made on that account. Those are simply the risks of the particular business, and wherever it is known that they are applicable to any kind or group of equipment or other assets, certainly the current operations should bear their share.

After all, depreciation charges due to any causes are much of the nature of insurance which has to be carried by the enterprise itself because the risks have not yet been reduced to an insurable basis. Much as a proprietor may dislike to carry his own depreciation insurance, he is compelled to. In connection with accidents as a part of the depreciation charge, it should be noted that the product should not be charged twice for this item. If regular insurance is carried for fire, flood, tornado, earthquake, and the like, certainly those elements should be omitted from the insurance risk carried as depreciation by the concern itself.

Disease. Under certain conditions as to climate and local environment, the ravages of disease must be reckoned with. Diseases are caused by:

1. Parasites 2. Water pollution 3. Growths in water mains 4. Electrolysis 5. Crystallization[25]

[25] A. S. C. E., Vol. 31, page 220, article by R. Montfort. A. S. C. E., Vol. 40, page 178, article by C. H. Snow. Association Engineering Societies, Vol. 31, page 49, by F. W. Hodgson. U. S. Gov't, Bureau of Entomology Bulletin #94, Pt. 1, by T.E. Snyder. U. S. Gov't, Bureau of Plant Industry Bulletin #64, by G.T. More and K.F. Kellerman. U. S. Gov't, Bureau of Plant Industry Bulletin #76, by G.T. More and K.F. Kellerman. U. S. Gov't., Dep't of Agriculture, Forest Service, Circular #128 by C. S. Smith.

Losses and deterioration from these causes are quite appreciable in some enterprises. Telephone poles are subject to attack by borers and woodpeckers. "More than 50% of the weight of the wood may be removed ... without being greatly manifested upon the surface." "At least 10% of the chestnut poles reset or replaced are injured by insects." Railroad trestles, bridges, docks, piers, wooden shipping, and structures of all sorts are more or less subject to this kind of depreciation. Minute vegetable growths known as algae may cause a marked depreciation in a water utility. Other forms of vegetable and animal organisms sometimes cause growths in water-pipes, resulting in a partial shutting off of the capacity. Similarly, mineral growths may produce like effects. Iron oxide (common rust) and lime deposits or scale are frequent causes.

Electrolysis. Depreciation caused by electrolysis is a highly technical subject, discussion of which will not be attempted here. "Electrolysis is a chemical decomposition produced by an electric current. As applied to utilities, electrolysis is the disintegration of metal structure caused by the electrolytic action produced by stray electric currents, generally from the return circuits of single trolley electric railways." The damage, both direct as above stated, and indirect as in the leaking of water, gas, etc., or in the flooding of adjacent premises or injury through gas explosions, is recognized by the courts, but the satisfaction granted is limited to enjoining a continuance of the injury.

Molecular Change. In some kinds of machinery subject to heavy strain and shock when in use, a disintegration of the structure itself takes place whereby its resisting power and therefore its efficiency are greatly impaired. This condition is known as a crystallization of the molecules.

Depletion. Finally depreciation due to contingent causes may be brought about by a diminution in the supply. This is more in the nature of a depletion charge and will be fully considered in connection with that subject treated on page 117.

Terminable Rights

The intangible property subject to depreciation consists of terminable or limited rights. Rights given or held for a definite period of time expire or waste away through the lapse of time. Decrepitude is the controlling factor here, and because of the definiteness of the length of time, the depreciation charge is easily calculated. Therefore provision must be made for it. Various methods, resulting in quite different charges to each period, are sometimes employed. These methods will be discussed in Chapters IX and X. Rights which are not terminable or limited—and even limited rights—may, however, be given up or abandoned. This is a situation which cannot usually be foreseen and therefore cannot be provided against except by means of a general reserve.

Effective Depreciation

One final point in connection with the causes of depreciation needs consideration. Though _all_ of these various causes or kinds of depreciation are seldom found operative on a given asset, frequently several of them are so operative. Where this is the case their effect is not cumulative. One or the other will prove a controlling factor in determining the service life of the asset and thus the amount of its periodic depreciation. There is a close relation between the operation of the chief factors in depreciation and the scrap value of the asset. Thus, if it is estimated that physical depreciation will be complete in 8 years, obsolescence in 10 years, and inadequacy in 12 years, scrap value would be slight. If, however, inadequacy is the controlling factor, becoming operative in 8 years, with obsolescence in 10 years, and physical depreciation in 12 years, clearly scrap value might be quite appreciable. Whichever factor is the controlling one, that factor is said in a given case to constitute the _effective_ depreciation for that asset. Thus, in the first case mentioned, physical depreciation constitutes effective depreciation and would form the basis for the estimated charge, while in the second case inadequacy is the effective factor.

CHAPTER VIII

DEPRECIATION—FACTORS OF RATE DETERMINATION

Fundamental Purpose of Depreciation

Under the head of accounting for depreciation, which forms the subject of this and following chapters, will be considered:

1. The purpose of the depreciation charge. 2. Rates of depreciation and their relation to repairs, renewals, and replacements. 3. Methods of reckoning depreciation and their effects. 4. Handling depreciation on the books. 5. Financing depreciation and some related problems.

Though much has been written about the causes and kinds of depreciation, the necessity of considering it, and methods of calculating its amount, so far as the author knows there has been no adequate presentation of the fundamental purpose of the depreciation charge viewed _both_ from the valuation or balance sheet point of view and the operation or profit and loss standpoint. The statement is frequently made that the purpose of depreciation and the necessity for considering it is to maintain intact the value of the original capital invested. In so far, therefore, as this necessitates a periodic charge against revenue, resulting in a retention in the business, either in a specific or floating form, of some of the revenue-producing assets, the operating or profit and loss phase of the business is affected. This secures the integrity of the original fund of capital by making the revenue receipts unavailable for distribution among the stockholders until the portion of the assets wasted away has been made good. This view of depreciation has as its actuating purpose a showing of correct values in the balance sheet, with little regard to the purposes to be served by the depreciation charge against operations. This emphasis of the problem of valuation is usually looked upon as primarily the engineering viewpoint.

Depreciation a Cost of Operation

On the other hand, many students of the problem view the depreciation charge as incurred for the sole purpose of determining the correct costs of doing business. Unquestionably, depreciation is a cost of production. A portion of the service life of equipment goes into each unit of the product, and depreciation constitutes a cost which must be borne by the product with as much reason as the labor power that fashions and forms it and the raw material out of which it is made. To determine a cost of production and a profit without the inclusion of the depreciation charge would be, as R. H. Montgomery[26] says, just as logical as “to state that a candy manufacturer had earned a net profit of $100,000 and that out of said $100,000 there had been set aside $20,000 to pay for the sugar consumed in the manufacture of the product. The use of that which is consumed is a loss or expense. Machinery is consumed; sugar is consumed. You cannot say that one is an operating expense and the other is an item which need not be ascertained nor taken into account until the net profit is shown.... If the provision for depreciation is an item which cannot be included among the costs of operation, there is something wrong.”

[26] In “Income Tax Procedure, 1918.”

This view of depreciation attempts to show the correct costs in the profit and loss statement of operations, without much regard to its effect on the balance sheet except that, in so far as every charge against operations is reflected among the assets, the fact of its inclusion as an operating cost automatically works also as a means of declaring correct values. Under this view—which may,

without any misstatement perhaps, be called the accountant's viewpoint—the emphasis is placed on the effort to show true costs of the product, and only incidentally a true valuation of the assets.

Complication of Short Fiscal Periods

Theoretically there is no conflict of views here—only a difference in emphasis. It is purposed, however, to show some of the practical difficulties encountered in the full application of either view. As has been stated in an earlier chapter, the ideal time in so far as depreciation is involved for the determination of financial results would be the time when all the elements of production entering into the product have been completely used up—if this were possible. There would then be no troublesome problems as to inventories, accruals, or deferred charges. The fiscal period would coincide with the natural service-life periods of all the producing elements. The problem of depreciation would then be a simple one, and the entire value of the equipment would be a charge to the product turned out during its life-period. Such a method of determining the financial results of an enterprise is, of course, merely fanciful. There is always, and will be always, an overlapping of the life-periods of the various units of a plant. Furthermore the practical necessities of modern business and competition require a much shorter fiscal period with a more frequent figuring of results and showing of condition. It is due to this shortening of the fiscal period to one month, six months, or a year that the difficulties of the depreciation problem arise and inaccuracies of statement are consciously or unconsciously made.

The handling of the problem hinges on the answer to the question as to the correct basis for the distribution of the depreciation charge. Shall a fiscal period of arbitrary length be used as the basis for determination of the service life of the operating equipment? Or shall the life of inanimate equipment be measured in terms of units produced, service rendered, results achieved, just as human life and age may be measured in terms of intensity of thought and action? It is unfortunately true that once the depreciation charge is settled, this same charge is constantly applied with little adjustment to changing conditions. Thus, varying intensity of service is not reflected in the periodic charge.

The Factor of Idle Time

Were it possible to foretell length of service life in terms of units of product instead of units of time, a much better approximation to actual results would be secured. And this very thing is _attempted_ under almost all methods of estimating depreciation. The life-period of the equipment is estimated on an assumption of _average_, _normal_ use of the equipment—an assumption which will give good practical results when and so long as operations are normal or average. When, however, a period of depression comes and much of the equipment is idle, it is clear that that period would be burdened unduly with a depreciation charge based on _years_ or _months_ of service life. On the other hand, a period of feverish activity would not bear its just share of the burden of wasting assets. The period which is really overburdened must necessarily reflect it as an undervaluation of the assets—more has been charged off than has been used up; while the opposite is true of an underburdened period. Of course, on the theory of averages, by the end of the life-period of an asset all inequalities would be ironed out. Some methods of cost-keeping take this factor of intensity into account and spread the depreciation charge on a man-hour or machine-hour basis, which proportions it somewhat equitably to the product turned out by the use made of the machine and not to its elapsed life in days or months. The best that can be hoped for is as near an approximation to the truth as possible.

Depreciation a Means of Financing

Another view of the purpose of the depreciation charge is that it is a method or means of _financing_ depreciation as it is sometimes termed. Under this view the effect of the depreciation charge on intermediate periods is lost sight of and it is used solely as a means of securing a sufficient contribution in hand _at the end_ of the service life of the asset to finance its replacement. In other words, no attempt is made through the periodic depreciation charge to secure an accurate or necessarily true statement of the values of the assets, nor to see that the product of a given period is burdened with its just share of _all_ costs, though this may be an incidental purpose. H. V. Hayes[27] in discussing this phase of depreciation says:

[27] In "Public Utilities, Their Cost New and Depreciation."

"It is argued that the plant unit 'deteriorates' year by year and that this 'deterioration' is the true measure of the 'depreciation' in the value of the unit during the intermediate years of its life, and, being a physical condition of the plant, can in no way be measured by the purely financial considerations upon which the reserves for depreciation necessarily must be based. Such a line of reasoning is absolutely faulty. Any attempt to reconcile 'deterioration' with 'depreciation' at any intermediate period in the life of the plant of an undertaking, is not only unnecessary but futile. The error in such an attempt arises from a failure ... to recognize the fact that ... if

definite agreement has been reached as to the serviceable life (of the asset), the physical ‘deterioration’ of the unit, at any time during its life, can be a matter affecting its intrinsic value in no way whatever.”

Danger of the Financing Viewpoint

The above statement is a fair presentation of the case for depreciation as a financing device. It would seem, however, that the exponents of this view lose sight of the inevitable fact that the depreciation charge is _pro tanto_ an evaluator of the wasting asset during the intermediate period of its life. Therefore a logical conclusion to be drawn from the view as expressed in the quotation above, would be the countenancing of any method by means of which provision could be made to replace the asset by _the end_ of its life, no matter whether the charge was spread evenly over its life, was made all in one year, or was made to depend on the amount of the net profits at the end of a given year. This latter alternative is a dangerous policy, always to be deprecated, for depreciation is a cost of production to be taken account of _before_ profits can be determined.

After all, it may be said without fear of serious contradiction that all three views, i.e., the engineering, the accounting, and the financing viewpoints, must be held in mind in any adequate treatment of the depreciation charge. The important point from the commercial and accounting standpoint is to secure a fair and equitable charge to each unit of product, regardless of whether or not the burdens of each fiscal period are equal. This is particularly evident when wear and tear from use is the _effective_ factor in depreciation—and it is also contended that the factors of obsolescence and inadequacy may be as successfully and relevantly estimated in terms of business output as in years. If this results in an accurate valuation of the asset—and it is conceded that from the engineering viewpoint it may sometimes so result—the inaccuracy is of minor importance. According to the general law for the valuation of fixed assets, changes in the market need not and should not, as a general thing, affect the values at which the assets are carried on the books _of a going concern_. It is, of course, a corollary to the main proposition that this treatment also makes adequate provision for financing the fact of depreciation. Various methods and means for the accomplishment of these purposes are given in Chapter IX.

The Standardization of Depreciation Rates

The determination of the rate of depreciation of a given asset is essentially an engineering problem. But as the accounting for depreciation is dependent on the rate, and the records of the accounting department must furnish much of the information for estimating the rate, the whole problem of fixing depreciation rates will be considered under the one head. Much study and effort to reduce all the conditions under which assets depreciate to a common basis and so to a definitely stated rate for each set of conditions, have, so far, come to naught and all qualified experts say without reserve that the rate of depreciation is an individual problem. It is to be hoped that a further gathering of statistics as to expectations of life of different assets under varying conditions will ultimately furnish tabulations, corresponding to insurance tables, according to which under known and expected conditions a fairly accurate rate of depreciation for a particular asset may be made. Unlike insurance rates, however, the depreciation rate once established will not necessarily remain constant, but must be subject to a periodic revision in the light of new data and conditions.

Effect of Local Conditions

Many factors enter into the rate of depreciation. They may be classed roughly as “stable or normal” factors and “contingent” factors. It should be constantly borne in mind that in the present state of the actuarial development of the subject, general rates, i.e., rates which will apply without readjustment, cannot be determined. For the determination of individual rates local conditions are always the controlling factor. An illustration in point is given by Henry Floy,[28] showing the varying rates used by thirty-one different concerns for the depreciation of their rolling stock equipment. The methods vary in almost every case, comprising annual charges of an arbitrary amount, per cent of the original cost, cents per car mile, arbitrary deductions from income irregularly applied, per cent of gross earnings, per cent of present estimated values. Reduced to a common basis, the per cent methods show a range of expected life varying between ten and one hundred years. While it is improbable that had the determination of the depreciation rate for the different concerns been in the hands of the same expert, there would have resulted these bewildering variations in method, still it does bring out in strong relief the fact, well recognized by experts but so often lost sight of by those unacquainted with the technical phases of the problem, that local conditions are a _controlling factor_; and that until local conditions can be somewhat standardized there is no hope of establishing rates of depreciation which will be of general application.

[28] In “Value for Rate-Making,” pp. 255-256.

Factors in Determining Depreciation Rate

In the determination of rates the factors to be taken into account are:

1. Normal operating conditions. 2. Normal load or normal _intensity_ of operation. 3. Normal repairs policy. 4. Normal climatic conditions.

These constitute the most important stable or normal factors. Among the contingent elements, the most important are:

5. Probable misuse and neglect brought about by the demands of the trade, resulting in a change in the factor of normal intensity. 6. Probable change in ownership and consequent change in policy. 7. Probable change in the requirements of the market, necessitating an adaptation of the equipment to uses for which it was not originally intended.

At the time of installation the rate of depreciation must be based only on the normal factors—things which can with reasonable certainty be counted on. At intermediate periods in the life of the asset, a physical inspection should be made to compare the actual depreciation of the property with the estimated. If, then, it is found that any contingent factors have become real or reached the point of reasonable expectancy, these provide the basis for an adjustment of the rate for the remaining life-term of the asset.

Basis of Normal Rate

With regard to the normal rate, the following items demand first consideration:

“1. Exterior or movable apparatus

(a) Abuse (b) Neglect (c) Temperatures (d) Oxidation (e) Irregular shocks in use, such as starting or braking, also road or rail defects

2. Installed operating and generating machinery

(a) Reversals, increased by rapidity and aggravated by shock (b) Irregular loads or service, aggravated by speedand sudden character (c) Excessive usage, resulting in increase of temperature of parts

3. Fixed equipment including boilers and piping

(a) Excessive and irregular strains (b) Interior causes of decay (c) Chemical action

—all these being of greater or less effect, according to the time of daily usage and lack of periods of rest.”[29]

[29] R. P. Bolton in “Power for Profit.”

Policies as to Repairs

Without doubt the most important single factor in the determination of the depreciation rate is the normal policy as to repairs and maintenance. Physical deterioration is constantly at work. If this is counteracted by a liberal maintenance policy, not only is more efficient service secured but a longer service life is thereby insured. As soon as repairs are needed, although the efficiency of the asset may not be immediately impaired, the _rate_ of deterioration is much accelerated unless the condition is corrected. Deterioration takes place day by day, but repairs obviously cannot be made at such short intervals—both because of the difficulty of detection and also because such a policy would not be economically practical. Every concern must consider its own peculiar problems and determine from these what shall constitute its normal repairs policy, and so far as possible this should be adhered to. The charges for repairs are bound to be of a more or less irregular character. Their handling is discussed on page 147.

Regardless of what the established policy as to repairs may be, conditions are sure to arise which make strict adherence to it impossible. There may occasionally be lack of funds at the time repairs are customarily attended to; it may be impossible to get the expert labor needed or the parts to replace worn-out units; or, and of oftenest occurrence, the need of repairs may coincide with a period of intense activity when the plant is being worked to its limit and in consequence there is no opportunity for making repairs. It is clear that rates based on one shift and the normal use of equipment during eight hours would be inadequate for three shifts and twenty-four hours of use; for in addition to a threefold intensity of operation this makes impossible adherence to the normal repairs policy based on an eight-hour schedule.

Depreciation Rate an Engineering Problem

From the above discussion it is apparent that the determination of rates is essentially an engineering problem. The accountant, however, needs a knowledge of the fundamental considerations and requirements of fixing depreciation rates and an appreciation of the difficulties of the problem. As Henry Floy[30] says: “What engineer is able to foretell the misuse and neglect or care and high degree of maintenance that any given apparatus or ... property as a whole will receive, even during the next five or ten years, with vicissitudes of climate, load conditions, changes of management, and requirements of the public?” On the other hand, in the opinion of another prominent engineer, “Consideration of these matters (misuse, neglect, etc.) may eventually form the basis for a systematic appraisal of the probabilities of life, or average of the risks, which would provide a method for the insurance of the life of machinery.”

[30] In “Value for Rate-Making.”

The author does not attempt to discuss the relative merits of the two contentions other than to point out the fact that engineers are not discouraged in spite of the many contingencies and uncertainties inherent in the problem. They are constantly gathering data from which conclusions as to rates are being formed, the use of which is being compelled by regulating bodies. It is possible that the problem will ultimately be worked out on some kind of an insurance basis.

Attitude of Regulatory Bodies

At the present time the attitude of most regulatory bodies—public service boards, federal commissions, and tax officials—is well expressed by a regulation of the Public Utility Commission of New Jersey which says that, “Until otherwise prescribed, the amount estimated to be necessary to cover such wear and tear and obsolescence and inadequacy as have accrued during any month shall be based on a rule to be determined by the accounting corporation; such rule may be derived from a consideration of the said corporation’s history and experience. A general statement of the rule in use by each company, together with the general information upon which it is based, is to be filed with the Board of Public Utility Commissioners.” The trend at the present time is towards a more thorough supervision of depreciation rates on the part of many public service boards, and the future will undoubtedly see interesting developments.

Methods of Handling Repairs

Three distinct practices are met with in handling repairs and renewals on the books. The most general method is dictated by ease of application and rests on the theory of averages, viz.: that the amount of repairs annually recurring for depreciating equipment in all degrees of deterioration and all stages of decay and age is a fairly constant figure which secures an equitable distribution over the product of the different years. The larger the plant and the greater the variety of the equipment used, the more nearly does this work out as expected.

Further consideration will be given to this point in the discussion in Chapter X of the effect of the various methods used for calculating depreciation on the equality of the distribution of the charge.

Another method, used in plants where a very accurate determination of the costs of production is desired, has as an outstanding feature a preliminary estimate, made at the time of installation, of the expected amount of repairs needed during the entire life of the asset. Periodically this estimate, or proportional share thereof, is brought on the books as a charge to Repairs and credit to Reserve for Repairs and so is spread evenly over the service life of the asset. As repairs are actually made, the cost of these is not charged against operation but against the reserve created for that very purpose. At a given time, the status of the reserve account shows: (1) if the equipment has just been placed in a normal state of repair, the under-or over-estimate of the amount of actual repairs needed, or (2) if the equipment is not in repair, the reserve account gives an index of the probable amount of deferred maintenance. Both items of information are of value in the proper management of properties. It is to be expected, of course, that during the early years of the life of an asset there will be a fairly large credit balance in the reserve because repair charges are light. The credit balance so accumulated will be needed during the later years when the costs of maintenance become heavier.

The third method, which is a variation of the second, has as its characteristic feature the inclusion of the repairs cost with the depreciation charge. This likewise necessitates a preliminary estimate of the amount of expected repairs during the life of the asset. Instead of being handled separately, it is added to the depreciation rate and in this way charged against the product. This method has been prescribed in the case of some utilities in England but is not much used here. Under this method two depreciation

estimates of probable life are necessary, viz.: (1) maximum life brought about by an inclusion of repairs, renewals, etc., and (2) minimum life without such repairs. By this it is not meant that other methods of calculating the depreciation rates fail to take cognizance of the repairs factor, but that this method specifically calls attention to it and includes it in the charge made. It seems best for regulatory boards to make a separate book record of repairs and depreciation, thus insuring against any oversight of the factors of depreciation and also insuring the correctness of a statement of condition.

CHAPTER IX

DEPRECIATION—METHODS OF CALCULATING

Methods of Calculation

Many methods of reckoning depreciation have been devised; some good, some bad, and some too theoretical and involved ever to serve the practical needs of business. It is proposed here to explain those methods which have found most favor and, in Chapter X, to discuss their effects from the standpoint of the true purpose of any scheme of depreciation.

There are several ways in which the depreciation calculation can be made, and the methods may be classified broadly, though with some overlapping, under four heads. These classes are:

1. Proportional Methods 2. Variable Percentage Methods 3. Compound Interest Methods 4. Miscellaneous Methods

Factors of Calculation

The factors which must be known under most methods of calculation are:

1. Original cost of the asset 2. Scrap or residual value 3. Estimated service life 4. Under some methods, an arbitrary interest rate

By original cost is meant full cost of the asset in position ready for use. By scrap value is meant the estimated value of the asset at the time of its discard, when removed from position and ready for sale or other mode of disposal. This is sometimes called its salvage value as distinguished from its value while still in position to render service but awaiting discard or break-up. By estimated service life is meant the time during which the asset will be used for service. This may be expressed in ordinary units of calendar time, such as the year; or in units of service time, such as working hours; or finally in units of output, such as tons, cubic feet, kilowatt hours, etc.

Symbols to be Used

For purposes of notation and reference the following symbols will be used:

V = original cost V■ = depreciated value at end of first period V■ = ” ” ” ” ” second period V■ = ” ” ” ” ” last period, i.e., scrap value n = length of service life d = rate of depreciation per period D = total amount of depreciation, i.e., V - V■ D■ = amount of depreciation during first period D■ = ” ” ” ” last ” r = rate of interest R = 1 + r, i.e., 100% plus the rate 1 - r = 100% minus the rate A = annual amount to be paid under the compound interest methods

It should be noted that the foregoing factors are all estimates, with the exception of original cost, and that when making these estimates the principles of depreciation as discussed in preceding chapters must be taken into consideration. Thus, a decision must be made as to whether physical or functional depreciation is the controlling factor in determining service life. In the determination of service life, the policy as to repairs, renewals, and maintenance has a very important bearing. In fixing the scrap value, the relation of inadequacy, obsolescence, wear and tear, and age to the values remaining in the asset must be considered.

1. PROPORTIONAL METHODS

Proportional methods include all those in which the periodic depreciation is calculated as a proportional part of some fixed basic value. These may be grouped under the following subclass titles, each of which will be separately considered:

(a) Straight Line (b) Working Hours (c) Composite Life (d) Service Output

(a) Straight Line Method

The “Straight Line” method, so called because its graphical representation is a straight line, is perhaps the simplest of all methods for calculating the periodic depreciation charge and is therefore the most widely used. Under it the loss of value for each period is proportioned to the length of service life. Thus, an asset whose service life is reckoned as 10 years will have depreciated one-tenth by the end of the first year, two-tenths by the end of the second year, and so on. The depreciation for each year is the same. Shown by formula, using the notation above, this will be:

(V - V■) D (1) D■ = ------- or --- and, evidently, n n

V■ = V - D■; V■ = V■ - D■; etc.

From these formulas a schedule of appraisal for a given asset may be made up showing its values as at the end of each year of its estimated life. For an asset costing $150, of which the service life is 5 periods and the scrap value, due to inadequacy, is $50, such an appraisal schedule would work out as follows:

==========+==============+==================+================== Age in | Periodic | Depreciated or | Total Accumulated Periods | Depreciation | Appraised Value | Depreciation ----------+--------------+------------------+------------------ 0 | $..... | $150.00 | $..... 1 | 20.00 | 130.00 | 20.00 2 | 20.00 | 110.00 | 40.00 3 | 20.00 | 90.00 | 60.00 4 | 20.00 | 70.00 | 80.00 5 | 20.00 | 50.00 | 100.00 ----------+--------------+------------------+------------------

Here, the fixed depreciation base, i.e., the amount to be written off over the 5 periods, is $100 ($150-$50). Graphically presented below, we have the straight line AB representing the periodic appraised values, and the line OC, the accumulating depreciation.

[Illustration: _Graphic Chart—Straight Line Method_]

(b) Working Hours Method

Where the “Working Hours” method is used, the life of the asset, instead of being estimated in calendar units of time, is given in service units as so many working hours. Thus, if it is estimated that a machine will stand 12,000 hours of operation, its service life is stated as 12,000 working hours. Record is kept of the number of hours the machine is operated during each fiscal period and compared with the estimated length of service life (also in working hours) to give the proportion of the total depreciation which must be charged to a given period. Using the same example—an asset costing $150, with scrap value of $50, and service life of 12,000 working hours—the appraisal schedule will be as shown below, assuming that during the first fiscal period the asset was used 3,000 hours, during the second 4,500 hours, the third 2,700, the fourth 1,200, and that it was scrapped some time during the fifth fiscal period after another 600 hours of operation.

=========+=========+==============+=================+============= | | | Total Age in | Service | Depreciation | Depreciated or | Accumulated Periods | Hours | Rate % | Appraised Value | Depreciation ---------+---------+--------------+-----------------+------------- 0 | ..... | ..... | $150.00 | $..... 1 | 3,000 | 25 | 125.00 | 25.00 2 | 4,500 | 37½ | 87.50 | 62.50 3 | 2,700 | 22½ | 65.00 | 85.00 4 | 1,200 | 10 | 55.00 | 95.00 5 | 600 | 5 | 50.00 | 100.00 | ------ | ------- | | | 12,000 | 100 | | ---------+---------+--------------+-----------------+-------------

The following chart shows graphically the appraised values and the accumulated depreciation as at the end of successive fiscal periods. The character of the curves here has no relation to the lapse of calendar time, i.e., fiscal periods, but depends entirely on the degree of intensity of operation of the asset, i.e., its service life in working hours. The above curves are true, therefore, only for the particular data assumed and do not, in any way, indicate a characteristic tendency of this method. Were the bottom line of the chart, the abscissa, laid off proportionately on the basis of working hours instead of fiscal periods, both graphs would, of course, become straight lines. It is only because information as to values is desired at the close of each fiscal period that the curves representing values become broken lines.

[Illustration: _Graphic Chart—Working Hours Method_]

(c) Composite Life Method

Another proportional method, which in its operation is similar to the straight line method, is known as the “Composite Life” method. Its feature is the calculation of depreciation on the plant as a whole, rather than on each individual asset. Under it what is known as the _mean_ life of the plant is calculated. Depreciation may then be estimated, on the straight line or other basis, for the entire plant. To determine mean life it is necessary to “weight” the life of each individual asset with its value and so get a common basis,

the dollar-year, for all assets. The process of calculating mean life will be explained in Chapter XI where also its use and adaptability are discussed. Aside from the determination of mean life, the method does not differ from others which have been or will be discussed.

(d) Service Output Method

A fourth type of proportional method is known as the “Service Output” method. Under it, the life of the asset is reckoned in terms of _quantity_ of output. This is very similar to the working hours method but differs in the unit of measurement for service life. The life of the asset is measured by its product. Thus, the life of a water filter may be given in terms of gallons or cubic feet of water run through it; that of a rock crusher in terms of the cubic feet of rock handled; that of a freight car or engine in terms of car miles; and so on. If, therefore, record is kept of the performance of such an asset for the fiscal period, the amount of depreciation to be charged off is readily calculated, being such a portion of the total depreciation as the units of output for the current period bear to the total units of life output. It is thus a straight proportional method. Its appraisal schedule and graphical representation are exactly similar to those of the working hours method. It should be said, however, that sometimes the service output method is operated on a sinking fund basis instead of on a total depreciation basis. When the sinking fund basis is used, the total payments into the fund, excluding all interest accretions, constitute the total amount of depreciation to be distributed over the service output.

2. VARIABLE PERCENTAGE METHODS

The second main classification of methods, called for want of a better title, “Variable Percentage” methods, differs from the proportional methods in that either the base or the percentage rate varies for each estimate of depreciation. The various proportional methods can all be expressed as percentages but their base remains fixed and is always the total amount of depreciation to be charged off. Under the variable percentage methods, if the percentage is fixed, the base varies; and if the base is fixed, the percentage varies. The subclasses here are:

(a) Fixed Percentage of Diminishing Value Method (b) “Changing Percentage of Cost Less Scrap” Method (sometimes known as the “Sum of Expected Life-Periods” Method) (c) Arbitrary with Increasing Amounts (d) Arbitrary with Decreasing Amounts

(a) Fixed Percentage of Diminishing Value Method

The “Fixed Percentage of Diminishing Value” method estimates the periodic depreciation as a fixed percentage of the appraised or book value of the asset as at the time of the last appraisal. Thus, if the asset cost $1,000 and the fixed rate is 10%, the first depreciation estimate is $100 (10% of $1,000) giving an appraised value of $900; the second depreciation estimate is $90 (10% of $900), with a new appraised value of $810; the third estimate is $81 (10% of $810), with an appraisal of $729 for the asset; and so on. It is evident that a final zero valuation can never be reached (although it may be approximated) as the series becomes an indefinite or indeterminate series. If there is any scrap value, and there usually is, the series becomes determinate. From the standpoint of calculation the problem here is the determination of the fixed rate necessary to reduce the asset value to residual or scrap value in the given life-term. Using the standard notation, we may formulate the following equations:

V■ = V(1 - d); V■ = V■(1 - d) = V(1 - d)(1 - d);

V■ = V■(1 - d) = V(1 - d)(1 - d)(1 - d); whence

V■ = V(1 - d)■, which solved for 1 - d gives _____ 1 - d = ■√V■/V) , and, solving for d, we get _____ (2) d = 1 - ■√(V■/V)

While complex, the formula is readily solvable by means of logarithms. For an asset costing $150 with a service life of 5 years and a scrap value of $50, the rate is found by the above formula to be approximately 19.726%.

_____ d = 1 - ■√(50/150) = .19726

The appraisal schedule is, therefore, as follows:

=======+==============+============+=================+============== | Fixed | | | Total Age in | Depreciation | Periodic | Depreciated or | Accumulated Periods| Rate % |Depreciation| Appraised Value | Depreciation
-------+--------------+------------+-----------------+-------------- 0 | ..... | $ ..... | $150.00 | $ ..... 1 | 19.726 | 29.59 | 120.41 | 29.59 2 | 19.726 | 23.75 | 96.66 | 53.34 3 | 19.726 | 19.07 | 77.59 | 72.41 4 | 19.726 | 15.32 | 62.27 | 87.73 5 | 19.726 | 12.27 | 50.00 | 100.00 | | ------ | | | | 100.00 | | -------+--------------+------------+-----------------+--------------

The following chart shows graphically the appraised values and the accumulated depreciation:

[Illustration: _Graphic Chart—Fixed Percentage of Diminishing Value Method_]

(b) Changing Percentage of Cost Less Scrap Method

Similar in effect to the method just explained is the “Changing Percentage of Cost Less Scrap” or the “Sum of Expected Life-Periods” method. Here, the base remains fixed, but the periodic depreciation rates change. Each depreciation rate is a fraction the common denominator of which is the sum of the expected life-periods as viewed from the beginning of each successive period, and the numerator of which is the expected life for the period in question. For example, an asset of which the expected life is 5 periods has at the beginning of each successive period expected life-terms of 4, 3, 2, and 1 periods respectively, making a total of 15 which becomes the common denominator of the fractions whose numerators are 5, 4, 3, 2, and 1 respectively; i.e., the changing depreciation rates are ■/■■, ■/■■, ³/■■, ²/■■, and ¹/■■. For an asset costing $150 with expected life of 5 periods and scrap value of $50, the appraisal schedule would be as follows:

=========+==============+==============+==============+============= Age | Changing | | Depreciated | Total in | Depreciation | Periodic | or Appraised | Accumulated Periods | Rate % | Depreciation | Value | Depreciation ---------+--------------+--------------+--------------+------------ 0 | ..... | $ ..... | $150.00 | $ ..... 1 | 33■ | 33.33 | 116.67 | 33.33 2 | 26■ | 26.67 | 90.00 | 60.00 3 | 20 | 20.00 | 70.00 | 80.00 4 | 13■ | 13.33 | 56.67 | 93.33 5 | 6■ | 6.67 | 50.00 | 100.00 ---------+--------------+--------------+--------------+------------

A comparison of this appraisal schedule with that of the fixed percentage of diminishing value method shows that this method charges more depreciation during the early life-periods and less during the later periods. The general effect of this method and its significance are discussed in Chapter X where the relative merits of the various methods are considered. The graph for the sum of expected life-periods method is not shown as it differs little from that of the fixed percentage of diminishing value method on page 158.

(c, d) Arbitrary Methods

The two other arbitrary types of this variable percentage method are hardly to be classed as methods as they do not rest on any law according to which they may be operated. Under them arbitrary amounts are charged to depreciation each period, the only controlling principle being that in the one case these periodic amounts increase from period to period, while in the other case they decrease. In the one case, therefore, the appraisal schedule would be similar as to its “Periodic Depreciation” column to those of the two methods just explained, excepting that the column must be reversed, i.e., read from the bottom upward. In the other case, the appraisal schedule would be exactly similar to those just shown. Within the restriction that they must be increasing or decreasing amounts for succeeding periods and that the total depreciation must be charged off within the estimated life-period of the asset, the periodic depreciation charges are, under these methods, purely arbitrary, neither based on fact nor logic.

3. COMPOUND INTEREST METHODS

The third general type of methods for making the depreciation estimate may be called the “Compound Interest” type. This differs radically from any of the others in that it uses the compound interest principle to determine the amount of periodic depreciation. In the practical application of some of these methods, not only is depreciation estimated on this basis but an actual fund of cash or other assets is set aside for accumulation on the compound interest principle so as to provide ready funds for financing the replacement when the old asset is discarded. The setting aside of the fund is not an essential part of the method, and its discussion is therefore deferred to Chapter XXV where the subject of funds and their treatment is fully considered. Under this type there are three methods:

(a) Sinking Fund (b) Annuity (c) Unit Cost

(a) Sinking Fund Method

The problem under the “Sinking Fund” method is the calculation of the amount of a sum of money which placed at compound interest at the end of successive periods will accumulate to the amount of the total depreciation of the asset during its life-term. At the end of each period, this amount plus any accumulated interest on the amounts previously set aside becomes the depreciation estimate for this period. Unless a fund is actually established, there can, of course, be no accumulation of interest. Under this

method the amount of such theoretically accumulated interest is, nevertheless, made a part of the periodic depreciation charge.

The method thus becomes simply a mathematical device for making the estimate. The calculation of the fixed periodic amount is in accordance with the following mathematical formula, using the notation given on page 151. The development of this formula is given in full in Chapter XXV, “The Sinking Fund”:

(V - V■)r Dr (3) A = --------- = ------ R■ - 1 R■ - 1

For the asset used in the other illustrations, i.e., for an asset with a full valuation at the beginning of its life of $150 and a residual value of $50 after a service life of five years, this periodic amount is $18.10, if interest is reckoned at 5%. Any other rate of interest within reason would, of course, be equally appropriate.

The following appraisal schedule may be set up:

=======+==================================+============+============ |Periodic Depreciation Composed of:| | Age in +----------+----------+----------+Depreciated | Total Periods| Periodic | Interest | Total |or Appraised|Accumulated | Amount | | | Value |Depreciation -------+----------+----------+----------+------------+------------ 0 | $ ..... | $ .... | $ ..... | $150.00 | $ ..... 1 | 18.10 | .... | 18.10 | 131.90 | 18.10 2 | 18.10 | .90 | 19.00 | 112.90 | 37.10 3 | 18.10 | 1.85 | 19.95 | 92.95 | 57.05 4 | 18.10 | 2.85 | 20.95 | 72.00 | 78.00 5 | 18.10 | 3.90 | 22.00 | 50.00 | 100.00 | | | ------- | | | | | $100.00 | | -------+----------+----------+----------+------------+------------

The following chart shows graphically the appraised values, the accumulating depreciation and the elements which compose it, the curve OD representing the fixed periodic amounts, and EF the theoretical interest accumulations. The curve OD is a straight line inasmuch as it represents fixed periodic amounts. The depreciation and interest curves, OC and EF, representing gradually increasing amounts, are both slightly concave and would become increasingly so the longer the period covered. The appraisal curve AB is slightly convex and its convexity is accelerated by lapse of time.

[Illustration: _Graphic Chart—Sinking Fund Method_]

(b) Annuity Method

The “Annuity” method also makes use of the compound interest principle, but in addition to the method of the sinking fund it adds to the periodic depreciation charge as determined thereunder interest on the successive appraised values of the asset. The effect of this is to charge to the product, by way of Profit and Loss, interest on the capital invested in each asset used in manufacture. The appraised values of the asset are exactly the same as under the sinking fund method, but the expense charge to depreciation is larger under the annuity method by the interest on the appraised value of the asset. This charging of interest to the product under the title “depreciation” makes it necessary to capitalize the interest charge by adding it to the value of the asset. If the amount to be charged off, i.e., V-V■ is the same under both methods, for both to arrive at the same scrap value, V■, the interest under the annuity method must be added to the value of the asset each time before deducting the depreciation charge, a part of which is this same interest. The annuity method thus makes a larger periodic charge than the sinking fund method.

The problem involved in the calculation of the periodic depreciation charge by the annuity method is sometimes stated as the method of finding a fixed or constantly equal periodic charge sufficient to charge off not only depreciation as such but also the interest which has been added to the value of the asset. The mathematical formula may be derived as follows, using the standard notation:

VR = V(1 + r), or the asset with interest added to it

VR - D■ = V■, appraised value at end of first period

V■R - D■[31] = VR² - D■R - D■ = V■, appraised value at end of second period

V■R - D■[32] = VR³ - D■R² - D■R - D■ = VR³ - D■(R² + R + 1) = V■, appraised value at end of third period, etc.

[31] Inasmuch as by hypothesis the periodic depreciation charges are the same D■ = D■ = D■ etc., hence, D■ is used to represent the fixed depreciation charge per period.

[32] Inasmuch as by hypothesis the periodic depreciation charges are the same D■ = D■ = D■ etc., hence, D■ is used to represent the fixed depreciation charge per period.

Generalizing, we have:

V■■■R - D■ = VR■ - D■(R■■[1] + R■■[2] ... + R² + R + 1) = V■,

scrap value. Whence

R■ - 1 VR■ - V■ = D■ -------. Solving for D■; we have: R - 1

(VR■ - V■)(R - 1) (VR■ - V■)r (4) D■ = ----------------- = ----------, R■ - 1 R■ - 1

= periodic depreciation charge

That this is the same as the amount of the periodic depreciation charge by the sinking fund method plus interest on the investment, is seen by comparing formula (4) with formula (3). Formula (4) may be written as

(VR■ - V■)r + Vr - Vr ---------- , R■ - 1

i.e., the quantity Vr-Vr = 0 is put into the numerator. Adding zero (Vr-Vr = 0) cannot change its value. Performing the multiplication indicated by the parentheses, we have

VR■r - V■r + Vr - Vr ---------- . R■ - 1

Rearranging the terms, we have

(Vr - V■r) + (VR■r - Vr) ----------, R■ - 1

which factored in each group becomes

(V - V■)r Vr(R■ - 1) -------- + ---------- . R■ - 1 R■ - 1

By reducing the second fraction, this may be written as:

(V - V■)r (5) --------- + Vr R■ - 1

which is seen to be identical with formula (3) for the sinking fund except for the addition of Vr, which represents interest at r% on the investment V. The identity of the annuity formula (4) with the sinking fund formula (3) plus interest on investment can be established similarly for any of the periods.

It will be noted that by the annuity method the whole original value of the investment is always earning interest either in the sinking fund or in the diminishing appraised value. Thus, the portion of original value deducted each period earns interest in the sinking fund, while what is left as appraised value earns interest outside the fund. Thus, the annuity method of charging depreciation may be said to consist of two parts, viz., the fixed periodic amount and interest on the original investment. This will be seen from the appraisal schedule which follows. The same illustrative data are used as before, including interest at 5%.

=========+===+ | Periodic Depreciation Charge | | Composed of: | +--------+----------+------------+---------+ | | | | Age in | | Interest | Interest | | Periods | Fixed | on | on | Total | | Amount | Fixed | Investment | Charge | | | Amount | | | | | | | | | (a) | (b) | (c) | (d) | ---------+--------+----------+------------+---------+ | | | | | 0 | $..... | $.... | $..... | $..... | 1 | 18.10 | | 7.50 | 25.60 | 2 | 18.10 | .90 | 6.60 | 25.60 | 3 | 18.10 | 1.85 | 5.65 | 25.60 | 4 | 18.10 | 2.85 | 4.65 | 25.60 | 5 | 18.10 | 3.90 | 3.60 | 25.60 | +--------+----------+------------+---------+ | $90.50 | $9.50 | $28.00 | $128.00 | ---------+--------+----------+------------+---------+

=========+===========+==============+========================= | | | Accumulated | | | Depreciation | | +----------+------------ | Appraised | Depreciated | | Age in | Value | or Appraised | | Periods | Plus | Value | Including | True | Interest | | Interest | Depreciation | | | | | | | | | (e) | (f) | (g) | (h) ---------+-----------+--------------+-----------+------------ | | | | 0 | $..... | $150.00 | $..... | $..... 1 | 157.50 | 131.90 | 25.60 | 18.10 2 | 138.50 | 112.90 | 51.20 | 37.10 3 | 118.55 | 92.95 | 76.80 | 57.05 4 | 97.60 | 72.00 | 102.40 | 78.00 5 | 75.60 | 50.00 | 128.00 | 100.00 | | | | | | | ---------+-----------+--------------+-----------+------------

It will be noted, as stated above, that the sum of the two interest items in columns (b) and (c) is the same for each period, viz., $7.50, interest on the _original_ investment. The total of column (d), total charge for periodic depreciation, minus the total of column (c), interest on the diminishing appraised values, gives $100, the true depreciation as shown by column (h). _True_ depreciation

under the annuity method is the same as under the sinking fund method. The periodic depreciation charge differs, however.

A graphical illustration of the main items of the appraisal schedule is shown below:

[Illustration: _Graphic Chart—Annuity Method_]

In the above chart the points A^1, A^2, etc., represent the appraised values plus interest, the segments, A^1I^1, A^2I^2, etc., representing interest on each period's investment. It is to write down these increases in value that the additional $28 of periodic depreciation charges is needed. The curve OC is a straight line since each period's depreciation charge is the same. Curves AB and OD are identical with those of the sinking fund method. Curve OE represents the accumulating interest on investment as shown by the segments A^1I^1, A^2I^2, etc. Curve OC is the sum or resultant of curves OD and OE.

The annuity method is termed the "Equal Annual Payment" method in a preliminary report of the Valuation Committee of the American Society of Civil Engineers. As here illustrated it does bring about an equal periodic charge but only because the assumed rate of interest for the sinking fund accumulations is taken also as the rate for interest on the investment. If these two rates differ, the periodic charges will also differ. For example, if the sinking fund rate is taken as 5% and the rate applicable to the appraised values is 8%, the sum of these two interest amounts will not be constant because the bases on which they are calculated are changing each period. Because of this fact the Committee above referred to called this the "Compound Interest" method in its final report. To distinguish this from the sinking fund method which also uses the compound interest principle, the title here adopted, i.e., the "Annuity" method seems to accomplish that purpose.

(c) Unit Cost Method

A third method which uses the compound interest principle is called the "Unit Cost" method. Because of the involved mathematical processes required for the calculation of the amount of its periodic charge, and the doubtful practical value of the method, only a description of its main features will be given here.[33] The aim of this method is to equalize over each unit of product three costs, viz.: the cost of interest on investment, the cost of operation and repairs, and the true depreciation cost, all of these to be included in a periodic charge under the title of "depreciation."

[33] The interested student is referred to Proceedings—American Society of Civil Engineers—December, 1916, in which will be found the Valuation Committee's report, and to Salier's "Principles of Depreciation," in both of which the formula is developed.

The calculation of the true depreciation cost by the sinking fund principle is the reason for including this method in the compound interest type. The problem to be solved is the determination of the price to be paid for an asset at a given time so that the cost of each unit of product turned out during its remaining service life shall be the same as the cost of each unit of product turned out during the spent portion of its service life. The difference between the original cost of the asset and the price determined as above will be the depreciation of the asset for the elapsed period. A symbolic showing of the problem will make the matter clear. The following notation will be used:

V = original cost of the asset installed ready for use V■ = price that could be paid for it at the end of the period as above explained O = estimated average operating costs per period, including repairs, for V o = estimated average operating costs per period, including repairs, for V■ D[34] = true depreciation rate or multiplier under the sinking fund method, for V d[35] = true depreciation rate or multiplier under the sinking fund method, for V■ U = units of output for V during one period u = units of output for V■ during one period r = rate of interest on the investment

[34] D and d may be expressed as the respective periodic amount-multipliers necessary to create sinking funds of one dollar each under the conditions as to time and rate for V and V■. VD and V■d become, therefore, the periodic amounts of true depreciation, i.e., decrement in value.

[35] D and d may be expressed as the respective periodic amount-multipliers necessary to create sinking funds of one dollar each under the conditions as to time and rate for V and V■. VD and V■d become, therefore, the periodic amounts of true depreciation, i.e., decrement in value.

Then:

$$\frac{O + DV + Vr}{\text{----------}} = \text{the cost per unit of output for V, U}$$

o + dV■ + V■r ---------- = the cost per unit of output for V■. u

Since, by hypothesis, these two costs are to be equal, we may form the equation

O + DV + Vr o + dV■ + V■r ---------- = ----------, U u

which solved for V■, the price to be paid, gives

u ( ) --- (O + DV + Vr) - o U ( ) V■ = ---------- . (d + r)

Evidently, V-V■ is the amount of the depreciation charge. The values for D and d, as indicated in the footnote, may be substituted and the amount of V■ determined. The process is somewhat complicated in its practical application and will not be carried further here.

4. MISCELLANEOUS METHODS

Other methods of calculating the depreciation charge are used, but they cannot be classified under any of the three groups discussed so far. They are a miscellaneous, mongrel breed, scarcely to be dignified in some instances as methods. Among these may be mentioned the following:

(a) Maintenance Method (b) Replacement Method (c) Fifty Per Cent Method (d) Appraisal Method (e) Insurance Method (f) Gross Earnings Method

(a) Maintenance Method

In this case a periodic charge for depreciation is made, equal in amount to the cost of maintenance of the asset for the period. It is thus a definite but variable amount, depending upon the maintenance policy.

(b) Replacement Method

This is hardly a method of _calculating_ the depreciation charge, but rather of recognizing the fact of depreciation by charging all renewals and replacements to revenue. It is argued that in a large, widely extended plant after depreciation has reached the point where renewals are necessary, the charging of all renewals and replacements as expenses will take care of all accruing depreciation and secure a fairly uniform charge to product from period to period. Under this plan depreciation as such does not appear on the books but is taken care of under other titles.

(c) The Fifty Per Cent Method

This is somewhat similar to the replacement method in that it is applicable only after depreciation has reached the renewals stage. It is claimed for it that, in a property or class of asset consisting of many similar parts, as railroad ties, for example, after the stage of normal repairs has been reached so that the parts are in all degrees of repair from 0% to 100%, the normal maintenance and renewals policy will maintain the property or asset always in about 50% condition. Therefore the total depreciation for the asset or class is the other 50%, which never reaches a larger amount because of a constant renewal of parts. This 50% depreciation may or may not be carried on the books but it exists nevertheless. For the conditions under which it is applicable as above, the law of averages doubtless applies and makes the estimate a fairly good one.

(d) Appraisal Method

Here a physical appraisal of the asset or property is taken at the close of every fiscal period. The difference in value between the two appraisals for successive fiscal periods represents the depreciation for the period and would be brought on the books as such.

(e) Insurance Method

This is applicable only to large properties with assets widely distributed. Its operation “involves the actuarial principles of ordinary insurance. This means that the fund accumulated by depreciation charges should not be reserved as an accumulation until it can be spent for the purpose of replacing the identical property upon which the fund accumulated when such property is abandoned; and furthermore, that this fund should be expended, in whole or in part, during the year in which it is created, in the replacement of equipment.”

(f) Gross Earnings Method

Here the depreciation estimate is based on the gross earnings for the period. This does not necessarily mean that the depreciation estimate will be large when profits are large, and small or nothing when profits are small, although it may be made to apply in that way in individual cases. The policy of making ample reserves for depreciation in good years and scant reserves in poor years is not to be wholly condemned. Depreciation, however, has no relation to, or dependence upon, profits. Rather, profits depend on depreciation in the sense that they cannot exist until after charges for depreciation have been taken care of. Depreciation considered as a fixed per cent of gross earnings is almost the same in effect as the service output method, and has much to commend it.

Condition Per Cent

Before leaving the topic of method, it may be well to explain a term used in connection with the depreciation estimate, viz., condition per cent. The condition per cent of an asset is found by subtracting from 100%, the fraction which represents the ratio of the present accumulated depreciation to the total estimated depreciation. Thus, if an asset has depreciated in value one-quarter, its condition per cent is said to be 75 (100%-25%). Hence, condition per cent is easily calculated if depreciation has been estimated by any of the proportional methods. If, in addition to the standard notation used, we assume that:

D■ = total amount of depreciation for m periods V■ = value of the asset at end of m'th period

then, in general, condition per cent may be expressed by the formula:

D■ (6) 100% - ---- D

Evidently, therefore,

(D■) V■ = V(100% - ----). (D)

Under the proportional methods D■/D = nd. Therefore, condition per cent is 100%-nd.

Under the sinking fund method, the calculation is more complex. D■, the total amount of depreciation accumulated to date, i.e., after m periods, is the amount of the annuity A for m periods. From formula (3), Chapter XV, page 272, the amount of an annuity A is seen to be

A(R■ - 1) ---------- . r

A(R■ - 1) Therefore, D■ = ---------, r

A(R■ - 1) and D = ---------, r

from which the ratio

A(R■ - 1) --------- D■ r R■ - 1 --- = ---------- = -------- . D A(R■ - 1) R■ - 1 --------- r

Accordingly, condition per cent under the sinking fund method is:

R■ - 1 (7) 100% - -------- . R■ - 1

CHAPTER X

DEPRECIATION—APPRAISEMENT OF THE VARIOUS METHODS

General Considerations

No method of estimating depreciation will ever be devised which will be applicable under all conditions and to all kinds of property. Such a panacea for the ills of wasting assets can obviously never be found, for the very good reason that the same medicine will not suit all patients. What gives good results in one case may not be applicable or not equally so, in another case. In discussing the relative merits of the various methods, therefore, no dogmatic rules for their use can be laid down; furthermore, without a detailed knowledge of operating conditions, only their main points of strength and weakness can be pointed out, and this is all that will be attempted here.

In a critical discussion of methods and their effects, the fact of depreciation may be considered from either the viewpoint of time or service. Depreciation when viewed from the aspect of time may be said to be due to:

1. Decrepitude, which is merely the lapse of time.

2. Inadequacy, which is lack of capacity to do the work which increasing markets demand (a condition the essence of which is also time).

3. Obsolescence, which represents the inability to perform efficiently as compared with the service secured from more modern equipment, and which may be a condition brought about by lapse of time and the developments of an art or science.

When viewed from the aspect of service, depreciation may be due primarily to wear and tear, which is a condition directly dependent upon the service rendered.

It has been pointed out that these elements of depreciation, viz., wear and tear, inadequacy, obsolescence, etc., are single and isolated in their action and not cumulative. One of them, therefore, is the controlling element in any estimate of depreciation. Accordingly, in judging the merits of a method the kind of depreciation must be taken into account; i.e., depreciation must be viewed from a time and service standpoint.

Ideal Basis for Distribution of Depreciation Charge

Regardless of the actual progress of depreciation, the theoretically ideal method of distributing the charge, from the standpoint of a going concern, is so that each unit of output shall bear its just proportion of the burden. Any other attitude is inconsistent. Thus, assuming that actual depreciation does not progress uniformly, that, as some maintain, the rate of depreciation is heaviest towards the end of the service life of an asset, it would not be equitable to charge the product of those years with a much higher burden than that of the earlier years. Just as it is a misfortune to be born under some conditions, so here it would be a misfortune to a commodity to be produced during the latter years of the service life of an asset. The life-period of an asset must be viewed as a whole and its total depreciation should be distributed evenly over its output, if equity is to be secured—other conditions, of course, remaining the same. This principle does not apply alone to the depreciation charge but equally to all other charges in connection with the asset, such as repairs, maintenance, etc. The author does not believe that these other costs should include a charge for an assumed rate of interest on the money invested in the asset. For a full consideration of the question of interest on capital as an item of cost of production, the student is referred to Chapter XXVI. Any method of distributing the depreciation cost must take cognizance of the other costs as well.

1. PROPORTIONAL METHODS

(a) Straight Line Method

The straight line method is, first of all, simple in application and can easily be adapted to any asset under almost any conditions. Partly because of the ease of calculation and application, it has been designated as an official method by many regulatory boards. Its basis is a time basis and it spreads the charge evenly over the periods of the service life of the asset. Accordingly, where the time elements of depreciation, viz., decrepitude, inadequacy, or obsolescence, control and where the output does not fluctuate much from period to period, the straight line method should give satisfactory results for its intended purpose, i.e., for allocating the real depreciation charge.

Its effect, however, must be considered also in conjunction with the distribution of the other costs connected with the asset. Many engineers maintain that repairs are light during the early life of an asset and heavy during the later years. If this is true and these costs are charged to the period in which they are incurred, the combined depreciation and up-keep costs place an unjustly heavy burden on the output of the later years. Almost equally good authority maintains that the cost of repairs is in no sense uniformly graduated as implied above but can be counted upon in practice to be extremely irregular. If this is true and up-keep costs are charged as above, then many periods are apt to be underburdened and others loaded too heavily.

While, however, these considerations must be given weight when a single asset is under view, in a large plant after operation has continued to the point where a normal and fairly regular cost of up-keep has become established, the inequalities of the individual up-keep charges may merge into fairly equal charges for the up-keep of the plant as a whole. This the law of averages accomplishes to a greater or less degree. But in a small plant with few assets subject to depreciation, the equality of the whole

might not result from the individual inequalities. After all, this magic rule of averages which is invoked to cover up many troublesome and embarrassing situations is obnoxious to scientific accounting; it is a makeshift which carries with it a shiftless trust in the happy outcome of things—a trust which has been so often betrayed as to carry little weight.

If depreciation costs can be predetermined with a satisfactory degree of accuracy—and an estimate of them is all that can ever be made—with equal accuracy and satisfaction can up-keep costs be predetermined. The one is no more difficult than the other and equal reason exists for predetermination in both cases, viz., the securing of an equitable distribution of costs. With both estimates made at the beginning of the service life of the asset, all costs in connection with the asset can thus be prorated over the years of its service life.

If, as stated above, the output is fairly regular as between periods, fair and equitable results will be obtained. If the output fluctuates violently, unsatisfactory costs and an inequitable burdening of product will be the result. The proper treatment of overtime and "beyond-capacity" work, i.e., abnormal operations, requires care. It is expected that such work will have a higher unit cost than normal output, and it is proper that a sliding scale of depreciation be applied in such a case.

(b) Working Hours Method

Most of the considerations taken into account for the straight line method are equally applicable to the working hours method. Here, with the service life expressed in terms of working hours instead of fiscal periods, a far step has been made towards securing an equitable distribution of depreciation costs over product. The rate per working hour can in this way be applied directly to the product. The machine-hour and sold-hour methods of costing distribute the depreciation along with all other costs on this basis of "rate per working hour."

Where a machine or other asset is limited in its use to a few operations equally wearing in their effect, this method should give satisfactory results. Where, however, one asset can be used for many different processes, involving inequalities in wear and tear, if the service rendered is the controlling factor, an inequitable distribution will result. Similarly, beyond-capacity operation, i.e., operation beyond the normal speed at which depreciation cost has been predetermined, will not be taken care of automatically by this method. Adjustment is necessary and, though arbitrarily made, must be attempted. Thus, ten articles might be turned out in one working hour, whereas an estimated output of six formed the basis for determining the rate of depreciation per working hour. As with the straight line method, so here equal care must be exercised in securing an equitable distribution of up-keep costs.

(c) Composite Life Method

This is not a working method for estimating individual depreciation costs, but rather a method of proof or check, which proves very valuable in some cases. The method is discussed in detail on page 197 where the uses to which it may be turned are pointed out.

(d) Service Output Method

The service output method bases the depreciation cost not on years of life nor on life in terms of working hours of service. Here an attempt is made to predetermine the output of the asset in terms of units of product, and so burden every unit with its fair share of depreciation. To secure full equality of charges, up-keep costs must be reckoned on the same basis, rather than on a time basis of service hours or length of life. If conditions are uniform and normal, this method, where applicable, secures perhaps the most satisfactory of all allocations of depreciation costs. To an individual machine performing several different processes the method would scarcely be applicable. To a group or battery of machines, turning out a uniform product in finished form or in the same degree of partly finished condition, the method could be well applied. The estimated total output of the group would then be taken as the basis for calculating the service output of each machine in the group. When calculating service life in whatever units, that speed of operation which secures the highest efficiency is taken as the figure of normal operation.

From the foregoing it follows that the service output method of calculating the depreciation charge per unit of output is well adapted to an inherently wasting asset, such as a mine, a quarry, and timber lands, and is almost invariably applied in such cases.

2. VARIABLE PERCENTAGE METHODS

(a) Fixed Per Cent of Diminishing Value Method

The chief merit of the variable percentage methods, in the eyes of their advocates, is the way they are automatically adjusted to the up-keep charges. The reader should study the graphs of these various methods as a means of comparing results.

On the graph, page 158, it is shown that under the fixed per cent of diminishing value method the periodic depreciation charges are heavy in the beginning and decrease toward the end. It is argued that, inasmuch as up-keep costs increase as the depreciation charge decreases, this method automatically equalizes these two costs. This argument was examined in detail under the previous discussion of the straight line method. What was there set down applies equally here. The fixed per cent method is also based on service life by periods—a time basis rather than a service or output basis. Furthermore, it involves a complex calculation and is perhaps never applied with any degree of accuracy. Lawrence R. Dicksee prefers this method for handling depreciation on machinery.

(b) Sum of Expected Life-Periods Method

The objection of complexity of calculation to the method just discussed is overcome largely in the sum of expected life-periods method. Here the rate of decrease is more marked, but the method has the same general effect as the fixed per cent method. If the repair charges are handled, as suggested, by means, of pre-estimates, the results will not be equitable. If repairs increase with uniform regularity as the depreciation costs decrease, fair equality is secured. Otherwise the method has little to commend it.

(c, d) Arbitrary Methods

The two other methods under this main group, viz.: arbitrary with increasing amounts in the one case and decreasing amounts in the other, are not based on any orderly scheme of calculation and, having little logic behind them, are not to be relied upon. Ease of calculation is perhaps their only merit.

3. COMPOUND INTEREST METHODS

General Considerations

In a discussion of compound interest methods the basic feature, that of the compound interest principle, requires consideration. The thought of progression on a compound interest basis is fascinating to many. It is a powerful instrument of accumulation and its charm seems to lie in the fact that through its instrumentality small sums can be made to grow into large sums. Whether the principle is applied to the creation of a fund or simply as a method of _calculating_ periodic amounts, the remarks of P. D. Leake,[36] an English authority, are equally appropriate. He says: “May I impress upon you that these devices are dangerous expedients in any but the most skillful hands.... It (the sinking fund) is apt to give a sense of false security, because its whole virtue depends upon its obligations being faithfully carried out over the whole period, and this condition is not always fulfilled.... It is probable that in many cases the use of a sinking fund is an altogether unwarrantable draft upon the future, because there is no reasonable certainty that the fund, whether it be state, municipal or commercial, will not be raided before it attains its object.”

[36] In “Depreciation and Wasting Assets.”

Over short periods the difference between the periodic amounts under this method and the straight line method is slight, as will be apparent from a comparison of the two charts on pages 153 and 162, giving graphic illustration of the two methods. There the period is for five years. When the period is extended to, say, twenty or fifty years, the difference in burden, due to interest accumulations, between the early years and the later years is very marked. “Thus, a 10-year unit having no salvage value, loses half its value in 5 years under the straight line theory, regardless of the rate of interest, and at 5% under the compound interest theory it loses nearly as much—about 44% of its value in the same time; ... but a 50-year unit, losing half its value in 25 years, under the straight line theory, loses only 22.8% of its value, at 5%, under the compound interest theory.”

(a) Sinking Fund Method

The sinking fund method as an orderly scheme for estimating the periodic depreciation charge _will_ make the estimate, and, if adhered to faithfully, the entire depreciation will be written off by the end of the service life of the asset. In this respect it is to be preferred to any arbitrary or haphazard method. That it secures an equitable distribution of depreciation costs over the product of the various periods, or that it effects a correct valuation of the asset at intermediate periods of its life is open to serious questioning. The periodic charge under the sinking fund method perhaps bears no relation to the fact of depreciation. The method is, at the best, simply a mathematical device for an orderly calculation of periodic amounts. In the valuation work of public service companies or in

regulation work where, as in California, actual funds must be set aside to accumulate at compound interest, there is no serious objection to the method. Although it rests on false or doubtful assumptions of fact and results in an inequitable burden on the product as viewed from the standpoint of individual assets, these are minor considerations; for the method does by the end of its service life take care of the loss in value. Judged from the standpoint of its relation to up-keep costs, the method lays an increasingly heavy burden on the later years of the life of the asset.

(b) Annuity Method

All that has been said with regard to the sinking fund method applies with equal point to the annuity method. As previously indicated, in the explanation of its essential features, this method automatically secures a charge for interest on the investment as a part of the depreciation charge. Not only is the charging of interest of doubtful propriety in itself, but certainly its inclusion under the title of depreciation is misleading and indefensible. The courage of one's convictions with regard to interest as a part of cost should not allow interest to shelter itself under the cloak of "depreciation." By referring to the appraisal schedule and chart, it is seen that the real depreciation charge is exactly the same under the annuity as under the sinking fund method.

(c) Unit Cost Method

The unit cost method represents an attempt to secure an equal burdening of each unit of product with interest, depreciation, and operating costs. In the language of its proponents, "this theory is probably the soundest theory of depreciation, and when applied with intelligence, probably furnishes the truest measure of accrued depreciation." While the end sought by the unit cost method is commendable, it is a compound interest method and it mixes interest, up-keep, and depreciation under the one title "depreciation."

4. MISCELLANEOUS METHODS

Criticisms of the miscellaneous theories can be brief.

(a) Maintenance Method

This method is irregular in its incidence, and under it the depreciation charge fluctuates violently between periods. Just as maintenance is subordinated to the requirements and demands of the trade, so also are depreciation costs made to depend on the same conditions. The charging of depreciation thus becomes a matter of business convenience instead of an inexorable fact of production. Just as repairs are postponed to a slack period during which maintenance charges are in consequence heavy, so does the depreciation charge increase even though actual wear and tear has decreased. Presumably the method makes charges light during the early years and heavy during the later years of the life of the asset. In a large plant with various kinds of assets, after a normal up-keep charge has been established, the maintenance method of estimating the periodic charge for depreciation for the plant as a whole may work out fairly well on the theory of averages or by accident; for maintenance is not a measure of depreciation.

(b) Replacement Method

This is not a method of measuring depreciation but rather of financing it, i.e., of making good the loss. It also is based on the law of averages, and in a large plant after the point of normal replacements has been reached it may prove a satisfactory method of accomplishing its purpose. It does not serve as a means whereby a periodic depreciation charge can be brought on the books. Furthermore, it disregards the depreciation accrued up to the point of normal replacements.

(c) Fifty Per Cent Method

This method is also based on the law of averages. Here the law is very apt to work out satisfactorily. When the point of normal replacement of the assets, to which the 50% method is applicable, has been reached, the amount of depreciation is approximately 50% of the original value of the group of assets. This amount may be booked at that time and will remain without change thereafter, for the assets are maintained constantly in that condition. As a means of valuation, the method may serve well; as a measure of periodic depreciation or as a means of distributing the depreciation cost over the product, it is inadequate.

(d) Appraisal Method

This method is also inadequate as a means of measuring the periodic cost of depreciation. The physical facts of depreciation are not usually discernible at such short intervals. A judgment of values must, therefore, almost invariably make use, consciously or unconsciously, of some of the other methods of estimating the amount of depreciation by periods. After all, all methods of measuring depreciation are appraisals. Under the appraisal method confusion between original cost and reproduction cost is almost certain to occur, for present market values usually control physical appraisals. A discussion of the relative merits of original cost and reproduction cost as a proper basis for estimating depreciation will be presented in Chapter XI.

(e) Insurance Method

This method of carrying the depreciation charge is analogous to the policy practiced by some concerns of taking care of their fire losses by carrying their own insurance. If physical conditions are such as to make such a policy advisable or prudent, it should work out satisfactorily. It should be noted, however, that the insurance method is a means of providing funds for financing replacements and renewals rather than a method of insuring an equitable distribution of the depreciation cost over the product. The method of providing funds does not need to be the same as the method of measuring the periodic cost of depreciation. The insurance method serves the former purpose but is not well adapted to the latter. Much of the criticism of the sinking fund method is here applicable.

(f) Percentage of Gross Earnings Method

Measuring periodic depreciation as a percentage of the period's gross earnings is a convenient and fairly satisfactory method under some conditions. If the principal element is wear and tear—a service factor rather than a time factor—output may have a very direct relation to gross earnings. If the commodity dealt in is a standardized product and its price does not fluctuate to any extent or, better still, is fixed, gross earnings will be a very fair measure of output. It is true that the estimate is based on a sales valuation of output rather than its cost of manufacture, but under some conditions this is a good measure of relative output as between periods. A depreciation charge based on gross earnings may thus give an equitable distribution of the depreciation burden. In the case of public utilities, when the price of the commodity or service dealt in is fixed, an estimate based on gross earnings usually gives satisfactory results where used. In applying the method, the expected earnings during the composite life-period of the plant are estimated and depreciation costs are then prorated over periods on the basis of earnings for the period as compared with total earnings for the composite life-period; or more simply, a fixed percentage based on past experience can be applied to the earnings of each period. Some objections to the method, arising in some cases from a misunderstanding of its operation, were pointed out when an explanation of its working was given.

In some cases gross earnings bear no relation, or only the remotest, to the quantity of output or the units of service rendered. A depreciation estimate based on earnings would not in that case be logical and could not give satisfactory results.

From the above discussion of some of the merits and shortcomings of the various methods, the cogency of the introductory remarks, to the effect that no method of measuring depreciation can serve as a panacea, should be appreciated. Every depreciation problem is more or less an individual problem; sweeping generalities will not serve.

Effect on Return on Investment

Many interesting studies have been made of the effect of some of the above methods on stability of income as between periods and their effect on the return of the investment, using hypothetical data as to the earnings of the depreciating asset. Except for the purpose of fixing rates in the case of public service corporations, where the public has an interest because of the monopoly granted, stability of income should be subordinated to the fact of depreciation and not serve as a test of the merit or demerit of a method.

CHAPTER XI

RECORDING DEPRECIATION ON THE BOOKS

Methods Commonly Employed

Two methods of booking depreciation in the ledger are commonly employed. The periodic adjusting entry on account of depreciation has as its basic purpose the separation of the mixed account under asset title into its two elements—the one to show the expense element, the other to set up the true valuation of the asset. The expense element is set up under the one title

“Depreciation” for all the assets. The deduction from the values as shown in the unadjusted asset account may be made either by credit entry direct to the asset account or by entry to a separate “Depreciation Reserve” account, each one of these reserves distinguished by the name of the asset to which it applies.

The latter method is preferred because thus the asset account at any time shows the original cost of the property—information of value for many purposes and worth the effort needed to maintain it distinct from other items. Under this method every wasting asset account is immediately followed by its particular depreciation reserve account, called its “valuation” account. The depreciation reserve is as much a part of the record of the asset as is the asset account itself. The two accounts are complementary, neither giving reliable information without the other. The reserve account is thus always and only a balance sheet account.

The above statement indicates the most satisfactory method of handling the various depreciation reserve accounts on the balance sheet. Although appearing on the credit side of the ledger, they are in no sense liability accounts, being interpreted always as credits to the asset account, held in suspense, as it were, in the reserve account, pending full determination of their accuracy, which governs their ultimate disposition. Thus, on the balance sheet, either only the net present value of the asset should be shown, or preferably its original cost with its value extended short, its depreciation reserve deducted, and the present value, thus determined, full-extended. Further information of some value is given if besides the amount of the reserve the rate of depreciation is shown, though this is not often done. Occasionally an entirely incorrect showing, from the viewpoint of strict form, is seen when not only are the depreciation reserves—usually in one item—shown on the right side of the balance sheet but are set up in the Net Worth section, seemingly as a part of the surplus or other true profit reserves. This practice cannot be justified on any ground except that the sheet is kept in balance—a consideration which is far removed from real essentials.

Renewals and Replacements

First Method. As to the handling of the reserve at the time of renewal of parts and replacement of the entire asset, here also two methods are met. Under the one, the original cost of the part (or whole) retired is transferred from the asset account, its salvage value as defined above being carried to a Salvage account, and the cost less salvage portion being charged to the reserve account of the asset. This clears the asset account of all capital charges on account of the part (or whole) retired. The new part (or whole) replacing it is now charged to the asset account which then represents true cost of the new asset. If it is a whole which is replaced, theoretically the charging of it against the reserve should just clear that account of all values. Practically the preliminary estimate or forecast of the amount and time of depreciation never coincides exactly with the fact of depreciation. A credit balance in the reserve indicates an overallowance for depreciation and is an item of true reserved profits, i.e., surplus; whereas a debit balance indicates an insufficient allowance and is an expense item chargeable against surplus and not _current_ profits. This matter is treated at greater length on page 205. When the whole asset is replaced, the depreciation reserve should always be cleared of any remaining balance, as indicated above, so that the new asset and its depreciation allowance may be handled and watched unobscured by the record of any inherited sins or virtues from the past.

Second Method. The other method of handling the reserve at the time of replacement requires a comparison of the cost of the displaced asset and the cost of the new asset. The old asset account is allowed to stand untouched, but any betterment, i.e., excess of reproduction cost over original cost, is charged to it so that the asset account may show cost of the new asset. This cost, except for its betterment portion, if any, is now charged against the reserve. Both methods thus accomplish the same purpose, but the first is more direct and simpler of operation. It may be interesting to note that, in early instructions to railway accounting officers, the Interstate Commerce Commission prescribed the second method, which emphasizes the betterment feature. The present regulation is in accord with the first method.

Occasionally one finds a practice which, though based on the second method, differs in that no determination of betterment values is made, the original asset values remaining undisturbed and the entire reproduction cost being charged against the reserve account. This practice, of course, is due to a lack of understanding of the nature and purpose of the depreciation charge and its offsetting reserve, and is counter to correct principles. There is, however, seeming judicial support for it in cases of the valuation of utility properties for rate purposes. The problem is discussed in full on page 202. The entries on the general books thus present no difficulties.

Subsidiary Records

Subsidiary records should usually be kept to show the detail of the group asset accounts carried on the general ledger. Not only is this necessary to maintain an adequate check on the inventory of the group asset and control over it, but without a detailed record of items it is impossible to keep careful watch over the operation of the forces of decay and depreciation and, therefore, equally impossible to build up reliable experience data concerning each group of assets. The amount of detail necessary in the record of the plant assets is dependent upon the information desired and capable of being obtained within a limit of cost low enough to make it worth the cost. This is a matter of policy which the management must determine. It may be desirable to carry the records in much greater detail for a period than would be justifiable as a permanent policy. It may be worth while to make more or less frequent studies of particular groups of assets in order to check up the effect of the depreciation rates.

As is pointed out elsewhere, while the preliminary estimate of expected life, and determination therefrom of the depreciation rate, are of great importance and the utmost skill and judgment possible should be employed, only a policy of everlasting vigilance and readjustment, in the light of new data available with the increasing age of the asset, will bring satisfactory results. To predetermine a rate and then to expect it without supervision to work out to a successful conclusion is, to say the least, foolish. Only by means of a complete record of life histories can a mass of reliable data be built up which can be made to serve as a guide for the future. The depreciation problem is an individual problem and must, from the nature of things, remain so to a marked degree. Until conditions under which the lives of assets are to be lived become more or less standardized, or so long as each concern must carry its own depreciation insurance, standard rates of depreciation will not have a controlling significance.

Grouping and Classification of Plant Assets

From what has been said it is evident that the assets of a plant must be divided into groups for the sake of simplicity and convenience in keeping record of them. The basis of grouping should be physical similarity, process, or product. Thus, all tram cars might be carried in a group, as also all machines doing the same work or process. Groups of machines performing different processes on the same product could well be treated as a depreciation unit, and likewise all buildings used for the same purpose, if of a similar type of construction. If the latter are of different types it might be desirable to keep separate records. As stated above, the information desired must govern the groups under which record of behavior and performance are kept.

A numerical or an alphabetic numeric system of classification and identification is advantageous. Each machine, piece of equipment, or other asset should be marked or tagged when installed so that any particular piece of equipment can be identified at any time. The tag should carry date of installation and the name of the maker or vendor, as well as its own identification number. By the use of a combined alphabetical and decimal numerical system, almost any possible grouping can be made according to main and auxiliary groups, processes, or products.

Form of Plant Ledger

The form of the plant register or ledger need not be elaborate. Its main subdivisions should correspond with the subdivisions of plant and equipment carried on the general ledger. Thus, if we find therein accounts with buildings (factory, store, office, etc.), machinery, furniture and fixtures for factory, store, and office, delivery equipment, etc., subsidiary records should show corresponding subdivisions. It should be a matter of fixed policy to require a periodic proof of these subsidiary records against their respective controlling accounts on the general ledger. Only thus can the inclusion of all items in both records be made certain. The control established must cover both the items of the assets record—the original cost as shown by the asset account—and the accumulated depreciation as shown by the reserve account.

Asset Record

Aside from the title and classification and identification number, the plant register should provide a record of the asset under the heads of:

1. Date of installation or adjustment. 2. Estimate of life in periods, working hours, service output, etc. 3. Original value, including installation costs. 4. Periodic depreciation burden. 5. Periodic appraisal value.

On the form shown below, provision is made for adjustment of the original estimate of depreciation. Where there is a realizable scrap value, additional columns to show scrap value and total depreciation to be written off should be provided. The form shown would have to be adapted to the method of depreciation decided upon as applicable to a particular asset. Thus, if working hours or service output are the basis, provision should be made to show the basis of calculation of each period’s depreciation burden. The

following form is well adapted to make record of the asset under the straight line method of depreciation.

[Illustration: From “Principles of Depreciation” by Earl A. Saliers.

Plant Ledger (showing adjustment of value)]

Periodic Revision of Rates

In Chapter VIII where the problems in connection with depreciation rates were discussed, a periodic testing of the effects of the particular rate employed was laid down as an essential for the application of any rate. The determination of the rate in the first place is a problem requiring expert knowledge and the most careful consideration of many factors. Hardly less important, however, for the successful operation of any depreciation scheme is the attention given to the manner of its operation and a modification and readjustment of rates to bring the theoretical expectation of the wasting of the asset into accord with its actual wasting to date.

At the beginning, when the asset is first installed the depreciation rate must be based, so far as this particular asset is concerned, entirely on contingencies. None of its life has been lived; none of its actions and behavior have yet become a matter of record. What it is apt to do can be forecast only by a study of its ancestors—heredity as modified by a reasonable expectation of change due to different environment. However, at the end of five years, say, there is available a record of service and behavior in the light of which not only can the accuracy of the forecast be judged, but also a more reliable forecast for the remainder of its service life can be made.

Frequency of Revision of Rates

Because of the conditions stated above, a periodic testing of rates should be made. How frequently this should be done depends largely on local conditions. Certainly sufficient time should be allowed to pass to secure a really worthwhile test. What constitutes a sufficient time depends largely on the expected length of life. Long-lived assets obviously need not be tested so frequently as short-lived assets; and the periods should be shortened when the asset has been serving under supernormal conditions; the intensity of its life would be a controlling factor. It is usually stated that this testing of rates and conditions should be made at least every five years in the form of an appraisal. In the physical appraisal care should be used not to allow present market prices to enter into it, else the element of fluctuation may easily be brought in to nullify or exaggerate the real results of depreciation.

Test of Condition Per Cent

At the time of reappraisal the estimated condition per cent or the expectancy as to remaining service life are the points most to be considered. C. E. Grunsky has made an interesting contribution to the study of expectancy—theoretical, it is true, in the sense that it is based on assumed hypotheses, but nevertheless of value as calling attention to a phase of the subject that presents large possibilities. He takes 10,000 similar articles, all of probable life-terms of 10 years, and all simultaneously installed. Assuming that of these 10,000, 100 will fail or go out of service at the end of the first year, 200 at the end of the second year, that the largest numbers will fail in the years just before and just after the expected life-term of 10 years, and from then on, that there will be a gradual decrease in the number of failures until the 20th year, beyond which time (double the estimated life-period) none will remain in service—the following table is shown, which gives in the last column at the right the life expectancy of all remaining articles as at the beginning of a given year.

It will thus be seen that an article which has survived its 5th year, has at the beginning of its 6th an expectancy, not of 5 years but of 6.12 years; an article which has lived its allotted 10 years has an expectancy of 3.67 years; and so on. Certainly Mr. Grunsky’s study, if it serves no other purpose, at least draws attention to possible lines of development and, read in connection with facts as to the known length of life of many assets which have outlived their expected terms, it draws strong attention to the need of very careful use of any so-called mortality tables. These life history tables for assets are similar to the mortality tables used by life insurance companies.

TABLE OF EXPECTANCY[37]

The probable life of each article is 10 years or periods. For terms other than 10 years, each year in the table may be regarded as a period equal to one-tenth of the probable life-term.

(Based on the special hypothesis of failures as explained in the text)

========+===+========== | FOR 10,000 ARTICLES | SINGLE ARTICLE +----------+------------------+------------+---------- Year or | | Remaining Number | Remaining | Period | Number | of Articles at | Service at | Expectancy at | of | Beginning of | Beginning | Beginning of | Failures | Year | of Year | Year or Period --------+----------+------------------+------------+---------- 1 | 100 | 10,000 | 100,000 | 10.00 2 | 200 | 9,900 | 90,000 | 9.00 3 | 300 | 9,700 | 80,100 | 8.27 4 | 400 | 9,400 | 70,400 | 7.46 5 | 500 | 9,000 | 61,000 | 6.77 6 | 600 | 8,500 | 52,000 | 6.12 7 | 700 | 7,900 | 43,500 | 5.51 8 | 800 | 7,200 | 35,600 | 4.95 9 | 900 | 6,400 | 28,400 | 4.44 10 | 1,000 | 5,500 | 22,000 | 4.00 11 | 900 | 4,500 | 16,500 | 3.67 12 | 800 | 3,600 | 12,000 | 3.33 13 | 700 | 2,800 | 8,400 | 3.00 14 | 600 | 2,100 | 5,600 | 2.67 15 | 500 | 1,500 | 3,500 | 2.33 16 | 400 | 1,000 | 2,000 | 2.00 17 | 300 | 600 | 1,000 | 1.67 18 | 200 | 300 | 400 | 1.33 19 | 100 | 100 | 100 | 1.00 20 | 0 | 0 | 0 | 0 --------+----------+------------------+------------+----------

[37] From “Valuation, Depreciation and the Rate-Base,” by C. E. Grunsky.

Composite and Group Rates

In the practical application of the depreciation rate in a large plant, every separate piece of property is not, of course, considered by itself. The plant is divided into groups of similar assets, determined roughly on the basis of life expectancy, conditions of service, etc. Using these groups it is possible to find the rate of composite depreciation—a figure which serves as a check over the group depreciation. This is also sometimes called the “mean life” of the plant. It is determined by two methods—one called the direct, the other the dollar-year method. Assuming groups of assets of varying life lengths and costs, the following examples show the manner of estimating the amount of depreciation for the whole plant and also composite life; that is, the mean average life of the individual assets when viewed not as units but as a composite whole:

MEAN LIFE DIRECT METHOD

======+=========+================+==============+============= Group | Life | Value | Rate | Amount of | in | to be | of | Periodic | Periods | Depreciated[38]| Depreciation | Depreciation ------+---------+----------------+--------------+------------- A | 5 | $100,000 | 20 | $20,000 B | 10 | 75,000 | 10 | 7,500 C | 15 | 60,000 | 6■ | 4,000 D | 20 | 120,000 | 5 | 6,000 | | -------- | | -------- | | $355,000 | | $37,500 ------+---------+----------------+--------------+-------------

[38] That is, cost less salvage.

Mean life is $355,000 ÷ $37,500, or 9■/■■ periods.

Under the dollar-year method, the invested values are weighted by the length of their investment term and thus all investments are reduced to the common basis of one dollar for one year:

MEAN LIFE DOLLAR-YEAR (OR WEIGHTED RATIO) METHOD

=====+====+===========+=============+================+============ | | Values |Turnover Rate|Total Investment| Group|Life| to be | in Longest | During Longest |Dollar-Years | |Depreciated| Life-Period | Life-Period | (a) |(b) | (c) | (d)[39] | (e) | (f)[40] -----+----+-----------+-------------+----------------+------------ A | 5 | $100,000 | 4 | $400,000 | $2,000,000 B | 10 | 75,000 | 2 | 150,000 | 1,500,000 C | 15 | 60,000 | 1■ | 80,000 | 1,200,000 D | 20 | 120,000 | 1 | 120,000 | 2,400,000 | | -------- | | -------- | ---------- | | $355,000 | | $750,000 | $7,100,000 -----+----+-----------+-------------+----------------+-------------

[39] That is, the number of times renewal of the asset will be required during the longest life-period of any of the assets.

[40] Dollar-years, column (f), is the product of the total invested values as shown in column (e), and the life of each group as shown by column (b). Thus, $400,000 invested for 5 years is the equivalent of $2,000,000 invested for 1 year.

Column (f) ÷ column (e), (7,100,000 ÷ 750,000 = 9■/■■) gives the mean life.

Column (e) ÷ the longest life-period, 20 years, (750,000 ÷ 20 = 37,500) gives an annual charge for the whole plant.

What is known as “mean” age or plant expectancy as to remaining life may be found similarly. Assume a physical appraisal made after 12 years’ life of the above assets:

MEAN AGE (LIFE EXPECTANCY) DIRECT METHOD
=====+====+==============+=========+============+=============== | | Unexpired or |Condition|Values to be|

Values Already Group|Life|Remainder Life| % |Depreciated | Depreciated (a) |(b) | (c) | (d)[41] | (e) | (f)
-----+----+--------------+---------+------------+--------------- A | 5 | 3 | 60 | $100,000 | $40,000 B | 10 | 8 | 80 | 75,000 | 15,000 C | 15 | 3 | 20 | 60,000 | 48,000 D | 20 | 8 | 40 | 120,000 | 72,000 | | | | -------- | -------- | | | | $355,000 | $175,000
-----+----+--------------+---------+------------+---------------

[41] (d) = (c) ÷ (b).

Group A assets, having been twice renewed, would be in 60% condition; Group B, 80%; Group C, 20%; and Group D, 40%.

Column (f) ÷ column (e), (175,000 ÷ 355,000 = 49²¹/■■%) gives the per cent of composite depreciation already taken effect.

The mean life, as determined above, multiplied by per cent of composite depreciation gives the mean age or portion of the mean life already lived (9■/■■ × 49²¹/■■% = 4■).

The figure of mean or composite life may serve two purposes. First, it forms the basis for comparison with other similar plants and is about the only fair basis for comparison. Second, it gives the basis for estimating the amount of annual depreciation of the plant as a whole. This statement does not mean that individual depreciation reserves are not to be carried for each group of assets and those charged with the value of the asset as soon as it is discarded and renewed. But the use of the estimated mean or composite life figure does give a control over the amounts which should always be found in the individual group reserve accounts, i.e., at any given time the sum of the individual reserve account balances should be approximately equal to the amount as shown by the reserve when calculated on the mean life basis.

The Reserve as an Index of Financial Condition

The statement is often made that a balance sheet showing depreciation reserves points to a conservative policy in the treatment of plant properties. Usually such a balance sheet affords little or no basis for expressing a judgment as to conservatism or the lack of it. All that it does show is that recognition is made of the _fact_ of depreciation. As to its _adequacy_ or _inadequacy_, a knowledge of other factors is necessary.

Fluctuating Reserve. According to successive balance sheets a reserve may vary little from year to year, or it may show considerable increase or decrease, and any of these conditions may be entirely normal and express adequacy of reserve requirements. In the first case, stability of the reserve may result because the asset is short-lived and hence is more or less frequently replaced; or different units of the property may have been installed at somewhat regular intervals so that retirements from service are also somewhat regular. Under either supposition, the charges against the reserve for the units displaced would just about keep pace with the regular credits to reserve for replacement purposes. In other words, that condition of the reserve for that class of asset is the normal condition—except perhaps in the case of a rapidly expanding plant, or other conditions not counted as normal when the reserve requirements were put into operation—and any other condition should lead to inquiry and investigation.

Increasing Reserve. In the second case where the reserve is showing a considerable increase from year to year, that also may be a normal condition. Long-lived assets are seldom replaced with any degree of regularity in the annual charge against the reserve, except in the case of very large plants where the number of such assets is correspondingly large in proportion to their size. Here more or less regular installations may take place as a result of an expanding business, covering a period of approximately the same length as that of the life of the asset. So here, too, any other than a regularly increasing reserve must incite inquiry.

Decreasing Reserve. As to the third case, that of a somewhat regularly decreasing reserve, the condition is not usually normal but may occasionally be met in a plant where one type of equipment is being retired and not replaced, due perhaps to a changing line of activity; as when, for instance, a stock furniture manufacturer works gradually into the exclusive manufacture of automobile and carriage bodies. Some types of equipment will thus be gradually retired and their reserves will constantly diminish, their place being taken by other reserves covering the new type of equipment. However, this condition of decreasing reserves, while entirely normal under certain circumstances, being unusual, should always receive careful investigation. It is here that mean life and mean age or composite plant depreciation are of assistance in forming a judgment as to the general adequacy of reserves.

The Reserve in Relation to Expanding Plant

In the case of a plant the development of which is stationary, the problem of judging the adequacy of the reserves is simple in comparison with a plant which is expanding, resulting not only in the installation of more of the same kind of equipment but also of

equipment of other kinds. A disturbing element is thus introduced and careful oversight of the depreciation policy must be exercised. In all cases, intelligent reading of the reserve and its sufficiency are internal problems based on intimate knowledge of conditions. Lacking this knowledge no true judgment can be made. The character of the asset, number of units in use, dates of installation, a comparison of the assumed conditions at date of installation with the actual conditions of the present—all are factors to be taken into account.

Reserve as Related to Efficiency

The general relation of efficiency to depreciation has already been discussed. As to whether the condition of the reserve is any index of the efficiency of the service rendered by the plant unit, attention is briefly directed to a misinterpretation of individual reserves. Experts state that many types of equipment cannot deteriorate actually more than a fixed per cent of their cost and continue to give efficient service. If, say, 30% is the limit in the case of one type, this does not, of course, indicate that, as soon as the depreciation reserve shows an amount equal to 30% of the cost, the approach of inefficient operation and the time of discard are at hand. It must be borne in mind that the reserve is a device based on financial considerations and, if properly calculated and handled, no asset should be ready for retirement until its reserve approaches in amount the value at which the asset is carried in its account. Nor is the point of approaching inefficiency shown until that condition of the reserve is found.

Reserve not Based on Cost of Replacement

The question is sometimes raised as to whether reserve requirements should be based on original cost or cost of replacement new. The question usually reveals a lack of understanding both of the purpose of the depreciation charge and the means of financing depreciation. It is usually said that the reserves carried on the books are for the purpose of providing the means of financing the replacement. It is not the purpose here to go into the question of original cost versus cost of reproduction new, either as a basis for valuation of public utility properties or from the viewpoint as to where the incidence of the burden of replacement properly should rest—whether on the users of the service given by the asset to be replaced or on those using the new asset. In the private enterprise where the rights of the public are not so apparent, under present-day tenets of political and economic philosophy, only internal policies and purposes to be accomplished need be considered.

As stated above, the basic purpose of the creation of the reserve is to burden the product with depreciation charge as a real part of the cost of production. If we are concerned with real and actual costs of production, by no stretch of the imagination can replacement cost—what it might cost to replace the asset at some more or less distant time—enter into the question. It might, with equal obscurity of logic, be said that, because the labor cost is bound to be higher 10 years from now than at present, in order to get the true _present_ cost of the product the estimated future labor cost should be taken in place of the actual present cost.

The Financing of Replacements

If one purpose of the depreciation reserve is that of financing depreciation, this can mean only that the reserve must insure provision being made so that the capital invested will not be lessened or encroached upon by the wasting of the assets in which it is invested. It is no necessary or proper purpose of the reserve to provide for increasing the invested capital. _Financing_ the _replacement_ of the retired asset is a separate financial problem and only concerns accountancy, so far as the records may reflect that policy. The reserve, in itself, does not furnish the means of financing any part of replacement, as was fully shown above. If the new asset is expected to cost more than the old, certainly business prudence would dictate provision for the added cost as well as ready funds of an amount equal to the original cost. The actual capital provided originally need be sufficient only for the time being; to provide more than that, if remaining idle, would be folly. If there is evidence of expansion, or if it is recognized that more will be needed—due to change in markets—for replacement purposes than was originally needed at the inception of the enterprise, provision must be made therefor.

Methods of Financing Replacements. In the financing of replacements, three courses are open:

1. Capital stock may be increased. 2. Funds may be borrowed. 3. Profits of the past may be reserved in the business and the actual value of the holdings of the owners thus be enhanced.

In the third case present dividends may be sacrificed for the sake of the future. Such reserve profits must be kept and used for the intended purpose, the purpose dictating their form as liquid or fixed. It cannot be too strongly emphasized that these are reserves of _profits_—not valuation or offset accounts under the title of reserves. Depreciation reserves, except they become secret reserves

in the sense referred to below, have no right to serve any other purpose than that intended, viz., to provide insurance that none of the originally invested capital shall be dissipated and that the current product shall be burdened with its just share of _all_ the materials and costs of production.

Secret Reserve

A great deal has been said about inaccuracies in the depreciation charge; the need of periodic readjustments has been emphasized. Now it is purposed to look into the effects of inaccurate charges remaining unadjusted on the books. In a desire to be on the safe side, some concerns, notably financial institutions, make very liberal provision for depreciation. Such a policy is not entirely to be condemned and is decidedly refreshing in comparison with the parsimonious allowances, begrudgingly made in some quarters. The effect of such a policy, if operated without check, is to create what is known as a “secret reserve.” The value of the asset is charged more rapidly against operation than the asset actually wastes. Hence the books show a reserve sufficient to cover the cost of asset while there are still values remaining in the asset. In other words, the business possesses an asset of value which is carried on the books as of no value. Were the real present value of the asset brought on the books, the contra credit would appear in some surplus or _profits_ reserved account. Such would constitute a true record of the item, openly stated. So long as the asset remains concealed, i.e., without record on the books, its contra credit is also latent and constitutes a _secret_ reserve of profits.

A too liberal depreciation policy, if recognized and adjusted at the time of a reappraisal, will require a separation from the depreciation reserve of the portion brought about by the overallowance, and its showing as a part of the surplus. When so handled, an overcharge for depreciation has no permanently bad effect except as it may show, for purposes of comparison, too high costs of production for the period overburdened. However it may be and sometimes is, used for purposes of fraud and therefore, as a fixed policy, the practice of the secret reserve is to be condemned.

Insufficient Charge

On the other side is the parsimonious policy of too low a charge or none at all. This results, whether consciously or not, in a charge against capital instead of revenue. At the close of the fiscal period the books are supposed to be brought into accord with the facts of true condition as then existing. Therefore, if the full portion of the accrued expenses is not separated from the wasting asset accounts, but is allowed to stand on the books under the title of assets, then these true expense items will still be carried hidden under the cloak of asset titles. The depreciation is thus carried as a charge against capital. The depreciation of a _going_ concern should never be so treated; it is an operating charge, and no flight of fancy or shuffling of figures can make anything else of it.

In the case of a property, showing inflated values because of too low depreciation charges in the past, which is taken over and rehabilitated, the sums spent on the property previous to operation to put it in condition are properly capital charges. This is allowed on the theory—unfortunately, not always a fact—that the difference between the book value of the property and what was paid for it represents the estimated expenditures necessary to bring the property up to its book value. If such is not the case and full book value was given for the property, the charge is still allowed, being looked upon as in the nature of an organization expense, representing in an instance of this sort the measure of the bad bargain made. This will, of course, result in a penalty in the form of an added depreciation burden on all product from the property taken over and rehabilitated.

Appreciation as an Offset to Depreciation

If depreciation is so inevitable and the necessity of its charge so absolute, can anything be said in support of the proposal to offset depreciation against appreciation? By appreciation is meant an increase in value due to the passing of time. Judicial authority can be found in support of it in cases of valuation for rate purposes.[42] There is no question but that a _realized_ increment in land or any other asset offsets a depreciation or any other expense charge in just the same way that any other item of income offsets an expense. There is, however, this marked difference between depreciation and appreciation: the former is an inexorable reality advancing day by day entirely independent of market fluctuations, whereas the latter is dependent on the market and usually cannot be realized until the asset is sold.

[42] See Consolidated Gas Co. v. City of New York, 157 Fed. Rep. 855, and 20 I. C. C. Rep. 344.

When, however, as is too often the case, the proposal to offset depreciation by appreciation is meant to justify a policy which takes no cognizance of depreciation on the books because it is offset by appreciation, no support can be found for that view. In itself it

reveals an entire lack of knowledge of the purpose of the depreciation charge or a disregard of the fundamental and obvious requirements of prudence. Depreciation is one of the costs of production and without it true cost cannot be shown. Failure to show depreciation on the books would justify also the omission of a cash income item because the cash was to be spent immediately in payment of salaries—a cancellation outside the business records of income against expense which can under no circumstances be justified.

Appreciation Due to Physical Changes

There is a kind of appreciation which is not dependent on fluctuations of the market and which as surely accrues, up to a certain point, day by day as does depreciation. Properties the value of which has been enhanced by earth construction work done on them are susceptible of this kind of appreciation. “Appreciation is generally restricted to physical items, and measures their gain in value due to age, use, and properly directed labor.... It results from work not specifically charged to capital account ... and covers items not represented ... in connection with a valuation.”[43] It is found in connection with such items as roadbeds, solidification and grassing of slopes, drainage, dams, embankments, etc.

[43] Valuation Committee of the American Society of Civil Engineers.

Its two forms are called solidification and seasoning, and adaptation. By the first is meant a settling and compacting of loose earth and its protection from wasting and washing away, as by the grassing of slopes, and the planting of trees and shrubs to hold the snows. When a roadbed is turned over to the operating division, it frequently is far from complete in the sense of being in a high state of efficiency, and the cost of its maintenance and up-keep during the early years of its life is much higher than during later years. This appreciation due to seasoning is difficult of valuation, but perhaps the difference in up-keep between early and later years is the best measure of it.

Appreciation Due to Adaptation to Use

“Adaptation” is a term used to cover that class of expenditures needed for the better adaptation of the property to its use. In the early stages of the development of a property many things cannot be foreseen nor can a proper basis be settled upon for a determination of the charges as between capital and revenue. The proper handling of such expenditures as those incurred for drainage requirements, better adaptation of the roadway to the surrounding topography of the country, etc., are difficult. If these costs have not originally been charged against capital, the properties may truly be said to have appreciated in value by reason of them. Items of this kind require a wise discrimination between costs of operation and capital charges. The effect of such changes is almost always lost sight of so far as physical appearance shows, and the appreciation due to them is difficult of valuation at a later time. In the case of railroads, perhaps the difference in maintenance cost as between the early and later years of the roadbed is the best index.

In the case of industrial concerns, the cost of a rearrangement of machinery and working facilities for the better and more economical handling of the product frequently results in an appreciation in value due to adaptation to use. This has already been discussed in Chapter V.

As stated above, appreciation has judicial sanction and its valuation, although fraught with many difficulties and uncertainties, has been made and the results accepted. The generally haphazard method of roughly estimating the value of an appreciation when its determination becomes necessary suggests that it were better, by far, to attempt the proper segregation of the charge between capital and revenue at the time of its incurrence, rather than to take cognizance of an appreciation in value at a later time. There are undoubtedly circumstances in which appreciation in value can be properly recognized and should be taken into the accounts not only of public utility properties but also of industrial concerns.

Unearned Increment

Appreciation in value due to so-called unearned increment is entirely a matter of market value. By this is not meant that the monetary value of this kind of appreciation fluctuates with the market; it accrues from day to day and is just as real as depreciation. Although very real, it does not become _realized_ until the property is disposed of, a thing which is determined by business policy and does not rest on any principles of accountancy. It is not good practice to bring such unrealized values on the books. For a fuller consideration of this phase of the subject, see Chapter XVII where the problem is treated in connection with land and real estate.

Depreciation Policy and Stockholders

A final consideration concerns the relation of the depreciation policy to the stockholder. As stated above, a too liberal depreciation policy results in the creation of secret reserves which may be used to the prejudice of the stockholder by an unscrupulous managing clique desirous of buying minority holdings at a depreciated value or of manipulating the stock for speculative purposes. An insufficient depreciation allowance results in a false optimism, a payment of dividends out of capital, and perhaps finally in a wrecking of the property. Except for the transient, speculative shareholder, a fixed depreciation policy based on a conservatively accurate allowance is always for the best interest of the property and its owners.

CHAPTER XII

CASH AND MERCANTILE CREDITS

Introduction

In Chapter V an effort was made to establish the general principles of valuation as applicable to the main classes of assets found on the average balance sheet. In doing so, the fundamental distinctions between capital and revenue charges were set forth. In the six chapters on depreciation the general principles of depreciation and their application to problems in accounting have been developed, with particular emphasis on the problems of valuation and true costs. It is purposed now to consider in detail the various problems met in the valuation of the individual items found on the commercial balance sheet. It will be necessary also to consider the method of showing these items so as to indicate the basis of valuation and something of the financial policy employed. The various assets will be considered in the order of their appearance on the balance sheet, the arrangement being based on degree of liquidity, beginning with the most liquid.

What Cash Includes

There is little to be said about the _valuation_ of an asset of such evident and definite value as cash. The problem here is rather one of showing the nature of the asset, although certain principles of valuation under given conditions need also to be considered.

The term cash as an item in the balance sheet usually includes all money and whatever serves as money. Thus, all legal tender of the realm, bank notes, checks, bankers' drafts, postal and express money orders, and occasionally postage stamps and even "IOU's" are classed as cash. Not all items, however, that may be carried on the books as cash should appear under this caption on the balance sheet. There only the current asset cash should be listed in the group of current assets. All other cash, including that held for specific purposes under deed of trust or otherwise, should, unless it is readily applicable for the cancellation of current liabilities, be shown in some other group.

Where the petty cash or working funds of all sorts are operated on the imprest system, the funds should be replenished before the books are closed and should thus be truly valued at their ledger figures. The bank account should be reconciled with the cash book, and the figure should represent the amount at which the item is to be taken into the balance sheet. This means, of course, that all properly authorized claims against cash in bank are to be treated as cash disbursed if they have been regularly issued, whether presented for redemption at the bank or not. Checks written but not yet mailed are not usually treated as cash disbursed because they are still under control. Similarly, items left at the bank for collection and deposit may be counted as cash on hand. If, however, as might happen in exceptional cases, a comparatively large amount represented dishonored items and a second attempt was being made to collect these dishonored items, the better procedure would be to omit them from the cash total and include them with the receivable items. In this connection attention should be called to the practice occasionally met with of holding the cash open for a few days after the closing date for the purpose of making a better showing as to balance on hand by means of new collections. This, of course, is a practice which cannot be countenanced under any circumstances as it is simply an effort to mislead, even though the effect may not always be bad. A balance sheet is a statement of financial condition purporting to be true as on a certain named date. The values shown therein are therefore to be those applicable to, and true on, that date and no other.

Stamps Remitted as Cash

Some concerns dealing in commodities of small value sold through the mails allow, and even encourage, payment by means of postage stamps, these in turn being used for their own correspondence and parcels post expense. The proper place to record the value of this item at the close of the fiscal period is in the inventory of office supplies or other similar heading instead of treating it as

a part of the cash. This necessitates a transfer from cash to office supplies. The transfer can be accomplished in either of two ways without interfering with the usual handling of the cash whereby it is checked against the bank's record of deposits and checks as explained in Volume I, Chapter XXXV. The customary method is to use the cash book as the place of record for the receipt of stamps and then transfer them to the stamp drawer for office use. All other "cash" being deposited in the bank, the record of cash receipts as shown by the cash book does not thus check against the record of deposits as shown by the bank. To secure this agreement, a check may be made out payable to "Cash," "Ourselves," or "Postage," and passed through the bank periodically as a deposit and so secure the proper agreement between the bank's record and the concern's. The record of the check among the cash disbursements thus secures the proper charge to Postage or Office Supplies and also effects the proper agreement between the bank's record and the concern's. The use of a "postage" journal, operated on the same lines as the cash book and recording all receipts and disbursements of postage, would accomplish the same purpose and in some circumstances would be advisable.

Temporary Cash Disbursements

The practice of allowing proprietor, cashier, or others to take cash from the cash drawer and leave a memo of some sort to show responsibility or purpose is to be deprecated. Only where the principle is strictly adhered to of depositing all cash and disbursing only by check and by means of a petty cash fund handled under the imprest method, can adequate control over cash even be approximated. Where, however, such is not the practice, the problem is not that of the valuation of cash, for the memos are not cash, but of the valuation of claims receivable—a subject to be treated later in this chapter.

Disposition of Cash Funds

In the showing of cash for purposes of management, it is essential to indicate the present disposition made of the various cash funds or to show the immediacy of the control over them. Thus cash should be listed as:

1. Safe or drawer 2. Various working funds 3. Petty cash fund 4. Bank

Under "Bank" should be indicated how much is held on "current" account and how much is restricted to special purposes. Of the current balance it is desirable to show the portion subject to check for immediate needs and the portion representing surplus funds not immediately needed and therefore held to earn interest. These amounts subject to interest are almost always available on short notice, but usually only with the sacrifice of interest earnings to date.

Cash from the sale of capital stock or bond issues, or from the sale of old plant or any portion of it, under authorization from the stockholders that it be held for purchase or construction of new plant, or for other capital purposes, comprises that held for specific purposes. Sometimes even cash in the sinking funds might be included in the list. As it is usually of importance to keep the management informed as to the amounts of cash available for the various purposes stated above, an effort should be made to give this information, without too much detail, in the balance sheet if it is drawn up for internal use.

Cash Held Abroad

There remains to consider moneys held in a foreign branch and thus subject to fluctuations of exchange. In Chapter XXXI, where the subject of the foreign branch is treated, a full discussion of the problem of exchange in its relation to the accounting records will be given. Here it is sufficient to say that as between countries where exchange rates vary little, the general practice is to use an arbitrary conversion figure for incorporating the results of the foreign branch with those of the head office. This conversion figure applies to cash as well as to all other items. The use of such an arbitrary basis will give substantially correct results under the conditions named.

The assets of the foreign branch are the properties, usually and for the most part, of proprietors and stockholders residing in the country of the home office, who are concerned merely with the distribution of the earnings of the foreign branch. Profits are made in one currency to be distributed as dividends in another currency. Hence, the rate of exchange prevailing at the time of closing the books would usually give the most accurate results and should, of course, be used when exchange is not fairly stable between the two countries. It may even be conservative and advisable to set up a reserve for fluctuations in exchange, with the object of absorbing what might otherwise be too great a charge or credit to the current period's profit and loss if a particularly unfavorable or favorable rate were prevailing on the date of conversion.

Accounts and Notes Receivable

In the valuation of accounts and notes receivable the problem is largely one of appraising the uncollectible items. The book account and note are intermediate stages in the conversion of merchandise into cash. Were they always worth their face value there would usually be no problem in their valuation except for the element of theoretical interest which is not commonly taken into account by commercial enterprises. In considering this problem of valuation, the question of the correct use of terms arises. For the sake of clearness, when showing the items on the balance sheet, attention will be first directed to this latter phase of the subject.

Objection to the Title, Accounts Receivable

The governing principle here is that only current items can be included in this group of assets when shown on the balance sheet. In accounting, as in economics, there is no distinctive scientific terminology. The economist makes use, for the most part, of every-day words and phrases. These are often open to misunderstanding and are sometimes capable of being used even for wilful misrepresentation. Recognition of this fact has made necessary a more careful definition of some terms. In the language of the street, almost any claim against outsiders may be spoken of as an “account receivable.” The term is thus so broad as not only to include current claims against customers in regular course of trade, and accrued income, such as rents, commissions, interest, dividends, etc., earned but not yet received, but also to serve as a cloak covering many other kinds of claims and deposits. Among these may be enumerated:

1. Cash deposited to cover breakage or damage to equipment in use, to guarantee the payment of prospective expense, or to guarantee good faith in the performance of a contract. 2. Moneys advanced to subsidiaries, salesmen, and other employees on account of expenses and salaries. 3. Claims against creditors for returned or damaged goods, against railroads for lost or damaged goods, and against governments for rebates, drawbacks, and the like. 4. Prepayments on purchase or expense contracts, as payments made to bind a bargain or before delivery of goods; and expenses paid in advance, such as royalties, rents, interest, etc. 5. Unpaid calls or instalments on stock subscription contracts. 6. Claims against absconding officers for property appropriated or trusts violated.

It is necessary, therefore, to employ a term of more definite meaning which cannot be misused. The word “Customer” is sometimes used and is not objectionable. However, the term “Trade Debtors” is more generally employed and will be so used here as denoting all claims against customers, clients, etc., in regular course of business. Its appearance in a balance sheet is usually evidence of a careful discrimination among the various classes of claims and is not therefore a misleading term.

Risk from Credit Losses

As stated above, the chief problem in valuing accounts and notes receivable is that of estimating bad debts. It is a matter of general experience that some of those to whom credit is extended do not pay their bills. Hence, at the close of the fiscal period it is necessary, so as not to overstate the asset, to estimate the amount which probably cannot be collected. The necessity for this is recognized in a decision of the United States Supreme Court in Providence Rubber Co. v. Goodyear, 9 Wall. 788, and has the sanction of conservative business policy.

The effect of such an estimate is that the period in which the sale is effected is made to stand the loss, and not the one in which failure to secure collection is experienced. There is a close relationship between the actual loss from bad debts and the credit policy of a concern. Where the sales force is allowed to grant credit, the loss from bad debts is almost invariably large. Where the extension of credit is controlled by a credit department, the loss is less than in the other case but depends on thoroughness of information and investigation of the risk. However much care may be exercised, there will be nevertheless some loss, but a live credit supervision should keep the loss at a minimum.

Risk and Length of Credit Period

The amount of loss, or rather the percentage of loss, is not the same for different lines of business nor even for different concerns in the same line. The normal credit period for a particular business has some relation to the loss. Thus if credit supervision and collection effort are the same for two concerns, the one with the shorter credit period will usually have the smaller loss. In a business, for example, where the credit term is 60 days, we would expect fewer uncollectible accounts than in one whose credit period extends for a year or more. As between two concerns in the same line of business, _where conditions are fairly uniform_, however, there should be little variation in the loss from bad debts. As pointed out in Volume I, Chapter XXXVI, the sales discount policy is for the most part a device for overcoming the element of risk in the extension of credit.

Analysis of Customers' Accounts as the Basis for Estimate of Bad Debts

In estimating the amount of bad debts, experience within the particular business is the only safe guide. Oftentimes, however, the manager or proprietor is not the most competent person for the task. The auditor, in consultation with the manager, may often arrive at a better estimate than could someone closely connected with the business. In making the estimate, it is an aid to analyze the accounts according to the length of time they are past due. Thus, there would be, after analysis, the amount of those overdue not more than 30 days, the amount of those overdue not more than 60 days, the amount of the 60 to 90 days overdue items, those 90 days to six months, those six months to a year, and all those more than a year overdue. The total amount outstanding minus the sum of these overdue classes represents the portion not yet due. Some part of the not-yet-due portion is, of course, still subject to discount if paid within the discount term. With the claims against customers thus analyzed, a much better basis is afforded for testing the adequacy of the provision for bad debts. The various methods of estimating this provision are discussed on page 219.

It may here be noted that when making up the estimate of bad debts it is by no means always necessary to analyze the outstanding items as suggested above. Such an analysis is of value in three cases:

1. In the case of a new concern where there is no past experience on which to base the estimate. 2. In the case of an outsider—a professional auditor or other party—being called upon to make the estimate. 3. Periodically, in any business, as a check on the work of the collection department.

The value of the analysis in cases (1) and (2) is based on the principle that the longer an item is overdue, the greater is its likelihood of proving uncollectible. The need of an increasing rate for the different classes as analyzed above is apparent. In case (3) its value lies in the fact that it reveals the general effect of the collection policy and incidentally points out any change in policy. Any additional factors which may have wrought a change in the general financial situation must, of course, be taken into account.

Basis of Estimate of Bad Debts

Three methods of making an estimate of bad debts are found, in all of which a percentage of some given base is used. The various bases are respectively:

1. The amount of outstanding trade debt at the time of the balance sheet. 2. The amount of sales on credit made during the present fiscal period. 3. The total sales, both cash and credit, for the present period.

Trade Debtors as the Basis. The use of trade debtors as a base is obvious because it represents the uncollected charges from which alone can any loss from bad debts arise. The use of such a base seems correct in principle. This is so in cases where a balance sheet is made up only once a year, so that conditions as to the periodicity of the sales are practically the same from year to year. The amount of loss from uncollectible items is then somewhat nearly proportional to the amount of claims outstanding at the close of the fiscal year. But where it is necessary to make the estimate monthly, or oftener than once a year, it is very probable that at some of the intermediate periods the amount of outstanding claims will bear no logical relation to the loss from bad debts. Thus, in the garment industry the sales for practically the whole year are made within a few months, and during the other months the processes of manufacture and collection are carried on. For these reasons the amount of bad debts is not proportional to the outstanding claims at the end of each month, nor does such a base properly allocate the losses to the periods in which the sales are made. Accordingly one of the two other methods previously mentioned is used.

Sales as the Basis. Inasmuch as there cannot be any loss from bad debts in the cash sales, theoretically the credit sales provide the proper base for making the estimate. Practically, total sales, either gross or net, furnish the base most frequently employed because the total is always available without the necessity for analysis. So long as the ratio of the two kinds of sales remains fairly constant, the loss from bad debts does bear a direct relation to total sales.

Summary. It may be said with respect to the use of trade debtors as a base, that it gives satisfactory results where conditions are uniform from period to period. In its use, however, cognizance must be taken of any change in the credit policy of the business whereby the term of credit is shortened or lengthened as that in itself would tend to change the ratio of the base to the estimated loss from uncollectible items. As between credit and total sales, theory favors the former but practical considerations the latter. If for any reason the ratio of cash to credit sales should change, the change would have to be taken into consideration when making a comparison between periods of the loss from bad debts. No justification can be found for a fourth method sometimes met with, which makes the provision for bad debts bear some relation to the net profits—large if profits are large, and small or none if profits are small.

In handling the estimate of bad debts on the books, the same considerations are to be observed as in booking depreciation. Care must be exercised not to allow the reserve to grow beyond liberally estimated requirements and so create a secret reserve, nor to fall below such requirements. This must be watched closely and, if need be, the rate changed to accomplish the desired result.

Discounts and Collection Costs

In connection with the valuation of trade debtors, the problem of collection costs and cash discounts must be considered. Some authorities connect these costs directly with sales and make provision for them in the valuation of the current trade debtors; i.e., an estimate of the cost of collecting the outstanding claims and of the probable amount of loss from discounts on the amounts outstanding is deducted by means of reserves from trade debtors and so shown on the balance sheet. Where such a practice is followed, strict consistency would require that a similar credit provision be made for discounts on purchases—a practice not often advocated. The weight of opinion is in favor of taking all such costs and credits into account only when they are actually met. This accords with the treatment of these items as financial management items (explained in Volume I, Chapter XXXVI) and as therefore bearing no direct relation to sales. If, however, unusual costs of this or any other kind are anticipated, prudence demands that provision, by means of reserves, be made for them. Usually the costs average up pretty well from period to period.

Valuation of Other Receivable Items on Open Account

The problem of valuing the other classes of receivable items previously mentioned on page 215, does not differ in the main from that of trade debtors just discussed. If they are worth their face value they should be so shown. If worth less, the necessary valuation reserves should be set up. With these items the _chief_ problem, however, is their proper showing on the balance sheet; i.e., their correct classification and a suitable nomenclature. Most of the items are not strictly current, but even their inclusion under this head is not misleading if they are carefully earmarked to show their true nature. Some of them are decidedly fixed, some are in no sense assets. In some cases even trade debtor balances as carried on the books are not strictly current. In concerns where sales are made on an instalment basis, usually the payments extend over several months and oftentimes years. The customer is charged with the whole amount and credited with the regular instalment payments as made. The portion of the outstanding balance covered by the more remote payments is thus not current. In concerns where both regular and instalment sales take place, a separation of the customers' balances on the basis of the sales contract gives the necessary information for balance sheet purposes. The accounts of instalment trade debtors normally require a much more liberal valuation reserve than those of regular credit customers.

Loss on Notes Receivable

In some cases the expected loss because of uncollectible notes may be less than that from open accounts, due to the greater formality of the note as an instrument of credit and the probably greater loss of credit to the maker in case of dishonor. However, in making provision for bad debts, the practice is almost universal to class the two receivable items together. Such practice is undoubtedly sound. In the case of notes, the request for payment is more forceable because of the definitely stated due date and the loss of standing if unpaid after such date. In some cases the payment of notes is not pressed, nor is any extraordinary provision made for past-due items—as in industries allied with farming when an unusually bad season makes impossible the payment of notes given by farmers. Again, the practice is sometimes made of taking notes for a long overdue, open account. These have usually no better value than the accounts and must be treated accordingly.

The usual method of handling overdue notes receivable is given in Volume I, Chapter XXXVIII. As there stated, where payment is allowed to lapse, it is generally advisable to insist on the giving of new notes in place of the old. There may be circumstances in which this is not advisable, but the proper method will usually be apparent in each case.

Interest on Notes Receivable

The valuation of notes receivable—using the term to include all written promises to pay, i.e., promissory notes, accepted drafts, and the like, requires a consideration of interest. By far the larger number of notes given in trade are non-interest bearing and are not therefore worth their face value until they become due. The interest problem in the valuation of notes is thus whether the notes should be shown at their face value or present, i.e., discounted, value. Notes which are interest bearing from their date of issue are, of course, worth their face, on the assumption that the interest takes care of the discount. Where non-interest bearing notes form a very considerable item it is well to value them on a discounted basis; if their amount is small, theoretical principles of valuation give

place to practical considerations and they may be valued at their face. Where notes bearing interest are valued on a discounted basis, care must be exercised not to include the interest accrued both in their face valuation and also under the head of accrued income.

Balance Sheet Titles for Notes Receivable

The problem of terminology is also met in handling notes receivable. Under the balance sheet caption “Notes Receivable” should usually be included only notes received from trade debtors, and certainly it should never represent any but current asset items. Notes received from officers and employees, of indefinite term and the payment of which will not be pressed, should be recorded under some such title as “Notes Receivable Special.” Long-term notes and those representing loans or advances of any sort should be properly earmarked, as should also loans carried on open account, salary overdrafts, and the like. The latter should be shown under Deferred Charges. These nicer points of valuation cannot be presented on a condensed balance sheet, but care should at all times be taken to make such a showing as will not be misleading and will serve the purpose for which the statement is to be used.

CHAPTER XIII

MERCHANDISE STOCK-IN-TRADE

Definition and Scope of Term

Stock-in-trade, as the term is usually understood, comprises all commodities purchased for resale. Thus, assets, which in one concern belong to the fixed asset group, may be the stock-in-trade of other concerns. In stating the principles of valuation for these assets, it is definitely to be understood that they apply only to such as are used as stock-in-trade, and not to the same items when used as fixed assets. Oftentimes the process of manufacture intervenes between the purchase of a commodity and its sale. In such a case the commodity, at the time of valuation, may be in different stages of completion. It is then usually so listed on the balance sheet under suitable titles, such as Raw Material, Goods in Process, and Finished Goods, all of which are treated as current assets. Included in the problem of valuation of stock-in-trade is the treatment of goods out on consignment, goods of others held for sale on a commission basis, and scrap material. Finally, some points to be observed in taking the physical inventory will be considered.

Valuation at Market or Cost Price

Inasmuch as stock-in-trade is purchased solely for resale or ultimate conversion into cash, it is desirable for the balance sheet to reflect the proper value of what remains on hand unsold. Such goods may have a realizable value higher or lower than cost value, from the standpoint of the market in which they were purchased, and will usually have a higher value in the market where they are to be sold. The value of all current assets to be shown on balance sheet is usually stated at the present realizable value. As applied to stock-in-trade, that must not be understood to mean sale or retail value. To value the stock-in-trade on such a basis would result in taking into the current period the profits on sales not effected until the next period; furthermore, these profits would not even be offset by the costs of making the sale. It may be laid down as a principle of business practice based on sound reason, that the period in which the sale is made should be given credit for it. Stock-in-trade must therefore be valued on the basis of its purchase or wholesale market price and according to well-established practice, either at cost or market, whichever is the lower. This principle has the support of conservative practice throughout the world.

Objections to Valuation at Less than Cost

The effect of valuing the stock-in-trade at a lower market than cost is to bring into the period’s results a loss which may never be realized, either because the change in the purchase market may not be reflected in the sale market, or because, if so reflected, the market may swing back before actual sale of the stock is made. If valuation is to be at the market when that is lower than cost, consistency would seem to demand that, when the market is higher than cost at the time of preparing the balance sheet, market value should be used and the profit occasioned thereby be credited to the current period. The answer to this argument is that operation would thus be placed on a speculative basis.

Again, it is sometimes argued that good buying is just as essential to profit-making as good selling. Accordingly, the purchasing department, with the foresight to buy in a favorable market, should receive the credit for it; if conditions are reversed, it should bear the blame, i.e., the loss. In other words, the period in which the purchase effort is expended should be credited or charged with the

gain or the loss brought about by a favorable or unfavorable condition of the current market as compared with its condition at the time the purchase was made.

Anticipation of Profits or Losses Undesirable

In answer to these various contentions, it may be stated that though good buying is an essential factor in profit-making, no refinement of logic can obscure the obvious fact that goods are bought to be sold and that no profit arises until the sale takes place. All effort before the sale, whether directed towards good buying, careful storing and display, the placing of advertising, or the selection of a sales force, will come to naught unless sales are made. It would seem, therefore, that potential profit or loss on any or all effort preliminary to the actual sale has no place in the current record. From the standpoint of the profit and loss statement, this conclusion as to the policy of valuation of stock-in-trade at cost can be stated without fear of contradiction. In support of this is a direction of the Treasury Department in connection with the federal income tax returns. This reads, as revised in October, 1916: “In case the annual gain or loss is determined by inventory, merchandise must be inventoried at the cost price, as any loss in salable value will ultimately be reflected in the sales during the year when the goods are disposed of.”

From the viewpoint of the balance sheet, objection is sometimes raised—and supported by conservative practice and legal requirement as indicated above—that a balance sheet showing stock-in-trade at cost may thus very obviously under-or over-value the item, a situation not at all desirable. In this discussion, the whole problem of valuation is being treated from the point of view always of a going concern and not of one facing dissolution and the forced sale of its properties. Under these circumstances, such a balance sheet must frequently be used as the basis for asking credit, and credit extended on inflated values of current assets is not properly extended.

Method of Treatment and Summary

To meet this situation, particularly in the case of large fluctuations in the market, the true status of affairs is disclosed by appending to the balance sheet a footnote in which is stated the present market value of the inventory. Without this information, oftentimes, when the market is showing steadily rising values, as much harm and financial ruin may result through the extension of insufficient credit, as under other conditions might arise from an ill-advised inflation of credit. Sometimes the present market value is indicated by setting up a reserve out of _profits_, called “Reserve for Market Fluctuations in Merchandise”—or other similar title—when the market is lower than cost. This method retains the inventory on the books at cost value and so does not burden the current profit and loss, although it does lessen the amount of profits available for dividend distribution. Without doubt the policy is good in cases of extreme and somewhat permanent changes in the market.

To sum up, therefore, the valuation formula of cost or market, whichever is the lower, while based on conservatism may unnecessarily and improperly burden the current income account. Valuation at cost, on the other hand, while placing the profit or the loss in the period when realized may cause the balance sheet to present an entirely inadequate and even misleading story as the basis for credit. To remedy this, three courses are open, viz.:

1. Carry the market valuation, whether more or less than cost, in a footnote to the balance sheet. 2. In case market value is less than cost, set up a reserve out of profits equal in amount to the difference. 3. Carry in an inner column in the body of the balance sheet the present market value.

It would seem, therefore, that valuation at cost with the present market value shown on the face of the balance sheet, is the most desirable practice from every viewpoint.

Depreciation of Stock-in-Trade

Quite apart from this discussion of the proper basis for valuation, which concerns itself with marketable merchandise, is the problem of the method of handling deterioration or depreciation of stock-in-trade as distinguished from fluctuations in value. Such deterioration may result from shelf wear, use of goods for display purposes, changes in style and shape, overstocking which causes an accumulation of goods which soon are out of date or of sizes and qualities seldom used, broken lots where such will injure the sale value, and so on. Many devices, such as the “spiff” or the offer of a premium to salesmen, are employed by up-to-date merchants to keep their stocks free from these items of deterioration; but in spite of all that can be done, it usually proves impossible to keep the stock live in every particular. A valuation at cost under these circumstances would be an obvious inflation of values. If the concern had purchased that quality of goods originally with the expectation of resale, valuation at cost,

under the limitations suggested above, would be the correct basis for showing. Since, however, such is not usually the case, the proper basis of valuation is now the market price—the present price at which goods of similar kinds and qualities can be bought.

It may be objected that the effect here also is unduly to burden the current period with unrealized losses, but this is not the case. The deterioration in value is a very real loss which is entirely independent of any fluctuations in the market. If goods are shelf-and window-worn from display usage, the deterioration is just as much an expense incurred for advertising as a display advertisement in a daily paper. The deterioration due to overstocking is a penalty which the current period should bear because of its poor buying effort or its inadequate sales efficiency. Thus, valuation of the inventory of any stock of goods must have regard to the effect of its present condition on its marketability. Any deterioration which renders the stock less salable is an expense to be borne by the present period and not the period in which the sale is made.

Full Costs of Stock-in-Trade

Cost having been established as the basis for valuing a stock of marketable merchandise, there must next be considered the elements of cost and their application to different classes of goods. By cost of goods is meant full cost, i.e., not only invoice price but all additional costs, needed to place them ready for sale. All costs, therefore, up to the point where goods are ready to create income are proper charges against the stock-in-trade. Customary costs of this kind are freight, drayage, insurance during transit and storage, duty, seasoning or aging costs, warehouse charges, and all similar items. The information as to these costs is usually recorded separately, but at a summary period they are loaded on the invoice cost of stock-in-trade.

In connection with this question of the proper composition of cost, attention is called to two other items sometimes requiring consideration. The first deals with the handling of cash discounts. The point at issue is as to whether the invoice figure should be recorded at the price quoted on a cash basis or on a credit basis. This point is discussed at length in Chapter XXXVI of the first volume where the conclusion reached is that the _credit_ policy of each concern must govern the manner of making the record. If the concern has a fixed policy of buying at a cash price, that price should be the price of record; whereas if all financial and other related policies are based on a 30-or 60-day credit term, the credit price for that term should be the price of record. Particularly is this true when viewed from the sales standpoint where the fixing of the selling price is a part of the financial policy. The second point requiring consideration in connection with cost is the item of interest on the money invested in stock. At the close of the fiscal period should the stock sold and that left on hand be burdened with interest on the average amount of capital tied up in it during the period? The student is referred to Chapter XXVI of this book, where a full presentation of the case for and against the inclusion of interest is made.

The Distribution of Costs Over Stock-in-Trade

It should be said that, due to the particular method of handling purchasing, delivery, and storage, it frequently is not practicable to take cognizance of all items which theoretically are constituents of cost. Each concern must establish a policy relative thereto and hold to it. Having done this, it is faced at inventory time with the problem of determining the cost figure applicable to each unit of the stock remaining unsold. Certain of the costs, such as freight and cartage, have probably been incurred by different lots of miscellaneous merchandise, and to distribute the proper charges to each unit comprising the lot is difficult. Usually a certain percentage sufficient to cover that particular item of cost is spread evenly over all units remaining on hand. Occasionally, especially where the stock is homogeneous and only a few varieties are dealt in, an effort is made to prorate these costs on a more accurate basis. In loading on the freight cost, for example, a combined weight and value record might bemused or, where possible, the official freight tariff might govern. Such minute accuracy is not often needed or desirable, the flat percentage rate on value giving in most cases sufficiently correct results.

The Pricing of the Inventory

A rule-of-thumb method of valuation requires that the purchase price as carried on the last invoice of the article shall be used for pricing the inventory. This usually proves a good working rule, but often raises perplexing problems and is subject to abuse and misuse. If several purchases have been made during the period at different prices, should the last price paid govern the valuation of the portion unsold? The argument for so doing is that the portions unsold probably belong to the last lot purchased, good merchandising requiring that the old stock be sold out before the new is brought forward. That, of course, is not always the case. If it is made an inflexible rule that the price of the last lot bought shall be the price of the inventory, a dangerous tool is placed in the hands of the unscrupulous. A manager needing or desiring to make a better showing of profits might in this way make an

insignificant purchase at a high price near the end of the fiscal period and so secure a much higher valuation than the cost for the whole inventory. Where the inventory is likely to contain remnants of the various lots purchased during the period, or where the condition as to an insignificant final purchase may exist, the policy of using an average price for the inventory will be more accurate in its results. The weighted average, whereby each purchase price is weighted with the volume or quantities purchased, is fairer, though more complicated than the straight average. Thus 10 units bought at $100 per unit, 15 at $90, and 3 at $110, would give a straight average of $100 but a weighted average of $95.71, (1,000 + 1,350 + 330) ÷ (10 + 15 + 3). In manufacturing establishments where the fiscal period is short, say one month, and it is desirable to keep the raw material cost as nearly uniform as possible, the method of the weighted average is to be recommended.

As mentioned above, each concern must fix its own policy as to what items shall be included in the cost of goods purchased. Whatever that policy may be, care must be exercised to make sure that the same items and no others form part of the value of the inventory. In the case of any doubtful items, instead of trusting to memory, a house classification of accounts or an accounting guide book should be drawn up so as to secure from period to period a similar handling of all items.

Valuation of Manufacturing Inventory

The whole of the foregoing discussion concerns the valuation of goods bought for resale, i.e., the inventory of a trading business. Some points in the application of the same principles to a manufacturing concern will now be considered.

Finished Goods. So far as finished goods are concerned, the principle of valuation at cost applies. What constitutes the cost of manufacture was discussed in Chapter III, from which it is evident that many other elements in addition to those which must be considered in a trading concern must be taken into account. The manufacturing cost formula comprises the three items of: (1) raw material consumed, (2) direct labor applied, and (3) factory expenses incurred, this latter item sometimes called overhead expenses. When a concern operates a detailed cost system, the valuation of the finished product is not difficult, being the goal towards which the system works. Where no cost system is used, great care must be exercised to make sure that every item of cost is calculated as accurately as possible and that a proportionate share of such costs is applied to the finished product still on hand unsold. It is sometimes urged that instead of this cost-to-manufacture price, the price at which the article could be bought on the open market should govern; or, alternatively, that the article should be valued at least sufficiently above cost to give a theoretical profit to the factory. Just as in the case of the discussion of “cost or market price” for the trading concern, the same conclusion is reached here, viz., that cost should govern, because while good manufacturing is an element in profit-making, yet no profit is made until the sale is effected. It is true that if cost to manufacture is lower than cost to buy in the open market, a real _saving_ has been made by the policy of manufacturing rather than of buying, but a saving is quite another thing from a profit. This differentiation between a saving and a profit will be fully discussed presently. Correct accounting, therefore, requires a valuation of finished goods at cost to manufacture.

Raw Material. The valuation of the inventory or raw material is on the same basis as that of a stock of goods bought for resale, i.e., raw material is to be valued at full cost up to the point of its consumption.

Goods in Process. The valuation of partially completed goods, i.e., “goods in process,” is a much more difficult problem. To simplify the discussion these will be divided into two groups, first, goods manufactured for stock, and secondly, those made on a specific contract or for special order. To the first group the principle of cost applies without any qualification. The problem involved is that of determining what has constituted cost up to that particular stage of completion. Where a detailed cost system is in use and a production schedule forms part of the system, it is possible at almost any moment to ascertain exactly the values accumulated on any article at each stage or process of manufacture. Where definite costs are not possible, a careful estimate based on full knowledge of conditions is the best that can be done. Where parts are first manufactured for assembly into a completed whole, they should be treated as finished goods and valued at full cost up to that point.

Contracts. The second group of goods in process, viz., those manufactured to fill specific orders, or, in large construction work, contracts taken but not completed, may be valued on a somewhat different basis from that applicable to the first group. Here a sale has actually taken place and only the intervention of the closing of the books raises the question of valuation. In a case of this sort it is customary to make a careful estimate of the costs of the work or contract, up to its present state, due weight being given to remaining costs necessary to complete it and to any provision for possible contingencies. When handled in this way, the estimated profit on the work already done is said to be applicable to the current period and is therefore taken into account. In other words, the portion completed is treated as sold, after making the provisions indicated above, and is charged off the books against a

corresponding part of the sale price. Hence, the valuation involved here does not concern the inventory, but the cost of goods sold.

It may be objected that, in the case of large contracts, perhaps running over a period of years, many unforeseen things may happen to wipe out any seeming profits on the completed portion, and that conservatism would demand that no profits be taken until the contract is completed or in a sufficiently advanced stage as to be reasonably sure of results. In such a case it frequently happens, however, that not only are stockholders impatient of delay, but very serious injustice may result to any who might be forced to give up their holdings before the completion of the contract. Moreover, a fair method of making payment on the contract is usually in force, the sale price often being on the basis of units of work accomplished, so that the contingencies giving rise to the objection mentioned are greatly minimized. Thus, some contracts may be on a fixed price per cubic yard of earth removed, per unit of goods manufactured, or other similar basis for periodic payment, a certain per cent being retained as a guarantee for the satisfactory completion of the whole. Again, where the price is for a lump sum, engineers representing the contracting parties may agree on the amount completed and periodical payment may be made on that basis.

This topic of uncompleted contracts will come up again for treatment when considering the profit and loss summary for the year. It is sufficient to note here that some share of the profit on the completed portion of a contract may be taken as indicated above, in which case the inventory problem may be disposed of either by adding the amount of estimated profit to the cost value of the uncompleted contract, or by treating the payments made as sales.

Contracts and Length of Cost Period

In some lines of business, orders are booked several months ahead of delivery date, the factory operations depending somewhat closely on the contracts entered into. During the period of manufacture there may be few deliveries of the product, and therefore no actual profit. Obviously, the easiest method of handling such a situation is to make the fiscal period long enough to include the greater part of the deliveries, and so leave the inventory comparatively free of goods in process. Where this method is adopted, there is no serious objection to valuing the goods still in process at the close of the period so as to take a fair portion of the profit, although conservative practice usually values them at cost. The difference in the amount of profit under the two methods is insignificant under the condition named. Under other conditions valuation at cost is the rule.

Valuation of Scrap

Raw materials are never completely used up in manufacture; portions too small for the main product, corners, odd-shaped pieces, defective pieces, etc., are usually thrown into scrap. This scrap is frequently utilized in the manufacture of side lines if a market can be developed; otherwise it may be valueless. The problem of the valuation not only of the scrap but of any product that may be made from it presents some interesting features. If the entire cost of the raw material is charged to the main product, the scrap material used in the side line costs nothing, and to charge anything for it, either on the basis of cost or some arbitrary estimate, would result in inflation. Furthermore, the cost figures of a side line which is not charged for material might at some time be made the basis for a bid on a contract too large to be filled entirely out of scrap material, and so result in a loss. On the other hand, if the main product is charged only for the material actually consumed, and the side line is compelled to bear the cost value of the material it consumes, the cost of the side line may so increase that it cannot be marketed at a profit. The lowered cost of the main product might lead, in the face of keen competition, to the cutting of its price below real cost, unless, of course, all the scrap is being utilized in the side line which is also being sold at a profit. If such is the case, the valuation of the main product, the side line, and the scrap should be on a cost basis. This is not usually the case, however. No basis for valuation can be found which will prove entirely satisfactory under all circumstances.

In the light of the conditions involved, particularly as to whether there is a constant market for the utilization of all the scrap material in the manufacture of the side line, each concern must adopt whatever policy best suits its peculiar needs. At all times the application of materials costs to the product should provide an intelligent basis for entering into future contracts. A _blind_ use of cost figures frequently invites disaster. In cases where scrap is not utilized in a side line, it has only scrap value. The thing to guard against is the double charge for the same material, i.e., a charge to the main product and also to the side line, resulting in an inflation of values.

Inventory-Taking

There remains, as a corollary to the problem of valuation, a consideration of the method of taking the inventory, for if the count is wrong the most careful valuation per unit will not give true total value. In connection with the count of the inventory, two

fundamental rules must be observed. These are: (1) make sure that everything, i.e., all stock-in-trade, belonging to the business is included; and (2) be careful that there is no duplication of count nor inclusion of any stock belonging to others.

In accordance with the first fundamental rule, care should be exercised to include all goods out for sale in other markets—these to be valued at full cost in those markets—and all goods not yet received into stock but belonging to the business. These latter include goods invoiced but not received, and goods received but not unloaded prior to the close of the period.

In accordance with the second fundamental rule, any goods of others held for sale on a commission basis must be carefully excluded from the count, as should also goods received before the close of the period but with invoices dated some time in the future. Furthermore, all goods inventoried from their invoices, i.e., all goods not taken into stock, must be earmarked so as not to be charged into the next period's purchases. This is best accomplished by stamping the invoices as "Included in the 19.... Inventory."

Inventory Methods. The careful organization of the physical stock to be inventoried, sorting any misplaced items, and separating them into classes, and an equally careful organization of the clerical force, acting under explicit directions based on a well-thought-out plan, are fundamentally essential to accuracy and to the prevention of any duplication of count. In some cases the use of duplicate or coupon tags proves very valuable. On these tags provision is made for recording in duplicate the number of units and condition as to salability, and they are ruled with two money columns. The tags are numbered on both parts consecutively and are charged out to the various departments, as many being issued as there are classes or compartments of goods. As the count is made of a certain class of goods, a tag is attached to the compartment or other storage place as evidence that the count has been made, after which the lower portion is torn off and sent to the office. Any missing numbers indicate omissions in the count. If the card has been lost, the duplicate still attached to its compartment will indicate the count. After all cards are accounted for, the duplicates are detached and the goods covered by them are then released for sale or other use. In taking the inventory it is especially important that where goods are below normal as to salability, their estimated per cent of normal condition be noted on the tag. This gives a basis for valuing and should show the amount of deterioration and its cause.

Perpetual Inventory

The use of a perpetual inventory system is quite general in some lines. Its operation requires almost as careful a record of stock as is made of cash, i.e., not only must all receipts be recorded but all disbursements as well. In a trading concern this record usually takes the form of a stock book of some sort, to which entry is made, as to quantities only, from the purchase and sales invoices, the balance shown at any time being the stock remaining on hand. The application of the unit value gives the value of the entire stock and so makes possible monthly statements of approximate condition. In a factory, a separate stores ledger may be operated, carrying an account with every kind of material used. This ledger is controlled by the Raw Material or Stores account on the general ledger. Entry to the stores ledger accounts is made from the purchase invoices for receipts, and from formal requisitions drawn on the stores-keeper for disbursements, i.e., for the issuance of material. The stores ledger may record not only quantities but also values, so that its balance should be the value of the stores on hand. This is possible because the material is drawn out at cost price.

Oftentimes, for retail concerns, instead of the stock book method, the percentage method of book inventories described in Volume I, page 506, gives more satisfactory results when sufficient past experience can be drawn from.

Necessity of Physical Count. It must not be assumed that a perpetual inventory system obviates the necessity of taking a physical inventory, for it does not. All that it accomplishes is to secure a closer supervision over stock between inventory times and to make possible the showing of approximate results at interim periods. Where operated, it is possible to take the physical inventory piecemeal, although there is a marked advantage in taking a complete inventory periodically. The piecemeal method means that any department can do its stock-taking during a slack time without regard to the time when other departments take theirs. Thus there is less interference with the regular conduct of business. It must be borne in mind, however, that the physical inventory is just as essential as ever because of the many inaccuracies that tend to creep into the perpetual inventory system, and furthermore because of loss, theft, over-measure, and so on, which throw the book record out of agreement with the actual count.

CHAPTER XIV

TEMPORARY INVESTMENTS; ACCRUED AND DEFERRED ITEMS

TEMPORARY INVESTMENTS

Nature of Temporary Investments

The next item to be considered for valuation in the current assets section of the balance sheet is temporary investments. These are assets, such as stocks and bonds of ready marketability, in which current funds are tied up temporarily. Investments in stocks and bonds for purposes of securing business connections and privileges essential to the most efficient conduct of the business do not belong to this category. The term usually covers only those assets representing the investment of temporarily surplus cash or those acquired in settlement with debtors with the expectation of early realization. As A. L. Dickinson[44] so well says, “such investments have no relation whatever to the business and can be disposed of without in any way interfering with its earning capacity, other than the loss of the dividends thereon.”

[44] In “Accounting Practice and Procedure.”

In the case of concerns affected by seasonal changes in volume of business, there are periods when sums of surplus cash lie unemployed, unless the concern depends upon borrowed money to take care of seasonal increases. Business policy, therefore, demands that the surplus cash be put where it will earn something. Such investments are frequently of a somewhat speculative character. In fact, other things being equal, business acumen demands that the investment be made in those securities in which there is a chance of gain in addition to the regular income therefrom. It cannot be stated too strongly, however, that safety, freedom from great fluctuations, and ready marketability are always prime essentials to be observed in securing stocks and bonds for temporary investment. While the procedure is unusual, there may at times be circumstances under which such investments may be bought on a margin basis.

Valuation of Temporary Investments

The usual rule for valuing temporary investments at the time of drawing up a balance sheet is at cost or market, whichever is the lower. Inasmuch as they may be needed on short notice, the information desired is what they will be likely to realize. This is particularly true in the case of a concern with a rapidly expanding market, for which provision may need to be made by increasing the plant as well as the working assets. Where reserved profits have become tied up in fixed plant, the need for ready funds is apparent.

It may be argued that inasmuch as realizable value is the information desired, valuation at market, whether lower or higher than cost, is the only proper basis. The rule stated is, however, held to be the correct one from the standpoint of conservatism and the further fundamental objection to bringing unrealized profits into the current period, as would result from a market valuation higher than cost. Of course, a lower valuation than cost brings unrealized loss into the period’s operations, but this is not regarded with the same disfavor. Where the market price is fluctuating from day to day, as is normally the case, the market valuation on the date of the balance sheet is perhaps no nearer to the amount that will be actually realized than the cost value, since cost value merely represents one of the many changing points in the market. If a distinct market tendency in one direction or the other were likely to continue until the time of realization on the investments, there might be good reason for taking the profit or loss accrued to the date of the balance sheet. However, these considerations are of too speculative and uncertain a character to be given any weight.

There is some valid objection, on theoretical grounds at least, to the results of the period being affected by the unrealized profits or losses caused by taking the market valuation of temporary investments onto the balance sheet. Valuation at cost, with a footnote to show market value, gives all the information essential to a full understanding of the exact condition of the investment. The habit of adding footnotes to the balance sheet may, however, become objectionable and the practice is to be avoided wherever possible. Also, really essential information usually carries greater weight when incorporated in the balance sheet figures.

Reserve for Investment Fluctuations

To meet the foregoing objection and, at the same time, that of allowing unrealized items to affect the period’s profit and loss, use may be made of an account called, say, “Reserve for Investment Fluctuations.” The account should be operated in the same way as the Reserve for Market Valuation of Merchandise discussed in the preceding chapter. That is, if market is lower than cost, at the close of a fiscal period, surplus is charged and the reserve credited for the difference. On the balance sheet the reserve is treated as an offset to the investment account carried at cost. This incorporates the market valuation as a significant figure of the balance sheet and shows the cost for purposes of information. The charge to surplus avoids fluctuation in the current profit and loss results because of an unrealized item and so makes it more useful for comparative purposes. In case market is higher than cost, the

difference is charged to the asset and credited to the reserve. On the balance sheet, cost is thus the effective figure and the market price is given for informational purposes. When the investment is sold, the entry creating the reserve should be reversed in either case. This brings on the books in the period when the sale takes place, the actual profit or loss realized, being the difference between cost and sale prices. The adjusting entries on account of valuation do not thus permanently affect surplus, while the actual profit or loss reaches surplus in the usual way—a valuable desideratum.

“Stock Rights” on Investments

It may occasionally happen that while stocks are held for purposes of temporary investment, stock rights arise. Such a “right” is a privilege of subscription to a new issue of stock, granted holders of stock on a certain date, at a rate below the market quotation of the old stock. The stock records are closed temporarily to any transfers of stock in order to determine those entitled to these rights. Up to the date of closing the records, the market value of the stock carries an increased value to cover the value of the rights belonging to it, and the stock is quoted “rights-on.” After this date the rights are dealt in separately and quoted separately on the exchange. Stock then sells “ex-rights.” Should the end of the fiscal period of a concern holding stocks subject to rights fall after their issue, the stock and rights may be booked separately, though often shown together.

An illustration will show the theoretical method of valuation of rights. Take a corporation whose stock now sells at 125, issuing the right to subscribe at par for additional stock to the extent of 10% of present holdings. The case of a stockholder with fifty shares would work out as follows:

50 shares at $125 $6,250.00 5 ” at 100 500.00 -- --------- 55 ” at a cost of $6,750.00

The average cost of one share is $122.73. Based on the former quotation of $125, the right is seen to be worth theoretically the difference, or $2.27. The quoted market price will usually be less.

Cost of Investments

In connection with the cost of temporary investments it may be well to point out that cost means full cost to the purchaser, including brokerage and other costs in connection with the purchase or subsequent thereto. If the investment is being carried on margin, the customary practice is to charge to the investment account the interest on the funds borrowed by the broker to finance the transaction and to credit thereto any dividends or interest received. The difference between the asset account kept with the investment and the liability account with the broker thus shows at any time the original equity in the investment. A credit to the investment account when the stocks are sold develops the net profit or loss on the entire transaction. There may be circumstances under which it will be desirable to separate from the asset account all charges and credits subsequent to the original purchase, carrying them in a suitable expense and income account.

Valuation of Bonds

In the case where bonds are held for temporary investment, purchased either at a premium or discount, it is not customary to take account of amortization, because the investment is temporary. The problem of amortization is postponed to Chapter XV, in which permanent or long-term investments are treated.

In brokerage firms, where stocks and bonds comprise the stock-in-trade, the same principle of valuation applies as with a merchandise stock except that the rule of valuation at cost or market, whichever is the lower, is applied to each _individual_ holding. In this way, decreases in the value of one stock are not offset by increases in the value of others as would be the case if total market and cost values for the entire lot were first determined and then the valuation formula applied. In this chapter the principle of valuation of stocks and bonds as stock-in-trade is mentioned only by way of contrast.

Valuation of Unissued Stock

Under the head of temporary investments, the company’s unissued and treasury stocks or bonds are sometimes included. Such unissued stocks or bonds manifestly represent an inflation of asset values, offset, it is true, by an equal inflation of capital stock. In the first place, conceding for the sake of argument that the inclusion of unissued stocks among the assets is legitimate, the principle of equilibrium requires that they be valued at par on the balance sheet, a figure which is not cost and which may be very far from market. Again, the company’s unissued stocks may be in no sense current assets. Furthermore, stocks which have never been issued have no owners and so can command no proprietorship in the enterprise. The most that can be said about them is that they

are contingent assets, showing that certain legal formalities have been met which authorize their issue if so desired. The remaining necessary procedure, viz., that the stock be placed on the market and sold, is, however, the condition which must be met to create a real asset and to create proprietorship. Until that has been done there is neither proprietorship nor asset. Reference to Volume I, Chapter XLIX, where the various methods of opening the books of a corporation are illustrated, will show that the method to be preferred is one which eliminates the account Unissued Stock from the books. However, where it is set up, correct classification would seem to require that it be treated as of the nature of a valuation or offset account for capital stock. In other words, the two accounts, Capital Stock and Unissued Capital Stock, must be read together to show the true status of the proprietorship stockholdings. The correct method of presentation on the balance sheet is here only indicated but will be illustrated in Chapter XXI where the problem of valuation of capital stock is treated.

Valuation of Treasury Stock

The case against the inclusion of treasury stock in temporary investments is not quite so apparent, but equally convincing upon examination. Treasury stock differs from unissued stock only in that it has once been issued but has, through various channels, found its way back into the possession and control of the company. While outstanding in the hands of stockholders and under their individual control, the increased stock proprietorship is reflected in increased assets. If the stock comes back into the treasury through donation, the decrease in proprietorship stockholdings is compensated by a new proprietorship element under donated surplus. Thus, while there are not so many shares outstanding, the value of each is enhanced by a combined or common proprietorship in donated surplus, which reflects exactly the status of the treasury stock. Whereas formerly there was individual control over the stock, now that it is in the treasury, control is common or combined. Stock proprietorship has been diminished and the balance sheet should show it by treating Treasury Stock as an offset account and not as a part of current assets under Temporary Investments.

As to the valuation of treasury stock at some other figure than par, the same argument holds as in the case of unissued stock. If the treasury stock has been acquired by purchase on the open market, its price may be a good and sufficient basis for valuation; but even here individual ownership and control has been exchanged for common and combined ownership. The individual stockholdings are decreased, and the decrease is reflected on the assets by the amount paid for the stock. It would seem, therefore, that a showing more in accord with the facts would require treasury stock to be treated as a deduction from the capital stock authorized. Thus the best practice eliminates a company's own stocks from the list of its assets. Where such holdings are small and insignificant, they may without any serious impropriety be included among the assets and even under the caption "Temporary Investment" so long as substantial accuracy obtains.

Summary of Valuation Formula

To sum up, then, the valuation formula for current investments requires their showing at cost or market, whichever is the lower. The most satisfactory method of applying the formula is by means of the Reserve for Investment Fluctuations which makes possible the incorporation of market value whether lower or higher than cost, with the differences between market and cost carried in the reserve account. Thus the conservatism of the valuation formula is made effective and at the same time information is given as to the present market values of the investment.

ACCRUED AND DEFERRED ITEMS

Nature of Accrued Income

Income derived from many different sources is never fully received at the close of the fiscal period. For instance, of the sales made many will still be outstanding as charges to various customers; interest will have accrued on notes receivable and on investments held; rental income is earned day by day but is received only periodically; royalties based on the use of some machine or process are accumulating where the device or process is being used but settlement is made only periodically; and dividends on stocks or other investments may have been declared during the current period but are not payable and therefore will not be received until the next period.

Inadequacy of Cash Method of Handling Accruals

All these accrued items give rise to claims which must find expression in the accounts either currently or ultimately. In the case of sales of merchandise the customary practice is to set up the claim on the books when the sale is made. In the case of the other

items usually no record is made until the income is actually received. Under this method—called the cash method—it is evident that the true income cannot be shown in the period in which it is earned and that the period in which it is received secures the credit for it. This means not only that the current period may at its beginning receive credit for items of income mostly earned during an earlier period, but at its end it will be deprived of similar earnings accruing from day to day up to its close but not credited because their time of payment overlaps into the next period. This method is defended as being substantially correct on the principle of averages, i.e., those earnings which do not entirely belong to the current period but for which credit is taken will in the long run just about offset the earnings accrued at the end of the period which are not taken account of.

The statement may be true and, if so, can be easily tested; but, whether true or not, modern practice requires the _accurate_ accounting of all claims. It is therefore required that these accrued earnings be brought onto the books if reliable results are desired.

Correct Method of Handling Accruals

To show all earnings in the period in which they actually accrue is called the “accrual method.” Under this method the income earned but not received during the current period is set up among the assets, just as in the case of sales, with this difference, however: the claim for the broken portion belonging to this fiscal period need not be recorded day by day but only at the end of the period. Most income items of this sort are due, either by contract or by custom, at the end of certain definite periods. The setting up of a claim for a broken, i.e., an uncompleted portion, does not mean that such a claim is on that date legally enforceable, but that it is a claim equitably belonging to the current period.

Showing of Accrued Items on Balance Sheet

As to the section of the balance sheet in which these accrued income items should be shown, usually they are true current assets and should be so listed. They frequently arise in connection with current assets, e.g., the interest accruing on notes, stocks, and bonds held, and are therefore just as current as the assets themselves, or even more so. Where not so arising, as in the cases of rents, royalties, etc., usually the contract or customary period of settlement is so short as to make the claims under them true current assets. Occasionally the accrued earning is added to the value of the particular asset and so shown in the balance sheet. A better practice, because more definite, is to list them separately under the title, Accrued Income, Accrued Accounts Receivable, or other similar title.

Valuation of Accrued Items

The principle of valuation of accrued income items is apparent. On the supposition that the concern will continue in business, the accrued income is proportioned between the two periods on the basis of the portion of the time belonging to each period. However, this does not mean that the portion so taken shall be valued at its face. The accrued portion is worth as a portion neither more nor less than the whole is worth as a whole. If there is doubt as to the ability to collect it when it falls due, certainly the valuation placed on the accrued portion should express that doubt. In other words, unless the claim is fully secured by collateral or other pledges, valuation should be on exactly the same basis as for the other receivable items, such as the claims against trade debtors, other open accounts receivable, notes receivable of various kinds, etc.

Accounting for Accrued Income

The accounting for accrued income presents no particular difficulties. In addition to the two methods discussed in Volume I, pages 116 to 119, a third which is considerably more laborious than either of them is frequently employed, and is as follows: At the time of adjusting and before closing the books, for every item of accrued income a separate asset account is set up. Thus, for royalties an account, Accrued Royalties Receivable, would record the claim on account of royalties at the same time the accrued income from royalties is being recorded in a suitable income account. Thus there is distinct separation of the asset and income elements.

From this point two methods are in use for handling the subsequent record of the item. Under the first method, the income when actually received or legally due is recorded in the regular income account. This thus shows an inflated figure because it is not offset by the portion credited to the previous period, the asset account covering this, remaining unchanged throughout the current period. At its close, however, proper adjustment is made by adding to, or subtracting from, the amount held over from the close of the previous period such an amount as will make its new balance show the correct amount of accrued income as at the close of the current period. The contra credit or debit to the above entry, as the case may be, is of course to the particular income account,

causing it to reflect the true income for the current period.

Under the second method, the first entries for the new year consist in transferring all accrued income asset balances to their respective income accounts, where they serve the purpose of automatically adjusting the full receipt of income a portion of which was credited in the previous period, to the amount properly belonging to the current period. At the close of the period any adjustment on account of accrued income is handled by debiting the asset account and crediting the income account exactly as before.

An illustration will show the differences between the two methods.

Illustration of Different Methods of Recording Accrued Items

Problem. The royalties income accrued December 31, 1916, amounted to $5,000. During 1917 payments were received on account of royalties to the amount of $35,000. On December 31, 1917, accrued royalties were $5,250.

Solution—Method 1

ACCRUED ROYALTIES RECEIVABLE ========== 1916 | Dec. 31 $5,000.00 | 1917 | Dec. 31 (A) 250.00 | |

ROYALTIES INCOME ========== | 1917 | $35,000.00 | Dec. 31 (A) 250.00 |

Method 2

ACCRUED ROYALTIES RECEIVABLE ========== 1916 | 1917 Dec. 31 $5,000.00 | Jan. 1 (A) $5,000.00 --------- | --------- 1917 | Dec. 31 (B) $5,250.00 | |

ROYALTIES INCOME ========== 1917 | 1917 Jan. 1 (A) $5,000.00 | $35,000.00 | Dec. 31 (B) 5,250.00 |

Of the two methods, the second is somewhat fuller and probably presents the facts more consistently, although involving a little more book work. From a practical standpoint where regard is had to the amount of book work required, the method used in Volume I, pages 116 to 119, sometimes known as the inventory method, serves all the purposes of either of the above methods and requires much less work. By it the above problem would appear as follows:

ROYALTIES INCOME ========== 1916 | 1917 Dec. 31 Accr. $5,000.00 | $35,000.00 1917 | Dec. 31 Accr. 5,250.00 Dec. 31 P. & L. 35,250.00 | $40,250.00 | $40,250.00 ======== ========== | ======== ========== 1918 | Jan. 1 Accr. $5,250.00 |

An objection, not at all serious, is that under this last method the ledger will show, as on the date of the balance sheet, the current assets in two places, viz., the current assets section and the income section, instead of altogether as under the other methods. This objection is more than offset by the saving in clerical labor. There is in some quarters an all too prevalent tendency to multiply the number of accounts and increase the bookkeeper’s work without any adequate return in results.

Prepaid Items—Definitions and Kinds

Closely related to current assets, because through an overexpenditure of current funds this period a lesser expenditure will be required next period, is the class of items known as prepaid expenses or deferred charges to operation. These items are not current in the sense that they will be turned into cash shortly, but they are analogous in that a saving in the expenditures of the next period will result. Because of the ease with which they may be put to improper uses, it is best to segregate them from current assets under a suitable balance sheet caption, such as “Deferred Charges to Operation.” Where the two captions, Current and Working Assets, are shown, items of this class properly belong to the latter. Under this head will be considered such items as supplies of all sorts—office, factory, power house, stable—stationery, printing, postage, repair parts, insurance unexpired, advertising contracts and material, rent, royalties, interest and discounts paid in advance, salary overdrafts, premiums on long-term investments and discounts of long-term obligations, and sometimes organization expense, although this last item is perhaps best handled with the intangible assets.

Valuation of Prepaid Items

The purpose in considering these items at the close of a fiscal period is to secure a proper and accurate allocation of charges as between the two periods, without which true results as to profit and loss are not possible. The same argument as to these items averaging up fairly well between periods applies here as for accrued income. The only other point to be considered in connection with them is the basis for their valuation. Realizable values, i.e., what the items would bring under the hammer or at other forced sale, are manifestly inequitable. A three-year insurance policy with one year expired is to a concern which intends to avail itself of the remaining two years' protection worth more than the surrender value of the policy calculated on the short-rate basis with perhaps the expenses of doing business also subtracted by the insurance company. Evidently to a going concern the protection enjoyed for the year just expired is worth neither more nor less than a pro rata share of the entire cost, nor are the remaining two years' protection to be valued at a less rate because redeemable at a less rate.

Hence, a valuation based on the going concern principle is to be used for deferred charges. As indicated above, this means, when used in this connection, a pro rata valuation based on the life of the supply and the portion unused. In the case of tangible supplies the rule can be most easily applied as a unit cost figure to the unused units still on hand. That is, an inventory of supplies is taken and valued at full cost. Although nearly related to current assets, deferred charges are seldom influenced by market fluctuations after they are once purchased, because if properly classed as deferred charges they are always held for own use and never for outside sale.

Danger of Overvaluation

Care must always be exercised—even more than in handling the stock-in-trade inventory—to see that there is no padding of this class of items. To this end, before taking inventory, a general clean-up of supply materials all over the plant is an exceedingly good policy. This should result in discarding, or reducing to scrap value, all obsolete and unusable supplies. Without such a clean-up it is easy, even when motives are of the very best, to carry forward from year to year as assets supply materials which will never be used and which are therefore nothing but expense items and should be charged against operation. Only a careful periodic appraisal of supply materials and an equally careful inventory indicating their usability can give a correct basis for applying the valuation formula.

Two or three items of deferred charges need a word of further explanation. In some mining industries, notably coal and precious metals, leasing is done on a royalty basis with a minimum amount to be paid each period based on a minimum production of ore to be mined. If less than the minimum is mined, a frequent provision in the terms of the lease makes possible the application of any royalties overpaid one period against a future production of more than the required minimum. That is, no increased royalties are charged for a production over the minimum until all accumulated royalties from periods of underproduction are used up. In any period of underproduction such royalties may properly be treated as deferred charges only on condition that there is reasonable expectation that future production will increase to the point where it will consume the overpaid royalties of earlier periods. At times a company finds itself bound to such a contract, based on a minimum production, without any hope of relief because the prospect has not developed as anticipated. Under such conditions the entire periodical royalty charge is a charge against operation and must be absorbed entirely by the operations of each fiscal period.

Accounting for Deferred Debit and Other Items

The accounting for deferred debit items proceeds along the same lines indicated for accrued income. Nothing further need here be said than that such items as insurance, supplies of various sorts, etc., are frequently recorded originally as asset items instead of as expenses. At the close of the period so much of each of them as has been used is transferred to suitably named expense accounts and is thus taken into profit and loss. There is no objection to this and it usually works out very satisfactorily, although the usual practice is to treat all items of this class as expenses rather than as assets. This method is usually prescribed by regulatory commissions in the case of public utility companies.

The treatment of premiums paid on long-term investments and of discounts arising through the marketing of long-term obligations at a figure below par is reserved for consideration in the next chapter where their relation to the interest account and the problem of amortization will be considered.

CHAPTER XV

PERMANENT INVESTMENTS

Nature of Permanent Investments

As distinguished from the type of investment discussed in the preceding chapter, investments of a more or less permanent character will next claim our attention. These may be permanent in the sense that at the date of the balance sheet they have a long term to run before they mature and the expectation is they will be held for a considerable period of time; or permanency may be indicated because ownership of the investment is necessary or, at least, a valuable requisite to operation. Ease of conversion into cash may or may not be a characteristic of such investments, and certainly it is not a determining test for valuation as is the case with temporary investments, discussed in Chapter XIV.

The necessary test is always the condition in which the company would be placed, viewed from the standpoint of efficient operation, if the investment were disposed of. If its efficiency or its contracted or moral obligations would not be impaired, the investment may be said to be of a temporary character. Examples were given in the previous chapter. If, however, its efficiency would be materially affected, or its continuance as a business be hampered or threatened, then the investment must be considered as of a permanent character. This latter type of permanent investment will be discussed first, followed by a consideration of the long-term securities (bonds, stocks, and land) held as investments for certain funds (such as the building fund, bond and redemption fund, etc.).

Permanent Investments as an Aid to Operation

These permanent investments may take the form of ownership of the stock or bonds of other corporations, as in the case of the holding company. They may represent interests, active or silent, in partnerships; or they may take the form of advances of working capital or funds to other concerns. Whatever the form may be, and whether evidenced by formal securities, collateral, or merely by open book accounts, they serve the purpose of securing some essential facility without which operation could not be successfully carried on. A newspaper may secure full or controlling interest in a paper mill to insure its supply of print paper; a railway may become a heavy owner in a terminal company in order to give it terminal facilities; a refinery may purchase a controlling interest in an oil production company in order to give it a sure supply of crude oil; etc. Thus, the permanent or fixed investment is always a means of bringing about the efficient operation of a business. It may be effected in any one of three ways, viz.:

1. By practically full ownership of the subsidiary enterprise to secure complete control and so direct its policies. 2. By only a controlling ownership. 3. Through the agency of advances, particularly when, because of poor credit, the usual money markets may be closed to the borrowing company.

Valuation of Permanent Investments

The problem of the valuation of investments under the three forms mentioned presents some interesting features. It might seem that, inasmuch as the investment is in the nature of a fixed asset, valuation should always be at full cost; that market fluctuations should have no effect. The last half of this statement is correct but the first part needs modification. It is to be expected that a concern in purchasing the stock of another will not pay more than it considers the stock to be worth. The price may be more or less than the face value of the stock, depending upon the existence of an element of good-will or the overstatement of the assets on the books of the vendee company; or again, where the stock is bought on the open market many other factors may cause a variance of purchase price from par value of the stocks.

Were the investment simply an inanimate asset to be used, cost, perhaps less depreciation, would be the proper basis for valuation. Since, however, a corporation cannot remain stationary—it must usually record a gain or a loss from year to year—ownership in that corporation must accordingly suffer change from year to year. So many things can happen to an operating corporation that cannot befall an inanimate asset held for use that the proposal to value both on the same basis is hardly tenable. Furthermore, if proper principles of valuation are applied to the subsidiary concern, its true value can be determined with fair accuracy. Accordingly, a true basis is secured for valuing it as an investment on the books of the holding company. Any increase in value over cost is due to the profits made by the subsidiary enterprise, and in the case of its complete ownership by the holding company these profits belong in full to the holding corporation. If all the profits are disbursed as dividends to the holding company, the subsidiary enterprise suffers no change in condition and therefore no change in value. If, however, some of the profits are retained, this would result in an increased value which should be reflected in the valuation of the subsidiary enterprise on the books of the holding company. How this may best be shown also requires consideration.

Holding Company and Subsidiary Enterprises

A holding company may have but few assets aside from its holdings in subsidiary concerns. A balance sheet showing only these few assets and its investments in the other concerns does not usually give much useful information. Therefore, as the assets of the subsidiaries belong to the holding company and really comprise its operating plant, a more intelligent way of showing the investments of the holding company is to combine or consolidate the balance sheets of the subsidiaries and incorporate them in the balance sheet of the holding company in place of the item of investments. This method is known as the “consolidated balance sheet” and is given fuller treatment in a subsequent chapter. Here attention is called to it merely as a device for showing the valuation of permanent investments represented by substantially full ownership of the subsidiary companies.

Controlling Investments

Where ownership is not complete but still controlling, the method of the consolidated balance sheet is not so fully applicable and often is not used. In this case the investment will appear as such on the balance sheet with whatever adjustments in value may be necessary due to the success or failure of the subsidiary’s operation for the past period. Whatever profits are made enhance its value and in the enhanced value the controlling company has a pro rata share, the effect of which should be taken up in the valuation of its investment therein. The net amount of the enhancement in value is the difference between the net profit made by the subsidiary concern and that portion paid out in dividends—in other words, the portion reinvested in the business.

This portion, i.e., such part of it as belongs to the controlling company, may be taken up directly by charging the investment account and crediting a proper income account; or the share of the entire net profit belonging to the controlling company may be charged to the investment and credited to an income account. In the event of dividends being paid by the subsidiary company, these would be credited to the _investment_ account of the controlling company, which account would then show, as in the first method, the new value due to the profits reinvested in the business. That this policy of increasing the value of the investment is conservative and sound is apparent when one considers that the holding company’s ownership of the subsidiary concern controls the latter’s policies, including the dividend policy. The profit taken onto the books of the holding company by the above method is a real, not a book, profit.

Advances to Subsidiary Concerns

Where control is secured through the medium of advances made on open account or by means of such advances together with ownership of stocks and bonds, a valuation must be made of these claims separately from the stocks owned. Where ownership is complete and valuation is shown by the consolidated balance sheet method, intercompany accounts and claims are, of course, eliminated and so do not show. In all cases, however, where claims against a subsidiary arise on account of advances, or even of sales, and these must be shown on the balance sheet of the owner of the claims, more than average care must be taken in placing a value on them. In the case of advances, frequently their exact status is not known at the time when made. The record is carried in a suspense account until its final status is determined, when record is made accordingly. The advance may be temporary, for the purpose, say, of enabling the subsidiary concern to take advantage of very favorable market conditions in the purchase of raw materials, in which case, of course, the claim is a current asset; or possibly the subsidiary company is about to make additions to plant and equipment and is financing the expansion temporarily by means of borrowings from the parent company. Whatever method of permanent finance is finally settled upon, this should convert the open-account claim of the parent company on account of advances, into the regular securities or obligations of the subsidiary concern. Again, it is unfortunately true that advances to the subsidiary company often become necessary to recoup it because of operation at a loss. This may continue with little hope of repayment for years to come, if ever. The parent company may ultimately lose all the funds advanced to the subsidiary company because of the latter’s financial instability.

Rules for Valuation

Because of the many factors involved, it is apparent that no absolute rule can be laid down for valuing the advances to a subsidiary enterprise. Each case will require careful investigation and must be settled on the basis thus established. If the investigation shows the loan to be temporary with good expectation of its full return, it should be shown at its face value among the current assets. If the advance is to be converted into the securities of the subsidiary concern and the latter is in good condition, the advance may be carried at par among the fixed assets. When the securities are received they should be valued as any other permanent stock investments, with due regard to the basis of conversion in comparison with the value of the securities given in settlement. If

conditions upon examination are found to be serious, it may be necessary to treat advances made as expenses, i.e., they are of no realizable value. If the bankruptcy of the subsidiary concern seems probable, a question of financial policy and law arises, viz.: whether the interests of the parent company are best conserved by allowing its claims to remain on open account and so rank with other creditors, or to be converted into stock and rank with those of other owners. It may be necessary to take that phase of the matter into account when determining the value of claims against the subsidiary concern.

Investments in Partial Holdings

For the sake of business connections, prestige, and good-will, oftentimes more or less permanent investments are made of such a nature or in such amounts as not to secure a controlling interest. Here, because the reins of business control are not held by the investing company, manifestly such an investment is on a very different basis from those in companies whose control is held by the investor. In the one case, business policy can be determined and made effective; in the other case, success or failure is under the control of others. Accordingly, the valuation of these partial holdings differs from investments in companies entirely owned or controlled by the investor. Where the holdings of these minor interests are not particularly substantial in comparison with other properties owned, there is no serious objection to valuing them at cost. They are held to secure certain benefits, and so long as the real values of the companies concerned are being maintained or enhanced, there is little probability of the investment being disposed of. Market fluctuations, therefore, should be given little or no consideration. Where, however, partial or minor holdings form a comparatively large portion of the investments, it may sometimes be wise to value them on the same basis as temporary investments of a current nature. In this case the profit or loss attendant upon bringing market values into the books should be handled as with temporary investments.

Where investments of this kind are shown on the balance sheet at cost, it is sound policy to call attention in a footnote or otherwise to their market values, as oftentimes the market gives some indication of the condition of the company. The savings banks of the State of New York, in reporting to the State Department of Banking, must show the market value of the securities held. Usually three values are shown, viz.: market, par, and so-called investment value, to be explained later. Where the securities held are not listed on any exchange or are held closely and not traded in extensively, it is often difficult to secure reliable market quotations for them. Here cost, unless known conditions demand otherwise, seems the best basis for valuation.

Investments Producing No Income

Some investments may be of a permanent type and yet of themselves produce no income. Such are memberships on stock and produce exchanges, boards of trade, and the like, which are valuable for the privileges and prestige accruing therefrom and the business associations secured thereby. They should usually be valued at cost, thus allowing the period in which they are sold, if disposal becomes necessary, to get the profit or loss incident thereto.

Bond Values and Market Interest Rates

In connection with the valuation of bonds, some additional considerations should be taken into account. Assuming that the margin of security for the mortgage covering the bonds is ample, the value of a bond, i.e., its price on the market, is largely dependent upon the prevailing interest rate in the money market. Thus, if a bond bearing 5% interest is offered for sale in a market where the rate is 6%, it can be sold only at a discount sufficient to provide approximately 6% on the money invested. Similarly, a 6% bond offered in a 5% market should bring something more than par. It is not intended to convey the impression that whenever a bond sells below par it is because the market is demanding a higher rate than that offered by the bond; nor when a bond sells at a premium need the entire amount of the premium be a reflection of money market conditions. An additional factor is oftentimes the credit standing of the issuing company. Thus, even though a bond may be amply protected, the poor credit rating of the issuing concern will be reflected in a downward tendency of the price of the bond, for under such circumstances foreclosure proceedings preliminary to sale and conversion of the security always loom large in the background. On the other hand, bonds of the United States are often above par because of the government’s credit standing.

On the assumption that there is reasonable expectation that the bonds will be paid at maturity, their valuation on the balance sheet during the time they are held by an investor must have regard to the price paid as determined by the bond interest rate and the money market rate at the time of purchase. A bond bought at a discount and held to maturity is redeemed at par. If the bond is carried at cost until the period of redemption, that period would secure the credit for the difference between cost and par. Similarly for a bond bought at a premium, and carried at cost constantly, the period of redemption would bear the loss between cost and

redemption price.

Nature of Bond Discount or Premium

To bring out more clearly the real nature of bond discount or premium, under the limitation stated above, consider a bond selling at 90 and bearing 4½% interest. This should be interpreted to mean that the issuing company, because of the low rate offered on the bond, will have to pay at maturity $1,000 for every $900 now received. It is, as it were, having to prepay $100 interest on every bond sold, in addition to its promise to pay the stipulated bond rate of interest periodically. It is selling a $1,000 security for $900 and is thus depriving itself of $100 which it might have had by contracting to pay the present market rate of interest. From the other (i.e., investor's) point of view, he is willing to lend money at the bond rate only because he expects to be compensated by the $100 to be received in a lump sum at the maturity of the bond.

The wisdom of fixing the bond interest rate so that the bond will command either a premium or a discount hinges upon the soundness of the forecast as to the money market in the future. It is, of course, a speculative transaction. Since, then, discount on bonds is, from the standpoint of the issuing concern, a prepayment of a portion of the interest in amount sufficient to make the income rate on the bond correspond with the rates prevailing in the market, this prepayment is applicable to the whole period of the life of the bonds and should be spread equitably over that period. To accomplish this it is necessary, every time bond interest is paid, to transfer to the Bond Interest account a portion of the Discount on Bonds account, thus gradually wiping off the Discount account and making the Interest account show every period the real amount (and real rate) of interest as distinguished from the amount paid as indicated by the bond rate.

In the present discussion, the chief concern with the problem of bond discount and premium is from the point of view of the investor. Having established from the other point of view the true relation between premium and discount and bond interest, there will be considered the two additional problems as to the manner of carrying the record on the investor's books and as to the method of valuing the investment at each balance sheet period. First, then, is the problem of making the record.

Record of Bond Investments

When bonds are purchased the record may be made in two ways. Accounts may be kept with the bonds at par, separate valuation accounts being carried for the discount or premium. An account with bond interest is also opened and sometimes one with prepaid interest on bonds, where, as is usually the case, the bonds are bought with accrued interest to date of purchase. The accrued interest, however, is more conveniently recorded as a charge in the bond interest account, thus automatically adjusting the income from the bonds when the first coupon after date of purchase is redeemed. As stated in Chapter XIV, the amount of the discount or premium is to be spread equitably over the life of the bond. The method of making an equitable distribution is a problem to which consideration will be given in later pages of this chapter. The entry to effect the distribution is a transfer entry between the premium or discount account and the bond interest account for the portion accrued as on the date of each payment on the coupons. The result of the transfer is to establish with the bond account at par a true valuation of the bonds held as on that date, and to secure the correct amount of income from bond interest to be credited to the current period.

The second method of making record of the bond investments is to record the purchases at cost in the bond account, carrying there full information as to premium or discount, no separate accounts with these being opened. When the bond interest falls due, the bond account itself is written up or down for the amount of the discount or premium accrued during the current period. The contra entry is in the bond interest account just as above. This latter method does not commend itself when the only record kept of bonds is that mentioned above. If the investments are so numerous as to require a subsidiary ledger for their record, where with each kind of bond accounts will be kept with its par, discount or premium, and interest, there is no objection to handling the controlling account on the general ledger by making the discount or premium adjustment directly to the bond account. Fuller information is given and the record is less involved, however, when handled by the first method.

Amortization of Bond Discount and Premium

The equitable distribution (technically known as "amortization") of the discount and premium on bond investments is the essence of the problem of their valuation. There are two methods of making this distribution, termed the "straight line" and the "scientific" method. Under the straight line method the amount of the discount or premium is divided by the interest periods the bond has yet to run, and the quotient is made the amount of periodic amortization. Although not scientifically accurate, the method commends itself because of its simplicity and consequent ease of operation. Its use is allowed by the Department of Banking of the State of New

York for valuing the investments of savings banks. The scientific method is based upon compound interest calculations and will be best understood by means of examples. Under this method the discount or premium is looked upon as the amount of an annuity. The portion which must be written off for any period is the present worth of the annuity on that date, taking into consideration the rate of interest and the time in interest periods the bond has still to run.

In practice, however, the amount of amortization is not found in that way. To find the periodic amortization, it is necessary to know the cost of the bond, its coupon interest rate, and the effective rate. By effective rate is meant the real income rate on the basis of the price paid for the bond. Assume that a 3% bond, interest payable January and July, has 3 years (6 periods) to run and is bought for $971.99 so as to yield 4% on the investment. At the end of the first semiannual period the actual interest received will be $15, but the real income on the investment is $19.44 because it was purchased on a 4% basis for $971.99 (2% on $971.99). Of the total discount of $28.01, $4.44 (19.44-15.00) is to be credited to the current period. The adjustment of discount brings about a new valuation of the bond, it being now worth $976.43 (971.99 + 4.44), because nearer by six months to maturity when it will be worth par or $1,000. So, for the next period the coupon is $15 and the effective income, $19.53 (2% on $976.43), hence the amortization is $4.53; and so on for the six periods, at the end of which the discount will have been completely distributed, i.e., amortized.

The following schedule shows the periodic amortization and new values of the bond:

3% bond, par $1,000; bought on a 4% basis for $971.99; 3 years to run; interest January and July. ============+========+=========+============+========+========= | | | | Discount |Nominal|Effective| Periodic |Value of| Adjusted Date |Income | Income |Amortization| Bond | Amounts ------------+-------+---------+------------+--------+--------- Jan. 1, 1915|$..... | $..... | $..... | $971.99| $28.01 July 1, 1915| 15.00 | 19.44 | 4.44 | 976.43| 23.57 Jan. 1, 1916| 15.00 | 19.53 | 4.53 | 980.96| 19.04 July 1, 1916| 15.00 | 19.62 | 4.62 | 985.58| 14.42 Jan. 1, 1917| 15.00 | 19.71 | 4.71 | 990.29| 9.71 July 1, 1917| 15.00 | 19.81 | 4.81 | 995.10| 4.90 Jan. 1, 1918| 15.00 | 19.90 | 4.90 |1,000.00| ..... +------------+ | Total discount amortized $28.01 | | ----------+--------+---------

A similar schedule for a bond bought at a premium immediately follows:

5% bond, par $1,000; bought on a 4% basis for $1,028.01; 3 years to run; interest May and November. ============+========+=========+============+=========+========= | | | | Premium |Nominal|Effective| Periodic |Value of | Adjusted Date |Income | Income |Amortization| Bond | Amounts ------------+-------+---------+------------+---------+--------- May 1, 1917|$..... | $..... | $..... |$1,028.01| $28.01 Nov. 1, 1917| 25.00 | 20.56 | 4.44 | 1,023.57| 23.57 May 1, 1918| 25.00 | 20.47 | 4.53 | 1,019.04| 19.04 Nov. 1, 1918| 25.00 | 20.38 | 4.62 | 1,014.42| 14.42 May 1, 1919| 25.00 | 20.29 | 4.71 | 1,009.71| 9.71 Nov. 1, 1919| 25.00 | 20.19 | 4.81 | 1,004.90| 4.90 May 1, 1920| 25.00 | 20.10 | 4.90 | 1,000.00| ..... +------------+ | Total premium amortized $28.01 | | ----------+---------+---------

The problem of amortization is thus seen to be comparatively simple when the cost of the bond, its nominal rate, and effective rate are known, and successive valuations of the bond are equally simple. The crux of the whole calculation is thus seen to be the determination of the original purchase price of the bond. At the time of the purchase of the bond the following facts are known: the par of the bond, the time it has to run, its rate of interest, and the rate of earning desired on the investment. There are three methods or formulas by which this price can be determined and they will be explained in turn. However, the development of the formulas will be more easily understood if some points in compound interest and annuity calculations applicable to the three methods of valuing the bond are first explained.

Formulas for Compound Interest

In the determination of the present worth of a sum of money at compound interest due a certain number of years hence, the following symbols will be used:

A = the sum which placed at interest at the given rate will accumulate to the given amount in the given time. B = the given amount accumulated r = given rate of interest per _period_ R = 1 + r n = the given number of periods

The present worth of B is manifestly A, the sum which, when placed at interest, amounts to B. At compound interest the amount to which A will accumulate in n periods is given by the formula:

(1) B = A(1 + r)(1 + r) ... to n factors, which reduces to

= AR■, whence solving the equation for A

B B (2) A = ----, i.e., the present worth = ---- . R■ R■ 1 From this, the present worth of $1 is seen to be ---- . R■

Formulas for Annuities

An annuity is a given sum of money placed at interest usually at the end of each successive year or period, and allowed to accumulate at compound interest for a number of periods. For bond valuations it is necessary to know the amount of an annuity and the present worth of this amount. The following terminology will be used in the solution of the problem:

A = the sum put at interest periodically B = the amount to which A accumulates r = the rate of interest per period R = 1 + r n = the number of periods P. W. = the present worth of the annuity

The first sum, A, placed at interest at the end of the first period will accumulate for n-1 periods and, according to formula (1) above, will amount to AR■■¹. The second sum, A, placed at interest at the end of the second period will amount to AR■■²; etc. The last sum, A, will not accumulate and so is worth just A.

The amount of the annuity is thus seen to be the sum of the amounts of the several periodic sums. Expressed as a formula:

B = AR■■¹ + AR■■² ... + AR + A

= A(R■■¹ + R■■² ... + R + 1), whence

R■■¹ R■■¹ (3) B = A------ or A----- R - 1 r

The expression in parentheses is a geometric series whose sum may be written in the fractional form shown.

The present worth of B, i.e., of

R■■¹ A-----, r is found from formula (2) above to be:

R■■¹ A----- divided by R■. r

Expressed as a formula:

R■■¹ (4) P. W. = A----- R■r

Formulas for Bond Valuation

The method of valuing a bond makes use of the formulas (1) to (4) just established. The symbols used in the bond formulas will be:

P = the par or face value of the bond r = the effective rate c = the nominal rate—the rate specified in the bond C = Pc, i.e., the value or amount of a matured interest coupon, the nominal yield of the bond Pr = the interest yield on par at the effective rate V = present worth or value of the bond

First Method. The present value of a bond may be looked upon as the sum of two present worths, viz.: the present worth of the face of the bond and the present worth of the annuity represented by the periodic interest payments, i.e., the coupons. The present worth of the face is, according to formula (2), P/R■. The present worth of the coupon annuity is, from formula (4), seen to be

R■■¹ C-----. R■r

Hence the present value of the bond is the sum of these two present worths, i.e.:

P C(R■■¹) Pr + C(R■■¹) (5) V = --- + --------- or ---------- R■ R■r rR■

Second Method. Here, the determination of the amount of premium or discount which is fair payment for a bond is the point of attack. That is, using par as a basis, how much above or below par is the bond worth? The fair premium is based upon the difference between the nominal yield of the bond and the interest return in the present money market. Stated otherwise, in the case of a bond selling at a premium, the nominal interest return may be looked upon as composed of two parts, viz.: (1) a portion representing interest at the _effective_, i.e., current money market rate on the par value of the bond, and (2) a portion—the difference between the nominal yield and (1)—which is of the nature of an annuity for the life of the bond. The present worth of this annuity is the fair premium on the bond.

To illustrate: A 6% bond sold in a 5% market would have a nominal yield annually of $60. All that can be secured, however, on the par value is $50. Hence, on the basis of valuation at par there is a $10 excess of nominal over market yield which would be received every period. The present worth of this $10 annuity is the fair premium which the bond will command. With the use of the previous symbols, this annuity is expressed by the quantity (C-Pr) whose present worth, as determined by formula (4) is

(C - Pr)(R■ -1) ---------- . rR■

Therefore, the value of the bond is the face or par of the bond plus the present worth of this annuity, i.e.:

(C - Pr)(R■ - 1) (6) V = P + ---------- rR■

This formula when simplified reduces to

Pr + C(R■ - 1) ----------, rR■

which is identical with formula (5) and, of course, values the bond at the same amount.

Third Method. Valuation by either of the methods above is rather complex, requiring for easy solution the use of logarithm or compound interest tables. A third method, requiring only the ordinary arithmetic processes is sometimes used, although very burdensome when the periods are numerous. This is sometimes called the periodic method because working backwards from par, the value at the next preceding period is determined, and from that the next is found, and so on till the value at the desired period is reached. Reference to the second amortization schedule shown on page 270 will help in understanding the process. Using the same terminology as above and this additional:

P■ = the first preceding value above par ($1,004.90 in the schedule) P■ = the second preceding value above par ($1,009.71 in the schedule) Etc.

formulas 7 to 9 below may be developed.

It was noted that any particular value of the bond is found by subtracting from the next preceding value the difference between the nominal and effective incomes. The nominal income is always based on par, and the effective on the value at the last interest period. For example, in the schedule referred to: $1,004.90-($25-$20.10) = $1,000, the $20.10 being the effective income, 2% on $1,004.90. Using symbols the above equation may be generalized as follows:

P + Pc (7) P■ - (Pc - P■r) = P, whence P■ = -------, and 1 + r

P■ + Pc (8) P■ - (Pc - P■r) = P■, whence P■ = --------, and generalized, 1 + r

P■■■ + Pc (9) P■ - (Pc - P■r) = P■■■, whence P■ = -------- 1 + r

This gives a working rule whereby it is possible to work back from the known value, par, by successive operations until any desired value is found. The calculation is somewhat as follows for the example used in the schedule:

1,000 + (1,000 × .025) 1,025 ---------- = ------ = 1,004.90 1.02 1.02

1,004.90 + (1,000 × .025) 1,029.90 ---------- = -------- = 1,009.71 1.02 1.02

Similar calculations will develop the other values in the schedule. In the case of a bond with, say, 30 periods still to run, the burdensome nature of the calculation by this method is apparent.

While commercial houses rarely need to use the algebraic formulas for calculating bond values, it is the only really correct method of valuing bonds which are held for long-time investment, and the accountant should be conversant with it. For the balance sheets of savings banks, insurance companies, and other investment concerns, scientific valuation of bonds with the attendant amortization up and down of discounts and premiums is not only theoretically correct but practical considerations, in a market such as prevails in a time of marked but temporary depression, demand that it, or some approximation to it, be used.

A discussion of the valuation of serial and short terminal bonds, or those carrying more than one rate of interest, or those redeemable by lot at various times, is beyond the scope of the present work.

Valuation of Sinking Funds

The section of the balance sheet under consideration usually includes the various funds representing the investment of reserves. Sinking funds, building funds, insurance, pension, endowment funds, and the like, are examples of this class of asset. The use of the term fund should be strictly limited to specific assets set aside for specific purposes. The problem of valuation in connection with funds will be considered under two sets of conditions, viz., when the funds are invested in a concern's own securities and when invested in outside securities. The practical questions in connection with funds are those of finance rather than of accounting.

The determination of a policy of investment as between the concern's own and outside securities depends on many considerations, some of which do not come strictly in the purview of the accountant. It is argued that for the sake of immediate availability, investment of funds to be used for a specific purpose at a definite time should be in the securities of other concerns over whom control does not extend. In some cases, however, provision is made in the trust deed of a sinking fund to the effect that the funds set aside shall be used to purchase the bonds to retire which the funds have been created. These bonds may be canceled or held for the sake of their income in the fund till maturity. There would seem to be no choice between a concern's own and outside securities, provided the same standards of moral obligation are observed in both cases. If the securities purchased for the funds are the concern's own bonds, they should as a rule be valued at cost and the premium or discount amortized over the remaining life of the security. They may, of course, be carried on the books at par and the premium charged immediately against any income in the fund. The showing on the balance sheet should be in exact accord with the facts. If the bonds have been purchased and canceled together with their coupons, the amount of such cancellations should be shown as a deduction from the bond liability. The fund is thus serving its purpose _currently_ by reducing that liability. Any uninvested balance in the fund should, of course, be shown among the assets. When the bonds are purchased and held uncanceled for the sake of their income, it is probably better to carry them among the assets, indicating, if the information should be considered vital, that the securities in the fund are the concern's own securities.

If the funds are invested in outside securities, these should be valued on the basis of long-time investments. If bonds, their premiums or discounts should be amortized. If, however, the credit of the issuing concern is such as to cast doubt on its ability to redeem them at maturity, other bases for valuation should be taken. It might even be necessary to set up special reserves to replenish the expected shrinkage upon realization of the securities held in the fund. A final injunction may not be out of place, to the effect that all funds should be definitely labeled so as to show their purpose.

Valuation of Investments in Land

Investments of a more or less permanent nature sometimes take the form of investments in land. This may be for the purpose of securing an income; it may be of a speculative nature, as when land is held for appreciation in value; it may be to secure room for future expansion; or it may be for the purpose of preventing a competitor from securing favorable holdings as to trade location or facilities. For whatever purpose acquired, as here considered, the land is a permanent investment and should be separated in the records from land held for operating purposes. The manner of accounting for these investment holdings is somewhat dependent on the purpose for which they are held. In most cases, particularly if the land is income-producing, at least a land expense and income account will be needed in addition to the asset account or accounts with the land.

As to the valuation of these holdings, full cost with no account taken of depreciation or appreciation in value is the correct basis. As stated in Chapter XVII, page 307, under certain conditions the carrying charges on non-income-producing lands may be added to the value of the holdings. If lands are held over a long period to secure appreciation in value, certainly all carrying costs should be loaded on to the asset account, offset, as shown in Chapter XVII, by a suitable reserve. Care must always be taken not to secure inflated values by these methods. If any of these holdings are disposed of, the profit or loss then actually realized must be taken into account; but no unrealized profit or loss should be brought onto the books—except, perhaps, as a balance sheet footnote.

CHAPTER XVI

MACHINERY AND TOOLS, FURNITURE AND FIXTURES, AND OTHER EQUIPMENT

General Considerations

The valuation of assets grouped under the head of equipment presents nothing new in principle but requires consideration of many points in the application of principles and of some features in accounting. Here the principle of value as a going concern is particularly effective. As in the valuation of prepaid expenses on a going concern basis, so here forced sale or liquidation value has

no place. The business is viewed as established and as expecting to operate continuously. Capital has become tied up in certain equipment essential to the undertaking, in the sense that to dispose of it in its entirety would mean a break-up of the business. It cannot therefore be freed or put to other uses without a reconstruction of the present enterprise. Accordingly, the possible market value, as second-hand property, should not in any way influence the valuation at which this group of assets is carried on the books. Only full cost at the time of installation and depreciation, using the term in its broad sense, need be considered in the problem of valuation.

Distinction between Personalty and Real Property

The present chapter deals with such fixed asset equipment as machinery and tools, furniture and fixtures, delivery equipments, patterns, lasts, dies, maps, drawings, electrotypes, ovens, furnaces, etc., as distinguished from the more fixed group of lands, buildings, leaseholds, and the like. In the main, the point of differentiation is the legal one of personalty and real property, although the intricacies of the law on this vexed subject are never, so far as is known, reflected in the books of account, nor is it the purpose here to attempt to lay down any working rules or standards by which such differentiation can be made. There seem to be none except certain broad generalizations, each case resting on its own peculiar surroundings. Circumstances, however, may arise under which a clear-cut distinction is desirable. A bond issue supported by a mortgage on real property or on personal property _may_ depend, although not usually, on such a distinction for a large share of its security. The margin of safety may hinge on this point. It may be desirable to be able to trace on the face of a balance sheet the particular property covered by a mortgage. And should foreclosure of the mortgage become necessary, it is, of course, essential to know exactly the property subject to the lien. These are not points under contemplation in a going concern, although the possibility of their arising should not be lost to view. Here the problem of valuation and accounting for such valuation is viewed from the standpoint of a going concern and not one facing partial or total liquidation. Furthermore, as stated above, the point is, in its final analysis, one of law and not of accounting.

It is not intended by the foregoing statement to sanction any method of keeping the records in non-accord with fundamental rulings of the law, but only to state that, so long as substantial agreement is secured, accounting has served its intended purpose. Wherever any specific property is known to be subject to a lien, it is of value to the management for the accounts to reflect the fact. There may, however, be circumstances under which it is not desirable that the _accounting_ records give this information. Conditions must govern each particular case without prejudice, and the principle holds that so long as substantial accuracy is reflected in the accounts as to this point nothing more is necessary.

Machinery and Tools

Under this head will be included not only the assets carried under that ledger caption, but also power machinery, power transmission, shafting, connections, electric transmission cables, and the like. The term is used in a very broad sense. While all these items are subject to one general rule of valuation, usually each must be separately considered to determine the practical application of the rule. The valuation involves, of course, the factor of depreciation, and it is readily apparent that not only do different pieces of machinery differ in this respect, but the same machines in different factories will vary as to this element and even in the same factory two similar machines will not usually be affected in the same way. This may be caused by defects or differences in quality, almost invariably latent, inhering in the machine and also by the different conditions under which they are operated. As pointed out in Chapter VI on depreciation, many of these are engineering problems which the accountant alone cannot solve but the existence of which he should know. Manifestly, all that can be attempted here is to point out their existence.

Accounting Records

The valuation of machinery and tools as here contemplated is dependent largely on the accounting records. Therefore, it is desirable to keep separate records for each of the two classes. This is so because of the greater degree of fixity of the one over the other. As to tools a distinction is also made between machine tools and general shop or hand tools. Machine tools are those with which the machine does its work. Thus, cutting tools for use with any particular machine, auxiliary equipment used for some operations, but not for others, and the like, constitute a very essential and component part of the machine and should be recorded and valued with the machine even though the tools need to be replaced much more frequently than the machine. On the other hand, shop tools comprise those of general utility which are largely used by hand. Hammers, wrenches, hand shears, pliers, chisels, bits, and the like, are examples of shop or hand tools.

Where the number of machines is large, proper accounting requires a subsidiary record known as a machinery ledger or register controlled by the machinery account on the general ledger. In this subsidiary record accounts should be kept with each class of machines, and with each machine separately if the record as to the performance of any specific machine furnishes essential information.

Operation of Machine Accounts

Every machine should be charged with its full cost. Full cost is understood to include invoice price, insurance during transit, freight, duty, and drayage charges, and installation costs. The last item usually includes the platform or stand on which the machine is erected, with all costs in connection therewith, when special supports or platforms in addition to the regular factory floor are needed. The cost of attaching the machine to the power and meters for measuring its power consumption are not usually included therein, these being classed as costs of power equipment—although practice is not entirely uniform in this regard. The machine record should also show the name of its manufacturer and its order number and any other useful information such as terms and period of guarantee, estimated life, rate of depreciation to be applied, numbers and kinds of tool equipment, etc. All deductions from the value of the machine must be on the same basis of full cost. Such deductions might arise because of fire, sale, or replacement. The proper handling of the account when deductions are necessary will be explained at the close of the chapter, as the method is applicable to all classes of asset equipment.

Valuations of Machinery and Tools

The statement of the principle of valuation for machinery is simple, but the application of the rule is complex. The valuation formula for machinery is cost less depreciation. As stated above, the condition of the market has no influence on the going concern valuation of fixed assets. If the market is now lower than at the date of purchase, this simply means that more capital was then required to start operations than is now required. If the forces of competition are free to act, the margin of profit or the margin of return on the investment in machinery will be somewhat less in the one case than in the other. If the market is now higher, then the situation is in favor of the earlier investment rather than the present one. In neither case should costs of production be falsified by valuing the machinery and other equipment at any other figure than cost.

Estimate of Depreciation

Estimating the depreciation on machines is the chief and vital problem in their valuation, because depreciation is reflected in the cost of the article manufactured, being a cost of production just as truly as the raw material used. As brought out fully in Chapter V, page 93, the so-called depreciating assets are really of the nature of deferred charges to operation and a depreciation estimate is the amount of the periodic charge against production. Because of the speculative nature of an investment in machinery (neither the quality of the machine being exactly determinable nor the conditions of its operation known), its depreciation is always an estimate. For this reason it should be based on the best possible knowledge available at the time of installation.

Any estimate so made must be the subject of periodic revision. How frequently this revision should be made will depend both on the length of estimated life and the way in which actual experience compares with the expected or estimated conditions. The experience on which the estimate is based should, of course, be with the same or similar machines, gained, if possible, amid the same surroundings and conditions under which the new machine will operate. In default of such experience or as a valuable check thereon, the results of others in the use of the machine and the expert advice of those who have studied the problem of depreciation in its practical applications should all contribute to the making of this estimate.

History of Machine

This need of experience data creates the necessity of a means for gathering and preserving the data, and the machinery record above referred to serves the purpose. Therein should be set forth the complete life history of the machine—not only the original cost and the additional data given above, but also the time and cost of all replacements and all information relevant thereto and, as a memorandum, the cost of maintenance, repairs, up-keep, etc. The record is not complete without the data as to repairs. A periodic statement should also be made as to any abnormal conditions under which the machine has been operated, such as overtime, overload capacity, etc. Where possible, the output of the machine in units of product should be included in the record. Where a group or battery of similar machines is operated, the average experience of all of them is the best possible data on which to base future estimates of depreciation.

The more life histories available, the more reliable will be the average obtained therefrom. After making due allowance for changed conditions of operation, this average should prove a reliable forecast of future experience. After all, an estimate of depreciation is in many respects very like an insurance charge, and the time may come when the life histories of a sufficiently large number of machines will provide a very reliable basis for estimate at any given time of the expected life of a machine when operating conditions are known.

Standards of Operation

One phase of the modern efficiency movement relates to the study of machine operation. This has helped in the study of depreciation, in that standardized methods of use have been established. These comprise a standard speed of operation, proper periods of rest, correct methods of throwing in the power, the proper adjustment of parts for each machine; and for each kind of machine tool, the proper degree of hardness to which the cutting edge must be tempered, the speed of cutting, and the number of operations before resharpening—all these standards have been established, resulting in an average performance of maximum efficiency which may be called the normal operating conditions of the machine. Where such studies have been made and where the set standards are uniformly observed, a very reliable basis is furnished for forecasting the future. To insure the observance of these standards a permanent card should be attached to every machine, giving all the information essential to standardized operation. A copy of this standard should be made a part of the record in the machine ledger.

Abnormal Operation

To make the periodic revision of the estimate of depreciation accord with the fact or rather with the best possible estimate of the fact, any abnormal operation of the machine should be considered. Thus, if the machine has been worked overtime, say on a three-shift day instead of one-shift, or if it has been crowded beyond its capacity, if repairs have not been made when they were needed, if the wage policy has been changed from a per diem or per hour basis to a piece-work basis—all these points must be considered.

Machines which are seldom used require careful consideration. It is oftentimes necessary to include in the equipment special machines for infrequent operations and processes. The normal operation of such must be estimated for each particular factory and depreciation based on such use.

All of the foregoing points must be taken into account in connection with the operation of both machines and power equipment. In the case of the power machinery, a consideration of kind and quantity of fuel, manner of feeding and cleaning, quality of the boiler water, etc., with the set standards, forms the basis for a revision of depreciation rates and estimates.

Map of Machine Location

In connection with the machinery record, a complete map showing location and number of every machine is especially desirable. In case of fire it makes identification easy.

Methods of Application of Depreciation

In the application of depreciation, three methods are used more generally than any others. The straight line method, as discussed in Chapter IX, is the one most widely employed. It is to be preferred to all others, giving satisfactory results and being easy of application. The fixed rate of diminishing value method also has many adherents, and depreciation based on the number of units of product turned out is a third method often used where applicable—though applicable in a very limited degree.

Under the straight line method, it may be ventured as an opinion that 10% is a fair average minimum rate and 15% to 20% an average maximum. The knowledge as to what constitutes an average rate serves little useful purpose, however, although it does give a rough estimate when spread over a large variety of machines. It has been said that from a mechanical point of view no machine can depreciate _actually_ more than 30% and be operated efficiently. This does not, of course, mean that the depreciation reserve should never show more than a 30% offset to the value of the machine, as this would indicate too high a rate were the machine still in operation. It does mean that, according to a theoretical standard of operating efficiency, any machine which cannot fulfill at least a 70% efficiency test should no longer be used. It should be remembered that the depreciation reserve is a device for financing depreciation and nothing else.

Basis of Valuation

The basis, therefore, for the valuation of machinery is its full cost less estimated depreciation. Such an appraisal is subject to periodic revision by comparing the estimated with actual depreciation as more of the facts brought out by the period of life already expired become available. Perhaps the method of inventory, as will be explained in connection with hand tools, is best applicable to machine tools and even to certain small bench machines on the boundary line between tools and machines. However, special tools made for a particular purpose and perhaps not adapted to any other use should be charged against the job and not carried as an asset.

Scrap Material

A financial consideration in connection with machinery is the disposal of scrap material. This should be disposed of as advantageously as possible. It should be held until the market for old metals is high, if at the time of its discard prices are abnormally low.

Accounting for Tools

With regard to the method of accounting for hand and shop tools and the basis for valuing them, the additional factor of possibility of loss claims consideration. Unlike machines, which are for the most part securely attached to the premises, tools are loose, they may be carried off or lost, and so not only loss in value due to depreciation but loss from theft or carelessness must be taken account of. Unless an adequate control is established over the physical handling of loose tools, a very considerable _leak_ may result at this point.

In accounting for tools, different practices are encountered. Thus, the Public Service Commission for the First District of the State of New York, in its Uniform System of Accounts for Gas Corporations, authorized that, “hand and other small portable tools liable to be lost or stolen shall, when first acquired and before issued for use, be carried in a suitable Materials and Supplies account; when issued, they shall be charged to the appropriate expense account. Portable tools and apparatus of special value may, however, be charged to the appropriate tangible capital account, and remain therein so long as record is kept of the persons to whom such tools and apparatus are issued and such persons are made responsible therefor.”

Sometimes the practice is found of charging all purchases of tools to an asset account for a short period of, say, two or three years, and thereafter to a suitable expense account, with a periodic revision based on an inventory about once in five or six years. Again, the Loose Tools account may be handled just as any other asset account, i.e., charged with all purchases, credited with losses, and depreciation provided for. The manner of handling the record is not vital, any method sufficing that fits particular needs. All methods must, however, take cognizance of the fundamental distinction between capital and revenue charges and provide some means by which the Loose Tools account, as an asset account, shall represent substantially correct asset values. A successful method of securing control over the physical handling of tools, where the plant is large enough to justify it, is to place all tools when purchased in the care of a stores-keeper and issue them only on authorized requisition, thus securing an accurate record of them.

Depreciation on Hand Tools

As to the valuation of hand tools, depreciation is often left out of account on the theory that, so long as a tool can be used to perform the service expected of it, it is worth approximately what it cost. Where as an adjunct to this method of valuation, a physical inventory of tools is taken periodically and all losses so shown are charged to expense, substantially correct asset values are secured. Of course, _theoretically_, tools are as much subject to depreciation as other similar assets, but the method of the inventory valued at cost, and therefore disregarding depreciation, is perhaps the best practical way of handling the valuation of tools, and it gives sufficiently satisfactory results for most purposes.

Valuation of Home-Made Machinery and Tools

Machinery and tools made in own factory offer a problem in valuation. It may be stated thus: Shall such be valued at the market price at the time when made, or shall valuation be the cost to manufacture? It is argued that had the machinery been purchased on the market, as is usually the case, the cost would have been market price; the machinery is worth that price and should be so valued. If the cost to make is less than the market, to bring the machine on the books at market would necessitate the taking of a profit of the difference between cost and market. No profit has been made, only a saving in capital investment. This confusion between profit and savings is referred to in Chapter XIII.

In the long run, i.e., in the period covered by the life of the machine, it makes no difference in profits for that period whether the machine is carried at cost to make or at market, because its value is written off to depreciation during its life and the higher value means an increased depreciation charge. This will exactly offset during the period of the life of the machine the profit taken by bringing it onto the books in the beginning at market instead of cost. As a matter of principle, however, the point involved is of sufficient importance not to justify the practice. By cost to make is meant full cost, which includes materials used, labor applied, and a fair share of the overhead expenses. Whatever the cost to make, whether lower or higher than the identical equipment could be purchased for on the market, that represents the capital outlay and is the true basis for valuation, taking cognizance of depreciation for the elapsed period.

Expenditure for Rearrangement of Machinery

In connection with expenditures made in the rearrangement of machinery within the plant for various purposes, the question of the effect of it on the value at which the machinery is being carried requires some consideration. In Chapter V where an attempt was made to mark out broad boundary lines for capital and revenue expenditures, it was stated that any expenditure which produces greater earning capacity or without which a lessened earning capacity would result (assuming that all normal expenditures for maintenance and repairs are being made concurrently), may be treated as a capital expenditure or at least as a deferred charge to be spread over several periods.

In the case of depreciating assets, the practical identity of the two methods is apparent. Thus, if the expenditures for rearrangement of the machinery have either of the effects mentioned above, there is no serious objection on theoretical grounds to capitalizing them. Instead, however, of injecting such intangible values into the machinery account, it is far better, because more exact and accurate, to show them separately. Practical considerations demand that such expenditures shall not usually influence the valuation of machinery and a conservatism born of the fear of inflation requires that when treated as deferred charges, they should be written off as quickly as may be done without undue burden on the periods' profits.

Definition of Furniture and Fixtures

Furniture and fixtures, as an asset title, is not clearly defined. It may include the usual tables, desks, filing cabinets, bookcases, typewriters and other mechanical equipment, safes, chairs, counters, and in addition, light, heat, and plumbing fixtures, show windows, partitioning, shelving, and the like. The account should be charged originally with all such items at full cost. Great care must be exercised in handling repairs and betterments to avoid an inflation of values. The distinction between capital and revenue expenditures as regards all such assets already acquired is usually so slight and uncertain as to justify the establishment of a policy of charging all these to expense. Otherwise, the ease of inflation is apparent. All new purchases should be charged at full cost to the asset.

Valuation of Furniture and Fixtures

The basis for the valuation of furniture and fixtures is at cost less depreciation. In applying depreciation, account should always be taken of the usually very small residual values in this class of asset. Scrap value in some cases is only as kindling wood and therefore almost or entirely negligible. In some cases of easily movable equipment, the method of the inventory as used for loose tools will give better results in valuation than an appraisal method based on cost less depreciation. One often finds the conservative practice of bringing onto the books a rapid depreciation to scrap value during the first few years, at which nominal value the asset is carried thereafter. This is a common practice in financial institutions. While not theoretically justifiable, in comparison with the opposite tendency based on too great optimism as to the life of the asset, the practice is to be commended.

The average range for depreciation of this class of asset is from 10% to 20%, estimated by the straight line method. Where premises are leased and any equipment of this kind is, according to the terms of the lease, to remain with the building, it is necessary that a depreciation rate be taken high enough to accomplish complete writing off by the end of the lease. This rule also applies if the equipment may be removed but would be in a badly damaged condition, resulting in little remaining value.

Delivery Equipment—Definition and Valuation

Delivery equipment includes all property, direct or auxiliary, used in connection with the delivery of goods both inward and outward. Horses, wagons, and harnesses, motor trucks and cars, repair parts, and repair equipment, containers, holders, and the like, are common examples of this class of asset. In the main, these assets are handled very much as all the others of the general

equipment group. Valuation is on the basis of cost less depreciation for the most part, but in many instances the method of the inventory should be applied.

If horses comprise a part of the equipment, not only must depreciation due to wear and tear be reckoned, but accidental causes such as death and disablement must be given consideration. Experience in each business based on the particular kind of work to be performed and the conditions under which it is being performed furnishes the only adequate basis for estimating the depreciation rate. Thus, heavy or light draughting, speed to be maintained, kind of road on which the haul is made—cobble stones, brick, asphalt, wood blocks, or dirt—and the standard of appearance to be maintained—all these affect not only the cost of up-keep but also the rate of deterioration. Sometimes it may be safe, as with loose tools, to charge all purchases to capital for the first few years until the equipment is complete, and thereafter all renewals to revenue, depreciating the asset account, say, 20%, and maintaining it at that figure. Any marked increase or decrease in numbers would require respectively an added capital charge or a reduction of the original charge. Whether this method or the method of the inventory be used for valuation purposes, there should be a periodic appraisal by an expert horse dealer and adjustment of values based on this appraisal.

Wagons, trucks, and motor vehicles should be numbered and all accounted for periodically by physical inventory. It may be desirable in some cases to maintain a register for these, wherein the performance of each can be recorded and so compared. This is particularly desirable when a change of delivery policy is under contemplation and comparative records are needed of the performance of various types of vehicles. This class of delivery equipment is best valued on the basis of cost less adequate depreciation, with the periodic inventory as a check on numbers and condition.

Carriers and Containers—Valuation

The most difficult of all the items of delivery equipment to handle and value is that class represented by carriers and containers. These may be barrels, kegs, casks, bottles, baskets, and boxes, and are met in the brewery, dairy, bakery, laundry, and oil businesses. In some lines it is feasible and is the practice to charge the customer with the fair cost of the carrier, giving a return privilege with refund, dependent upon the condition of the returned carrier. This is good where applicable, although it necessitates having an adequate redemption fund which may be operated somewhat as a bank's reserve is, i.e., only large enough for normal needs but capable of ready enlargement when the need arises. In other lines of business such a method of handling the container cannot be used. Here, as in the bottled milk trade, only experience will give a proper basis for estimating the depreciation through loss, theft, and breakage. The rate is almost invariably high, and liberal depreciation should be provided for. Taken all in all, throughout the various kinds of delivery equipment rates ranging from 16■% to 25% constitute fair average rates.

Patterns, Molds, etc.—Valuation

The last kind of equipment items requiring consideration is comprised of such items as patterns, lasts, molds, dies, drawings, electrotypes, wood cuts, forms, models, and the like. Wherever possible, these should be charged to the particular job for which they were made and not carried as assets. Unless there is a probability that the pattern, mold, etc., will serve for other uses than those for which it was made, the costs of making should be borne by the job on which it was used. This is very often not the case, however, and these items can be used for successive production. This is particularly true of a standardized product which is not apt to be much affected by change in style or the whims of a purchasing public. At the best, however, they constitute a treacherous and highly speculative asset and require careful handling to avoid inflation of value. Thus, it is easy in the publishing business to allow electrotypes, wood cuts, etc., to assume unwieldy proportions to the other assets. In manufactories of wearing apparel, the fickleness of fashions requires that patterns, lasts, and models be written down ruthlessly to the lowest possible figure. Here obsolescence is a big factor.

Under the limitations set, valuation should be based on cost with a very liberal periodic depreciation. The rate will _average_ anywhere from 20% to 50%, though a lower rate may sometimes be proper.

Disposal of Assets

In connection with the handling of the asset and its valuation account, the disposal of all or some portion of the asset requires consideration. It is a fundamental principle that whatever is taken out of the asset account must be taken at the same cost as it was introduced into the record. Thus, an asset recorded at cost of $5,000 and sold for $4,500 would be shown as taken out of its account at $5,000, the apparent loss of $500 being recorded in a suitable expense account. If the asset has suffered depreciation between the date of purchase and sale, and the depreciation reserve shows this, that must be taken into account. Practically, it is

best handled by transferring to the asset account from the depreciation reserve the part of the reserve applicable to the portion of the asset disposed of. Upon disposal there is an additional credit to the asset account of the difference between cost and the depreciation to date, i.e., the amount of this credit is the present appraised value of the asset sold, taking into account not only the recorded depreciation but the accrued as well. This brings out the true as distinguished from the apparent profit and leaves in the reserve only that portion which is applicable to the asset remaining.

An illustration will show the process of handling. Assume that the $5,000 asset is a portion of a $50,000 machinery account, for which the recorded depreciation reserve is $10,000 and the depreciation on the portion sold accrued to the date of sale is $200. The entries, necessary to effect the sale, are:

(1) Depreciation $200.00 Depreciation Reserve Machinery $200.00 Accrued depreciation to date on the asset sold.

(2) Depreciation Reserve Machinery 1,200.00 Machinery 1,200.00 To write down to appraised value the asset sold.

(3) Cash 4,500.00 Machinery 3,800.00 Profit on Sale of Machinery 700.00 To record sale of machine and the profit on it.

CHAPTER XVII

BUILDINGS, LAND, AND WASTING ASSETS

Definition of Real Property

The movable fixed assets—paradoxical as the limiting adjectives may seem—having now been considered, the present chapter will treat of the immovable tangible fixed assets. By immovable is meant real property as distinguished from personalty, and by tangible the intention is to exclude from the present consideration such intangible items as good-will, patents, copyrights, trade-marks, franchises, and the like.

In accounting for this group of assets there is no place for the caption “real estate.” In its stead the two titles, “land” and “buildings,” are used. This is to avoid confusion and to afford a better basis for calculating depreciation. The term real estate or real property has a very definite legal connotation, but in the popular mind is held to include land and buildings. From the accountant’s point of view there is no objection to the use of the term in the balance sheet, but in the accounts themselves the two assets should be carefully separated. For the private commercial enterprise, land as a fixed asset is subject neither to depreciation nor to appreciation; whereas buildings are constantly depreciating in value. While depreciation can be calculated with fair accuracy on the combined basis, the single basis of building values is the only scientific basis. The separation of the two values is also essential for insurance purposes and the proper adjustment of fire losses. They will therefore be separately treated in this discussion.

Cost of Buildings

Buildings as fixed assets should be valued by the formula for the fixed asset group, viz., full cost less depreciation. Some points in connection with proper methods of accounting and special cases of valuation require comment.

First, as to making the proper record of cost of the buildings. Three cases must here be considered:

1. If the building is purchased outright for cash, whatever costs are incurred in securing full title and expert opinion as to the sufficiency of the title are proper charges against the building. If the building is erected on contract, the full cost of the contract and any necessary supplementary charges comprise the carrying value of the structure.

2. If the building is bought by the issue of stocks or bonds, the present value of those securities and all costs in connection with their issue should constitute the cost of the building. Determination of the present value of the securities is oftentimes a difficult matter. When sales on the market take place concurrently, that determines the price. When, as is usually the case, several existing companies are bought up or merged to form a larger company, the old stockholders are given shares in the new company for their equities in the old. The book value of their old holdings may be the basis for the issue of the new stock or the issue may be on the basis of a larger or smaller value than this. This whole question of the value of the assets taken over is equally a question of the value of the securities issued therefor. This is considered in full in Chapters XX and XXI and will be given only brief treatment here.

Manifestly all considerations relating to buildings purchased by stocks and bonds have equal application to all other fixed assets so purchased, and the treatment in later chapters will therefore be more inclusive than could be any statement of the case applicable

only to buildings. It suffices to say here that usually the par value of the securities issued constitutes the value placed on the assets bought. The valuation as a rule is made by an appraisal committee from the board of directors which inspects the various properties taken over and places a value on them. In the absence of fraudulent intent, the courts will usually sanction and uphold these values as having been made by interested parties competent to act. This is the method generally used for injecting water into properties.

3. When buildings are put up by the concern itself, full cost may include not only cost of material and labor and a fair proportion of the overhead where supervision of construction is local, but all other expenses directly incurred in connection with construction. These will include architects' fees for plans and supervision, cost of permits and licenses, interest on borrowed moneys and insurance during construction, accidents and injuries to workmen during the construction period, easements, damages, strike costs, and the like. If the structure is being erected on a site occupied by an old building, the cost of wrecking less any salvage value is a proper charge against the new structure. If bonuses have to be paid tenants in the old building to secure release of their quarters, these, too, are similar charges to the new structure. Charges such as interest and insurance during construction are capital charges only up to the point of fitting the building for occupancy and so making it an operating and income-producing unit. Thereafter these must be treated as revenue charges.

Some interesting and at times complicated situations arise when, as in the case of an office building, the structure is occupied in sections as completed. Theoretically, only the portions of the charges of this kind applicable to the completed sections now become revenue charges, the rest still being capitalized so long as sections remain uncompleted. Practically all that is desired is substantial accuracy. The items may be comparatively insignificant but when in doubt the bias should always be on the side of conservatism.

Valuation of Buildings

In the valuation of buildings a much more difficult problem is encountered after the structure is completed and repairs and alterations are made. It is the old problem of the proper differentiation between capital and revenue charges, and is particularly difficult of solution in some instances. Nothing more can be said here than was stated in Chapter V where the fundamental rules to be observed in distinguishing between repairs, renewals, and betterments were laid down. Changes in interior arrangement to accommodate new fixtures and equipment, or a different distribution and arrangement of existing equipment with a view to better operating conditions require particularly careful handling. Such expenses were mentioned in connection with the treatment of machinery on page 290, and the reader is referred to it. Whatever decision is reached on any doubtful item of this or a similar kind, the supporting vouchers, bills, and papers constituting the full evidence should be carefully preserved and made available for review in case of any future questioning of the charges.

Betterments on Leased Buildings

In the case of betterments made on leased buildings, provision must be made to write off their entire cost by the time of the expiration of the lease, as they almost invariably revert with the building to the owner. Sometimes the betterment, if material and so agreed as between lessee and owner, may be taken over at a depreciated value upon expiration of the lease. Here depreciation of the betterment must be provided for. Whether all or only part of the cost of the betterment is to be charged off periodically, record of this is best accomplished as an addition to the periodic rent charge.

Application of Depreciation

As stated above, the basis for valuation of buildings is at full cost less depreciation. It is the method of appraisal, although the inventory may provide a good check in the case of concerns owning many structures. A subsidiary record of buildings showing separate costs and location, or at least a map showing location, may then prove very essential, particularly in the case of fire losses. In the application of depreciation to buildings many things must be carefully considered. Not only must the depreciation of use, i.e., wear and tear and lapse of time, be considered but also obsolescence and inadequacy as factors in shortening the service life of the structure.

Buildings used for some purposes deteriorate more rapidly than when put to other uses. Vibrations, whether caused by own use or due to exterior causes, increase the rapidity of deterioration. Susceptibility to fire, explosion, and the like, due to the nature of their use, should be taken into account. It is stated that power plants operating under normal conditions provide for an entire replacement of plant every five years. Power houses depreciate more rapidly than store houses. A building put to various uses will be subject in its different parts to varying rates of depreciation. Although a composite rate applicable to the whole structure will give a satisfactory valuation, if accurate departmental costs are required it would be desirable to apply the different rates to the building

values distributed over the various departments. In practice this is seldom done.

According to different authorities, rates of depreciation ranging from 1% to 5% constitute a fair average. The nature of the structure, whether occupied by owner or tenant, its location, kind of composition, etc., are additional factors for consideration. While some authoritative rates are available, no standard rates, unless compulsory, should be used without a careful study of local conditions. Structures which are temporary should, of course, be charged for their net cost, i.e., full cost less salvage value, against the product or the job which makes use of them. Other cheap structures such as mine buildings, shaft houses, temporary housings for lumber mills, and the like, should be written down very rapidly. Having practically no realizable salvage value and their life being brief, they should be charged off the books at least during the period of their use.

Buildings owned as a freehold for life, or, stated otherwise, a life interest in buildings, are not subject to depreciation, the remainderman taking the building in its condition as released by the party owning the life interest.

Accounting for Land

In accounting for land as a fixed asset used in the conduct of a business, one or more accounts may be carried as seems best. If the land is in several different plots, perhaps widely separated and each plot held with other groups of assets and under varying conditions as to taxes and other obligations, some plots being subject to mortgages and others not so subject, separate accounts with each plot would be desirable. Otherwise, usually the one account will suffice.

The record should be as complete and full as possible. Notation after the title or elsewhere, giving the description and location of the holdings, is an advantage as a means of exact reference. The various items in the account should be supported by full explanatory matter together with documents available for the analysis of the various items and proof as to their legitimacy. It should thus be possible, at any time, to determine the items comprising full cost. The purchase contract price, the attorney's fees, and broker's commissions or a fair portion of the purchasing agent's salary, the costs of search and guarantee of title (if these are borne by the purchaser), notarial and recording fees, the assumption of taxes owing at date of purchase, local improvement taxes and assessments, such as sewer, water, curbing, paving, and the like—all these should be indicated with clearness and definiteness.

Where accounts with a "large number" of plots are kept, it may be advantageous to carry these accounts on a subsidiary record specially ruled to give the detailed information desired and control them all by one general ledger account. Local conditions and the information desired will determine the manner of keeping the records. In all cases, the account should carry a notation as to where the supporting legal papers and documents covering each parcel or plot may be found. This prevents much needless loss of time and worry when quick reference to those papers is desired.

Valuation of Land

The basis for valuing land with unclouded title, as a fixed asset for business purposes has already been clearly indicated. Full cost, usually with neither depreciation nor appreciation, constitutes the valuation formula. By full cost is meant complete cost in condition ready for use or, at least, up to full-title date. In addition to the items enumerated in the preceding section, there may sometimes properly be included such expenses as leveling, grading, filling, and draining. Even the costs of dikes, dams, and embankments, and in the case of railway construction the cost of the care and up-keep of _growing_ trees planted to prevent land or snowslides, tunneling, and the like, may be carried as a part of land costs, although some of these may more accurately be recorded as improvements. In the case of mining land, the cost of stripping the surface to reach the ore body, and the cost of shaft-sinking and of tunneling are proper capital charges and may be recorded under the land account, although preferably under a development account.

Whatever costs are necessarily incurred to make the land serve its intended use are proper capital charges and should be recorded in the land account unless better purposes are served by record in some supplementary account.

Depreciation or Appreciation of Land

The relation of depreciation and appreciation to land valuation is not difficult in theory but is often very perplexing and gives rise to complicated situations in practice. In theory, so long as the land is used for its intended purpose, fluctuations in the market either up or down should not affect the valuation at which it is carried on the books. Just as with the equipment group of assets discussed in Chapter XVI, any increase or decrease in the value of the land cannot be realized so long as the land is employed in operation. Its cost represents the capital tied up in it and the amount on which profits must be earned. This is therefore the value at which it

should be carried on the books. Sometimes other considerations than those of accounting influence business policy in connection with the market value of land; but so long as it is used for the business purposes for which it was purchased, full cost price should be its valuation. This may sometimes place a prospective borrower at a disadvantage when using his balance sheet as the basis for credit. A footnote or other notation giving market value will usually suffice, although such value is often difficult of determination without a disinterested appraisal.

Appreciation of Land Values

When land is held over long periods in a growing community, appreciation in value almost always results; occasionally depreciation ensues. The amount of appreciation is oftentimes not as much as it seems because land with buildings on it may not be convertible to some other use at the market price of similarly located vacant land; the cost of scrapping the buildings often being as much or more than the appreciation in land value. Also, appreciation may sometimes be of a temporary character, in the nature rather of a market fluctuation. If so, the distinction must be carefully observed. Perhaps in the majority of cases requiring consideration, appreciation not only is very real but also very considerable.

It may sometimes be desired to base an issue of bonds on real estate—land and buildings—which is being carried at an old cost figure as of many years ago but which has a greatly appreciated and available market value at the present time. Prudent financial considerations would require an independent appraisal to determine the amount of the bond issue. Upon the assumption that the issue is for a larger amount than the original cost of the security, a peculiar situation arises. In showing the transaction on the books and balance sheet, not only would no margin of security appear, but even an insufficiency of security so long as the original value of the security is carried. Here it would undoubtedly be wise to bring the appraised value of the security on the books, offsetting the appreciation in value by a suitably named surplus or reserve account, such as “Reserve for Land Value Increment” or “Appreciated Land Value Surplus.” Another method and perhaps a better one where possible of application is to reorganize the concern by a sale of the old to a new company and so capitalize the increment in value of the old company’s assets.

Another financial consideration in connection with appreciated real estate values concerns the advisability of the sale of the old and the erection of a new plant on less valuable land. Usually, the appreciation of land values is not reflected in increased profits; it may even result in lessened profits due to higher rates of taxation and other expenses. If there are equally favorable locations for the particular kind of business, it may be the part of business sagacity to use the old location for rental purposes so that the benefit of the appreciation may be secured, or to sell and move to a less expensive site. In the one case the status of the land has been changed from that of an operating fixed asset to an investment, perhaps best considered permanent. In the other case, the increased value is through sale realized in a lump sum and, as a surplus item, is available for any purpose to which surplus may legitimately be applied. Of course, the amount of such surplus is the difference between the sum realized by sale and the cost of an equally efficient plant on the new site. It will usually happen that a better plant is erected, thus consuming some of the surplus arising from the sale.

Depreciation in Land Values

In a great many instances land depreciates. Decrease in value due to use will be considered under the discussion of wasting assets, page 311. When land suffers depreciation it is usually because of obsolescence or inadequacy. Due to certain natural facilities giving out, or to the removal, dismantling, or decay of artificial facilities, a site may depreciate so much as to become untenable. Business and residence property in a mining town may be of mushroom growth and have practically no value when the market, which is dependent on mining operations, declines. Ventures of this sort are recognized as highly speculative from the beginning and should be handled as such in the accounts. Wherever depreciation due to these causes can be foreseen, suitable provision should be made; otherwise the burden will fall entirely on the period when the plant has to be abandoned and this stage is usually preceded by periods of lessened profits. Depreciation of land is therefore always a local question.

Valuation of Land Investments

Business considerations oftentimes make advisable the purchase of adjoining or otherwise located tracts of land, with an eye to the future when enlarged facilities will be required. These should be carefully differentiated and segregated in the accounts from the land in use for business purposes. Some points in their valuation, in addition to those treated under the discussion of investments in land on page 278, need to be considered. Such tracts of land may usually without prejudice be valued at cost.

If later developments should turn out as originally expected, there can be no objection to loading the carrying costs of these lands, including taxes and interest on any borrowed purchase money, on their value year by year. The only reason for their purchase at the present time is because it is expected that the transaction can be more advantageously made now than later. If such should not be the case, the cost of the land proves to be higher than if purchased later. Only by loading these carrying charges can this information be developed. If the land is finally put to its intended use, no serious objection is seen in carrying it at the figure of full cost to the date of use. Because of the speculative nature of the transaction, it is usually advisable to set up a reserve of the same amount as the accumulating carrying charges. This reserve becomes free when the land is put to its intended use.

Because of the ease of inflation of values in transactions of this kind, due largely to an overoptimism as to the future and even sometimes to fraud, all such transactions must be scrutinized very carefully and ample provision against an unfavorable outcome should be insisted upon. It is interesting to note in this connection that in the case of valuations for rate-making purposes, as a usual thing carrying costs on land of this kind are not allowed as expenses to be covered by the rate of the service rendered. But when these lands come into use such expenses become a part of the cost of the service.

Mortgages on Land

Mortgages on land require consideration as affecting the manner of showing the land value. Freehold land, i.e., land held in fee simple, if afterwards mortgaged should be shown on the balance sheet at full face value with the mortgage listed among the liabilities. The liability is usually a note or other bond which in case of the deficiency of the security would be a general claim against the free assets of the concern. It is therefore best, theoretically, not to show such a mortgage as an offset to its security. In the case of the purchase of land subject to mortgage without the assumption of the mortgage as a direct liability, theoretically the mortgage may be shown as a deduction from the full land value and only the equity value of land be extended as a significant asset. This differentiation is almost entirely an academic one and is seldom seen in practice. The land is usually listed among the assets and the mortgage as a liability.

Donated Land

The valuation of donated lands presents some interesting points. A town may offer a free site to secure the erection of a plant within its midst rather than allow it to go elsewhere. Sometimes the donation may be outright and absolute; at other times it may be conditional, depending upon the doing of certain things by the donee, such as the employment of a minimum force of men for a certain number of years, or the circulation of a certain amount of advertising, or the purchase of given amounts of raw material supplied locally. In the case of an outright gift, the cost to the company is usually nil, but for the proper statement of the concern's financial condition the land must be shown as an asset. If the acceptance of the gift necessitates the scrapping of the old plant and removal expense to the new site, such costs would provide a minimum carrying value for the land. Where this is not the case, the land might be given a nominal value, with suitable explanation.

Usually, however, neither of these methods is so satisfactory as that of bringing the land onto the books at a fair appraised value and showing the contra side of the transaction as surplus, or donated surplus, or donated land surplus. Any gift received increases the proprietorship of a concern and should be so shown, and there need be no suspicion of inflated value in such a surplus item, if conservatively set up, and with the supporting records available. Any expense in connection with the acceptance of the gift is a proper charge against the donated surplus. Aside from this, it is free surplus available for customary uses so far as this transaction is concerned.

In the case of a conditional gift subject to reversion until the satisfactory fulfillment of the condition, no title nor asset value, other than a contingent one, inheres in the land. It is not therefore proper to show any. If a condition, extending over a period of, say, five years must be met, at the end of the first year one-fifth of the time has elapsed and the condition is nearer to fulfillment—the contingency has become more nearly a fact. But until its full satisfaction and the danger of a lapse has passed, there is no value in the gift. To show the progress and status of condition, the pro rata portion of the gift may be shown periodically by a charge to Donated Land or Equity in Land, offset by an equal credit to some suitable reserve such as Donated Land Reserve or Unrealized Profit on Land. On the balance sheet the reserve would be treated as a valuation item, no value being extended among the assets. This would seem to satisfy all demands for information and show the exact status of the transaction.

Land as Stock-in-Trade

A final consideration, not logically belonging here but treated as a matter of convenience, is that of land as stock-in-trade. In the case of a land company developing a tract of land for certain purposes, the individual plots, or the whole piece if division is not contemplated, constitute its stock-in-trade and it should be valued as such, i.e., as a current asset and not a fixed. All costs necessary to put it in condition ready for the market are capital charges and should be loaded onto the cost of the lands. These include all of the usual costs mentioned in connection with land as a fixed asset, and in addition all improvement costs such as parking, the laying out of streets, roading, etc. The loss in the use of land for these purposes should be prorated over the plots, or otherwise equitably distributed. Plots of land so developed are not usually sold all at one time. Any unsold plots should be inventoried at cost. Sometimes the first plots may be sold at a loss to make the rest of the proposition move. The practice is met of loading the loss in the early sales onto the unsold plots, and it is quite common to add any carrying charges to the cost of the unsold plots.

Both of these practices are to be deprecated and opposed. They are not right in theory and serve no necessary purpose. All costs after the stage of sale is reached are operating costs—charges against revenue which should not be capitalized. It may be desirable to know at what price the unsold plots must be disposed of to cover all expenses and losses and to make a profit, but that does not justify an inflation of the carrying values of the asset. If it is desired that the books shall show this, an amount equal to these costs and losses may be added to the carrying values if offset by a valuation reserve of equal amount, the costs and losses themselves being handled as operating expenses of the current period—or spread over several periods if applicable.

Wasting Assets—Definition and Characteristics

Wasting assets, as they are usually called, are better described as assets subject to depletion. They differ from depreciating assets in that, whereas the latter wear out through use or the effect of age, wasting assets simply “give out.” They are subject to depletion because they comprise stores of raw materials and natural resources the supply of which, through being mined and disposed of, is definitely and finally diminished. The stores will in every case finally come to an end through yielding up their product. Examples of enterprises of this kind are minerals and deposits of all sorts, such as coal, gold, silver, lead, clays, slate, gravel, stone quarries, oil, asphalt, nitrate, timber, and “all growing plants yielding recurring crops, such as tea and rubber.”

Dividends May Include Return of Capital

The law recognizes the distinction by requiring in the case of depreciating assets that the decrease in value must be made good before the payment of dividends—i.e., dividends cannot be paid out of capital—while in the case of assets subject to depletion it is recognized that some portion of the dividends paid may represent a return of the capital originally invested in the undertaking.

If the latter is the policy pursued, there will be no liquidating dividends at the time of the break-up of the undertaking, inasmuch as the regular dividends have already included a return of all or some portion of the capital. If, however, it is a matter of business policy to continue the enterprise elsewhere when the present natural stores are exhausted, then the dividends should represent only profits. During the process of operation, assets in other forms which represent the capital investment of the undertaking are retained in the business. This is accomplished on the books by a charge to each period’s operations of such an amount as represents the depletion of the stores of product prepared for the market during that period and by a credit to a depletion reserve account or direct to the property or stores account.

Basis of Depletion Charge

The amount of the period’s depletion charge is reckoned by comparing the amount of product worked during the period with the total estimated amount owned. Whatever value was taken for the original purchase, that value becomes the basis for the annual or periodic depletion charge. There is, of course, a large element of speculation in some estimates of this kind. In the case of timber, the original amount purchased is easily determinable with fair accuracy by _cruising_; the amount cut each period is a matter of record. The ratio of the amount cut to the original amount is the portion of the original value or cost of the timber tract to be written off periodically. In the case of a mine or pit, the estimate cannot be made with an equal degree of accuracy. Competent engineers do make calculations of the amounts of available ores with sufficient certainty to warrant the expenditures of vast sums in the purchase of properties. If their estimate avails for this purpose, it can with equal certainty be made the basis for the periodic depletion charge. Nice questions arise in this connection when the property is being operated under a lease or on a royalty basis.

Application of Income Tax to Wasting Assets

Under the 1916 income tax law specific provision was made for allowing depletion and the manner of handling it is prescribed. First, for such a charge to be allowed as a deduction, it must be recorded on the books. Secondly, as soon as the depletion reserve equals the capital investment no further deduction can be made—all else is pure income. If, however, it is desirable to carry on the books as an asset the estimated amount of product still remaining in addition to that written off, it may be done, the offsetting credit being to income, which must be shown as income on the tax return for the year in which it was brought onto the books. This new value may be depleted until wiped off the books.

The law as now operated bases value of the asset subject to depletion on the value existing as on March 1, 1913, or at cost or purchase price if acquired subsequent to that date. Because the book values on March 1, 1913 seldom agreed with the estimated values, it was necessary to adjust these by charging the asset, plant, or mining property and crediting an account called “Property Surplus” with the amount of the adjustment where the estimate showed more than the book value. When dividends are paid, if it is the policy to return capital as well as profits, the charge should be made partly against operating surplus for the profits share, and partly against property surplus for the capital share.

Depreciation on Buildings and Machinery of a Wasting Asset

In addition to the depletion charge, proper allowance should be made for depreciation of the other fixed assets, such as buildings, machinery, and the like. The limit of their service life is evidently the working life of the venture, which must be estimated. If there is still operating value in the equipment at that date, this is covered by the higher salvage value taken into account when fixing the depreciation charge.

Unusual Risks

In connection with both the estimate for depreciation and for depletion, the elements of unusual risks, due to fires, floods, and the like, should be taken into account. Their effect might be to cut down the supply of available product and so increase the periodic depletion charge. Another factor, of great importance at times, is the available supply of any auxiliary product needed for the treatment of the main product. Thus, large ore bodies may remain unmined and unprofitable because of the failure of a ready supply of auxiliary material needed in the reduction, smelting, or refining of the ore. This applies particularly to iron ores.

Water Rights

Sometimes valuable water rights are acquired along with mining property, and it may be profitable to utilize them for the manufacture and sale of power long after the depletion of the mine. In that case their capital value should be separated from that of the mining venture, and retained as an investment; or a new company may be formed to carry on the power project after ceasing mining operations.

Leaseholds

On the boundary line between a depreciating asset and one subject to depletion stands a leasehold, i.e., the right of occupancy of premises for a stated term. Thus, a building may be rented for a term of years; or a piece of land may be leased for a long enough period to justify the erection of a building thereon, the building going to the owner of the land as a gift or at an appraised value, or the land may revert in its original condition to the owner upon expiration of the period of the lease, according to the contract. The payment for the lease may be an annual sum similar to a rental charge, or a bonus and an annual sum. In the latter case, the bonus should be treated as a deferred charge and spread as additional rent over the period of the lease.

Leases may run for any period up to 99 years, 63 and 84 years being favorite terms in New York. An original lessee may sell his lease outright for a set sum sufficient to cover the remaining period of the lease, or on an annual rental basis. The set sum is calculated as the present worth of an annuity of the amount of a fair annual rental.

Where property values have greatly appreciated, a leasehold on favorable terms may have a high market value which may not appear on the books or balance sheet. If the terms of the lease call only for a _periodic_ payment like rent, the value of the lease will not usually appear on the books. If the lease is purchased outright for a lump sum or a bonus is paid, some value for it will appear on the books. Where the balance sheet is to be used as the basis for credit, the present appraised value of the leasehold should appear, either in a footnote or preferably incorporated into the balance sheet with an offsetting reserve.

If the leasehold is carried at any value on the books, this must, of course, be depreciated or amortized by the end of the leased period. As stated above, the periodic charge for this is to the rent account and the credit to the leasehold account, writing it down directly instead of by means of a reserve. The straight line method of amortization is the easiest of application, but authorities seem to favor, on theoretical grounds, the annuity method which brings in the element of interest. If the agreement provides for the reversion of the building to the owner of the leased land, then also the full cost of the building must be depreciated over the life of the lease. Any excess of this depreciation over normal depreciation is in the nature of a rental charge but not usually of sufficient importance to require segregation. If the premises must be returned in original condition to the owner, the net costs of demolishing any structures erected thereon must be treated as expenses of the lease and provided for accordingly.

CHAPTER XVIII

INTANGIBLE ASSETS—PATENTS, FRANCHISES, GOOD-WILL

General Considerations

The final place among the assets of the balance sheet is given to the intangible items. Because this class of assets has so frequently been used for doubtful or illegitimate purposes, whatever the value given to them they should be shown boldly in a group by themselves and not merged with the values of tangible assets. Their real value, if any, should be open to verification. To list them with tangible items on the balance sheet is apt to raise a suspicion as to their validity much more than if they are shown in a group by themselves.

Because the assets of this group are intangible is no reason in itself for the hasty judgment frequently made that therefore they are worthless. It is true, as above stated, that the doubtful uses to which they may be put have caused them to be viewed with suspicion. Yet they have an entirely legitimate use and oftentimes constitute the most valuable portion of the assets. Therefore, the values at which these intangible assets are carried on the books should always be open to investigation and capable of verification.

It is purposed here to lay down the principles of the legitimate use of intangible assets, and to point out some of the wrong uses to which they easily lend themselves. The group comprises patents, copyrights, trade-marks, formulas, receipts, franchises, organization expense, going concern value, and good-will.

Patents a Monopoly Grant

A patent is “a grant made by the government to an inventor conveying and securing to him the exclusive right to make and sell his invention for a term of years.” The purpose of the government in making such grants is to encourage and stimulate individual ingenuity along lines that will ultimately redound to public welfare. Letters of patent are in the nature of a monopoly grant but, although extreme care is taken in their issuance to see that they cover really new devices, no governmental guarantee implies that the patentee shall have free and uncontested use of his invention. If encroachment is made upon his rights under the patent, the courts are open to him for protection and similar privileges are extended to all alike. Oftentimes, until infringement proceedings have established a clear and uncontested right and property in an invention, little commercial value attaches to it. Patents therefore tend to create a monopoly in the marketable product protected by them and accordingly have value so long as the right to monopoly continues.

Purchase of Patents

The valuation of patents owned and made use of by a business should always be on the basis of cost. If owned by purchase from the inventor, the consideration paid for the patent constitutes cost. When the consideration is cash, there is no question as to the valuation at cost. When payment is made in the capital stock of the purchasing concern the problem is the same here as in the proper valuation of other fixed assets purchased in the same way, referred to in Chapter XVII. The federal income tax law takes cognizance of this different basis for valuation and attempts to establish a true cash basis by allowing depreciation on patents, when purchased by means of stock, only on the basis of the cash value of the stock. Prevailing practice sponsors the bringing of patents onto the books at cost, as shown either by the cash paid for them or by the _par_ value of the stock issued for them. Except where deceit and fraud are the points at issue, no serious objection can be raised to the practice, for any overvaluation thus occasioned is absorbed in the product by means of the depreciation charge spread over the life of the patent. Any additional costs necessary to secure the full enjoyment of the rights granted under the patent are considered proper charges against the patent, as giving it additional value.

Patents Developed within the Plant

When the patent is not purchased from outside but is developed within the plant itself, only the costs of development and of securing the patent are proper charges to the asset as constituting its value. In some concerns an experimental laboratory is maintained for the purpose of working out improved methods and devices. Much of the work of such a laboratory is often fruitless so far as patentable devices are concerned, but if the entire effort is directed towards the development of patents, then the entire cost becomes a proper charge to whatever patents result from the effort. More often some portion of the laboratory organization is also used for other purposes. However developed, whether in the formal laboratory or in any other way, the full cost of development and of securing letters patent is the figure for the original valuation of the patent. This cost includes the labor and material used in the process, drawings, models—including discarded models—attorney's fees, government fees, etc.

As in the case of purchase, all the costs, whenever incurred, of defending the right to the patent or of prosecuting for infringements constitute additional elements of value, as only by such means can the real holder be made secure in the exclusive enjoyment of his right. It is hardly necessary to point out that if such proceedings and prosecution establish the right of the other party to a device which practically destroys or greatly diminishes the worth of the contested patents, not only must such costs usually be charged against revenue but also the whole or major portion of the value at which the patent is being carried. However, where the development of patents is one branch of a concern's organization, costs of this nature may usually be absorbed by those patents which are successful. Because inflation of values is easy at this point, a careful investigation to establish the legitimacy of all such charges is always desirable. Each case must be judged on its merits.

Patents Purchased and not Used

Patented devices are sometimes purchased with no intent to use them. This may be for the purpose of eliminating competition, of forestalling obsolescence or supersession, and so of postponing the necessity of making expensive alterations that would be required to meet threatened competition, even to the point of scrapping a valuable organization. The ethics of such practice is not under review here. Correct accounting practice justifies the addition of the purchase price of such devices to the value of the asset, patents, and its periodic depreciation in regular course.

Elements of Depreciation on Patents

Patents are subject to depreciation. At the time of their purchase or acquisition, they should be valued at full cost, as stated above. At any subsequent time, value should be calculated on the basis of full cost less depreciation. The elements of depreciation as applied to patents are (1) time lapse, (2) supersession, and (3) obsolescence.

1. _Time Lapse._ There is no such thing as wear and tear on a patent itself, but since the grant by the government is for a definitely prescribed term of years, as each of those years goes by there passes with it some portion of the value attaching to the exclusive enjoyment of the right for the prescribed period. In this country a mechanical patent is granted for a term of seventeen years, after which the patented device or process becomes common or public property. The period allowed for patents covering designs is three and one-half, seven, or fourteen years, depending on the application. Thus, simply through the lapse of time the value of the right diminishes.

2. _Supersession._ If no other causes than time lapse were operative, the problem of depreciation would be a simple one, consisting of spreading the value of the patent over its life. In addition to lapse of time and operating simultaneously with it is the possibility of supersession. Supersession as an element of depreciation is the attempt to measure the probability of the patent's being superseded before the expiration of its term by a better machine, device, or method. The measure of this element of depreciation is always speculative but should be attempted with the best judgment possible.

3. _Obsolescence._ Akin to the element of supersession is that of obsolescence. Obsolescence is particularly operative in cases where the patent covers a product the life of which depends on the whims of fashion. Obviously, when the market for the product ceases, the value of the patent is gone.

From the above it is seen that the three elements of depreciation are usually operative concurrently and the rate of depreciation must take cognizance of them all.

Service Life of Patents

While the vast majority of patents become valueless before their expiration, some few may have a value beyond their protected term. It may happen that the concern using the patent has built up such an organization that competitors cannot with profit enter the field after the patent has expired; or it may have acquired the good-will of the purchasing public to such a degree that buyers come to it rather than to a competitor. In these and other ways the value of the patent may extend beyond its life. This is exceptional, however, and cannot with conservatism form the basis for estimating the service life of the average patent.

The prevailing practice authorizes writing off the value of a patent quite rapidly during the early years of its life when its earning capacity should be at a maximum, leaving only a small part of the value to be spread over its later years. This policy applies to the possession of single or separate patents. An effective method used for extending the life of a patent is the securing of auxiliary patents every few years. Thus an improvement of some part may be patented, without which the use of the original or basic patent would not be worth while. The basic patent may thus have its effective life—though not its legal life—extended almost indefinitely.

Where an additional cost, such as infringement costs, is incurred some time after the grant is made, strict accuracy would demand that these costs be spread over the remaining life of the patent. Where, however, the above policy of securing periodic improvements is in force, sufficiently accurate results are secured by wanting off at the end of each year—in the case of mechanical patents—one-seventeenth of the total values to date. In this way, by the end of the original 17-year term, there will be values left in the account which may be looked upon as applicable to the patented improvements. There is in these cases a constant overlapping of the grant periods and no serious inequity results as between fiscal periods by writing off each year one-seventeenth of the total value in the Patents account. In the case of the one original patent or an _occasional_ improvement, the more accurate method is desirable because here the life of the patent is rather definitely limited.

If the estimated life on which the depreciation estimate is based, should prove longer than the real life, the value remaining in the asset at the end of its real life must be absorbed by the profits; i.e., charged against surplus. The Federal Income Tax Law allows this remaining value to be charged against the profits of the period in which it is written off.

Booking Depreciation on Patents

In booking the depreciation of patents, the periodic charge is to the expense account, Depreciation—or Depletion—and the credit is made either direct to the asset account or to the corresponding Depreciation Reserve account. It is sometimes argued that since the life of the patent is for a definite term, its depreciation is equally definite and the value of the asset should be written down rather than carry the estimated amount of the periodic depreciation in a reserve account. Because of the elements of supersession and obsolescence on which in the majority of cases the service life of the patent depends more than on its time grant, it is evident that determination of the amount of periodic depreciation is just as much a speculative estimate as is the case with any other asset. Either method of showing the periodic value of the patent may be used with equal propriety. If an easy determination of “total value to date” is sought, as under the policy referred to above, the information is better secured by carrying the offsetting estimate of depreciation in a reserve account. When no such purpose is to be served, it is a needless multiplication of accounts to use the reserve account.

Accounting Classification of Depreciation on Patents

A problem closely related to the valuation of patents has to do with the classification or incidence of the periodic depreciation of the patent. According to some theorists it is stated that if the patent applies to the _process of manufacture_—i.e., to any part of the manufacturing equipment used—the periodic depreciation is a cost of manufacturing and should be allocated to the product at that point. But if the patent covers the _article itself_, its periodic depreciation expense should be treated as a selling expense. Perhaps the point is well taken but the distinction is rather finely drawn. Another view requires the showing of depreciation on patents among the general administrative items, on the several grounds that there is no logical basis or method for distributing it directly to the product; that there is no direct connection between the product and this expense; and that it is a general overhead item which must be cared for out of gross earnings but cannot be applied definitely to manufacturing or selling. Failure to establish a suitable basis on which to apply the cost in practice cannot, of course, be allowed to militate against the determination of its theoretical incidence.

Royalties

An analogous problem arises in the treatment of royalties where such cover the cost of renting the patented devices of others for the purpose of manufacture. Although the general practice is to treat this expense as a cost of manufacture, it is sometimes handled as a general management expense on the ground that it represents a policy of management which has adopted the royalty

method of production in preference to the outright purchase or development of the patents. The point seems not well taken, however. The value of a patent may be looked upon as a prepaid expense item which is the equivalent of royalties expense and should therefore usually be treated as a manufacturing cost. There may be instances, however, where such treatment would not be advisable on practical and perhaps theoretical grounds.

Relation of Depreciation Rate to Cost of Manufacture

Related to this problem of patent costs is the effect on manufacturing costs of the rate of depreciation of the patent. It is evident that a too rapid depreciation will result in an inequitable loading of the product made during the early years of the life of the patent as compared with that of its later life. A product made under a patent still valuable after all value has been written off the books, bears none of the burden though enjoying the benefit accruing from its being a patented article. On the other hand, if the rate of depreciation is not rapid enough, the product is then underburdened. It should constantly be borne in mind that depreciation is always an estimate. It should be the best estimate possible and subject to periodic revision where accurate results are desired. Slight inaccuracies and inequities are bound to occur and must be absorbed by the future product; the record of the past is a closed book and cannot usually be reopened.

Sale Price of Patents

The sale price of a patent, as distinguished from the value at which the owner may carry it in his accounts, frequently is based on the estimated savings in royalties which could be made by a purchaser. When a new concern is organized and patents are owned by some of the incorporators, and purchased from them, the value at which they are carried is almost always speculative and arbitrary. A valuation based on the saving in royalties has no place on the books of a concern unless that price were paid in purchase. Similarly, licenses to use patents should not be carried as an asset unless purchased by a lump sum payment even though they grant a virtual monopoly in the product.

Copyrights

Copyrights are similar to patents in that they secure to the author or publisher the exclusive right for a term of years to make and sell copies of literary or artistic productions. They are thus in nature a monopoly grant. The term for a copyright is 28 years, with a renewal privilege of 28 years if application is made within one year prior to expiration of original copyright.

A more rigid application of the principles of valuation enunciated for patents must be made for copyrights. On the books of the original grantee they should be carried at full cost which may be only the fees required in securing the copyright. For a subsequent purchaser they should be set up at full cost to him. A much smaller proportion of copyrights than of patents continue valuable for their granted term. Periodic valuations, then, require a very liberal and rapid depreciation from original value. In the accounts of publishers who make outright purchases of copyrights, extreme care is needed in keeping track of and valuing this asset, else a too optimistic outlook will result in carrying false and misleading values. Oftentimes the only satisfactory and reliable method of valuation will require an examination of each copyright owned and an independent appraisal of its worth.

Trade Secrets

Akin to copyrights are formulas for manufacture, receipts, and other trade secrets. These may constitute very valuable holdings, perhaps the most valuable of all the assets, but they are not usually carried on the books as assets under this title. A baker with a secret economical process of making yeast may have a marked advantage over competitors. An oil refiner with a process which secures a larger return of gasoline has a similar advantage over competitors without such means of refining. If costs are incurred in developing or acquiring these formulas or processes, the same reason exists for treating them as assets as in the case of patents or copyrights. If not protected in any way by the government, greater need of rapid depreciation is apparent as the discovery of the secret by others might greatly reduce its value.

Trade-Marks

A trade-mark is an earmark of ownership for advertising and selling purposes. Thus a firm may adopt a label for their products or a manner of marking or displaying them which wherever used is evidence of the make, brand, and quality of the goods. A concern enjoying a trade built up by educating the public to recognize its trade-marks and what they represent may possess therein a very valuable property. The courts of the country guarantee the rightful owner in the exclusive enjoyment of any benefits arising from the

use of his trade-mark. Priority of continuous use is the factor determining rightful ownership. Such priority is most easily established through registration of the trade-mark with the government. Registration is not necessary but is offered by the government as a convenient and certain means of establishing rightful ownership. Continuous use is necessary to retain unquestioned ownership of the right.

Trade-marks must be valued at cost. Cost to develop, cost of purchase, cost to defend—all are legitimate charges to the asset. At times even some portion of the advertising expense may be capitalized under the caption “Trade-Marks.” This question and that of periodic revaluation follow so closely the principles of revaluation of good-will and the treatment of depreciation in relation thereto, that its consideration is deferred for combined treatment in later pages of this chapter.

Franchises—Definition and Kinds

A franchise is an intangible asset of considerable value in most cases. Its appearance on a balance sheet is usually limited to those of public, or quasi-public, utility companies. There it is included as an asset of value from the standpoint of rate-making rather than for ordinary commercial purposes. Such companies are usually under the close supervision and regulation of public service commissions. The latter prescribe the manner of showing the utility company’s accounts and the basis for the valuation of its assets, chiefly from the point of view of an adequate protection of the interests of the public. It is neither the purpose nor within the scope of the present volume to raise the question of the valuation of public utility companies, part of which problem would be concerned with the valuation of franchises. An attempt will be made, however, to lay down some principles of valuation from the commercial standpoint as distinguished from the rate-making standpoint, applicable to a very limited number of concerns which are not subject to state regulation, and to indicate briefly the tendency of the rulings of the best public service commissions with regard to franchises.

A franchise is defined by H. A. Foster[45] as “a privilege given by the community to a private person—or corporation—for use of the public property for the benefit of the public, and only incidentally is it the intention of the community in granting such a right, to allow the person accepting the same enough profit to insure his willingness to take advantage of it by investing in plant to make use of the grant.” To the same effect is the statement of the Federal Court in the case of the Consolidated Gas Co. of New York, 157 Fed. 373: “The franchise is but a part of the power or privilege of sovereignty allotted to a private person for the benefit of all, and only incidentally given for private emoluments.”

[45] In “Engineering Valuation of Public Utilities and Factories.”

Franchises may be perpetual, where the grant is without time limit; limited, where the term is definitely stated; and indeterminate where the privilege granted is good “during good behavior and may be terminated by the authorities at any time by paying the fair value of the property exclusive of the franchise.” It may be noted that in Massachusetts no provision is made for buying the property of the utility company in case of revocation of the franchise. Manifestly the contract entered into with the state will influence very largely the manner of handling and the valuation of all the assets. Without regard to such contract and on the general principles of valuation as laid down for fixed assets, a franchise should be taken onto the books at full cost to acquire. Proper charges to the account would cover:

1. Lump sum payments to the state or some division thereof, applicable to the life of the franchise as distinguished from regular annual payments which are in the nature of a license or rental charge and are therefore an operating expense. 2. The full purchase price paid another company for the assignment of its rights and privileges under a franchise owned by it. 3. Legal and other fees in connection with securing the grant. 4. Any other legitimate expenses, such as the cost of securing the consent of affected property owners or of the whole community where such cost is to be borne by the petitioning company.

All of these are costs which from the standpoint of good business practice may be capitalized under the caption “Franchises.”

Depreciation on Franchises

For periodic revaluations, depreciation should be in accordance with the terms of the grant. If the grant is perpetual, no depreciation need be taken account of; if it is for a limited term, the cost of the franchise should be prorated over that term; if the grant is indeterminate, as defined above, not only should a very liberal depreciation policy be pursued with regard to the franchise but, in the case of the type of franchise granted by Massachusetts, a liberal provision for writing off all the assets should be made, unless in the execution of the law a policy of non-revocability of franchises has become fairly well fixed.

In contrast with the above, note the ruling of the Public Service Commission for the First District of the State of New York. “To this account—Franchises (Gas)—shall be charged ‘the amount (exclusive of any tax or annual charge) actually paid to the state or to a political subdivision thereof as the consideration for the grant of such franchise or right’ (Section 69 of the Public Service Commissions Law) as is necessary to the conduct of the corporation’s gas operations. If any such franchise is acquired by means of assignment, the charge to this account in respect thereof must not exceed the amount actually paid therefor by the corporation to its assignor, nor shall it exceed the amount specified in the statute above quoted. Any excess of the amount actually paid by the corporation over the amount specified in the statute shall be charged to the account ‘Other Intangible Gas Capital.’ If any such franchise has a life of _not more than one year after the date when it is placed in service_, it shall not be charged to this account but to the appropriate accounts in ‘Operating Expenses,’ and in ‘Prepayments’ if extending beyond the fiscal year.” To a depreciation account called “General Amortization” is to be charged, besides depreciation of tangible fixed capital, “such portion of the life of intangible fixed capital as has expired or been consumed during the month.”

Such careful regulations as to the content of intangible asset accounts are not always nor everywhere imposed at the present time. It is not putting the case too strongly to say that the reader of a balance sheet containing items about which practice is not standardized should always be on his guard to assure himself as to the content of such items in order to establish the legitimacy of their use and value.

Organization Expenses

Organization expenses are those costs necessarily incurred for the purpose of getting an enterprise under way, i.e., of putting it in readiness to do business and produce income. These expenses usually comprise such costs as state incorporation fees, attorney’s fees for drawing up the application and other papers, the cost of prospectuses, soliciting costs for stock subscriptions, fees paid promoters and organizers, cost of printing and issuing certificates of stock, cost of capital stock records, and similar items. These are necessary and unavoidable expenses without which the company cannot come into being. A company organized and ready to commence business is in a better position than one whose elements have not been brought into harmonious working. In the same way that the costs of installing machinery in position and ready for use are capitalized by being added to the value of the equipment, so may the organization expenses of a corporation be legitimately capitalized as being the measure of the amount of the greater value which these organized business elements have over the same elements unorganized. Capital has been brought together and set to work, management and plan of operation have been secured, and business is ready to begin.

Organization expenses are therefore, from the standpoint of classification, best treated as an intangible asset rather than as a deferred or prepaid expense. In strict theory the value of these costs will last as long as the corporate existence. In Italy where corporate life is limited to fifty years, it is prescribed that organization costs be prorated over the full life of the corporation. The best practice in this country requires a much more rapid writing off of these items; R. H. Montgomery[46] advocating writing them off as they occur or at most over the first two years’ operation. To one not cognizant of the many abuses which have crept in—and even frauds perpetrated—through this channel, the treatment advocated may seem harsh and severe. Perhaps no harm is done in pursuing a more liberal policy, if such expenses are carried under a proper title, if they are not used to inflate the value of the tangible assets, and if the caution stated above is observed as to the need for investigating the values of all intangible asset items. Certainly organization expense should never be used as a cloak for discount on stocks or other securities marketed.

Good-Will—Definition and Nature

The last of the intangible assets to be treated is good-will. Lord Justice Lindley, in an English case, says: “Good-will regarded as property has no meaning except in connection with some trade, business, or calling. In that connection I understand the word to include whatever adds value to a business by reason of situation, name and reputation, connection, introduction to old customers, and agreed absence from competition, or any of these things, and there may be others which do not occur to me.” The definition by George Lisle[47] is to the same general effect: “Good-will is the monetary value placed upon the connection and reputation of a mercantile or manufacturing concern, and discounts the value of the turnover of a business in consequence of the probabilities of the old customers continuing.” Good-will therefore includes every advantage connected with location, premises, reputation, personality, name, etc. That all these are elements of good-will cannot be gainsaid, but unless an earning power larger than that of a newly established competing concern goes along with these elements, no one would be willing to pay anything for the good-will of the old concern.

[46] In “Auditing, Theory and Practice.”

[47] In “Accounting in Theory and Practice.”

It sometimes happens in the case of a merger, that because of the dormant or latent good-will of the various units—or some of them—to be merged, a promoter may be willing to pay something more than the value of the tangible assets in order to acquire the various properties. Dormant or latent good-will signifies the excess earning power that would exist if it were not for poor management, an inharmonious working together of the various parts of the organization, and other similar handicaps which the new management will remove. It may be objected that until such handicaps have been removed there is no good-will; that any good-will brought into evidence through the removal of these handicaps is the good-will built up by the new concern and not the old. It cannot be denied, however, that all the other elements of good-will may have been acquired and built up by the old company and that without them the new concern would be unable to bring good-will into evidence simply by a change of management. It is true that the merger may be able to build up quickly a good-will of its own through the elimination of competition, and through the full utilization of all the advantages of the different units—such as access to supplies of raw material, favorable trade agreements of various sorts, and the like.

While there is a sense in which expected future performance as indicated above, may be an element in the determination of good-will and may be legitimately paid for as such, as a usual thing the essence of good-will lies in the ability to make a profit in excess of the normal. Past performance must be reviewed by which to judge the normality of the present profits and the probability of their continuance in the future.

Local and Personal Character of Good-Will

It should be pointed out, as a corollary to the above statement that only those elements which are transferable and are transferred can be disposed of for a price. Thus, when a business goes to the new owner, if there is apt to be a very appreciable shrinking in profits—as is the case in the transfer of some professional businesses—or if the favorable location on which in some cases depends the ability to earn excess profits cannot be turned over to the purchaser because of the expiration of the lease or other reason, good-will may not be worth much to a prospective purchaser. There is thus a local and personal character to good-will which cannot be ignored.

Difficulty of Valuing Good-Will

The valuation of good-will presents at times many complexities. The general principle of valuation at cost—and not market—may be said to apply here, too. What constitutes cost is sometimes difficult to determine. A corporation which buys out an existing business, paying an agreed sum for the good-will, should set up on the books that sum as the value of good-will. The vendor concern during the years of the establishment of its good-will, unless specific expenditures were made for that purpose, should not show any value for it on its books. In an English case, Stewart v. Gladstone, 1879, the court said: “Is it reasonable ... that a changing thing like good-will, the value of which would vary year by year according to the state of the trade ... and to the reputation which the house had acquired or had lost for integrity, punctuality, solvency, and mercantile prudence, was to be valued from year to year,” and the increase or decrease was to be treated as profit or loss for the year and distributed?

The impropriety of bringing good-will on the books unless paid for by purchase or otherwise, is established and rests on principles of sound business.

Creation of Good-Will by Advertising

There is perhaps only one case in which a concern which has not acquired good-will by purchase but has built it up for itself may with propriety set up its value on the books. Creating a demand for a product by means of extensive advertising is one of the quickest ways of building up good-will. The difference between the cost of the advertising necessary to retain a given volume of trade—which we may call the normal advertising expenditure—and the cost of the publicity required to secure that trade may be treated, in theory at least, as an expenditure on account of good-will and be so shown on the books. This is usually a difficult matter to determine at the close of the publicity campaign and before the cost of normal advertising is known, and the valuation at best is somewhat speculative. But where handled carefully and with conservatism there seems no serious objection to bringing good-will on the books at a value calculated in this way.

Unless it is possible to treat some expenditures of this sort as the direct cause of good-will, the evidence of the possession of good-will must be sought in the profit and loss record rather than in the balance sheet, as its existence would be indicated only by

above-normal profits.

Valuation of Good-Will Based on Normal Profits

Valuing good-will for a purchaser is not so difficult. Two standard methods are in use, the one based on profits, the other on excess profits. According to the first, the value of the good-will is estimated as so many years' purchase price of the net profits of the last year; or, better, the average of the last three or five years. This simply means multiplying the profits by the number of years' purchase. The number of years to be used as a multiplier varies from one to fifteen, or twenty in some instances. Thus, if the agreement is to pay three years' purchase of the average profit for the past five years and this average is $50,000, the price paid will be $150,000 and at that value good-will should be shown on the purchaser's books.

Valuation of Good-Will Based on Excess Profits

The other method determines first the excess profits, i.e., the amount by which the profits of a particular business exceed the normal or average figures for that line of business. Thus, if the profits are $75,000 and normal profits are $50,000, the excess earning capacity per period is $25,000. This amount is then capitalized on some arbitrary basis, ranging in practice from the prevailing interest rate, say 5%, to 20% or even 50%. The effect of such capitalization is to apply a multiplier, as in the first method, ranging from 20 to 5 or less. Thus, if 20% is the agreed rate, the excess, $25,000 multiplied by 5 gives $125,000 as the value.

It is, of course, apparent that the valuation of good-will for prospective purchase is largely dependent upon the individual judgment of the buyer and that seldom will any two men arrive at the same valuation. As a matter of prudence, under either method the average profits for the past few years should be used rather than those of the last year. The latter may be sporadic and under conditions such as not to warrant their continuance. An average figure gives a better indication of what the business may be expected to do under normal conditions. Inasmuch as the value of good-will depends on excess earning capacity, the second method of valuation rests on better theoretical grounds than the first. Practically there is no preference, since valuation is largely a matter of personal judgment under either method.

Valuation of Good-Will Based on Capitalization of Profits

A slight variation of the second method is sometimes used. Under it the average net profits are capitalized at some agreed rate, giving the amount of money on which the average profits could be earned at the rate used. The difference between this amount and the amount of capital actually invested gives the value of the good-will. Thus, if on an investment of $250,000 net average profits are $60,000 and the normal rate for this business is 15%, $60,000 would represent a 15% income on $400,000. Good-will must therefore represent the difference between $400,000 and $250,000, or $150,000. This must evidently work out in exactly the same way as the second method if the rate used is the same. Therefore it constitutes not a distinct method, but only a variation. In the one case the difference between the average and normal profits is capitalized; in the other both are capitalized and the difference of their capitalizations is taken.

False Good-Will to Cover Capital Deficiency

A method of valuing good-will which makes it represent the difference between the value of tangible assets contributed or purchased and the par value of the stock issued cannot be countenanced at all. This use of good-will to cover up a capital deficiency is not only improper and misleading but often fraudulent. It is the favorite means by which "water" is injected into corporations. Thus, a concern desiring to capitalize at $500,000 and unable to sell its stock for more than $300,000, might carry an asset, good-will, to take care of the $200,000 discount on stock. A partnership desiring to incorporate might issue for the partnership assets stock with a par value much more than the assets taken over, and either inflate the asset values or set up a good-will account to care for the difference. This practice cannot be too severely criticized. In connection with this it should always be kept in mind that a newly organized company can never include good-will among its assets except by purchase.

Somewhat analogous to the above practice is that of increasing the capitalization of a company and issuing new shares in exchange for the old. Thus a company capitalized at $1,000,000 might increase its capital to $2,000,000, issuing two shares of the new for each share of the old. This will necessitate bringing onto the books an intangible asset, usually good-will, to cover the additional $1,000,000 of stock issued. Sometimes a real good-will may be existent as shown by the abnormal profits. In such cases, the effect of an increase of capital stock will be to keep down the _rate_ of profit on the capital stock and so decrease the market value of each share, but not the real value of the total shares nor the _amount_ of profit distributable to each of the holders

of shares of the original issue. The purpose in such an increase of capital stock is usually an ulterior one, such as the desire to cover up real earnings in order to prevent a reduction of rates, as in the case of a public utility company. The purpose may sometimes seemingly justify the practice. The problem is mainly an ethical one and it is not proposed to discuss it here further than to say that the practice is usually to be condemned.

Periodic Revaluation of Good-Will

Periodic revaluation of good-will must next be considered. This involves a determination as to whether it is subject to depreciation. From what has been established as the essence of good-will, viz., the ability to earn excess profits, it is apparent, as stated in the case Stewart v. Gladstone on page 333, that its value must fluctuate from time to time with the earnings of the business. Because of this changing and at times doubtful value, some authorities advocate its being written off the books periodically, and a good many concerns do so write it off. The effect of this, so long as there is any value remaining in good-will, is to create a secret reserve and this is justified on the ground of conservatism. The practice is not reprehensible, though usually to be discouraged.

The weight of authority is to the effect that all purposes are best served by allowing it to remain always on the books at cost. There is no logical reason for writing it off. When profits are large, good-will is a very real asset. To write it off then is not logically consistent. When profits are small and good-will is accordingly of less value than before, it would hardly be logical to write off any amount less than its decreased value, yet the profits at such a time are rarely sufficient to stand so heroic a treatment.

As was stated above on page 330, all intangible assets should be examined carefully by a prospective purchaser as to the values at which they are being carried.

Good-will, because of the improper and misleading uses to which it has so often been put, is never above suspicion and its value should not be taken without close investigation. If it _really_ exists, the profit and loss record will show it. That should guide as to its valuation and not the value carried on the balance sheet. Accordingly, since the asset does not depreciate but only fluctuates in value, and since it is neither prudent nor consistently possible to take these changing values onto the books, the best course for all purposes seems to be to retain good-will in the accounts always at its cost figure.

The above considerations as to the depreciation of good-will apply with almost equal weight to the depreciation of trade-marks.

In closing this chapter attention should be called to the fact that the term “going value” is used in the case of public utility companies in much the same way as good-will.

CHAPTER XIX

LIABILITIES ON THE BALANCE SHEET; CURRENT AND CONTINGENT LIABILITIES

Form and Valuation

The problem of handling liabilities on the balance sheet is usually not so complicated as that of assets. The questions of arrangement, form, groups, and suitable nomenclature have in the case of liabilities an equal or even greater importance than that of the assets, the governing principle being clearness and fullness in the information given, with due regard to the purpose and intended use of the balance sheet.

The problem of valuation, which assumes great importance in the treatment of the assets, has normally little or no significance in the consideration of liabilities. This is due to several causes. In the first place, human nature being what it is, there is normally little danger of an overstatement of liabilities; they are usually sufficiently large, and no desire exists to make them appear more than they really are. Secondly, and likewise based on human frailty, while a concern may desire to undervalue its liabilities, the other party to the liability, the person holding the claim, can usually be depended upon to press his claim with sufficient insistence as to make the concern aware at all times of the amount of its liabilities.

From the viewpoint of a going concern, while all business experience points to a decrease and a necessary diminution in the values at which certain assets may appear on the books, no such diminution in the value of liabilities can be looked for; as legitimate claims must be met if a business is to exist as a _going_ concern. Similarly, there is normally no tendency to inflate the liabilities by the inclusion of items which do not rank fully in this class—intangible liabilities seldom find place in any balance sheet.

On the other hand, there is frequently a very real hesitancy about the inclusion of some liability items until their claim becomes urgent or their full liability status becomes determined. Occasionally, and usually with ulterior intent, the liabilities may be inflated in value and items included therein which are fictitious; but our present concern is not with such conditions.

The one principle underlying the showing of both assets and liabilities is that their _true_ status should be indicated. As applied to liabilities this means that they should be shown not only in correct amount but also in their true light, viz.: that all facts bearing on their relation to the business which ought to be known properly to judge conditions must be stated. The chief problem in handling liabilities is, therefore, how to show and list them so as to accomplish this purpose of truth and usually the further purpose of full truth. In a consideration of this problem, the auxiliary one of the inclusion of doubtful items among the liabilities will also receive consideration.

Arrangement on Balance Sheet

As to the classification and arrangement of liabilities on the balance sheet, it may be stated in a general way that whatever classification and arrangement are adopted for the assets, the liabilities should be shown similarly. For most purposes a standard grouping under the captions, Current, Deferred Income, Fixed or Funded, will suffice. The order of the groups as given here follows the order given for the assets. This is desirable for purposes of easy comparison, because in this way current liabilities are brought into juxtaposition with the group of assets to which current creditors must look for payment of their claims; and fixed liabilities and capital are opposed to the assets in which for the most part they have been invested.

Items within Groups

Arrangement within the group may be attempted on the basis of relative degree of liquidity of the items. This, however, is not always determinable nor is it an end to be sought; the chief desideratum is to show items in the main group to which they properly belong.

The manner of listing the items within the group is not a question of relative order so much as it is of nomenclature and clearness of expression. Thus, desirable and valuable information would be given by a separation of the items to show (1) those past due; (2) those due but not payable because of their credit term; (3) those neither due nor payable, such as accruing items; and (4) contingent liabilities.[48] It may be remarked that such an analysis is seldom seen on the ordinary balance sheet. Corporations which have to report to a regulating body may be required to give more information concerning their business than those not so regulated. For internal use the suggested analysis has undoubted merit. For public use, it is neither necessary nor usually desirable that the information be given in that form; a showing of the items under the usual titles within the group to which they properly belong being here deemed sufficient.

[48] P. J. Esquerré, in “Applied Theory of Accounts.”

Cancellation of Liabilities against Assets

Occasionally the practice is met of cancelling the liabilities, or some group of them, against corresponding assets, showing only the net assets remaining. Thus, Current Assets less Current Claims might appear as an item among the assets. Even for publication purposes this would not be deemed sufficient; for the outsider as a prospective creditor or investor has a right to judge for himself the relative sufficiency of the assets to meet the claims of creditors. No basis for such judgment is offered by a cancellation of the one against the other with a showing of the net amount only. A somewhat analogous situation arises in the double-account form of statement used by some English companies. Here, the capital assets are canceled against the capital and fixed liabilities and only the net surplus—usually of capital—appears in the balance sheet proper. The criticism is not so pertinent here, however, because almost invariably the balance sheet is accompanied by the so-called capital account which shows the full detail of the net item in the balance sheet. So also, the practice is often condoned wherever an accompanying schedule shows the full facts as to assets and liabilities. As a matter of principle, it should be condemned because accompanying schedules do not always “accompany.”

Inventory of Liabilities

The principle of showing the full truth as to the liabilities raises the problem of the complete inclusion or inventory of the liabilities. Under this will be considered any adjustments that must be made in the book record in order to show the true state of the liabilities, and also the proper treatment of contingent liabilities so as to show their relation to the state of the business.

The adjustment of the book record is not usually complicated. The necessary data are for the most part available. All that is required is an analysis of each item to determine what, if any, adjustment is needed to bring the books to a true statement of conditions as on the date of the balance sheet. These adjustments fall into six main groups, only two of which appear among the liabilities, while one of the others is often based on information obtainable only from an analysis of the liabilities. These groups are:

1. Accrued Expenses 2. Deferred Income 3. Deferred Expenses 4. Accrued Income 5. Valuation Reserves 6. Merchandise Inventory

The first three groups are discussed below, as well as another analogous group.

Accrued Expenses. These expenses comprise the liability existing at the close of a fiscal period because of expenses incurred but not settled for and oftentimes not yet due. Information as to these may be gathered—not in completeness however—from an examination of the various expense accounts and a somewhat intimate knowledge of the operations of the business. Unless a record is kept of all services being rendered to the business, it is very easy to omit some items of this kind. These will be discussed in detail under “Current Liabilities,” page 350.

Deferred Income. This income comprises the items of income received in advance of the full performance of the service required to earn it. In cases of this kind there are in the possession of the business certain assets which must be used to perform the service not yet completed in order to entitle the business to the full enjoyment of the income. That is, the property of the owners is liable for the service not yet rendered. Also, in order to make a correct showing of results as between the current fiscal period and the next, this unearned income must be carried forward for credit in the period in which the service is performed.

Premium on Bonds. Somewhat analogous to deferred income is the item of premium on bonds. As indicated in Chapter XV this is preferably treated as a direct deduction from the periodic interest payments on the bonds, because the bonds were marketed at a rate higher than the interest rate prevailing at the time of their flotation. Inasmuch as the premium must be spread over the life of the bonds, its unexpired portion will appear as of the nature of deferred income at all intermediate stages. A more detailed showing of this is given in Chapter XX, in the discussion of the liability, bonds.

Deferred Expenses. These expenses have been explained in detail in Chapter XIV. Here it is to be noted that, while this group of adjustment items is always an asset, for the proper determination of deferred interest an examination of the liability, notes payable, is often necessary. Notes payable given for a loan at the bank, or given to a creditor, with prepaid interest added to the principal of the debt as a part of the face amount of the note, will give the data for calculation of the amount of interest or discount to be deferred to later periods.

Contingent Liabilities

As stated above, the second group of items under the head of inventory of the liabilities is that of contingent liabilities. It is taken for granted that all items which on the date of the balance sheet have assumed a status of full and direct liability will, of course, appear as such on the books. Here, all that can be said without trespassing on the distinctive field of auditing, is that all such items must appear. For the method of detecting their omission, whether omitted with fraudulent intent or through carelessness and inaccuracy, the student is referred to a standard work on auditing.

We have here to consider, however, a group of items the status of which is one of suspended or indeterminate liability. Expressed otherwise, they are items concerning which it is hoped—it may be even expected—that the business will never incur liability but for which in the event of certain happenings liability must be assumed. There are, of course, degrees of contingency, ranging from almost certainty to negligible remoteness. It would seem that no business man would omit the almost certain type from his books, and in case of doubt prudence demands that decision be rendered in favor of at least the greater probability.

Yet there is often seen a failure to book even the liability on account of goods purchased and shipped, but not received. If it is argued that the liability is not fully established until receipt and acceptance of the goods, every manager knows that non-acceptance of purchases is the exception, not the rule. On the other hand, upon receipt of consigned goods to be sold on account of a principal, no liability except to exercise ordinary care usually attaches to a broker until some part of the goods has been sold by him. Between these two extremes are many shades and degrees of probability, all of which in some cases are recorded as liabilities; in others none are so recorded. The importance of the information as to contingent liability on account of notes receivable discounted and discounted acceptances is now accorded general recognition. As to liability under court judgments awaiting appeal, guarantees of work and product, deposits made on contracts or bids—these and other similar matters will be

treated fully in following pages.

These, then, constitute the main problems in connection with liabilities on the balance sheet. The group of current liabilities will now be considered, followed by a discussion of the nature of contingent liabilities.

CURRENT LIABILITIES

Notes and accounts payable, using the terms broadly, constitute practically all of the current liabilities. Not all notes nor all accounts payable are, however, current items. The term “current” cannot be standardized; it varies and will perhaps always vary according to customs and practices in any particular trade. In the main, the 90-day period may be taken as the average. That is, on the given date of the balance sheet a knowledge of the debts that must be met within the next 90 days is a minimum of necessary information for the purpose of judging business condition, particularly so far as concerns the credit extended to it. When a balance sheet is submitted to the bank as the basis for credit, other data concerning notes payable are usually called for—such as notes given for merchandise, notes negotiated to own banks, notes otherwise disposed of. The Federal Reserve Bulletin for April, 1917, under the title “Uniform Accounting a Tentative Proposal” suggests for balance sheet presentation a list of notes analyzed as to acceptances made for merchandise or raw material purchased; notes given for merchandise or raw material purchased; notes given to banks for money borrowed; notes sold through brokers; notes given for machinery, additions to plant, etc.; notes due to stockholders, officers, or employees. R. H. Montgomery[49] suggests a division of notes into the groups: notes issued for merchandise; notes discounted by own banks; notes sold through brokers; and demand loans. He suggests further that an additional separation into notes accompanied by collateral and notes with which no collateral is given would be desirable.

[49] In “Auditing—Theory and Practice.”

From the above it is seen that the present tendency of bankers is to insist on a full statement of essential facts needed to pass intelligent judgment as to the exact status of affairs. Even in the case of balance sheets, the accuracy of which has been certified by someone, some bankers require a certificate as to the character of the certifier unless he is well known. More and more is the fact being recognized that legitimate business has nothing to fear and much to gain by making a full and free statement of exact condition, and that the sooner business supported by fraudulent statement is eliminated, the better will it be for legitimate enterprises. In certain cases, however, the interests or purpose of a business would not be well served by the detailed information demanded by the banker and, here as elsewhere, no specific rule can be laid down other than that the purpose should in all cases govern the form and particularly the amount of detail.

Loans from Bank

In connection with advances from the bank it should be noted that the banker does not expect to become a permanent partner in the business, but that one of his legitimate functions is to furnish funds for seasonal fluctuations. Oftentimes a concern does not start with enough capital to carry its load of maximum trade, from the fear that advantageous investment of surplus funds during the dull season will not be possible. It may rightly expect its bank to furnish funds for this purpose when expenses are heaviest, and to await repayment of the loan out of the income, as accounts are collected after the peak of the seasonal trade is passed. This is one of the fields of legitimate banking and the banker has a right to whatever information is necessary to assure himself that his aid is being put to proper use.

General Classification of Notes

For general purposes, a separation of notes into notes for trade purposes and notes for other purposes is desirable. Trade purposes would be limited to merchandise purchases and loans for working capital. Other purposes would be long-time loans, purchase money notes often secured by mortgage on equipment, and notes of officers and employees. These last would best be classified by their showing as fixed rather than current liabilities.

Accounts Payable

The use of the term, accounts payable, to cover only creditors for stock-in-trade and other trade purposes is too indefinite and inaccurate, the term being too comprehensive and inclusive. The considerations applying to trade debtors have equal weight in requiring the use of the term trade creditors for the purposes mentioned above. Accounts payable to trade creditors are usually the current items, whereas those payable to stockholders, officers, etc., and those due to a parent or holding company are more or less

fixed, as there is usually no particular urgency as to the time of their payment. An analysis of trade creditors into “not due” and “past due” will at least bring out the information as to neglected discounts and some idea as to the amount of cash needed to pay off debts and to secure their discount.

There is no necessary relationship between accounts and notes payable, nor any significance in their relative amounts. In some trades notes are given in order to obtain the discounts; in others notes are given at the date of purchase of the commodities.

Deposits. Another group of accounts payable of a more or less current type consists of deposits of various sorts. The business may accept deposits from customers or employees for various purposes. Consumers’ deposits with gas and electric light companies as guarantee to cover payment of bills and possible damage to meters or other company property; deposits covering locker privileges, breakage of materials, keys issued, and the like, are examples of this kind. These deposits are seldom all claimed at any one time; experience only can indicate the necessary financial provisions to be made currently for them. In some instances there is an accruing liability on account of interest on these deposits which must also be cared for.

Guarantees. Sometimes goods are purchased and only partly paid for, a portion of the purchase price being retained as a guarantee of quality until opportunity is given for adequate examination and acceptance or rejection. Similarly, in the case of construction work done by contract or subcontract, the owner—or, if a subcontract, the general contractor—retains a certain percentage of the contract price as a guarantee of performance of the whole according to contract agreement. This liability for the portion retained is a current liability, as a usual thing, and is to be listed under accounts payable with suitable subtitle.

Long-Term Notes. Long-term notes and accounts, bonds, and other fixed liabilities become current as their maturity closely approaches and provision for payment must be made.

Future Deliveries. On the border lines between contingent and full liabilities may be classed the liability because of goods purchased with long future dating. This is sometimes allowed by a seller to secure warehouse room for new product. It is undoubtedly best to set up both the asset and the liability, even where the goods have not yet been received.

Consigned Goods Sold. The factor’s real liability on account of consigned goods sold should, of course, be shown as a current liability, offset by any claims for expenses incurred on account of the consignor and any accrued commissions earned on sales to date.

Dividends Not Yet Paid. Another item belonging to accounts payable is dividends declared but not yet paid. Though it may be the custom of a company always to declare a dividend on a given date, no liability is incurred on account of dividends until they are actually declared. Upon declaration of a dividend the company makes itself liable to stockholders for the amount of the dividend. This liability ranks as an unsecured debt on the same footing as unsecured liabilities to other creditors. The dividend liability in large part is usually soon liquidated. Any unclaimed dividends constitute a liability until claimed or authority is given for other disposition. The item is usually small and is best shown as a current liability even though the chance of its being claimed may be remote. The method of handling and safeguarding the dividend transaction is treated in Chapter XXIV.

Accrued Expenses

The final item to be considered among the current liabilities is the group of accrued expenses. These constitute such items as wages, salaries, rents, royalties, expense supplies purchased but unpaid for, interest, advertising, sales commissions, traveling expenses, freights, water and other taxes, etc.—in fact, all services which have been rendered the business previous to the date of the balance sheet but which on that date are unpaid. These usually comprise the most urgent of the liability items and so are properly classed as current. There is seldom any business in which items of this kind are not encountered and, as stated on page 343, a careful examination of the records and familiarity with the business is needed to secure a full statement of them.

With regard to some of these items, difference of opinion exists. It is argued that until the amount of the liability is known, no real liability can be said to exist. Thus, taxes for the current year may not be known until the following year. Proverbially taxes are as certain as death, and there would seem to be no unreality or contingency about their incidence. As the current year passes by, the accounts should include a charge for taxes. Since the real amount is not known, it must be carefully estimated; for any difference must be taken up when the real amount becomes known, and so may disturb and somewhat invalidate the results for comparative purposes. Because of the fact that the current amount is an estimate, the title given the liability thereunder is sometimes called “Reserve for Taxes” rather than “Accrued Taxes.” No matter what the caption may be, it should usually be listed as a current liability.

Booking of Accrued Expenses

As in the case of deferred expenses, so in the booking of accrued expenses, in some quarters it is thought highly unscientific to record both the expense and liability elements in the same account at the time of adjusting the books. Use is made of a separate liability account entitled “Interest Accrued,” for example. When so used immediately at the opening of the new period, this account is either transferred to the expense account where it will act as an offsetting credit to the expense when paid, so automatically reducing the amount to the part properly applicable to the new period; or the account may be allowed to stand untouched (and therefore having no real significance) till the end of the next period when only the difference between it and the new amount accrued is made the basis of the new adjusting entry. Both these methods, while securing a more evident separation of the expense and liability elements, do so only at the cost of a needless multiplication of accounts and work. To one acquainted with the significance of bookkeeping methods, the old way of treating the liability element as an inventory in the expense account makes a definite allocation of the two elements, and does so with less burden on the bookkeeper and is to be preferred in most cases.

Deferred Credits

Deferred credits, as already explained, are analogous to current liabilities in that they represent unearned income. The enjoyment or earning of this income requires the rendering of certain services which are a claim on the current assets. In this sense, then, they belong to the current liability group, for the payment of which the current assets must be available.

NATURE OF CONTINGENT LIABILITIES

Statement of Contingent Liabilities

As stated on page 345, contingent liabilities range from those almost certain to materialize to those extremely remote. For some purposes a full statement of all such liabilities is needed to give an adequate view of conditions within the business. For other purposes, so detailed a statement may not be necessary although usually desirable. The Federal Reserve Board requires on a balance sheet submitted as the basis for credit a full statement of contingent liability as follows:

Kind of Contingent Liability Amount

Upon customers’ notes discounted, sold, or otherwise transferred $..... Upon drafts negotiated ..... For accommodation indorsements ..... For guarantees ..... Upon leases ..... Upon bonds or other obligations of ..... subsidiary companies ..... Under contracts or purchase arrangements ..... Under agreements ..... Under pending lawsuits .....

This company is not a guarantor or indorser of any liabilities or obligations of any individual, firm, or corporation, and it is not liable under any contracts, bonds, or profit-sharing arrangements, or any other agreements, and there are no lawsuits pending except as set forth above.

Sign Company’s name here .....

By .....

N. B. It is most essential that each question be fully answered.

Full answers to the above inquisition would often prove embarrassing but very enlightening. Two additional kinds of contingent liability not listed above sometimes exist, viz.: that arising out of a call for the unpaid portion of stocks owned but not fully paid for; and in the case of a corporation, unpaid accumulated dividends on preferred stocks. Some of these contingent liabilities require detailed consideration.

Notes and Drafts Transferred

The proper method of handling notes discounted, sold, or otherwise transferred, and negotiated drafts is given in Volume I and will not be repeated here. The showing of these items on the balance sheet is by inclusion among both the assets and liabilities, or preferably by inclusion among the assets with the liability element shown deducted. When a person or firm lends its credit by means of an accommodation indorsement, the transaction should be recorded as a charge to the accommodated party and a credit to Notes Payable if the liability is primary; or to Indorser’s Liability, if secondary. In case of primary liability, liability is full and must be listed on the balance sheet as a note payable. In case of secondary liability, liability is contingent, as in the case of discounted

notes, and should be so shown on the balance sheet. In either of these cases, the practice of cancelling the liability against the corresponding asset and by a feat of mental dexterity persuading oneself that there is therefore no need to show the item on the balance sheet, is a practice to be universally condemned.

Guarantees as a Contingent Liability

Guarantees are of many sorts—guarantees of product sold or work performed, guarantees of the good faith of others in meeting their obligations, etc. The transferred note is one kind of guarantee. Oftentimes, a parent company may guarantee the principal and interest or the interest only of the bond or note obligations of a subsidiary. While the expectation is usually that the contingent liability will not become real, yet experience shows the need of making adequate provision against it. The recent example of the Denver & Rio Grande as guarantor of the bond interest of Western Pacific bonds drives home that necessity. In a case of this sort provision is best made in the creation of a contingency reserve, for there is no experience on which to base a better estimate. In the case of a policy of guaranteeing the quality of a product or its workmanship, after a few years' experience very accurate estimates can be made of the loss to be expected therefrom, and at the end of a fiscal period the books can be adjusted on that basis just as they are for taxes. A charge to a suitable expense account and a credit to a reserve or accrued account comprises the book entry, with a listing of the reserve as a real liability.

Long-Term Leases

Contingent liability brought about by a lease covering a long period may be disregarded if the lease has a marketable value sufficient to cover the liability. Otherwise a contingent reserve should be set up. Liability under the subletting of a lease is best handled by means of a reserve.

Purchases for Future Delivery

Purchase contracts for future delivery, if made at a fixed price, may be disregarded unless at the date of the balance sheet market value is lower than cost, when a reserve should be set up. A fuller statement of the facts shows the transaction among both assets and liabilities. If the contract, being speculative, is not at a named price, the showing of the reserve is prudent and conservative.

Pending Lawsuits

In the case of pending lawsuits, the contingent reserve is usually all that is necessary. If the case is on appeal, it might in addition be wise to create a fund which would provide funds for settlement if the decision is unfavorable. Here the item of costs, fees, and accruing interest is usually large and liberal provision must be made.

Stock not fully Paid

Where shares of stock are held which are not fully paid, a liability attaches for the unpaid portion contingent upon call being made for it. Showing the stocks at subscribed price with the offsetting liability for the unpaid amount as a deduction, is perhaps the best method, though there is no serious objection to omit mention of it if the stock has increased in value, or of using the method of a reserve. Where a double liability attaches to stock ownership in case of bankruptcy, no notice need be taken of the contingent liability so long as the business whose stock is held shows an entirely solvent condition. When such is not the case, whatever provision seems necessary should be made, even to the extent of liability to the full value of the stock held.

Accumulated Dividends on Preferred Stock

There is no liability on account of accumulated dividends on preferred stock until profits have been made out of which they may be paid. If the policy of management does not allow their declaration at the present time, although sufficient profits have been made, the accumulation of dividends should be shown as a liability. Where the company is unable to declare dividends because of insufficient profits, mention of the accumulating dividends should be made in a footnote as a possible future liability.

Signature to Surety Bond

The liability arising through signature to a surety bond is a contingent liability resting upon the good faith and honor of the bonded party. The practice of personal bondsmen is not so prevalent as formerly. Experience shows that the liability of the bondsmen may become very real, and not only should suitable provision be made for it but its existence should be shown on the balance sheet.

CHAPTER XX

FIXED LIABILITIES—BONDS AND MORTGAGES

Nature of Fixed Liabilities

Fixed liabilities, called also capital, bonded, long-term, and funded liabilities or debts, comprise all debts of which the date of maturity is some distance ahead and considerably longer than that of current liabilities. Government regulating boards, for purposes of standardization, may set a minimum life-period for this group of liabilities and any kind of debt falling within the period is so classified. Thus, the Public Service Commission for the First District of the State of New York says: “Funded debt comprises all debt which by the terms of its creation does not mature until more than one year after date of creation.” Private undertakings do not need such exact uniformity. Any debt the maturity of which extends beyond the period adopted within that business for current liabilities will usually be grouped with the fixed liabilities, there seldom being an intermediate group.

Purpose of Fixed Liabilities

Fixed liabilities, as distinguished from current, are those issued distinctively for the purpose of raising capital. Due to insufficient original capitalization, funds may be needed for one or more of many purposes. Working capital may be required; extensions of plant and market may be desirable; additional equipment and improvement within the plant itself may be advisable; the control of the plant of a competitor may prove advantageous; it may be deemed wise to fund floating liabilities; the refunding of liabilities soon to mature may become necessary; the financial policy may dictate the unification of several diverse forms of debt—these and other purposes may be served by the assumption of long-term debts.

Corporation Bonds

The most common type of fixed liability is the bond. As an instrument of credit the bond is limited almost exclusively to corporations. The purchasing public, interested in securities of this kind, looks with suspicion on a long-term promise to pay issued by either a single proprietor or by a partnership. Such businesses are almost wholly dependent on the health and ability of individual owners. During a long period of years so many contingencies may arise and seriously cripple the business that the long-term debts of a partnership or sole ownership have no market, although isolated instances of such issues exist. The corporation, however, has continuity of life, is not so dependent on individuals, and therefore has avenues for the raising of funds open to it which are closed to other types of organization.

Nature of Bonds

A bond may be defined as an instrument under seal promising to pay a certain amount of money at a definite or determinable future time. From a legal standpoint, a bond is a contract setting forth the terms and conditions under which the obligation is assumed. Furthermore, it is a negotiable contract transferable from hand to hand, though in some cases registration is necessary to prove ownership in the eyes of the issuing corporation. From a financial standpoint, a bond is essentially a long-term promissory note. Bonds, as here used, are to be distinguished from the old real estate bond and mortgage. Bonds are usually secured by a lien on some definite property or prospect of property, just as the real estate bond and mortgage. The corporation bond, however, is a separate instrument, divisible into small parts, whereas the bond and mortgage is not usually an instrument of that type.

Corporation bonds are also to be distinguished from the surety bonds mentioned in the preceding chapter. These latter, as already noted, are instruments whereby individuals, firms, or corporations bind themselves as guarantors for the conduct of others or for the payment of sums of money for which the guarantor is not directly liable.

Difference between Bond and Real Estate Mortgages

With regard to the mortgage covering the bond issue, points of difference from the ordinary real estate mortgage are to be noted. To the ordinary mortgage there are two parties, viz., the party obligated and the party accommodated, the obligor and obligee. To the bond mortgage, the obligee is a trustee standing in the stead of the numerous bondholders who could not conveniently act individually. In this trustee the title to the property liened is vested for the benefit of the bondholders. The mortgage instrument itself is often a model of completeness and comprehensiveness, defining with minute care the relations, duties, rights, interests, and status of the issuing corporation, the bondholders, and the trustee under present circumstances and all possible future

contingencies.

Kinds of Corporation Bonds

Since bonds were first issued, perhaps one hundred different kinds have been placed on the market. They all have the same fundamental characteristics but differ in minor particulars. No universally recognized basis exists for their classification, nor is such a basis possible, the use which they are to serve determining always the basis of analysis into classes. Thus, in the opinion of a leading authority[50] on the subject bonds may be classified under the following heads, according to:

1. The character of the issuing corporation under which are treated: (a) Civil Loans (b) Corporation loans

2. The security of the bonds under which come: (a) First mortgage (second, third, etc.) (b) General mortgage (c) Divisional (d) Guaranteed (e) Collateral trust (f) Debenture (g) Income (h) Land grant (i) Real estate (j) Prior lien (k) Consolidated (consols) Etc., etc., there seemingly being no limit to the descriptive titles that may be used in order to indicate some feature of the security.

3. The purpose of the issue, as: (a) Improvement (b) Construction (c) Refunding (d) Purchase money (e) Unified (f) Subsidy Etc.

4. The conditions incident upon payment of principal and interest, as:

For the payment of interest— (a) Income (b) Participating (c) Unconditional (d) Registered (e) Registered coupon (f) Coupon (g) Interchangeable Etc.

For the payment of the principal— (a) Premium (b) Gold (c) Silver (d) Straight (e) Serial (f) Extended (g) Callable (h) Optional (i) Convertible Etc.

[50] “The Principles of Bond Investment,” by Lawrence Chamberlain.

The issuing corporation often distinguishes its bonds by means of some descriptive adjectives purporting to classify them or indicate their nature. Thus, consolidated first and improvement, general and refunding mortgage, first mortgage extension, general lien railway and land grant, are titles sometimes met, though a simpler title carrying also the interest rate is more common, as general mortgage 4’s of 1965, C. & A. 5’s, Toledo Light & Power 4’s, etc. As listed on the exchange the title usually gives the name of the issuing corporation (i.e., the obligor), the distinctive name of the bond, and its interest rate.

Bonds rank very much as mortgages do in the priority of their liens. A first mortgage bond has a first lien on the property securing it; a second mortgage bond has a second lien and its claim is said to be junior to that of the first. No attempt can here be made to explain the distinguishing features of the above-named issues. Attention is called to them only because the reader of a balance sheet—an investor or prospective creditor—often must have a knowledge of the various classes of bonds and a detailed knowledge of the conditions of particular issues. It is obvious that the accountant should have a knowledge of the particular issues of a business in order intelligently to draw up a balance sheet and make a report thereon.

Authority for the Issue of Bonds

A corporation has generally a charter right to issue bonds for the purpose of securing money, acquiring property, or in payment for labor or financial services rendered. The exercise of this right may be curtailed by, or be dependent upon, authority from a regulating body. Within the corporation itself, the right to issue vests in the stockholders. In some cases a majority vote suffices; in others as many as three-quarters of the votes may be required to authorize the issue. The directors themselves may, upon proper authorization from the stockholders, make the actual issue, and usually the initiative for a bond issue comes from them because they have intimate knowledge of the business and its needs.

Financial Considerations Involved in Issue

Financial considerations involved in the determination to issue bonds may be reviewed briefly. It is interesting to note that the bond has been used very extensively as a means of securing capital. There is, however, no necessary relationship between the amount of capital raised by stock issues and that raised by bond issues. The sale of additional stock or of bonds or other similar securities is the main source of corporation funds for capital purposes. Some concerns have obtained approximately one-half of their capital through the issue of bonds. Percentages of capital so raised ranging from 15% to 40% are not uncommon.

The manner of raising capital is largely a matter of credit, expediency, and the question of fixed operating expenses. It rarely happens that bonds carry with them the privilege of voice in the management of the corporation's affairs; that is usually limited strictly to the shareholders. Accordingly, the issue of bonds instead of additional stock does not interfere with the management or control of the concern—so long as the contract requirements of the bond issue are adhered to.

Because of the definiteness of the income on bonds and usually the greater security of the principal, bonds may often find a market where stocks would not. On the other hand, if the stock can be marketed as advantageously as the bonds, no definite dividend rate is necessarily attached to them. The price at which stocks may be marketed, aside from the features of extra inducement which might influence the market, depends largely upon the prospective income rate judged mostly by what the company has been able to do in the past and any features of present condition or expected future condition which might influence the earning capacity of the corporation. Therefore, unless a dividend rate a little higher than the current interest rate is in prospect, the company usually finds it difficult to market its stock advantageously.

Bonds versus Stock Issues

The bond market furnishes opportunity for investment to quite a different class of people from those interested in stocks. Security, conservatism, and a definite income are the main elements desired. Thus conditions may oftentimes be such that one market or another may be more favorable for absorbing an issue of securities, dependent on conditions in that market as much as on the credit and standing of the issuing corporation.

Aside from these points which are usually given consideration, is the question of how heavy are the fixed charges the corporation can carry. While from the investor's viewpoint an income at a fixed rate is highly desirable, from the corporation's point of view it may impose so great a burden as to eat up all the profits. The bond interest constitutes a fixed charge deductible before the determination of profits. In case of failure to meet the bond interest, the mortgage covering the bonds is subject to foreclosure. Upon foreclosure at forced sale values always shrink greatly, oftentimes the shareholders lose their entire interest in the company, and all the net assets may be taken to satisfy the claims of the bondholders. As compared with an additional issue of stock—common or preference shares, as may best meet the situation—a bond issue may thus be of doubtful value. One of the knotty problems upon a reorganization following insolvency is that of lowering the fixed charges by converting some of the bond issues into preferred stocks in order to prevent the recurrence of operation at a loss and so of inability to meet bond interest.

Accounting for Bond Issue

Accounting for the bond issue presents much the same problems as those connected with an issue of stock. Inasmuch as most corporation issues are sold in block to a banker who in turn markets them to the investing public, often through a syndicate (or the process may be one of under-writing), there is usually no need for detailed subscription records and accounts. In the case of coupon bonds no record of individual ownership is required because the bonds pass by delivery, possession evidencing ownership and the interest coupon being payable to bearer. In the case of registered bonds, a record of individual holdings must be kept similar to the record of stockholders. The party in whose name the bond is registered on the company's records is the prima facie owner to whom the periodic interest check is also sent. If the bond is registered as to principal but bears coupons for the interest, records of individual ownership are also required here.

Entry of Issue on Books

Placing the bond issue on the books is accomplished by either of two methods. Assuming an issue of $500,000 of first mortgage 5% bonds of which $350,000 are sold at par for cash, the balance remaining unissued for the present, the entries would be:

First Method

(1) Unissued First Mortgage Bonds $500,000.00 First Mortgage Bonds Payable $500,000.00

(2) Cash 350,000.00 Unissued First Mortgage Bonds 350,000.00

Entry (1) is used to make a memorandum entry of the authorized issue. Entry (2) shows the amount sold for cash. The balance in the Unissued Bond account is treated as an offset to the Bonds Payable account. Sometimes the title "Treasury Bonds" is used instead of "Unissued," but the term is apt to be misleading because of the restricted meaning given the word in connection with treasury stock.

Second Method

(3) Cash $350,000.00 First Mortgage Bonds Payable $350,000.00

Under the second method, the desired information as to authorized issue would be carried parenthetically in the account title. At the present time the tendency is to deprecate an unnecessary multiplication of accounts as is brought about through the use of memorandum accounts. The second method is therefore the preferred method and in its operation brings onto the books the same information as the first method.

Entry of Premium or Discount on Books

Bringing the bond premium or discount onto the books is accomplished in the same manner as for stock. Thus, using the above data and assuming $100,000 of the bonds sold at 101 and the remaining $50,000 at 99¾, the entries would be, illustrating only the second method:

(4) Cash $101,000.00 First Mortgage Bonds Payable $100,000.00 Premium on First Mortgage Bonds Payable 1,000.00

(5) Cash 99,750.00 Discount on First Mortgage Bonds Payable 250.00 First Mortgage Bonds Payable 100,000.00

Subsequent handling of the premium and discount accounts will be shown on page 368.

Bonds may be issued for cash or property, as in the case of stock. Unless there is evidence to the contrary, when bonds are issued for property they are brought onto the books at par value, the courts holding here as with stock that the parties to the transaction (usually the corporation's directors) are in a better position to judge the value of the property taken over than anyone else. This oftentimes results in an inflation of property values—an injection of water—and should not be countenanced where a true basis for determining the value of the bond is offered. Thus, if almost simultaneously with the issue of the bonds for property, some are sold for cash, the cash price received would usually be a fair basis for booking the premium or discount on those issued for property. The sale for cash must be a bona fide sale in the open market if it is to represent the market's judgment of the offering. Sometimes an objection is raised to a Bond Discount account appearing on the books; hence the practice, wherever possible, of charging the discount against some asset account as a part of the cost of that asset. When the true nature of bond discount or premium in its relation to the periodic interest charge is appreciated, the objection has no weight.

Entry of Interest Payments on Books

Booking the payment of the periodic interest is accomplished by a charge to Bond Interest and a credit to Cash. This interest should never be entered in the regular Interest and Discount account. If the bonds are coupon bonds with the coupons redeemable through a designated trust company, a check for the full amount of the interest on the outstanding bonds should be issued and booked as above. If the coupons are redeemable at the company's office, an entry debiting Bond Interest and crediting Coupons Payable should be made, to record the interest charge and the liability therefor. As the coupons are redeemed, Coupons Payable is charged and Cash credited, any balance remaining in Coupons Payable account representing the liability existing because of coupons not yet presented for redemption. In the case of bonds registered both as to principal and interest, the interest checks made payable to the registered parties constitute a charge to Bond Interest and a credit to Cash. It is sometimes advisable to transfer by one check the total bond interest payable to a special bank account and issue the individual interest checks against this fund. Whenever the books are closed it is always necessary, unless the end of the fiscal period coincides with the bond interest date, to take account of the accrued bond interest as on that date. The adjusting entry here is similar to that for any accrued expense.

Relation of Bond Interest to Premium or Discount

The main problem in connection with accounting for bond interest is that of the relation between bond premium or discount and the periodic bond interest. At practically any time in the market there is a rate at which the bonds could be sold at par. This rate is known as the effective rate. If a company puts an issue of bonds on the market at a higher rate than this, the market will offer a premium for them. The amount of the premium will be, theoretically, the present value of the periodic sum represented by the difference between the stated bond interest and the effective interest, these periodic payments extending over the life of the bond. In other words, the premium represents the price paid to buy the additional interest, dollar for dollar, on a compound interest basis. The premium is therefore not an earning, an item of income, but is an offset to the excess bond interest. The portion of it applicable

to each period represents the excess interest which deducted from the bond interest shows the real or effective cost of the money borrowed and to be paid back. Thus, the bond interest rate based on the money actually received, i.e., par plus premium, is exactly the same as the market or effective rate on par. In other words, the corporation is paying for its actual borrowings simply the current market rate of interest.

It is therefore incorrect to show on the books the cost of the loan at any other figure than the effective interest. The actual periodic payment of interest is, however, at the bond interest rate. This must be brought down to the effective rate by application to it of a portion of the premium which represents the sum paid for the privilege of receiving the higher rate of interest. Similarly, bonds are marketed at a discount when the bond interest rate is lower than the market rate prevailing on similar security at the time the bonds are floated. This may be looked upon as a payment by the company in lump sum to compensate a purchaser for the difference in the income on the bond and what he might obtain on the open market. The discount should be applied, therefore, periodically to bring the cost of the loan up to its true figure, viz., the market or effective rate. An illustration will clarify the points of the above discussion.

Example of True Interest Cost

Assume a 7% bond, interest every six months, payable in 25 years (50 periods), par $1,000, sold in a market whose prevailing interest rate is 6%. By the method developed on page 273, the value of such a bond is found to be $1,128.6488, the premium being $128.6488. At the effective rate the real cost to the issuing company is 3% on $1,128.6488, or $33.8595. The actual sum paid as interest is $35, i.e., 3½% on $1,000. The difference between the effective and actual bond interest, or $1.1405, is the portion of the premium to be used that period in order to reduce the amount of actual interest paid to the real or effective cost of the loan. The bookkeeping entries are:

(6) Bond Interest $35.00 Cash $35.00

(7) Premium on Bonds 1.14 Bond Interest 1.14

Similar calculations and entries for each of the succeeding 49 periods would be made, the application of the effective rate always being, of course, to the amortized value of the bond as on that date. This process is called scientific amortization of the premium (or discount) of the bond. Its effect is readily seen to be to spread over the life of the bond the premium (or discount) and so not to take credit for it in a lump sum during the period in which the bond is matured. There are four cases to which this principle of showing the true interest cost is applicable, as follows:

1. A bond sold at a premium to be redeemed at par on maturity. 2. A bond sold at a discount to be redeemed at par on maturity. 3. A bond sold at a discount to be redeemed at a premium on maturity. 4. A bond sold at par to be redeemed at a premium on maturity.

At the close of a fiscal period which does not coincide with the bond interest period, not only must the bond interest accrued to date be shown as an accrued expense, but also there must be so shown the portion of the premium (or discount) accrued to that date required to bring the bond interest cost down to the effective basis.

Presentation on Balance Sheet

The final problem in connection with bonds concerns the manner of their showing on the balance sheet. That has perhaps been sufficiently indicated. The amount of the authorized issue should be short-extended, and the amount unissued subtracted therefrom with the net amount outstanding full-extended as the significant figure in the balance sheet.

Other Fixed Liabilities

Real Estate Mortgages. Another item among the fixed liabilities is the simple real estate mortgage. This is usually called a bond and mortgage, the bond being simply the promise to pay and the mortgage being the security for the amount of money borrowed. In some states the more formal document called the bond is used as a contract according to which a named sum is to be paid in case the amount borrowed on the mortgage is not paid. This named sum is usually the amount borrowed, although in some states it is twice this amount. In booking a note or bond supported by a mortgage, the customary title is “Mortgage Payable” rather than “Notes Payable” which is generally understood to be applicable in the main to current liabilities. In case the double amount is named in the bond, it is not customary to take cognizance of the contingent liability thereunder.

Loans on Collateral. Short-time loans are frequently made on collateral security. Stocks and bonds, particularly of the borrowing company or its subsidiaries, may also be made the basis of a long-time loan. This may take the form of a bond issue, promissory notes, or other similar obligations. Accounting for the loan and its showing on the balance sheet follow the principles already laid down. The title of the loan account should carry the word “Collateral” or other similar term to show its nature. Accounting for the collateral is usually accomplished by a memorandum in the stocks, bonds, or investments account to show exactly what securities have been withdrawn for deposit as collateral. No further record is needed other than a complete list of such securities; the securities are still owned by the company, though deposited under a conditional contract with someone else. If the loan is dishonored at maturity and the securities are sold in satisfaction thereof, the necessary entries must be made to show the sale of the securities, the profit or loss attendant thereupon, and the repayment of the loan. In showing the pledged securities on the balance sheet, it is well to present the securities in two groups or classes, viz., those pledged as collateral for the loan shown contra and those not so pledged.

Short-Term Securities. When the market is not favorable to the issue of long-term securities, because of the high rate of return demanded by investors, corporations often have recourse in their borrowings to short-term securities—usually note issues with maturities ranging from one to five years, two- and three-year terms being the commonest. The financial consideration in their issue is merely a speculation that by the time of their maturity the market will be more favorable for the flotation of long-term securities. Thus the company hopes at the maturity of the notes to free itself from the need of paying so high an interest rate as it is required to pay now for the short-term securities. These notes may be in different denominations and are accounted for just as other notes. On the balance sheet they are grouped with the fixed liabilities until within a short time of maturity, when they must be shown with the other current items.

CHAPTER XXI

CAPITAL STOCK AND ITS VALUATION

Problems in Valuation

The problems in connection with the valuation of the assets and the liabilities and the manner of showing them on the balance sheet—and in some cases the manner of booking them—have been treated in some detail in the preceding chapters. It might seem that, inasmuch as proprietorship or net worth is determined always by the excess of assets over liabilities, no question would arise concerning the valuation of net worth, its value being automatically determined by whatever values are placed on assets and liabilities. That its value is so determined, that every change in net worth must be reflected in the assets and liabilities, does not admit of argument. There are, however, certain phases of the question of valuation and certain problems connected with it, that, because of their close connection with net worth or their direct effect upon it, are best treated under this head rather than under the head of each particular asset that may be affected. Thus, if treated among the assets, the valuation of properties purchased with stock would require, under the head of each asset which might be so acquired, an almost identical statement of principle. For this reason, some problems in valuation have been reserved for treatment here in connection with capital stock.

In addition, there are related problems which concern the surplus and reserves. It is true, these all have their origin in the general considerations of valuation as given for the assets and liabilities. But questions as to what constitutes a profit, whether all profits are applicable to dividends, the proper treatment of capital profits, the relation of capital losses to profits and dividends, the differentiation of the classes of reserves, and finally the manner of showing and explaining the periodic changes in net worth by means of the supplementary statement of profit and loss—all these and other similar questions are closely related to the problem of valuation and, as indicative of the financial policy of a business, may directly affect all going concern values. On this account they require separate treatment from that of any individual assets and liabilities or group of assets and liabilities. Accordingly, the next few chapters will be concerned with these problems and any others which are relevant thereto.

Kinds of Stock

Capital stock is of various kinds—that with a stated par value and that without, common stock, various kinds of preference shares, debenture stock, guaranteed stock, founders’ stock, convertible stock, and redeemable stock. The student is referred to Chapter I where these various kinds of stock are discussed.

Par, Real, and Market Values

Capital stock may have several kinds of value, as the term value is used. All stock is expressed as so much per share. The value mentioned as the stated value of a share of stock in the contract of issue is known as the par, face, or nominal value.

The book value of stock is the value of the stock, as shown by the books—not the amount carried in the stock accounts, but the entire net worth of the corporation divided by the number of shares outstanding. Thus, if the assets minus the liabilities—the net assets—of a corporation amount to $1,500,000, of which $1,000,000 represents 10,000 shares of stock of par value $100, and the $500,000 is surplus, the book value of the stock is said to be $150 per share. From the standpoint of a going concern, this value is also spoken of as the real value in the sense that it is represented, dollar for dollar, by actual assets held by the corporation. Real value is also used to mean liquidation value, the value which the net assets upon forced or voluntary sale would realize for distribution to each shareholder.

Finally, there is the market value of stock by which is meant the value placed on it in the stock market or wherever stocks are dealt in. This value depends primarily upon the dividend-earning capacity of the stock, although many side issues of fact and opinion affect it. Thus, not only present, but past as well as prospective future dividends influence the market. At times, particularly in a declining market, the financial needs of the holders of the stock may affect prices more than the dividend rate of the stock.

The problem of stock valuation as related to the commercial balance sheet takes cognizance of only one of these values, viz., par value, though each of the others is related to and measured by the showing of values on the balance sheet. That par value is not always the true value cannot be controverted. As already shown, the inclusion on the balance sheet of assets of doubtful value is allowed when the doubtfulness of their value is generally recognized and no one is thereby misled. Some problems in connection with stock values and their inflation on the books will now be discussed.

Value Dependent upon Earning Capacity

Upon the inception of an enterprise the problem of stock valuation is always bound up with the question of valuation of the assets and liabilities, as pointed out above. When the asset to be valued is only cash, the problem is not usually difficult, as where the capital stock is sold for cash. Where, however, the sale is for a property taken over, the valuation of the stock is related to the larger problems of capitalization, with which in turn the valuation of the assets is bound up. It seems best, therefore, for an intelligent understanding of the question to review briefly some of the bases of capitalization.

As indicated above, the market value of any stock is dependent in the long run more on the factor of its earning capacity than anything else. If investment in a stock nets the prevailing income rate on money, that stock will approximate its par value. So when determining the capitalization of a company which expects to be taken over as a going concern, the main consideration is not so much its true valuation as it is its earning capacity and its ability to pay dividends. Thus, if on a cost basis the net values taken over amount to $250,000, but past performance and future expectation reasonably indicate a capacity to earn a normal dividend on $1,000,000, it is very probable that the new company will capitalize at $1,000,000. If this sum is actually and in good faith paid, little or no exception can be taken to recording the value of the plant taken over at $1,000,000. The transaction is the result of a bargain. The additional value over cost may, in the estimate of the purchaser, represent the true value of the good-will or other intangible assets acquired but not included in the $250,000 referred to above. In a bargain transaction such as the foregoing, judgment of value is sometimes wrong; but the buyer can only show the property bought at what it cost him at the date of the purchase—whether the payment is in cash, stock of a stated par value, or other assets.

Increase of Book Capitalization

If, however, the transaction is merely a reorganization of the old company by its owners solely for the purpose of increasing its book capitalization by bringing onto the books an existent good-will or by other means of inflation of assets, the result is a so-called watering of the stock. The propriety or impropriety of this is chiefly a question of business ethics, and its discussion is beyond the limits and the purpose of this volume. It may be said here, in passing, that under certain conditions the practice may be entirely proper and no inequities may result. On the other hand, the purpose of such a reorganization may be fraudulent, in which case it frequently works hardship and injustice. The main accounting problem involved when the book capitalization of a concern is increased is the method of recording the transaction, so that the true status of affairs will appear unmistakably and any attempted fraud will be shown.

Capitalization on Cost

Opposed to the basis of capitalization on earning power is that of capitalization on cost. In a case of capitalization it is very difficult to know exactly what is meant by cost, as there are so many kinds of cost. There is original cost; original cost less depreciation; present cost new of an identical property, i.e., reproduction new cost; reproduction cost less depreciation, etc. In this discussion original cost is taken as the basis, less depreciation, or such cost plus a bona fide payment for good-will or for the privilege of securing an established business. All these other factors may and frequently do enter into the determination of a bargain and sale price and therefore affect capitalization.

The regulation of the Public Service Commission of the First District, State of New York, concerning the manner of keeping the capital stock accounts of public service corporations, is as follows: “To the account for any class of stocks shall be credited when issued the par value of the amount of stock of that class issued. If such issue is for money, that fact shall be stated; and if for any other consideration than money, the person to whom issued shall be designated and the consideration for which issued shall be described with sufficient particularity to identify it; if such issue is to the treasurer, or other agent of the corporation, to be by him disposed of for the benefit of the corporation, that fact and the name of such agent shall be shown; and such agent shall in his account of the disposition thereof show the like details concerning the consideration realized thereon, which account when accepted by the corporation shall be preserved as a corporate record. If the fair cash value of the consideration realized upon the issue of any amount of stock is greater than the par value of such stock, the excess shall be credited to the account ‘Premiums on Stocks’ and the corresponding reference thereto shall be contained in the entry relating to such stock in the stock account.”

The Law and Stock Issues

Thus, it is seen that the state takes cognizance of financial arrangements and methods of accounting in some of those particulars wherein the state is vitally interested. These regulatory provisions are usually found in the corporation laws of the state or amendments thereto. At the present time there are at least three types of such laws:

Under one type it is provided that, when property is taken by the corporation in payment of its shares, the incorporators alone are the judges of the values of such property and that the state’s only duty is to prevent fraud. Fraud must be shown by the injured party and usually the facts by which this might be established are hidden in records to which a stockholder has no access. The remedy is against the directors personally. This type of corporation law is found in most of the states.

Under the second type active control of the issue of stock is undertaken by the state. This requires an independent appraisal and valuation by the state’s experts. This type of law is found frequently governing the incorporation of public utility companies. It is based on a paternalistic theory of state functions not yet recognized as applicable to private undertakings.

Under the third type, we find the law authorizing the capitalization of any and all kinds of property—in the absence of fraud, of course—provided that a full statement is put on record showing the amount of stock and the exact manner in which it is paid for. The amount of cash received must be shown; the property acquired so labeled as to render identification possible; and any payments for services or other expenses must be shown. The attitude taken is that a prospective investor, provided with these facts about the company, can make his own judgment as to stock values.

Thus, we find that practice is not uniform in these regards. From the viewpoint of theory, any accounting treatment of the issue of stock which shows the full facts with regard thereto may be considered as meeting all reasonable requirements.

Treatment of Discount or Premium

Valuing capital stock when issued for cash presents no problem in itself, but the treatment of the discount or premium incident thereto requires consideration. In most of the states and in Great Britain stock cannot be issued below par. The manner of nullifying this provision has already been referred to in Chapter I. There it was shown how the issue of fully paid stock is made for property and how treasury stock is created by donation, which may then be disposed of for any price obtainable, without any additional liability attaching to it. In most of the states and in Great Britain, however, a sales commission is allowed which has, in some instances, been used as a cloak for sales at a discount. The booking of the discount or premium presents no difficulties, but the manner of handling it on the balance sheet is not uniform. Premium or discount on stock should be recorded as such on the books, under titles of definite meaning.

One occasionally hears the argument that the discount on stock is a necessary expense incident to financing the company, a sort of “cost of getting started,” an expense without which the enterprise could not be launched; accordingly the discount should be

properly capitalized as a part of the property costs. The argument is plausible but not convincing. The information as to the discount on stock is very necessary to the prospective creditor or investor and should always appear as a separate item on the books. To the same effect is the ruling of the Interstate Commerce Commission that premiums on capital stock must be carried on the book permanently unless offset by discounts later allowed. Discounts may be extinguished by premiums, assessments, surplus, or by the retirement of an equivalent amount of stock.

A premium on stock may be looked upon as similar to a capital surplus. It represents a fund of capital originating upon the inception of an enterprise, and is in no sense an increase of capital, i.e., of net worth, due to operation. So far as the law is concerned, there is nothing to prevent the return of this surplus to the shareholders in the form of a dividend. To treat it as available for ordinary dividends, however, would seem not to be in keeping with the manner of its origin. Rather should it be set aside as a permanent surplus. One requirement in the case of national banks is the creation of a permanent surplus equal to 20% of the capital, and so, frequently the original subscribers agree to take their stock at a 20% premium, this premium providing the legal surplus required. In the case of discounts no accounting principles are violated if they are allowed to remain on the books. If there is a surplus from premiums, that should be used to wipe off any discounts. In the absence of premium or other capital surplus, conservatism usually sanctions the use of operating surplus for this purpose, thus bringing the value of the net properties owned at least into equivalence with the par value of the stock.

Valuation of Stock Issued for Property

The difficulty of valuing stock when issued for property has already been stated and the attitude of the laws towards any valuation placed on the properties taken over has been shown. Nothing further here need be said except to state that where also a bona fide sale of a portion of the stock takes place for cash at the same time, a fairly reliable basis for valuing the stock given for the property is offered. It is not the usual practice to show the probable discount on the stock, although such treatment would be logical and consistent with the facts. A similar valuation of the stock might be secured by an independent appraisal of the properties taken over, but this, if done, is not often made the basis for entry on the books. If all the facts are fully recorded, that probably is as much as can be hoped for under the conditions now prevailing. Undoubtedly the use of no par value stock for incorporations of this kind offers the best solution of the problem. With regard to booking the properties acquired by a stock issue, attention is here called to the method of valuation of the individual units by an appraisal committee usually appointed from among the directors and the use of their findings as the basis for the book entries of the transaction.

Valuation of Treasury Stock

In connection with the purchase of properties by stock, there often arises the need of working capital. This is frequently furnished by the pro rata donation or return of some of the stock to the corporation, the sale of which furnishes the necessary working funds. As illustrated in an earlier chapter this donation is booked at the par value of the stock, the charge being to Treasury Stock and the credit to Donated Surplus, Donated Working Capital, or other similar account. Being true treasury stock, it can be sold at any price without liability. It is usually disposed of at a discount which must be recorded on the books either as a charge to Discount on Treasury Stock account which will later be closed against Donated Surplus or as a charge direct to Donated Surplus. Thus when the treasury stock is all disposed of, the net credit balance in Donated Surplus shows the real amount of working capital obtained through the donation. If not entirely sold, the portion sold gives a fair basis for the valuation of the unsold portion, although this value is seldom brought onto the books, it being used as a guide to financing rather than as an item to be regarded in accounting valuation.

Redemption and Reduction of Capital Stock

The redemption and reduction of capital stock presents a problem of surplus adjustment requiring careful treatment. If a corporation has accumulated no surplus of any sort and redemption of the stock is at par, no difficulty is met in making the entry. If, however, a surplus has been accumulated and redemption is either above or below par, care must be exercised to record the transaction properly. Redemption at a stated price is sometimes one feature of a preferred stock issue. Again the stock may be bought in the open market for the purpose of cancellation. Reduction of capital, except when made a condition of the original issue, cannot usually be accomplished without the consent of at least a majority of the shareholders and authorization from the state. For the sake of simplicity, assume just one class of stock and a surplus in which each share has an equal interest. If redemption is at par, the surplus is evidently not affected but each share of stock remaining outstanding has a larger share in the surplus and so acquires a higher book value.

Redemption of a stock at its _book_ value is accomplished by charging capital stock for its par value and surplus for its pro rata share in the surplus, the offsetting credit to both these being to cash. The value of the remaining shares of stock has not been affected in the least. If redemption is at any other figure than book value, not only is surplus affected, being increased if the redemption price is below par and decreased if above par, but also the value of the remaining shares. In the case of different classes of stocks, a careful determination of their respectively equitable shares in surplus would have to be made before the effect on the remaining shares could be calculated.

In passing from the question of stock values, it should be pointed out that an undervaluation of stock when issued for property, though seldom seen in practice, has the refreshing effect of creating a secret reserve. That is, property values are carried on the books below their actual values and a secret reserve is thereby created. A further discussion of secret reserves will follow in a later chapter.

Dividend Stock

Stock is sometimes issued for dividend purposes. In such cases, it is always issued as of par value. If profits have been earned or a surplus accumulated out of which a dividend may be declared, that dividend may be paid in any way the corporation sees fit. Payment may be made in cash, scrip, or in the shares of the company. If the corporation has neither unissued stock nor stock in the treasury, permission to increase its capitalization must be secured before a stock dividend can be paid. Some corporations, notably financial institutions, often make it a matter of policy to accumulate a large surplus and then distribute it by means of a stock dividend. Declaration of the dividend is made and recorded as usual. Record of the payment in stock is made as a debit to Dividends account and a credit to Capital Stock.

The effect of a stock dividend is twofold. From the point of view of the management of the surplus it has the effect of a permanent investment of the surplus in the business. Thus it places the accumulated profits beyond the control of any future board of directors. If left in surplus, a cash dividend might have been declared and the asset dissipated to that extent. The stock dividend, however, keeps the profits invested in the business in such a way as not hereafter to be available for dividends. From the point of view of the stockholder, upon the declaration of a stock dividend his equity, his proprietorship in the business, is not in the least affected excepting that it is divided into more parts; he has more shares to represent it than he had before. Before he possessed as a community right a pro rata share in the surplus. Now the ownership of that share has become personal, individual. Each share of ownership thus has a smaller book value but each stockholder’s equity is the same as before.

Stock Issued as a Bonus

The manner of recording stock issued as a bonus with bonds or for any other purpose has been illustrated in an earlier chapter. Here, attention is called to the effect of such an issue in states where stock cannot be sold below par. There is no legal bar to the sale of bonds below par. If, then, the price received for the bond carrying a bonus of stock is at least equal to the par value of the bonus stock, there is nothing extra legal in the transaction. However, record must be made of the issue of the stock at par, the discount or bonus being carried as applying to the bond.

The valuation of stock issued in effecting combinations or for labor or services follows along the same general principles as of that issued for property, and the same general considerations are pertinent.

Unissued and Treasury Stock on the Balance Sheet

When showing capital stock on the balance sheet, it is best to treat unissued and treasury stock as valuation items. The reason for this was stated and discussed in Chapter XIV. Here the relevancy of showing the unissued stock will be considered, as a statement of the outstanding stock is thought by some to be all that is required. It has been argued that the unissued stock does not in any sense represent an asset nor does it show proprietorship. Why not, therefore, leave it off the balance sheet statement entirely? It is true that an investor, a creditor, or a stockholder is interested in the main only in the condition of the business as shown by its present assets and liabilities. Unissued stock has no value till placed on the market; all that it shows is that certain legal requirements have been met authorizing its issue and to that extent it has a contingent value which may become a real source of capital to the corporation if additional funds become necessary. While, therefore, the omission of the item entirely from the balance sheet does not affect present conditions, it is considered best, in the interest of full information as to the exact status of the company, to show the amount of the authorized capital with the amount unissued extended short on the balance sheet, the

difference being the amount outstanding—which is full-extended as the significant item, thus:

Capital Stock Authorized $1,000,000.00 Less Amount Unissued 250,000.00 ---------- Amount Outstanding $750,000.00

A similar showing of the treasury stock is also considered best, although good authority can be found for its inclusion among the assets.

Preferred Stock Covered by Redemption Contract

On the border line between liabilities and proprietorship is preferred stock covered by an unfulfilled redemption contract. Such stock is issued with a definite redemption contract to become effective at stated dates, and is manifestly different from preferred stock redeemable upon call at any time _after_ a named date. In the latter case the option of redemption is with the company, whereas in the former case the company binds itself to a contract enforceable at a definitely stated time. From the financial standpoint the wisdom of a company binding itself to a contract enforceable some time in the future may be open to question because of the inability at the time of issue to foretell the company's condition at the time of redemption; although in this respect the condition is practically the same as that confronting a company at the time of a bond issue. There is this marked difference, however: A bond issue is always a liability and continues as such after maturity; but in the case of a stock redeemable at a given date, the point at issue is whether the failure of the company to redeem automatically changes the status of the owner of the stock from that of a proprietor to that of an outside creditor.

"For instance, a corporation sold $750,000 of first preferred stock, with a provision for the retirement of $150,000 annually after a certain period had elapsed. When the first instalment became due the corporation was unable to meet its obligation. There was no provision in the certificate bearing on the treatment of the overdue payment in the accounts or the balance sheets. The auditors declined to certify the balance sheet until a decision was reached as to whether or not the amount represented a liability to be liquidated as soon as funds were available. So long as this possibility existed the position of the general creditors was subject to change. Finally it was decided to secure an extension from all stockholders and upon satisfactory evidences thereof the auditors passed the balance sheet.

"No general rule can be laid down for the auditor's guidance in such cases as this, as each case must be decided on its merits. The most important facts for the auditor to ascertain are the rights of stockholders to insist upon payment, and the aggregates and due dates of all probable obligations. Their disposition in the accounts is then a matter of disclosing full information to creditors, prospective creditors, and to other stockholders."[51]

[51] Montgomery's "Auditing, Theory and Practice."

CHAPTER XXII

PROFITS

Difficulty of Determining Profits

What constitutes a profit is oftentimes a perplexing question and at all times its determination is more an estimate than an absolute fact. This arises from the nature of accounting itself in that so many items of expense are known to exist and must accordingly be provided for but the amount of such expenses cannot be exactly determined. This is seen to be true in the case of the provision which must be made for bad and doubtful accounts and for depreciation of fixed assets and is, of course, inherent in all problems of valuation. As is proverbially true of the prescriptions of different physicians for the same malady, so no two accountants would arrive at the same figure of profit for any given concern.

Economic Definition

It may be of some advantage at this point to attempt a definition of profits although to compress the meaning of the word within defined limits is hardly possible and for this reason the formulation of a working definition is very difficult. Etymologically, "profit" comes from the Latin word _proficere_, meaning to make progress, and a better definition than this would be difficult to find. At the best the term is an elusive one, being used with slightly different connotations in different schools of thought. Thus, we find the word used and defined in economics, law, and accountancy, and some of the definitions are twisted almost to the point of absurdity. Alfred Marshall,[52] the English economist, says: "If a person is engaged in business, he is sure to have to incur certain

outgoings for raw material, the hire of labour, etc. And, in that case, his true or net income is found by deducting from his gross income 'the outgoings that belong to its production.'" Charles S. Devas[53] says: "The income from production combining both labor and capital is profits." He defines gross income as "the total wealth added to the property of a given person in a given time from _whatever_ source ... and net income as gross income minus the following items: (a) Destruction, damage, or loss by fire or other accident, by violence, by thieves, by bad debtors. (b) Using up of materials in production, and wear and tear of machinery and industrial buildings such as factories or shops. (c) All sums spent on purchases of goods that are to serve the purchaser not as subjects of enjoyment, but as means of getting an income. (d) All sums spent on hire of goods that in like manner are to serve as means of getting an income. (e) All payments for labor that in like manner are to serve as means of getting an income." One wonders if Marshall's idea of incomings and outgoings is limited to a cash basis or if he recognizes accruals. On the other hand, from the point of view of accounting, Devas includes too much, as will be pointed out later. E. R. A. Seligman[54] says: "Profits are the income from business enterprise.... Profits are always a surplus. They are the difference between the cost of production or acquisition and the selling price." He summarizes expenses of production as including cost of raw materials, wages, rent, interest on capital borrowed or _invested_, taxes, and miscellaneous outlays such as insurance, advertisements, and transportation expense. Again, he says:[55] "Income is that which comes in to an individual above all necessary expenses of acquisition and which is available for his own consumption." He recognizes depreciation as a necessary expense.

[52] In "Principles of Economics."

[53] In "Political Economy."

[54] In "Principles of Economics."

[55] In "Income Tax."

All of this attests the statement made above that the formulation of a satisfactory working rule for the determination of net profits, from the business standpoint, is extremely difficult. It should be said, of course, that in some respects the idea of net profit as used in economics differs from that used in business; the chief difference being that interest on invested capital is in economics looked upon as an expense deduction before the determination of profits.

Legal Definition

The efforts of the law, as evidenced by court decisions, to mark out definitely the meaning of net profits have resulted in many odd twists of terms and meaning. In an English case[56] decided as recently as 1902, this language is used: "If it is a mere question what were the profits made in a particular year, it seems to me that the duty is to ascertain what cash has been received and what cash has been expended, and, if that is fairly done, you know the profits of the year. If there is a large outstanding liability which cannot be settled, the partners will estimate that, and it will not be considered as part of the profits. If there is a large outstanding possible loss, and there is a large sum due to a client, then you would provide for that. But in ascertaining what is really actually divisible for the year fairly, you would take the cash account as it stands." In the light of such mental obtuseness and obliquity, one cannot wonder at the occasional reluctance of business to entrust the determination of important matters to the courts.

In cheering contrast is a legal opinion quoted by R. H. Montgomery,[57] in the following: "I should think that no commercial man would doubt that this is the right course—that he must not calculate _net profits_ until he has provided for all the ordinary repairs and wear and tear occasioned by his business. That being so, it appears to me you can have no net profits unless this sum has been set aside.... If you had done what you ought to have done, that is, set aside every year the sum necessary to make good the wear and tear in that year, then in the following years you would have a sum sufficient to meet the extra cost." Even here confusion is apparent between a valuation reserve and a reserve which has been funded and the emphasis is rather on the point of providing funds necessary for the purpose—a financial problem as distinguished from an effort to define net profits.

[56] Badham v. Williams.

[57] In "Auditing, Theory and Practice."

Between these extremes of legal opinion and phraseology one finds all shades and degrees of understanding and misunderstanding. In recent years there is evident in the decisions of our higher courts and of our many excellent governmental commissions and bureaus a real appreciation of some of the technical points involved in profits determination. It is believed that a body of authoritative decisions will in time and perhaps soon reflect the best opinion of the business men of the country.

Accounting Definition

The purpose of this chapter is to discuss some of the points at issue in this vexed problem, but before entering upon this discussion it will be of advantage to quote from leading authorities on the attitude of accountants towards the determination of profits.

A. Lowes Dickinson[58] says: “In the widest possible view, profits may be stated as the realized increment in value of the whole amount invested in an undertaking; and, conversely, loss is the realized decrement. Inasmuch, however, as the ultimate realization of the original investment is from the nature of things deferred for a long period of years, during which partial realizations are continually taking place, it becomes necessary to fall back on estimates of value at certain definite periods, and to consider as profit and loss the estimated increase or decrease between any two such periods.” It is in the making of these estimates that the most difficult problems of profits determination are met.

[58] In “Accounting Practice and Procedure.”

Mr. Montgomery in his dictum, “The net profit of a business is the surplus remaining from the earnings after providing for all costs, expenses, and reserves for accrued or probable losses,” offers the best available working definition, although a caution is needed against the danger of relying exclusively upon any one definition.

Methods of Determining Profits

Systems of bookkeeping, in the main, provide two distinct methods for the determination of profits, namely, by means of single entry and double entry. The student is referred to the author’s first volume for the detailed working out of profits by single entry. Here it is sufficient to say that the determination of profits rests upon a comparison of assets and liabilities as at the beginning of a fiscal period, with those as at the end of the period. Then the increase or decrease in net worth as so determined, after making due allowances for any withdrawals or investments of capital during the period, constitutes the figure of net profit or loss for the period. The disadvantages and inaccuracies inherent in this method have already been pointed out.

The method of determining profits by means of double entry provides an entirely distinct set of accounts known as temporary proprietorship or profit and loss accounts. These record the daily changes in net worth and must be summarized through the Profit and Loss account at the close of the fiscal period, at which time they must prove against the profits as determined by the balance sheet, the method of which is essentially the single-entry method. In addition to this control secured by checking the results obtained by one group of accounts against those of another group, is the important advantage of presenting in the record a mass of statistical information for guidance in the conduct of a business, without which the present-day enterprise with its many complexities of organization and working could not hope for any certain measure of success.

The Problem a Question of Valuation

Inasmuch as every profit made must be reflected in a corresponding increase of some asset or the decrease of a liability, and, conversely, every expense incurred is reflected as a decrease of assets or increase of liabilities, it is apparent that profits determination is largely a question of the valuation of assets and liabilities and therefore rests upon the principles already established. Thus the amount of _gross_ profit is not determinable until the value of the stock of merchandise on hand is known. Gross profit rests on inventory valuation, whether that be accomplished by the perpetual inventory method or that of periodic stock-taking. While under the double-entry system the charges for expense are more or less fixed and certain and not so dependent on inventory, it has been seen in Chapters XIV and XIX that before accuracy can be secured, here too there must be an inventory or appraisal to determine the prepaid and accrued expense items. The basis for valuing these was indicated in the chapters referred to. Estimates of depreciation, bad debts, and other similar items must also be made to secure a proper appraisal of the corresponding asset items. Similarly, in the determination of other income, accruals and prepayments must be taken into account. In the making of the record of temporary proprietorship data, the fundamental distinction between capital and revenue charges is vital and must be kept constantly in view.

Thus the problem of profits is seen to be in its broader aspects the same problem of valuation to which attention has already been directed. It is purposed here to point out the application of the valuation problem to the periodic determination of profits and to re-examine some phases of the problem from the standpoint of profits as distinguished from that of assets.

Effect of Asset Losses on Future Profits

The first question for discussion may be stated as follows: In the determination of _periodic_ profits must all the data which have affected proprietorship during that period be summarized in order to make a proper showing of profits for the period? An illustration will better present the issue. A manufacturing concern with plants in many places suffers a heavy loss from fire. Must this loss be considered (1) as an expense applicable to the current period and to be taken account of before the determination of profits for the period; or (2) may it be treated as a deferred expense to be shared by several succeeding periods; or (3) may it be charged directly against capital?

Three somewhat different solutions are thus presented. The first treats the loss as a _temporary_ proprietorship charge; the second as a deferred charge to operation and so includes the portion deferred among the assets and to this extent does not reflect the loss as a diminution of net worth; and the third treats the loss as a charge against _vested_ proprietorship.

Any adequate treatment of the question requires a consideration of (1) the type of business organization, i.e., single proprietorship, partnership, or corporation; (2) the appropriation of profits, whether they are to be withdrawn or reinvested in the business; and (3) the nature of the loss, as to whether fixed or current assets were affected. The practical aspect of the problem is the adoption of a policy not in contravention with the law, and in the determination of this phase of the subject there are some court decisions none of which, however, seem entirely trustworthy.

It must be borne in mind that in the types of organization known as single proprietorship and partnership, there is little legal restriction in their formation and operation. The law presumes that the full liability of the owner or owners offers sufficient protection to creditors. Hence the withdrawal of profits or capital is not safeguarded in any way in the interest of creditors. With the corporation, however, provision is specific that nothing shall be returned to the stockholder except profits so long as the business continues in operation. Exception here is usually made for those concerns operating assets which are subject to depletion, in which case it has been held that dividends may include a return of the depleted portion. The theory of the law is that, except as just indicated, the capital of a corporation is an _indication_ to creditors of the amount by which the assets may suffer shrinkage and their claims still be protected in full. Hence, the return of capital in the form of dividends is not allowed, as that would impair the margin of safety for creditors.

From the practical standpoint, therefore, the problem concerns only the corporate form of organization and that only in its relation to dividend payments. So long as the profits are reinvested in the business, neither creditors nor owners have any cause for action, except in case of fraud.

Legal Decisions as to Asset Losses

In decisions relating to this question of asset losses, the courts have seen fit to make a distinction between what they term fixed and circulating capital, corresponding in the main to the fixed and current classification of assets for the balance sheet. In the leading English case,[59] it was held that a trust company holding stock, which during the last business year paid 50 per cent dividend but which before the end of the year became utterly worthless, may include the 50 per cent in its yearly profit, without deducting a penny for the depreciation of the property from which this profit was derived. In the language of the court Lord Justice Lindley said: “Fixed capital may be sunk and lost and yet the excess of current receipts over current payments may be divided. But floating or circulating capital must be kept up, as otherwise it will enter into and form part of such excess (seeing that circulating capital, with the particulars of its purchase and sale, must appear in revenue account), in which case to divide such excess without deducting the capital which forms part of it will be contrary to law.”

[59] Verner v. General and Commercial Investment Trust, Limited, 2 Ch. 239 (1894).

The stock held by the trust company was for permanent investment and therefore in the nature of a fixed asset. The language of the court is quite specific and there would seem to be no _need_ for including all or any portion of the loss in the current statement of profit and loss. Other later decisions have somewhat extended the doctrine so that it has been held that the current profits may be determined without making any provision for a loss, even of circulating capital, occurring in a _previous_ year. Thus it would seem that so far as the _legality_ of profits determination is concerned, each fiscal period may be counted as entirely free from liability for the happenings in other periods—a unit of business history distinct from all other units. These decisions are English cases and have not always been followed in this country. For a statement of the prevailing opinion in this country, see page 443 of Chapter XXIV, “Dividends.” The danger of the position is apparent. In the hands of unscrupulous managers the profit and loss might be so manipulated that alternate years would always show profits in spite of the fact that the company’s capital was constantly being depleted.

Loss Charged against Current Profits

In stating the question on page 393, three alternatives were presented by way of solution. The first of these suggested that the entire loss be treated as a charge against the profits of the current period. It has been seen that there is no support in law for this method of handling the loss, nor is there any need or justification for it from the standpoint of correct accounting theory. Only such losses as occur more or less regularly and which within the experience of the business can be fairly accurately estimated, are proper charges to the current period. It is not the function of the periodic profit and loss statement to reflect charges covering contingencies which with almost equal certainty may or may not materialize.

Loss Treated as Deferred Expense Charge

The second solution suggested, viz., that the loss be treated as a deferred expense to be shared by several succeeding periods, has much to commend it and little to condemn it, except a possible lack of business foresight as will be evident when the third solution is examined. It may be argued, and with a good show of reason, that such losses are so infrequent, occurring perhaps only once or twice in the life of any business, as to make it unfair as between periods to burden some with a charge of this sort and not all. For comparative purposes, the spreading of the loss over several periods will tend to obscure the true state of operations for those periods, although that is largely a matter of the way in which results are presented. The situation is relentless, however. If it is desired to recoup the loss in order not to show an impairment of capital, the loss must be charged in its entirety or piecemeal against profits. If there are no accumulated profits against which it can be charged in its entirety, it must be charged piecemeal against current profits.

Loss Charged to Capital

The third solution suggested that the charge be made directly against capital. Without the limitation as to the policy of recouping the loss mentioned above, this solution may take two somewhat different directions. If a surplus has been accumulated out of previous profits, such surplus constitutes a part of the capital and provides the logical place for setting up the charge. If no surplus is available, the loss must be charged against the capital stock, thus constituting an impairment of it. In either case, the results of the current period's operation are not affected, except in so far as a diminution of the assets may have made necessary a curtailment of operation. Of course, the charge against the capital stock, whether made direct to the account or carried in a separate account, does not automatically bring about a reduction of the capital stock; that can be accomplished only by legal process and is often shunned because of the difficulties incident thereto and also because of a possible reflection on the concern's credit occasioned thereby. The charge does indicate a reduction in the value of the shares outstanding. Since there is no compulsion in law and there may be no need from a business standpoint that the loss be recouped, undoubtedly this third method offers the best solution both practically and theoretically.

That this is so is brought out clearly by H. R. Hatfield's almost classic illustration:[60] "An individual's entire income is derived from ten houses each worth $10,000 and each yielding 10 per cent net income. If two of these houses burn down, uninsured, the common sense view is that the proprietor's income is thereby cut down from $10,000 to $8,000 per annum, and that coincidentally, there is a loss of capital of $20,000. It never occurs to him that he must consider his income as entirely cut off for two years until the principal can be restored. Similarly it might be an act of cruelty to dependent stockholders to stop dividends entirely until an exceptional loss is reimbursed. The main difficulty is that in a corporation such an occurrence really calls for a reduction of the nominal capital, a cancellation of part of the capital stock.... The criticism properly to be made is not so much that dividends are paid before restoring the capital ... but rather that the capital stock has not been reduced to correspond with the amount of remaining assets, before the dividend is paid."

[60] In "Modern Accounting."

It should be stated that this criticism is of little real weight if the balance sheet shows the true condition of the business. Carrying the loss as a part of the assets, particularly if clothed with a title the meaning of which even a code expert could but lamely guess at, is to be condemned. If, however, the title clearly indicates the nature of the item, the situation is not so bad, although it does reflect the slavery to form which compels some very well-meaning individuals to show impairment of capital on the asset side of the balance sheet for the sake of making it _balance_. The best practice compels the showing of impairment items as direct deductions from capital. The carrying value of the asset destroyed must, of course, be reduced to accord with the facts of present value, and, if there is no surplus available, the amount of the loss should be shown as a deduction from the capital stock outstanding,

short-extended, with the present capital full-extended, somewhat as follows:

Capital Stock Outstanding $1,000,000.00 Fire and Earthquake Loss resulting in impairment $250,000.00 ---------- Net Capital available for the business $750,000.00

Profit on Work in Progress

A second problem to be solved in the determination of profits is concerned with the allowance or non-allowance of profit on work in progress but not completed. Most manufacturing and contracting concerns have at all times a more or less constant volume of work in various stages of completion. At the close of the fiscal period when results are summarized, the proper treatment of this uncompleted work is an important matter. The general principles governing the valuation of this work were discussed in Chapter XIII where it was pointed out that in the main conservative business policy demands that work in progress be included in the inventory at full cost, which is to include both prime cost and an equitable share of burden accrued to date. Manifestly this principle precludes the taking of any profit, the theory being that there is no profit until goods are sold. A full discussion of the subject requires separate consideration of work which is being done on order or contract and work for the concern's own stock-in-trade, due weight being given always as to whether the unit of work is large or small.

Goods Made for Stock but not Sold

The general principle mentioned above must usually be applied to the valuation of the concern's own stock-in-trade in process of manufacture. Here sales are being made constantly from finished stock and manufacture replenishes the stock. But the essential step before profits can be claimed, viz., making the sale, usually comes after the process of manufacture and not before. It may sometimes happen that stock is sold out ahead of its manufacture, because the factory is not able to keep up with sales. It is not intended here to include the case in which it is the custom of the trade to sell goods in advance of their manufacture and regulate the operation of the factory to turning out the advance orders booked. This will be considered later. The discussion here concerns those firms which usually keep their finished stock well ahead of sales but because of the exigencies of the market find themselves behind their sales. Such a situation is sometimes called a sellers' market. If purchasers contract for goods with full knowledge of factory conditions, such sales are in the nature of work on contract and might in unusual instances be so treated. Usually, however, conservative management requires that no profits be taken under such circumstances.

Goods Made to Order

Where the factory works only on order, conditions as to profit-taking are somewhat changed. Here, the sale has already been made for delivery of the product at some future time, named or left indefinite. While, of course, cancellation of the order is always possible before date of delivery and acceptance, inasmuch as here we have under consideration a special product made to individual specifications and not a stock or standardized article, cancellation of the contract is not probable without incurrence of damages or even being held to specific performance. Under these circumstances it is apparent that, within reasonable limits, a portion of the profit may be taken up in the current period, which has, of course, done a portion of the work and therefore earned a portion of the profit, if there is one. This last contingency is, of course, the crux of the whole problem. If a portion of the profit is taken, this necessitates a predetermination of profit on the whole contract, an estimate of the portion of the contract completed, and adequate provision for unforeseen difficulties in completing the work. Where conditions are such that these things can be done with any degree of certainty, there is not only no objection to taking up a portion of the profit for the current period, but it is the only way in which profits may be allocated to the period earning them and so stabilized somewhat as between periods. As has been said already a number of times, the summary of results at the close of regular periods is in many cases based on _estimate_, which in the final analysis is merely the expression of an opinion. If the estimates are made with due care, in the light of all available information and probable contingencies, and without intent to deceive or defraud, more than that cannot be asked of any concern.

The practical application of this principle requires consideration. In some few cases the volume of product passing through the factory will be fairly constant as between periods. Where this is so—and frequent tests should be made to establish it—it would be a useless expenditure of effort to make the estimates necessary for determining profits on uncompleted work. The same situation is met with also in concerns where the unit of work is small. Here the effort, entailed in making the estimate is more than offset by any advantage gained thereby. If the product is somewhat standardized, it may be possible as a result of past experience to make a rough estimate on the basis of the _volume_ of work in progress instead of by means of an examination of the conditions of each contract. Such a policy is fraught with many pitfalls and, as a usual thing, does not commend itself to conservative management;

speculative conditions are too many.

Profits on Long-Term Contracts

Where the unit of work is large, conditions are somewhat different, however. The necessary estimates are not based on so many uncertainties, and, oftentimes, financial considerations and an equitable treatment of stockholders demand the determination of profits on work in progress. Thus, one contract extending over a number of years may occupy the entire attention and facilities of a concern. To withhold profits if earned, until the completion of the contract might work a real injustice. Such contracts are usually financed by means of periodic payments on account, based on a careful estimate by the supervising engineer or architect of the portion completed on such dates. As these estimates are sufficiently accurate on which to base payment of contract price, they can be allowed to serve as the basis for a determination of profits after liberal reserves for contingencies are made.

The nature and terms of the contract itself will usually indicate the method of estimating the profit. If the price agreed upon is for the contract as a whole, then extraordinary care must be exercised in estimating the portion completed and almost a seer's prevision of the requirements to complete is needed. If, on the other hand, the contract is broken into smaller units on which price is based and there is no guarantee as to the number of units in the contract, profit may be taken on the number of units completed. Thus, a contract calling for excavation of earth or other material may be taken at a named price per cubic yard. The building of a canal, the driving of a tunnel, the construction of a dam and reservoir, are frequently handled on this or a similar basis. So, also, the use of a concern's equipment and organization on a per diem basis. Under these conditions each fiscal period can safely take its profits or losses with little regard for the uncompleted portion of the work. Contracts taken on a so-called "cost plus" basis, i.e., at cost plus a definitely agreed upon per cent of profit, may have their profits determined without consideration of the uncompleted portion.

Profit on Goods Awaiting Delivery

Similar to the problem of profits on work in progress is that of profits on goods awaiting delivery. The goods have been sold, are completed, and may even be prepared for shipment. All that remains is delivery and that cannot be effected until the date agreed upon. In some lines of trade this method of sale is a time-honored and even necessary custom. The practice is found in some kinds of clothing industries, woolen manufactures, farm implements, etc. Here because the product is a standard product, cancellations take place and are usually allowed right up to, and in some instances beyond, the date of shipment. Because of this trade practice, profits should never be taken until delivery has been effected. To a similar or even greater extent than with work in progress, costs and expenses are under this principle incurred and charged in one period and the profit is taken in another period which is not thus charged with the cost of getting the income.

Two methods of handling the difficulty are met. The one operates on the expectation that the volume of such orders awaiting delivery is fairly constant as between periods; hence, the income from goods of this sort delivered during the current period is charged with the costs and expenses of goods to be delivered in future periods. This is the rule-of-thumb method to be used where accurate allocation of costs is neither necessary nor justified by results.

The other and more accurate method consists of deferring the costs and expenses properly applicable to the deferred income. But the difficulty of determining just what expenses are so applicable often causes this method to break down, giving less accurate and dependable results than the first. The roseate optimism of the average proprietor or manager as to his own business almost always results in a too liberal estimate of the portion of expense to be applied against the deferred income. In treating this problem of profits in connection with contracts and the length of the cost period (Chapter XIII), the principle was stated that such goods should be included in the inventory at cost. This results in deferring the main item of cost, but omitting the further costs of selling and administration which belong to all sales effort made and to the progress of the order up to the point of delivery. While theoretically these should be deferred, practically the estimate of the amount to be deferred should lean on the side of too little rather than too much. Where, as stated above, the volume of this kind of trade is fairly constant, the rule-of-thumb method first stated gives more satisfactory and safer results.

Interdepartment Profits

The problem of interdepartment profits was stated and discussed briefly in Chapter XIII, page 233, and will later be treated in another connection (see page 607 following). Here, it may be repeated that while such profits are not to be allowed because they are not yet realized, they may, under exceptional circumstances, be estimated and shown if offset by reserves of an exactly equal amount.

Profits Due to Appreciation of Assets

The problem of profits due to appreciation of assets, both fixed and current, has also been handled in the chapters on valuing the various assets. All that need be said here is that such profits are not realized until the asset is sold. While for purposes of credit it may be wise and proper to show the true valuation of the assets, for the purpose of profits, particularly profits available for dividends, such appreciation in values must not be taken into account. It should be remembered that appreciating the value of fixed assets frequently results in the necessity of meeting higher depreciation charges and is thus not an unalloyed gain. The payment of dividends based on such profits would, without taking profits from other sources into consideration, always result in the diminution of the fund of working capital.

Capital Profits

There remains a final problem, viz., that of capital profits, which is more a question of their disposition than determination. When any of the fixed assets are sold, the profits, if any, are classed as capital profits. These are as legitimate as those arising from sale of stock-in-trade or other source, and belong to the owners. The question of their disposition hinges mostly on practical considerations. If the sale is for cash, funds are available for distribution without encroaching upon the working capital. If not for cash, payment of dividends based on such profits might seriously diminish working capital. The question as to whether capital profits should ever be distributed is, of course, a mooted one. Many well-known cases of such distribution—the so-called cutting of juicy melons—are on record. Conditions seem to justify their payment at times, and under other equally impelling conditions distribution of them should not be made. As a general policy it is always safe to set aside such profits in a special reserve to be used to care for capital losses. If the company is well provided with such reserves beyond any reasonable doubt, it is oftentimes unwise and unjust to withhold their distribution. Of a similar nature and to be handled under like considerations are the profits arising from sale of capital stock at a premium, the reissue of forfeited stock, etc.

In concluding this subject no better summarization of the accounting principles and practical considerations to govern in the determination of profits can be given than the following from A. Lowes Dickinson:[61]

[61] In “Accounting Practice and Procedure.”

“1. All waste, both of fixed and circulating assets, incident to the process of earning profits by the conversion of circulating assets must be made good out of the profits earned.

2. Profits realized on sales of fixed assets should be first applied to make good estimated depreciation (if any) in other fixed assets not resulting from the ordinary conduct of the business. If there is no such depreciation, such profits may be distributed as dividends, but should be distinguished from the operating profits.

3. A sufficient surplus should be accumulated (in addition to the provisions required to maintain wasting capital assets) for the purpose of making good losses due to shrinkage in values of fixed assets arising from causes other than the ordinary operations of the company. This provision must, however, be considered more a question of policy than a requirement of sound accounting.”

CHAPTER XXIII

SURPLUS AND RESERVES

Definition

Under the corporate form of organization, “surplus” in its broadest sense represents the difference between the net worth of the business and the capital stock issued and outstanding. Because of the legal requirement that the value of the capital stock be shown always at the original amount—which is usually par—any increments or decrements in value because of profits or losses made and reinvested in the enterprise must be shown under separate heads. Thus surplus—or deficit—is the general term to indicate this increase in value. In England the term “rest” is used in almost this same sense. “Margin” is also a title occasionally seen.

Because of a much narrower technical meaning given to surplus, the general adoption of another term with the broader connotation above given would serve a really useful purpose. Of the titles in use, margin seems best to express the exact shade of meaning. In the interest of a standard terminology, the highest accounting authorities are coming to restrict surplus to that portion of the margin

available for dividends and in that sense the word will be used in this chapter. Contrary uses of the word are frequently met. In banking institutions the surplus is almost as inviolable as the capital stock itself and is never used for dividend purposes. In government-controlled or supervised institutions, these special uses of the term have become too well established by law and custom ever to hope for a change in the interest of general uniformity.

Creation of Margin

The sources of the margin have for the most part been already indicated. The chief source is the net profit for the period as determined by the Profit and Loss account balance. What enters into that balance has been discussed in Chapter XXII, where it was also pointed out that under some circumstances it may be entirely legitimate to carry some temporary proprietorship items directly to a vested proprietorship account instead of by way of the summary account. Thus there may be other sources of margin than the current balance of Profit and Loss—extraordinary items whose inclusion with current summaries of operation would render those summaries useless as a guide for judging comparative results of various periods.

Capital Stock Premiums. Sometimes, for the purpose of creating a margin at the inception of an enterprise a fund is contributed beyond the par value of the capital stock issued. This is accomplished by purchase of the stock at a premium, and is frequently seen in banking institutions, where it serves as an easy and speedy way to satisfy the law's requirements for the accumulation of a "surplus." The effect of this is to give the institution a better standing than it would otherwise have. The reduction of the capital stock outstanding without full recompense to the stockholder also results in the creation of margin. This is often done in reorganizations when fewer shares of the new stock are given than were held of the old. The effect, then, is to set up a book profit against which may be charged the existing deficit, and so secure a balance between the real net worth and the par of the new stock issue.

Stock Donation. Another source of margin is a stock donation. This may result in only a book profit. It is exceedingly difficult and generally impossible to determine the true value of many speculative ventures, such as mining enterprises. As a general rule, capitalization based on opinion is usually overcapitalization. While a stock donation may have no relation to real values and is merely a method of securing working capital, its effect when the stock is sold is to increase the cash asset and show a profit of an equal amount. Some authorities hold that instead of retaining the profit on the books, the logical thing is to reduce the carrying values of the speculative assets by the amount of the realized profit on stock donation. There would be more reason for this treatment were there any real relationship between the amount of the stock donation and the overvaluation of the assets. Since usually there is none and the whole undertaking is speculative, there is no valid objection to showing the realized profit, as the public is sufficiently warned by the nature of the enterprise. All stock donation is not of this sort, however. Occasionally a very real profit results which should be treated as a margin item.

Stock Assessments, etc. Similar to a stock donation is a stock assessment. In cases of reorganization or of impending bankruptcy, a pro rata assessment is levied on the outstanding shares. Being a donation, it constitutes a proprietorship increase item and becomes a part of the margin. This method is frequently used for the purpose of wiping out a deficit, an impairment of capital, and is, of course, a _real_ profit as distinguished from a _book_ profit. Similarly, additional payments made by common shareholders to convert their holdings into preferred shares are a realized profit and should be recorded as part of the margin.

Capital Profits and Bonuses. Capital profits, as discussed in Chapter XXII, have their proper place of record direct into some margin account rather than by way of the current Profit and Loss. Donations from the outside, such as factory sites and other bonuses, sometimes given to induce enterprises to locate in certain places, must also be treated as entries direct to a margin account. These and other like items constitute the chief sources of the margin.

Disposition of Profits

The statement of profit and loss carries the summary of operations to the point of showing a net profit or a loss for the period. The next step for consideration is the disposition made of these profits. This is sometimes spoken of as the appropriation of profits. Two practices are met at this point. Under the one, appropriation is made directly from Profit and Loss for all desired purposes. Any unappropriated balance goes into Surplus account, which will represent the balance of profits available for dividends but not used. Under the other, the Profit and Loss balance is transferred to Surplus out of which all appropriations are made, the residue remaining therein showing the same condition as under the first method. Where this second method is followed—and it is more prevalent than the first—a statement of surplus is needed for full information of the period's transactions, thus providing a connecting link between the statement of profit and loss and the balance sheet. The form of this statement is given on page 426.

Reserves

From the point of view of the stockholder's immediate interest, the appropriation of profits for dividends is his chief concern. Other and equally vital and urgent uses are found for profits in any well-managed concern with an expanding outlook towards the future. The appropriations of these profits to definite uses are very generally carried under the title of reserves with suitable descriptive phrases. Thus we may have a Sinking Fund Reserve, an Insurance Reserve, a Building Fund Reserve. Sometimes these are called "reserve funds" but the demands of an accurate nomenclature limit the use of "fund" to an asset account. The title "undivided profits" is also met. Where careful differentiation is made, "surplus" should be used to denote profits available for dividends; "reserve," for profits set aside for a specific purpose; and "undivided profits," for those on which no definite action has been taken.

Different Meanings of Reserve

Because of the loose way in which the term reserve is used by the layman and its different uses by the professional accountant, an examination of these uses will be made at this point. As a distinctive banking term, "reserve" is used to indicate the amount of cash and cash items on hand and on deposit which under the law may be counted as a cash reserve fund held against deposits and note issues. This use of "reserve" is limited strictly to financial institutions.

We find also various so-called reserves shown on the commercial balance sheet, both among the liabilities and the assets. As deductions from the assets are the various depreciation reserves and reserves for bad and doubtful accounts and notes receivable. These items are "offsets" to the carrying values of the assets in order to effect a true valuation of them. For reasons previously set forth, these offsets are carried in accounts separate from their corresponding assets. Thus they are in the nature of suspended credits to asset accounts and, if properly estimated, are in no sense related to profits; nor have they any of the elements of profits or proprietorship in them. It is unfortunate that there is lacking an adequate title, other than reserve, for this group of items. The terms "allowance" and "estimate" have been suggested, but so far have not found general favor. This group of reserves are called valuation reserves.

Reserve for Bad Debts

A fine distinction is sometimes drawn between the reserve for depreciation and the reserve for doubtful accounts, on the ground that at the time of the creation of the reserve in the one case, the depreciation is an accomplished fact, all that is then required being a fair estimate of it; whereas in the other case no _particular_ account is known to be uncollectible, business experience teaching, however, that in the aggregate there will be some loss from this source. The purpose of this reserve is to bring about as on a given date an appraisal of the claims against customers in the light of past experience, and so apply the expense due to this cause to the period in which the sale transaction took place. This purpose is not always accurately accomplished but the estimate at the close of each period does effect an equalizing of the bad debts expense from year to year. This distinction makes the reserve for doubtful accounts closely approximate to a contingent reserve, as will be seen later. It seems best, however, to hold to the original classification and include the bad debts reserve with the other valuation reserves.

Under-and Over-Estimate of Reserves

Inasmuch as these reserves must from the nature of things always be estimates, the probability exists of an under-or over-estimate. It is apparent that an under-estimate effects an inflation of profits due to an overvaluation of the assets. Equally apparent is it that an over-estimate brings about an understatement of profits due to an undervaluation of the assets. The effect of this is to make the valuation reserve account a mixed account. Instead of its content being solely a suspended credit to an asset, it includes also a true reserve of profits. If at any time the facts indicate a too liberal or too parsimonious estimate in the past, adjustment should be made to accord with the newly determined facts of experience. An immediate adjustment is usually preferable to a gradual one effected by an allowance below or above the new basis determined for the estimate.

Depletion Reserves

Similar to the depreciation reserve is the depletion reserve. On the basis of the value at which the wasting or depleting asset was originally brought upon the books, a periodic estimate of the portion used up in operation is necessary to show the true present value of the asset. Thus, timber and mining properties require for their periodic appraisal an estimate of the extent of exhaustion of the natural product. This is neither required by law nor always by business policy. But when the estimate is made it is in the nature of a valuation reserve and will be so classed here.

Operating Reserves for Accrued Costs

Another group of items, frequently carried under the title reserves, includes estimates of expenses the exact amount of which is not known at the time of closing the books, and sometimes those of which the exact amount is known but which are unpaid as on that date. Among the first are such items as taxes, sales discounts, and the like. Among the second are wages, salaries, rents, etc., accrued. These two classes are together sometimes called “operating reserves.”

There is some difference of opinion with regard to the proper allocation of taxes and estimated sales discounts. Inasmuch as taxes are not usually determined, or at least payable, during the period covered by them, there is a temptation to defer their incidence to a later period. If the taxes become a claim of the state against the property as on a given date, certainly they should be treated as applicable to the period covered by the claim even though the amount of them cannot with accuracy be determined.

With regard to sales discount, the situation is somewhat analogous. At the close of any fiscal period, some of the open claims against customers are by the sales contract subject to discount, and experience proves that some of these discounts will be taken advantage of. Here also, difference of opinion prevails as to the proper allocation of the expense. Should the period in which the sale is made suffer the loss, or should it be charged to the one in which the discount is taken? If sales discount is looked upon either as a direct deduction from sales or as a selling expense, certainly it should be charged to the period making the sale. On the other hand, if it is regarded as an item of financial management, a means of securing ready funds, it is sometimes argued (though this is not the usual point of view) that the period enjoying the benefit should also be charged with the expense of securing the benefit. Against this argument it may be pointed out that the current period carrying the customers’ accounts which are subject to discount fails to show its liability, based on the sales agreement, to accept something less than the face amount of the claims. A balance sheet in which no suitable provision is made therefor is one which does not reflect the true status of all items, and to that extent is not a good balance sheet. Provision should be made not only for those expenses which are known to have been incurred and which remain unpaid, but also for those which the statistics of experience show will have to be met. Conservative practice, therefore, requires the inclusion of this estimate and applies it as an expense of the period in which the originating transaction took place. All the costs of the contract entered into, of which expected sales discount is one, are made to apply to the period giving rise to the contract.

Collection Costs not under Contract

The above argument is occasionally made use of in support of the inclusion of expected collection costs on claims against customers outstanding at the close of a period. From a theoretical aspect the point may be argued, but, unlike the item of sales discount, these are not costs which the concern is liable for _under contract_. From a practical standpoint, except under very unusual conditions, it is an undesirable refinement of the principle of allocation of costs as between periods. Where a collection department is maintained, costs of collection are practically uniform from period to period and are best considered as expenses of the period in which the cost is incurred.

Sales Discounts on the Balance Sheet

As to the manner of showing expected sales discounts on the balance sheet, practice is not uniform. It is sometimes shown added to the reserve for doubtful accounts and the sum of the two deducted from claims against customers, indicating thus the amount which it is expected can be realized therefrom. Others show it among the liabilities, on the ground that it differs from the estimate for bad debts in that it is an expense for which the concern has made itself liable under its sales contract. The distinction is finely drawn but probably well taken.

Distinction between Reserves and Accrued Items

The use of the title reserve for some of the items included as operating reserves is unfortunate and leads to confusion both in terminology and in understanding. Why unpaid expenses of any kind should be called reserves for expenses when the amount of them is definitely known has never been satisfactorily explained; yet the practice is sometimes met. There is some excuse in the case of expense items the amount of which cannot be definitely determined either from the nature of the item itself or other conditions over which the concern has no control. Thus, “Reserve for Wages” is usually a misnomer, the title “Wages Accrued” showing the item correctly; but “Reserve for Taxes,” while just as true a liability as the other item, may be justified on the ground that the latter is only an estimate subject to correction when the exact amount is known, whereas the former is already definitely

known.

Contingent Reserves

So-called contingent reserves are sometimes handled as a part of this group, although best classified by themselves. A contingent reserve is one which represents an effort to provide for certain contingencies, such as guarantees on work done or products sold, lawsuits pending adjudication, etc. As R. H. Montgomery[62] so pertinently says: “the reserve should be based on evidence more tangible than a mere desire to be conservative. A vague feeling that something might have been overlooked which would decrease the assets or increase the liabilities is not the proper subject for a reserve. Conservative management ‘reserves’ part of its surplus for such contingencies, but it appears as surplus and not as a liability.” As mentioned above, sometimes the reserve for bad debts is classed as a contingent reserve. Contingency is inherent in the item but the certainty of its occurrence cannot be reasoned away. The use of contingent reserves may therefore well be limited to provision against contingent liabilities. In other words, they represent the best available estimate of the amount of such liabilities. To draw a dividing line between operating and contingent reserves is extremely difficult; both are created by charges to various expense accounts. It is merely a matter of degree as to the certainty of the events’ happening for which provision is being made. On the border line between the two are such items as reserves for insurance where the concern carries its own insurance and must make a periodic expense charge in lieu of the usual premiums; reserves for pensions where a pension policy is in effect, the charge creating it being here viewed as a part of the wages expense—the share of wages to be paid in the future which must be borne by the current period; reserves for sick benefits, which are in all respects similar to pension reserves; and so on. In some cases reserves for supersession of patents, or other assets whose length of service life is dependent on extreme contingency, are classed with this group.

[62] In “Auditing, Theory and Practice.”

Deferred Income—Misuse of Term

Deferred income is sometimes classed as a reserve. Thus, insurance companies carry the portion of their unearned premiums as on a given date, as a reserve. The use of the title is well established in that connection and the nature of the items is well understood. On commercial balance sheets where no outside authority can give a definite meaning to the term, its use for deferred income is to be deprecated and discouraged. Deferred income is a liability and not a reserve; the current period has not rendered the service to earn the income and is liable to the period in which the service is rendered.

Proprietorship Reserves

This disposes of all the asset and liability reserves and leaves for consideration the true profits or proprietorship reserves. As between these two main classes of reserves, as their titles indicate, the proper allocation of the one is among the assets or liabilities, while the other must be shown as a part of the net worth of the corporation. As to the nature of proprietorship reserves little more need be said. There are just two classes of items met here, viz., those shown as such openly on the balance sheet and those which are hidden or secret, latent among the various other items on the balance sheet. Proprietorship reserves represent profits reinvested in the business. Any profits, operating or capital, not paid out as dividends give rise to proprietorship reserves.

Secret Reserves

So-called secret reserves are brought about in various ways. Their creation may be intentional or accidental, but their source is the same in either case. Reserves of profits may be hidden either by undervaluation of the assets or overvaluation of the liabilities. Undervaluation of the assets may point to an ultra-conservative policy of management. Thus, some concerns write off the value of their fixed equipment of various kinds as rapidly as the net profits can absorb it and still leave sufficient for a reasonable dividend. Financial institutions in this way carry their furniture and fixtures and sometimes even banking houses, at ridiculously low figures or do not show them at all.

Undervaluations are accomplished in various ways. Charging an excessive rate of depreciation; making unnecessarily large reserves for uncollectible accounts, sales discounts, etc.; showing a more rapid depletion of natural assets than justified by the amounts used; charging the sums spent for assets to an operating expense; setting up an excessive cost of goods sold by means of inventory valuations of stock-in-trade at a figure lower than cost or market; crediting items of income to asset accounts instead of to income accounts, such as rentals on properties owned; crediting interest and dividends received to the stocks and bonds accounts—all of these serve the purpose of creating hidden reserves by means of a misstatement of fact.

Items wrongfully included among the liabilities bring about the same result. Here, however, the procedure is somewhat more patent because the creditors themselves check up on all actual liabilities. Liabilities can be settled only by an actual reduction of assets. Manipulation of the operating and contingent reserves explained above offers, however, an easy means of overvaluing the liabilities. A too liberal estimate of the amounts of these reserves makes them represent in part true proprietorship reserves but the proprietorship element in them is obscured by their title and their inclusion among the liabilities on the balance sheet.

It is, of course, apparent that no balance sheet containing secret reserves is a true statement of condition and the practice of creating secret reserves must usually—perhaps always—be condemned.

Argument for Secret Reserve

In justification of the secret reserve, it is sometimes said that in certain lines of business where the maintenance of unquestioned credit or the promotion of a stability ordinarily lacking in speculative enterprises is highly desirable, there is a very pressing need for the secret reserve. Through its use, extraordinary losses, which otherwise would result in very unfavorable fluctuations of stock values, may be absorbed by means of a charge to some undervalued asset and so bring it to its true value; or by a charge against an over-estimated liability reserve and so bring it to a true showing. This frees the current profit and loss from the charge, maintains a regularity of net profits, and prevents the disasters sometimes attendant upon violent fluctuations of stock values brought about by the knowledge of these extraordinary losses. That is the strongest case which can be made out in favor of the secret reserve.

Argument against Secret Reserve

The fact, however, must not be overlooked that without any understatement or misrepresentation of property values at any time there could just as easily be created an open “surplus” or margin of an amount equal to the secret reserve, against which these losses could as well be charged. The creation of such a margin can be justified on the same grounds on which the justification of the secret reserve is attempted, viz., the maintenance of high credit and stability. The reduction of the margin through its absorption of the loss would, of course, be somewhat more patent than the reappearance of values previously written off, although analysis of a balance sheet will invariably bring the true state of affairs to light. Furthermore, present stockholders, and certainly prospective investors and creditors, have a right to know the true condition of affairs. The appearance of a large proprietorship in addition to capital stock, revealed by a sizable margin, gives the stock a value in addition to that based solely on the dividend rate. A stockholder has a right to his share of the profits during the period of his ownership. If it is not received in the form of dividends, he should at least be partially recompensed when he disposes of his holdings, by an increased price for the stock as reflected by the portion of profits reinvested in the business.

The attitude occasionally taken that directors know best what information as to true condition of affairs should be given to the owners and what should be withheld, should, in these days of increasing publicity, be given no serious consideration. In the hands of unscrupulous directors, the secret reserve is an instrument for the covering up of questionable and even fraudulent practices. Stock values can be intentionally hammered down by a false showing of profits and so inure to the benefit of a group of prospective purchasers desiring to “freeze out” unsuspecting stockholders. All in all, therefore, little can be said in justification, but much in condemnation, of the practice of accumulating secret reserves.

Earmarking of Reserves

According to the definition of surplus laid down in the beginning of this chapter, limiting the term strictly to the profits available for dividends, those profits which are applied to reinvestment for specific purposes must be separated from the “surplus” and given distinguishing marks to indicate their purpose. Thus, profits reserved for the purpose of acquiring a fund of assets out of which to pay off debt obligations maturing in the future may be set aside under the title “Sinking Fund Reserve”; those set aside for the purpose of extension of plant as “Building Fund Reserve”; those for the purpose of providing a pension fund as “Pension Fund Reserve”; and so on. This is sometimes called “earmarking” the reserve.

Separation into differently named reserves serves no other purpose, however; it does not in any way insure the inviolability of the reserve; it acts merely as evidence of the intention and purpose of the board of directors which authorized the application of profits to that purpose. It is the expression of a business policy and as such is, without other compelling force, subject to the approval and continuance or to the disapproval and nullification of any subsequent board. These reserves are profits and as such belong to the shareholders and may be distributed among them as dividends. A reasonably conservative policy as to reserves usually has the

support of stockholders, and a subsequent board will not risk loss of position and standing with the stockholders by a change of policy as to reserves without good and sufficient reasons for doing so.

Continuity of Reserve Policy

Effort is sometimes made to secure continuity of the reserve policy. This may be accomplished in several ways. Oftentimes it is made compulsory by outside regulatory authority, as in the case of national banks which are required to set aside annually a certain part of their profits until these have accumulated to an amount equal to 20% of their capital stock. Similar conservatism can also be compelled by contract entered into with creditors. It is a frequent provision of the trust agreement covering an issue of bonds that “there shall be set aside out of profits” a certain amount at the close of each fiscal period for the purpose of creating a fund with which to redeem the bond issue when it falls due. The funds may be placed in the hands of a trustee, which guarantees the application of them to their intended use but does not, of course, insure the retention of profits to an equal amount in the business. Finally boards of directors may be compelled by the stockholders to adhere to a certain policy by provision in the by-laws for the accumulation of reserves. This policy is, of course, subject to change by the stockholders themselves. Where the power to make and change by-laws is put in the hands of the directors, this last method is not applicable.

Reserves may always be made a part of the permanent capital through their distribution in the form of a stock dividend. This secures the continuance of profits reserved to date but does not guarantee either a similar application of future reserves

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Psyche's task

James George Frazer

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PSYCHE’S TASK

A DISCOURSE CONCERNING THE INFLUENCE OF SUPERSTITION ON THE GROWTH OF INSTITUTIONS

SECOND EDITION, REVISED AND ENLARGED TO WHICH IS ADDED THE SCOPE OF SOCIAL ANTHROPOLOGY _AN INAUGURAL LECTURE_

BY J. G. FRAZER, D.C.L., LL.D., Litt.D. FELLOW OF TRINITY COLLEGE, CAMBRIDGE PROFESSOR OF SOCIAL ANTHROPOLOGY IN THE UNIVERSITY OF LIVERPOOL

MACMILLAN AND CO., LIMITED ST. MARTIN’S STREET, LONDON 1913

[EPIGRAPHS]

Good and evil we know in the field of this world grow up together almost inseparably; and the knowledge of good is so involved and interwoven with the knowledge of evil and in so many cunning resemblances hardly to be discerned, that those confused seeds, which were imposed on Psyche as an incessant labour to cull out and sort asunder, were not more intermixt.

Milton, _Areopagitica_.

Il ne faut pas croire cependant qu’un mauvais principe vicie radicalement une institution, ni même qu’il y fasse tout le mal qu’il porte dans son sein. Rien ne fausse plus l’histoire que la logique: quand l’esprit humain s’est arrêté sur une idée, il en tire toutes les conséquences possibles, lui fait produire tout ce qu’en effet elle pourrait produire, et puis se la représente dans l’histoire avec tout ce cortège. Il n’en arrive point ainsi; les événements ne sont pas aussi prompts dans leur déductions que l’esprit humain. Il y a dans toutes choses un mélange de bien et de mal si profond, si invincible que, quelque part que vous pénétriez, quand vous descendrez dans les derniers éléments de la société ou de l’âme, vous y trouverez ces deux ordres de faits coexistant, se développant l’un à côté de l’autre et se combattant, mais sans s’exterminer. La nature humaine ne va jamais jusqu’aux dernières limites, ni du mal ni du bien; elle passe sans cesse de l’un à l’autre, se redressant au moment où elle semble le plus près de la chute, faiblissant au moment où elle semble marcher le plus droit.

Guizot, _Histoire de la civilisation dans l’Europe_, Cinquième Leçon.

[DEDICATION]

TO ALL WHO ARE ENGAGED IN PSYCHE’S TASK OF SORTING OUT THE SEEDS OF GOOD FROM THE SEEDS OF EVIL I DEDICATE THIS DISCOURSE

PREFACE

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The substance of the following discourse was lately read at an evening meeting of the Royal Institution in London, and most of it was afterwards delivered in the form of lectures to my class at Liverpool. It is now published in the hope that it may call attention to a neglected side of superstition and stimulate enquiry into the early history of those great institutions which still form the framework of modern society. If it should turn out that these institutions have sometimes been built on rotten foundations, it would be rash to conclude that they must all come down. Man is a very curious animal, and the more we know of his habits the more curious does he appear. He may be the most rational of the beasts, but certainly he is the most absurd. Even the saturnine wit of Swift, unaided by a knowledge of savages, fell far short of the reality in his attempt to set human folly in a strong light. Yet the odd thing is that in spite, or perhaps by virtue, of his absurdities man moves steadily upwards; the more we learn of his past history the more groundless does the old theory of his degeneracy prove to be. From false premises he often arrives at sound conclusions: from a

chimerical theory he deduces a salutary practice. This discourse will have served a useful purpose if it illustrates a few {viii} of the ways in which folly mysteriously deviates into wisdom, and good comes out of evil. It is a mere sketch of a vast subject. Whether I shall ever fill in these bald outlines with finer strokes and deeper shadows must be left to the future to determine. The materials for such a picture exist in abundance; and if the colours are dark, they are yet illuminated, as I have tried in this essay to point out, by a ray of consolation and hope.

J. G. FRAZER.

Cambridge, _February_ 1909.

NOTE TO THE SECOND EDITION

In this edition _Psyche's Task_ has been enlarged by fresh illustrative examples and by the discussion of a curious point of savage etiquette, but the substance and the form of the discourse remain unchanged. I have added _The Scope of Social Anthropology_, an inaugural lecture intended to mark out roughly the boundaries of the general study of which _Psyche's Task_ aims at setting forth some particular results. There is therefore a certain appropriateness in presenting the two discourses together to the reader.

J. G. F.

Cambridge, 6_th June_ 1913.

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PSYCHE'S TASK

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I. INTRODUCTION

[Sidenote: The dark side of superstition.] We are apt to think of superstition as an unmitigated evil, false in itself and pernicious in its consequences. That it has done much harm in the world, cannot be denied. It has sacrificed countless lives, wasted untold treasures, embroiled nations, severed friends, parted husbands and wives, parents and children, putting swords, and worse than swords between them: it has filled gaols and madhouses with its innocent or deluded victims: it has broken many hearts, embittered the whole of many a life, and not content with persecuting the living it has pursued the dead into the grave and beyond it, gloating over the horrors which its foul imagination has conjured up to appal and torture the survivors. It has done all this and more. [Sidenote: The brighter side of superstition.] Yet the case of superstition, like that of Mr. Pickwick after the revelations of poor Mr. Winkle in the witness-box, can perhaps afford to be placed in a rather better light; and without posing as the Devil's Advocate or appearing before you in a blue flame and sulphureous fumes, I do profess to make out what the charitable might call a plausible plea for a very dubious client. For I propose to prove, or at least make probable, by examples that among certain races and at certain stages of evolution some social institutions which we all, or most of us, believe to be beneficial have partially rested on a basis of superstition. The institutions to which I refer are purely secular or civil. Of religious or ecclesiastical institutions I shall say nothing. It might perhaps be possible to shew that even religion has not wholly escaped the taint or {4} dispensed with the support of superstition; but I prefer for to-night to confine myself to those civil institutions which people commonly imagine to be bottomed on nothing but hard common sense and the nature of things. While the institutions with which I shall deal have all survived into civilized society and can no doubt be defended by solid and weighty arguments, it is practically certain that among savages, and even among peoples who have risen above the level of savagery, these very same institutions have derived much of their strength from beliefs which nowadays we should condemn unreservedly as superstitious and absurd. The institutions in regard to which I shall attempt to prove this are four, namely, government, private property, marriage, and the respect for human life. [Sidenote: Four propositions to be proved.] And what I have to say may be summed up in four propositions as follows:--

I. Among certain races and at certain times superstition has strengthened the respect for government, especially monarchical government, and has thereby contributed to the establishment and maintenance of civil order.

II. Among certain races and at certain times superstition has strengthened the respect for private property and has thereby contributed to the security of its enjoyment.

III. Among certain races and at certain times superstition has strengthened the respect for marriage and has thereby contributed to a stricter observance of the rules of sexual morality both among the married and the unmarried.

IV. Among certain races and at certain times superstition has strengthened the respect for human life and has thereby contributed to the security of its enjoyment.

[Sidenote: Preliminary remarks.] Before proceeding to deal with these four propositions separately, I wish to make two remarks, which I beg you will bear in mind. First, in what I have to say I shall confine myself to certain races of men and to certain ages of history, because neither my time nor my knowledge permits me to speak of all races of men and all ages of history. How far the limited conclusions which I shall draw for some races and for some ages are applicable to others must be left to future enquiries to determine. That is my first remark. My second is this. If it can be proved that in certain races and at certain times the institutions {5} in question have been based partly on superstition, it by no means follows that even among these races they have never been based on anything else. On the contrary, as all the institutions which I shall consider have proved themselves stable and permanent, there is a strong presumption that they rest mainly on something much more solid than superstition. No institution founded wholly on superstition, that is on falsehood, can be permanent. If it does not answer to some real human need, if its foundations are not laid broad and deep in the nature of things, it must perish, and the sooner the better. That is my second remark.

II. GOVERNMENT

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[Sidenote: Superstition as a prop of government.] With these two cautions I address myself to my first proposition, which is, that among certain races and at certain times superstition has strengthened the respect for government, especially monarchical government, and has thereby contributed to the establishment and maintenance of civil order.

[Sidenote: Superstitious respect for chiefs in Melanesia.] Among many peoples the task of government has been greatly facilitated by a superstition that the governors belong to a superior order of beings and possess certain supernatural or magical powers to which the governed can make no claim and can offer no resistance. Thus Dr. Codrington tells us that among the Melanesians “the power of chiefs has hitherto rested upon the belief in their supernatural power derived from the spirits or ghosts with which they had intercourse. As this belief has failed, in the Banks’ Islands for example some time ago, the position of a chief has tended to become obscure; and as this belief is now being generally undermined a new kind of chief must needs arise, unless a time of anarchy is to begin.”[6.1] According to a native Melanesian account, the authority of chiefs rests entirely on the belief that they hold communication with mighty ghosts and possess that supernatural power or _mana_, as it is called, whereby they are able to bring the influence of the ghosts to bear on human life. If a chief imposed a fine, it was paid because the people firmly believed that he could inflict calamity and sickness upon such as resisted him. As soon as any considerable number of his {7} subjects began to disbelieve in his influence with the ghosts, his power to levy fines was shaken.[7.1] It is thus that in Melanesia religious scepticism tends to undermine the foundations of civil society.

[Sidenote: Superstitious respect for chiefs in Fiji.] Similarly Mr. Basil Thomson tells us that “the key to the Melanesian system of government is Ancestor-worship. Just as every act in a Fijian’s life was controlled by his fear of Unseen Powers, so was his conception of human authority based upon religion.” The dead chief was supposed still to watch jealously over his people and to punish them with dearth, storms, and floods, if they failed to bring their offerings to his tomb and to propitiate his spirit. And the person of his descendant, the living chief, was sacred; it was hedged in by a magic circle of taboo and might not even be touched without incurring the wrath of the Unseen. “The first blow at the power of the chiefs was struck unconsciously by the missionaries. Neither they nor the chiefs themselves realized how closely the government of the Fijians was bound up with their religion. No sooner had a missionary gained a foothold in a chief village than the tabu was doomed, and on the tabu depended half the people’s reverence for rank. The tabu died hard, as such institutions should do. The first-fruits were still presented to the chief, but they were no longer carried from him to the temple, since their excuse--as an offering to persuade the ancestors to grant abundant increase--had passed away. No longer supported by the priests, the Sacred Chief fell upon evil days”; for in Fiji, as in other places, the priest and the chief, when they were not one and the same person, had played into each other’s hands, both knowing that neither could stand firm without the aid of the other.[7.2]

[Sidenote: Superstitious respect for chiefs in Polynesia generally and in New Zealand particularly.] In Polynesia the state of things was similar. There, too, the power of chiefs depended largely on a belief in their supernatural powers, in their relation to ancestral spirits, and in the magical virtue of taboo, which pervaded their persons and interposed between them and common folk an invisible but formidable barrier, to pass which was death. In New Zealand the Maori chiefs were deemed to be living {8} _atuas_ or gods. Thus the Rev. Richard Taylor, who was for more than thirty years a missionary in New Zealand, tells us that in speaking a Maori chief "assumed a tone not natural to him, as a kind of court language; he kept himself distinct from his inferiors, eating separately; his person was sacred, he had the power of holding converse with the gods, in fact laid claim to being one himself, making the _tapu_ a powerful adjunct to obtain control over his people and their goods. Every means were used to acquire this dignity; a large person was thought to be of the highest importance; to acquire this extra size, the child of a chief was generally provided with many nurses, each contributing to his support by robbing their own offspring of their natural sustenance; thus, whilst they were half-starved, miserable-looking little creatures, the chief's child was the contrary, and early became remarkable by its good appearance. Nor was this feeling confined to the body; the chief was an _atua_, but there were powerful and powerless gods; each naturally sought to make himself one of the former; the plan therefore adopted, was to incorporate the spirits of others with their own; thus, when a warrior slew a chief, he immediately gouged out his eyes and swallowed them, the _atua tonga_, or divinity, being supposed to reside in that organ; thus he not only killed the body, but also possessed himself of the soul of his enemy, and consequently the more chiefs he slew, the greater did his divinity become.… Another great sign of a chief was oratory--a good orator was compared to the _korimako_, the sweetest singing bird in New Zealand; to enable the young chief to become one, he was fed upon that bird, so that he might the better acquire its qualities, and the successful orator was termed a _korimako_."[8.1] Again, another writer informs us that the opinions of Maori chiefs "were held in more estimation than those of others, simply because they were believed to give utterance to the thoughts of deified men. No dazzling pageantry hedged them round, but their persons were sacred.… Many of them believed themselves inspired; {9} thus Te Heu Heu, the great Taupo chief and priest, shortly before he was swallowed up by a landslip, said to a European missionary: 'Think not that I am a man, that my origin is of the earth. I come from the heavens; my ancestors are all there; they are gods, and I shall return to them.'"[9.1] So sacred was the person of a Maori chief that it was not lawful to touch him, even to save his life. A chief has been seen at the point of suffocation and in great agony with a fish bone sticking in his throat, and yet not one of his people, who were lamenting around him, dared to touch or even approach him, for it would have been as much as their own life was worth to do so. A missionary, who was passing, came to the rescue and saved the chief's life by extracting the bone. As soon as the rescued man recovered the power of speech, which he did not do for half an hour, the first use he made of it was to demand that the surgical instruments with which the bone had been extracted should be given to him as compensation for the injury done him by drawing his sacred blood and touching his sacred head.[9.2]

[Sidenote: Superstitious fear of contact with Maori chiefs.] Not only the person of a Maori chief but everything that had come into contact with it was sacred and would kill, so the Maoris thought, any sacrilegious person who dared to meddle with it. Cases have been known of Maoris dying of sheer fright on learning that they had unwittingly eaten the remains of a chief's dinner or handled something that belonged to him. For example, a woman, having partaken of some fine peaches from a basket, was told that they had come from a tabooed place. Immediately the basket dropped from her hands and she cried out in agony that the _atua_ or godhead of the chief, whose divinity had been thus profaned, would kill her. That happened in the afternoon, and next day by twelve o'clock she was dead.[9.3] Similarly a chief's tinder-box has proved fatal to several men; for having found it and lighted their pipes with it {10} they actually expired of terror on learning to whom it belonged.[10.1] Hence a considerate chief would throw away where it could not be found any garment or mat for which he had no further use, lest one of his subjects should find it and be struck dead by the shock of its inherent divinity. For the same reason he would never blow a fire with his mouth; for his sacred breath would communicate its sanctity to the fire, and the fire would pass it on to the meat that might be cooked on it, and the meat would carry it into the stomach of the eater, and he would die.[10.2] Thus the divinity which hedged a Maori chief was a devouring flame which shrivelled up and consumed whatever it touched. No wonder that such men were implicitly obeyed.

[Sidenote: Superstitious respect for chiefs and kings in Tonga and Tahiti.] In the rest of Polynesia the state of things was similar. For example, the natives of Tonga in like manner believed that if any one fed himself with his own hands after touching the sacred person of a superior chief, he would swell up and die; the sanctity of the chief, like a virulent poison, infected the hands of his inferior, and, being communicated through them to the food, proved fatal to the eater, unless he disinfected himself by touching the chief's feet in a particular way.[10.3] When a king of Tahiti entered on office he was girded with a sacred girdle of red feathers, which not only raised him to the highest earthly station, but identified him with the gods.[10.4] Henceforth "every thing in the least degree connected with the king or queen--the cloth they wore, the houses in which they dwelt, the canoes in which they voyaged,

the men by whom they were borne when they journeyed by land, became sacred--and even the sounds in the language, composing their names, could no longer be appropriated to ordinary significations. Hence, the original names of most of the objects with which they were familiar, have from time to time undergone considerable alterations. The ground on which they even accidentally trod, became sacred; and the dwelling under which they might enter, must for ever after be vacated {11} by its proprietors, and could be appropriated only to the use of these sacred personages. No individual was allowed to touch the body of the king or queen; and every one who should stand over them, or pass the hand over their heads, would be liable to pay for the sacrilegious act with the forfeiture of his life. It was on account of this supposed sacredness of person that they could never enter any dwellings, excepting those that were specially dedicated to their use, and prohibited to all others; nor might they tread on the ground in any part of the island but their own hereditary districts."[11.1]

[Sidenote: Superstitious fear of contact with kings in Africa and the Malay region.] In like manner the Cazembes, in the interior of Angola, regarded their king as so holy that no one could touch him without being killed by the magical power which emanated from his sacred person; however, any one who had accidentally or necessarily come into personal contact with his Majesty could escape death by touching the king's hands in a special manner.[11.2] Similar beliefs are current in the Malay region, where the theory of the king as the Divine Man is said to be held perhaps as strongly as in any other part of the world. "Not only is the king's person considered sacred, but the sanctity of his body is believed to communicate itself to his regalia, and to slay those who break the royal taboos. Thus it is firmly believed that any one who seriously offends the royal person, who touches (even for a moment) or who imitates (even with the king's permission) the chief objects of the regalia, or who wrongfully makes use of any of the insignia or privileges of royalty, will be _k■na daulat_, _i.e._ struck dead, by a quasi-electric discharge of that Divine Power which the Malays suppose to reside in the king's person, and which is called _daulat_ or Royal Sanctity."[11.3] [Sidenote: Marvellous powers attributed to rajahs by Malays and Dyaks.] Further, the Malays firmly believe that the king possesses a personal influence over the works of nature, such as the growth of the crops and the bearing of fruit-trees.[11.4] Some of the Hill Dyaks of Sarawak {12} used to bring their seed-rice to Rajah Brooke to be fertilized by him; and once when the rice-crops of a tribe were thin, the chief remarked that it could not be otherwise, since they had not been visited by the Rajah.[12.1] [Sidenote: Superstitious veneration for the rajah of Loowoo.] Among the Toradjas of Central Celebes "the power of the rajah of Loowoo rested for the most part on superstition and on tradition. The ancestors had served the rajah in their day, and should the descendants fail to do so they would have to fear the wrath of the ancestors. Often Toradjas said to us, 'The rajah of Loowoo is our god.' They saw in him the complete embodiment of the old institutions. It used to be said that he had white blood, and the mysterious power that went forth from him was thought to be so great that a common Toradja could not see him without suffering from a swollen belly and dying."[12.2]

[Sidenote: Magical powers attributed to kings in Africa.] Similarly in Africa kings are commonly supposed to be endowed with a magical power of making the rain to fall and the crops to grow: drought and famine are set down to the weakness or ill-will of the king, and accordingly he is punished, deposed, or put to death.[12.3] To take two or three instances out of many, a writer of the eighteenth century speaks as follows of the kingdom of Loango in West Africa: [Sidenote: The king of Loango.] "The government with these people is purely despotic. They say their lives and goods belong to the king; that he may dispose of and deprive them of them when he pleases, without form of process, and without their having anything to complain of. In his presence they pay marks of respect which resemble adoration. The individuals of the lower classes are persuaded that his power is not confined to the earth, and that he has credit enough to make rain fall from heaven: hence they fail not, when a continuance of drought makes them fearful about the harvest, to represent to him that if he does not take care to water the lands of his kingdom, they will die of hunger, and will find it impossible to make him the usual presents. The king, to satisfy the people, without however compromising himself with heaven, {13} devolves the affair on one of his ministers, to whom he gives orders to cause to fall without delay upon the plains as much rain as is wanted to fertilize them. When the minister sees a cloud which he presumes must shed rain, he shews himself in public, as if to exercise the orders of his prince. The women and children troop around him, crying with all their might, _Give us rain, give us rain_: and he promises them some."[13.1] The king of Loango, says another old writer, "is honoured among them as though he were a God: and is called _Sambee_ and _Pango_, which mean God. They believe he can let them have rain when he likes; and once a year, in December, which is the time they want rain, the people come to beg of him to grant it to them, on this occasion they make him presents, and none come empty-handed." On a day appointed, when the chiefs with their troops had assembled in warlike array, the drums used to beat and the horns to sound, and the king shot arrows into the air, which was believed to bring down the rain.[13.2] On the other side of Africa a similar state of things is reported by the old Portuguese historian Dos Santos. [Sidenote: The king of Sofala.] He says: "The king of all these lands of the interior and of the river of Sofala is a woolly-haired Kaffir, a heathen who adores nothing whatever, and has no knowledge of God; on the contrary, he esteems himself the god of all his lands, and is so looked upon and reverenced by his subjects." "When they suffer necessity or scarcity they have recourse to the

king, firmly believing that he can give them all that they desire or have need of, and can obtain anything from his dead predecessors, with whom they believe that he holds converse. For this reason they ask the king to give them rain when it is required, and other favourable weather for their harvest, and in coming to ask for any of these things they bring him valuable presents, which the king accepts, bidding them return to their homes and he will be careful to grant their petitions. They are such barbarians that though they see how often the king {14} does not give them what they ask for, they are not undeceived, but make him still greater offerings, and many days are spent in these comings and goings, until the weather turns to rain, and the Kaffirs are satisfied, believing that the king did not grant their request until he had been well bribed and importuned, as he himself affirms, in order to maintain them in their error."[14.1] Nevertheless "it was formerly the custom of the kings of this land to commit suicide by taking poison when any disaster or natural physical defect fell upon them, such as impotence, infectious disease, the loss of their front teeth by which they were disfigured, or any other deformity or affliction. To put an end to such defects they killed themselves, saying that the king should be free from any blemish." However, in the time of Dos Santos the king of Sofala, in defiance of all precedent, persisted in living and reigning after he had lost a front tooth; and he even went so far as to tax his royal predecessors with folly for having made away with themselves for such trifles as a decayed tooth or a little grey hair, declaring his firm resolution to live as long as he possibly could for the benefit of his loyal subjects.[14.2] [Sidenote: The chief medicine-man of the Nandi.] At the present day the principal medicine-man of the Nandi, a tribe in British East Africa, is also supreme chief of the whole people. He is a diviner, and foretells the future: he makes women and cattle fruitful; and in time of drought he obtains rain either directly or through the intervention of the rainmakers. The Nandi believe implicitly in these marvellous powers of their chief. His person is usually regarded as absolutely sacred. Nobody may approach him with weapons in his hand or speak in his presence unless he is first addressed; and it is deemed most important that nobody should touch the chief's head, otherwise his powers of divination and so forth would depart from him.[14.3] This widespread African conception of the divinity of kings culminated long ago in ancient Egypt, where the kings were treated as gods both in life and in death, temples being dedicated to their worship {15} and priests appointed to conduct it.[15.1] And when the harvests failed, the ancient Egyptians, like the modern negroes, laid the blame of the failure on the reigning monarch.[15.2]

[Sidenote: Superstitious veneration of the Peruvians for the Yncas.] A halo of superstitious veneration also surrounded the Yncas or governing class in ancient Peru. Thus the old historian Garcilasso de la Vega, himself the son of an Ynca princess, tells us that "it does not appear that any Ynca of the blood royal has ever been punished, at least publicly, and the Indians deny that such a thing has ever taken place. They say that the Ynca never committed any fault that required correction; because the teaching of their parents, and the common opinion that they were children of the Sun, born to teach and to do good to the rest of mankind, kept them under such control, that they were rather an example than a scandal to the commonwealth. The Indians also said that the Yncas were free from the temptations which usually lead to crime, such as passion for women, envy and covetousness, or the thirst for vengeance; because if they desired beautiful women, it was lawful for them to have as many as they liked; and any pretty girl they might take a fancy to, not only was never denied to them, but was given up by her father with expressions of extreme thankfulness that an Ynca should have condescended to take her as his servant. The same thing might be said of their property; for, as they never could feel the want of anything, they had no reason to covet the goods of others; while as governors they had command over all the property of the Sun and of the Ynca; and those who were in charge, were bound to give them all that they required, as children of the Sun, and brethren of the Ynca. They likewise had no temptation to kill or wound any one either for revenge, or in passion; for no one ever offended them. On the contrary, they received adoration only second to that offered to the royal person; and if any one, how high soever his rank, had enraged any Ynca, it would have been looked upon as sacrilege, and very severely punished. But it may be affirmed that an Indian {16} was never punished for offending against the person, honour, or property of any Ynca, because no such offence was ever committed, as they held the Yncas to be like gods."[16.1]

[Sidenote: Superstitious veneration for kings in ancient India.] Nor have such superstitions been confined to savages and other peoples of alien race in remote parts of the world. They seem to have been shared by the ancestors of all the Aryan peoples from India to Ireland. Thus in the ancient Indian law-book called the Laws of Manu, we read: "Because a king has been formed of particles of those lords of the gods, he therefore surpasses all created beings in lustre; and, like the sun, he burns eyes and hearts; nor can anybody on earth even gaze on him. Through his (supernatural) power he is Fire and Wind, he Sun and Moon, he the Lord of justice (Yama), he Kubera, he Varuna, he great Indra. Even an infant king must not be despised (from an idea) that he is a (mere) mortal; for he is a great deity in human form."[16.2] And in the same law-book the effects of a good king's reign are thus described: "In that (country) where the king avoids taking the property of (mortal) sinners, men are born in (due) time (and are) long-lived. And the crops of the husbandmen spring up, each as it was sown, and the children die not, and no misshaped (offspring) is born."[16.3]

[Sidenote: Superstitious veneration for kings in ancient Europe.] Similarly in Homeric Greece, kings and chiefs were described as sacred or divine; their houses, too, were divine, and their chariots sacred;[16.4] and it was thought that the reign of a good king caused the black earth to bring forth wheat and barley, the trees to be loaded with fruit, the flocks to multiply, and the sea to yield fish.[16.5] When the crops failed, the Burgundians used to blame their kings and depose them.[16.6] Similarly the Swedes always ascribed the abundance or scantiness of the harvest to the goodness or badness of their kings, and in time of dearth they have been known {17} to sacrifice them to the gods for the sake of procuring good crops.[17.1] In ancient Ireland it was also believed that when kings observed the customs of their ancestors the seasons were mild, the crops plentiful, the cattle fruitful, the waters abounded with fish, and the fruit-trees had to be propped up on account of the weight of their produce. A canon ascribed to St. Patrick enumerates among the blessings that attend the reign of a just king “fine weather, calm seas, crops abundant, and trees laden with fruit.”[17.2] [Sidenote: Survivals of the superstition in Scotland.] Superstitions of the kind which were thus current among the Celts of Ireland centuries ago appear to have survived among the Celts of Scotland down to Dr. Johnson’s time; for when he travelled in Skye it was still held that the return of the chief of the Macleods to Dunvegan, after any considerable absence, produced a plentiful catch of herring;[17.3] and at a still later time, when the potato crop failed, the clan Macleod desired that a certain fairy banner in the possession of their chief might be unfurled,[17.4] apparently in the belief that the magical banner had only to be displayed to produce a fine crop of potatoes.

[Sidenote: Touching for the King’s Evil.] Perhaps the last relic of such superstitions which lingered about our English kings was the notion that they could heal scrofula by their touch. The disease was accordingly known as the King’s Evil;[17.5] and on the analogy of the Polynesian superstitions which I have cited, we may perhaps conjecture that the skin disease of scrofula was originally supposed to be caused as well as cured by the king’s touch. Certain it is that in Tonga some forms of scrofula, as well as indurations of the liver, to which the natives were very subject, were thought to be caused by touching a chief and {18} to be healed, on homœopathic principles, in the very same fashion.[18.1] Similarly in Loango palsy is called the king’s disease, because the negroes imagine it to be heaven’s own punishment for treason meditated against the king.[18.2] The belief in the king’s power to heal by touch is known to have been held both in France and England from the eleventh century onward. The first French king to touch the sick appears to have been Robert the Pious, the first English king Edward the Confessor.[18.3] In England the belief that the king could heal scrofula by his touch survived into the eighteenth century. Dr. Johnson was touched in his childhood for scrofula by Queen Anne.[18.4] It is curious that so typical a representative of robust common sense as Dr. Johnson should in his childhood and old age have thus been brought into contact with these ancient superstitions about royalty both in England and Scotland. In France the superstition lingered a good deal longer, for whereas Queen Anne was the last reigning monarch in England to touch for scrofula, both Louis XV. and Louis XVI. at their coronation touched thousands of patients, and as late as 1824 Charles X. at his coronation went through the same solemn farce. It is said that the sceptical wits of Louis XVI.’s time investigated all the cases of the persons on whom the king had laid hands at his coronation, with the result that out of two thousand four hundred who were touched only five were made whole.[18.5]

[Sidenote: Conclusion.] The foregoing evidence, summary as it is, may suffice to prove that many peoples have regarded their rulers, whether chiefs or kings, with superstitious awe as beings of a higher order and endowed with mightier powers than common folk. Imbued with such a profound veneration for their governors and with such an exaggerated conception of their power, they cannot but have yielded them a prompter and more implicit obedience than if they had {19} known them to be men of common mould just like themselves. If that is so, I may claim to have proved my first proposition, which is, that among certain races and at certain times superstition has strengthened the respect for government, especially monarchical government, and has thereby contributed to the establishment and maintenance of civil order.

III. PRIVATE PROPERTY

{20}

[Sidenote: Superstition as a prop of private property.] I pass now to my second proposition, which is, that among certain races and at certain times superstition has strengthened the respect for private property, and has thereby contributed to the security of its enjoyment.

[Sidenote: Taboo in Polynesia.] Nowhere, perhaps, does this appear more plainly than in Polynesia, where the system of taboo reached its highest development; for the effect of tabooing a thing was, in the opinion of the natives, to endow it with a supernatural or magical energy which rendered it practically unapproachable by any but the owner. Thus taboo became a powerful instrument for strengthening the ties, perhaps our socialist friends would say riveting the chains, of private property. Indeed, some good

authorities who were personally acquainted with the working of taboo in Polynesia, have held that the system was originally devised for no other purpose. [Sidenote: Taboo among the Maoris of New Zealand.] For example, an Irishman who lived as a Maori with the Maoris for years, and knew them intimately, writes as follows: “The original object of the ordinary _tapu_ seems to have been the preservation of property. Of this nature in a great degree was the ordinary personal _tapu_. This form of the _tapu_ was permanent, and consisted in a certain sacred character which attached to the person of a chief and never left him. It was his birthright, a part in fact of himself, of which he could not be divested, and which was well understood and recognized at all times as a matter of course. The fighting men and petty chiefs, and every one indeed who could by any means claim the title of _rangatira_--which in the sense I now use it means gentleman--were all in {21} some degree more or less possessed of this mysterious quality. It extended or was communicated to all their moveable property, especially to their clothes, weapons, ornaments, and tools, and to everything in fact which they touched. This prevented their chattels from being stolen or mislaid, or spoiled by children, or used or handled in any way by others. And as in the old times, as I have before stated, every kind of property of this kind was precious in consequence of the great labour and time necessarily, for want of iron tools, expended in the manufacture, this form of the _tapu_ was of great real service. An infringement of it subjected the offender to various dreadful imaginary punishments, of which deadly sickness was one.” The culprit was also liable to what may be called a civil action, which consisted in being robbed and beaten; but the writer whom I have just quoted tells us that the worst part of the punishment for breaking taboo was the imaginary part, since even when the offence had been committed unwittingly the offender has been known to die of fright on learning what he had done.[21.1] Similarly, another writer, speaking of the Maoris, observes that “violators of the _tapu_ were punished by the gods and also by men. The former sent sickness and death; the latter inflicted death, loss of property, and expulsion from society. It was a dread of the gods, more than of men, which upheld the _tapu_. Human eyes might be deceived, but the eyes of the gods could never be deceived.”[21.2] “The chiefs, as might be expected, are fully aware of the advantages of the _tapu_, finding that it confers on them, to a certain extent, the power of making laws, and the superstition on which the _tapu_ is founded will ensure the observance of them. Were they to transgress the _tapu_, they believe that the _attua_ (God) would kill them, and so universal is this belief that it is, or rather was, a very rare occurrence to find any one daring enough to commit the {22} sacrilege. To have preserved this influence so completely among a people naturally so shrewd and intelligent, great care must, no doubt, have been taken not to apply it unless in the usual and recognised manner. To have done otherwise would have led to its being frequently transgressed; and consequently to the loss of its influence. Before the natives came into contact with the Europeans the _tapu_ seems to have acted with the most complete success; as the belief was general, that any disregard of it would infallibly subject the offender to the anger of the _attua_, and death would be the consequence. Independently, however, of the support which the _tapu_ derives from the superstitious fears of these people, it has, like most other laws, an appeal to physical force in case of necessity. A delinquent, if discovered, would be stripped of everything he possessed; and if a slave, would in all probability be put to death--many instances of which have actually occurred. So powerful is this superstitious feeling, that slaves will not venture to eat of the same food as their master; or even to cook at the same fire; believing that the _attua_ would kill them if they did so. Everything about, or belonging to, a chief is accounted sacred by the slaves. Fond as they are of tobacco, it would be perfectly secure though left exposed on the roof of a chief’s house; no one would venture to touch it. To try them, a friend of mine gave a fig of tobacco to a slave; who, after having used it, was informed that it had been on the roof of the chief’s house. The poor fellow, in the greatest consternation, went immediately to the chief telling him what had happened, and beseeching him to take off the _tapu_ from the tobacco to prevent the evil consequences.”[22.1]

[Sidenote: Taboo as a preserver of property.] Hence it has been truly said that “this form of _tapu_ was a great preserver of property. The most valuable articles might, in ordinary circumstances, be left to its protection, in the absence of the owners, for any length of time.”[22.2] If any one wished to preserve his crop, his house, his garments, or anything else, he had only to taboo the property, and it was safe. To shew that the thing was tabooed, he put a mark {23} to it. Thus, if he wished to use a particular tree in the forest to make a canoe, he tied a wisp of grass to the trunk; if he desired to appropriate a patch of bulrush in a swamp, he stuck up a pole in it with a bunch of grass at the top; if he left his house with all its valuables, to take care of itself, he secured the door with a bit of flax, and the place straightway became inviolable, nobody would meddle with it.[23.1]

Hence although the restrictions imposed by taboo were often vexatious and absurd, and the whole system has sometimes been denounced by Europeans as a degrading superstition, yet observers who looked a little deeper have rightly perceived that its enactments, enforced mainly by imaginary but still powerful sanctions, were often beneficial. “The New Zealanders,” says one writer, “could not have been governed without some code of laws analogous to the _tapu_. Warriors submitted to the supposed decrees of the gods who would have spurned with contempt the orders of men, and it was better the people should be ruled by superstition than by brute force.”[23.2] Again, an experienced missionary, who knew the Maoris well, writes that “the _tapu_ in

many instances was beneficial; considering the state of society, absence of law, and fierce character of the people, it formed no bad substitute for a dictatorial form of government, and made the nearest approach to an organized state of society."[23.3]

[Sidenote: Taboo in the Marquesas Islands.] In other parts of Polynesia the system of taboo with its attendant advantages and disadvantages, its uses and abuses, was practically the same, and everywhere, as in New Zealand, it tightened for good or evil the ties of private property. This indeed was perhaps the most obvious effect of the institution. In the Marquesas Islands, it is said, taboo was invested with a divine character as the expression of the will of the gods revealed to the priests; as such it set bounds to injurious excesses, prevented depredations, and united the people. Especially it converted the tabooed or privileged classes into landed proprietors; the land belonged to them alone and to their heirs; common {24} folk lived by industry and by fishing. Taboo was the bulwark of the landowners; it was that alone which elevated them by a sort of divine right into a position of affluence and luxury above the vulgar; it was that alone which ensured their safety and protected them from the encroachments of their poor and envious neighbours. "Without doubt," say the writers from whom I borrow these observations, "the first mission of taboo was to establish property, the base of all society."[24.1]

[Sidenote: Superstitious fear as a preserver of property in Samoa.] In Samoa also superstition played a great part in fostering a respect for private property. That it did so, we have the testimony of a missionary, Dr. George Turner, who lived for many years among the Samoans and has given us a very valuable account of their customs. He says: "I hasten to notice the second thing which I have already remarked was an auxiliary towards the maintenance of peace and order in Samoa, viz. _superstitious fear_. If the chief and heads of families, in their court of inquiry into any case of stealing, or other concealed matter, had a difficulty in finding out the culprit, they would make all involved swear that they were innocent. In swearing before the chiefs the suspected parties laid a handful of grass on the stone, or whatever it was, which was supposed to be the representative of the village god, and laying their hand on it, would say, 'In the presence of our chiefs now assembled, I lay my hand on the stone. If I stole the thing may I speedily die.' This was a common mode of swearing. The meaning of the grass was a silent additional imprecation that his family might all die, and that _grass_ might grow over their habitation. If all swore, and the culprit was still undiscovered, the chiefs then wound up the affair by committing the case to the village god, and solemnly invoking him to mark out for speedy destruction the guilty {25} mischief-maker. But, instead of appealing to the chiefs, and calling for an oath, many were contented with their own individual schemes and imprecations to frighten thieves and prevent stealing. When a man went to his plantation and saw that some cocoa-nuts, or a bunch of bananas, had been stolen, he would stand and shout at the top of his voice two or three times, 'May fire blast the eyes of the person who has stolen my bananas! May fire burn down his eyes and the eyes of his god too!' This rang throughout the adjacent plantations, and made the thief tremble. They dreaded such uttered imprecations.… But there was another and more extensive class of curses, which were also feared, and formed a powerful check on stealing, especially from plantations and fruit trees, viz. the silent hieroglyphic taboo, or _tapui_ (_tapooe_), as they call it. Of this there was a great variety."[25.1]

[Sidenote: Samoan taboos.] Among the Samoan taboos which were employed for the protection of property were the following:--1. _The sea-pike taboo_. To prevent his bread-fruits from being stolen a man would plait some coco-nut leaflets in the form of a sea-pike and hang one or more such effigies from the trees which he wished to protect. Any ordinary thief would be afraid to touch a tree thus guarded, for he believed that if he stole the fruit a sea-pike would mortally wound him the next time he went to sea. 2. _The white-shark taboo_. A man would plait a coco-nut leaf in the shape of a shark and hang it on a tree. This was equivalent to an imprecation that the thief might be devoured by a shark the next time he went to fish. 3. _The cross-stick taboo_. This was a stick hung horizontally on the tree. It expressed a wish that whoever stole fruit from the tree might be afflicted with a sore running right across his body till he died. 4. _The ulcer taboo_. This was made by burying some pieces of clam-shell in the ground and setting up at the spot several reeds tied together at the top in a bunch like the head of a man. By this the owner signified his wish that the thief might be laid low with ulcerous sores all over his body. If the thief happened thereafter to be troubled with swellings or sores, he confessed his fault and sent a present to the {26} owner of the land, who in return sent to the culprit a herb both as a medicine and as a pledge of forgiveness. 5. _The thunder taboo_. A man would plait coco-nut leaflets in the form of a small square mat and suspend it from a tree, adding some white streamers of native cloth. A thief believed that for trespassing on such a tree he or his children might be struck by lightning, or perhaps that lightning might strike and blast his own trees. "From these few illustrations," says Dr. Turner in conclusion, "it will be observed that Samoa formed no exception to the remarkably widespread system of superstitious taboo; and the extent to which it preserved honesty and order among a heathen people will be readily imagined."[26.1]

[Sidenote: Taboo in Tonga.] In Tonga a man guilty of theft or of any other crime was said to have broken the taboo, and as such persons were supposed to be particularly liable to be bitten by sharks, all on whom suspicion fell were compelled to go into water frequented by sharks; if they were bitten or devoured, they were guilty; if they escaped, they were innocent.[26.2]

[Sidenote: Taboo in Melanesia.] In Melanesia also a system of taboo (_tambu_, _tapu_) exists; it is described as “a prohibition with a curse expressed or implied,” and derives its sanction from a belief that the chief or other person who imposes a taboo has the support of a powerful ghost or spirit (_tindalo_). If a common man took it upon himself to taboo anything, people would watch to see whether a transgressor of the taboo fell sick; if he did, it was a proof that the man who imposed the taboo was backed by a powerful ghost, and his reputation would rise accordingly. Each ghost affected a particular sort of leaf, which was his taboo mark.[26.3] In New Britain plantations, coco-nut trees, and other possessions are protected against thieves by marks of taboo attached to them, and it is thought that whoever violates the taboo will be visited by sickness or other misfortune. The nature of the sickness or misfortune varies with that of the mark or magical object which embodies the mystic virtue of the taboo. One plant used for this purpose will cause the {27} thief’s head to ache; another will make his thighs swell; another will break his legs; and so forth. Even the murmuring of a spell over a fence is believed to ensure that whoever steals sticks from the fence will have a swollen head.[27.1] In Fiji the institution of taboo was the secret of power and the strength of despotic rule. It was wondrously diffused, affecting things great and small. Here it might be seen tending a brood of chickens and there directing the energies of a kingdom. The custom was much in favour with the chiefs, who adjusted it so that it sat lightly on them and heavily on others. By it they gained influence, supplied their wants, and commanded at will their inferiors. In imposing a taboo a chief need only be checked by a regard for ancient precedent. Inferior persons endeavoured by the help of the system to put their yam-beds and plantain-plots within a sacred pale.[27.2]

[Sidenote: Taboo in the Malay Archipelago.] A system of taboo based on superstition prevails all over the islands of the Malay Archipelago, where the common term for taboo is _pamali_, _pomali_, or _pemali_, though in some places other words, such as _poso_, _potu_, or _boboso_ are in use to express the same idea.[27.3] In this great region also the superstition associated with taboo is a powerful instrument to enforce the rights of private property. Thus, in the island of Timor “a prevalent custom is the _pomali_, exactly equivalent to the ‘taboo’ of the Pacific islanders, and equally respected. It is used on the commonest occasions, and a few palm leaves stuck outside a garden as a sign of the _pomali_ will preserve its produce from thieves as effectually as the threatening notice of man-traps, spring guns, or a savage dog, would do with us.”[27.4] In Amboyna the word for taboo is _pamali_. A man who wishes to protect his fruit-trees or other possessions against theft may do it in various ways. For example, he may make a white cross on a pot {28} and hang the pot on the fruit-tree; then the thief who steals fruit from that tree will be a leper. Or he may place the effigy of a mouse under the tree; then the thief will have marks on his nose and ears as if a mouse had gnawed them. Or he may plait dry sago leaves into two round discs and tie them to the tree; then the thief’s body will swell up and burst.[28.1] In Ceram the methods of protecting property from thieves are similar. For example, a man places a pig’s jaw in the branches of his fruit-tree; after that any person who dares to steal the fruit from the tree will be rent in pieces by a wild boar. The image of a crocodile with a thread of red cotton tied round its neck will be equally efficacious; the thief will be devoured by a crocodile. A wooden effigy of a snake will make the culprit to be stung by a serpent. A figure of a cat with a red band round its neck will cause all who approach the tree with evil intentions to suffer from excruciating pains in their stomachs, as if a cat were clawing their insides.[28.2] An image of a swallow will cause the thief to suffer as if a swallow were pecking his eyes out: a piece of thorny wood and a red spongy stone will inflict piercing pangs on him and make his whole body to be red and pitted with minute holes: a burnt-out brand will cause his house to burst into flames, without any apparent reason; and so on.[28.3] Similarly in the Ceram Laut Islands a man protects his coco-nut trees or sago palms by placing charmed objects at the foot of them. For example, he puts the effigy of a fish under his coco-nut tree and says, “Grandfather fish, cause the person who steals my coco-nuts to be sick and vomit.” The culprit accordingly is seized with pains in his stomach and can only be relieved of them by the owner of the coco-nuts, who spits betel-nut juice on the ailing part and blows into the sufferer’s ear, saying, “Grandfather fish, return to the sea. You have there room enough and great rocks of coral where you can {29} swim about.” Or again he may make a miniature coffin and place it on the ground under the tree; then the thief will suffer from shortness of breath and a feeling of suffocation, as if he were actually shut up in a coffin. And many other devices there are whereby in these islands the owner of fruit-trees protects the fruit from the depredations of his unscrupulous neighbours. In every case he deposits at the foot of the tree or fastens to the trunk a charmed object, which he regards as endowed with supernatural powers, and he invokes its aid to guard his possessions.[29.1]

[Sidenote: Charms for the protection of fruit-trees in Central Celebes.] The Bare’e-speaking Toradjas of Central Celebes protect their fruit-trees, especially their sirih plants and their coco-nut palms against thieves by amulets or charms of various sorts which they attach to the trees. The charms consist of the leaves of certain plants or parts of an animal tied up in leaves. Before the owner fastens one of these amulets to the tree, he says, “O charm (_ooroo_), if any man will take of these fruits, make him sick.” And the people in general believe that sickness will overtake the thief who disregards the taboo and steals the fruit. The kind of sickness or other mishap which will visit the sinner varies with the nature of the charm. The qualities of the object which is fastened to the tree

are supposed to enter into the culprit's body and to affect him accordingly. For example, if the charm consists of a particular sharp-edged grass, then the thief will feel sharp pains in his body; if it is part of a white ant heap, he will be afflicted with leprosy; if it is a certain weed of which the fruit drops off easily, his teeth will fall out; if it is a plant whose leaves cause itching, his body will itch all over; if it is the _dracaena terminalis_, he will be killed in war; and so on. There is a great variety of these amulets for the protection of fruit-trees; every man has his own in which he puts his trust. Yet while the Toradjas believe that sickness or other misfortune follows automatically the breach of such taboos, nevertheless they allege that they know how to evade the force and vigilance of the charm and to eat of the forbidden fruit with impunity. One of the expedients adopted for that purpose is as follows. You take a handful of earth and throw it at the tree; then with {30} your chopping-knife you chip a splinter from the trunk, and addressing the protective charm you say, "Make the earth sick first, and then the chopping-knife, and then me." After that you have practically nothing to fear from the amulet, and you can steal the fruit and eat it at your ease. But that is not all. Some artful thieves are able not merely to counteract the charm and render it powerless against themselves; they can even reverse its action and direct it against the owner of the tree himself. Indeed, so well-recognized is this power that many a prudent Toradja refuses to protect his trees with amulets at all, lest in doing so he should be simply putting in the hands of his enemies a weapon to be used by them for his own destruction. One of the ways in which a cunning robber will thus defeat the ends of justice is this. He goes boldly up to the fruit-tree which he intends to rob, removes the charm from it, and hangs it up somewhere else. Then he lays a plank on the ground with one end of it touching the trunk of the fruit-tree; on this plank he walks up to the tree and calmly appropriates the fruit. The charm, of course, in the meantime is helpless, since it is not on the tree. When he has stripped the fruit, the rascal restores the charm to its proper place and removes the plank. Again, the guardian charm is helpless; it cannot pursue the thief, since he has carried away the plank, leaving no possible exit from the tree. Thus the faithful guardian is, as it were, imprisoned in the castle which he has been set to guard; he frets and fumes at his confinement, and in his blind rage will fall foul of the owner of the tree himself when next he comes to inspect his property. This is, perhaps, the simplest and easiest mode of hoisting a fruit-farmer with his petard. There are, however, other ways of doing it. One of them is to get up into the tree and hang by your feet from a branch with your head down, and, while thus suspended in the air, to chew the root of a stinging nettle. This causes the owner of the tree either to be eaten up by a crocodile or to perish in war. A very popular charm among the Mountain Toradjas of Central Celebes is to take the head or paw of an iguana and hang it on the fruit-tree which is to be protected. The head bites the thief's head, and the paw grabs him by the {31} leg, so that he feels excruciating pains in these portions of his frame. But if you hang up the whole carcase, the thief is a dead man.[31.1]

[Sidenote: Taboo (_fady_) in Madagascar.] In Madagascar there is an elaborate system of taboo known as _fady_.[31.2] It has been carefully studied in a learned monograph by Professor A. van Gennep,[31.3] who argues that originally all property was based on religion, and that marks of property were marks of taboo.[31.4] However, so far as the evidence permits us to judge, it does not appear that the system has been used by the Malagasy for the protection of property to the same extent as by the Polynesians, the Melanesians, and the Indonesians. But we hear of Malagasy charms placed in the fields to afflict with leprosy and other maladies any persons who should dare to steal from them.[31.5] And we are told that some examples of _fady_ or taboo "seem to imply a curious basis for the moral code in regard to the rights of property among the last generation of Malagasy. It does not appear to have been _fady_ to steal in general, but certain articles were specified, to steal which there were various penalties attached. Thus, to steal an egg caused the thief to become leprous; to steal _landy_ (native silk) caused blindness or some other infirmity. And to steal iron was also visited by some bodily affliction."[31.6] In order to recover stolen property the Malagasy had recourse to a deity called Ramanandroany. The owner would take a remnant of the thing that had been purloined, and going with it to the idol would say, "As to whoever stole our property, O Ramanandroany, kill him by day, destroy him by night, and strangle him; let there be none amongst men like him; let him not be able to increase in riches, not even a farthing, but let him pick up his livelihood as a hen pecks rice-grains; let his eyes be blinded, and his knees swollen, {32} O Ramanandroany." It was supposed that these curses fell on the thief.[32.1]

[Sidenote: Property protected by superstitious fears elsewhere.] Similar modes of enforcing the rights of private property by the aid of superstitious fears have been adopted in many other parts of the world. The subject has been copiously illustrated by Dr. Edward Westermarck in his very learned work on the origin and development of the moral ideas.[32.2] Here I will cite only a few cases out of many. The Kouis of Laos, on the borders of Siam, protect their plantations against thieves in a very simple way. They place a "shaking tubercule" (_prateal anchot_) on the land which is to be guarded; and if any thief should thereafter dare to lay hands on the crop, he is immediately seized by a shaking fit like that of a drenched dog and cannot budge from the spot. They say that a fisherman at Sangkeah employed this charm with the best results. He used always to find his bow-net empty till one day he had the happy thought of protecting it by a "shaking tubercule." It acted like magic. The thief went down as usual into the river and brought

up the net full of fish. But hardly had he stepped on the bank when he began to shiver and shake, with the dripping net and its writhing silvery contents glued to his breast. Two days afterwards, the proprietor, making his rounds, discovered the thief on the same spot, shivering and chattering away as hard as {33} ever, but of course the fish in the net were dead and rotten.[33.1] Among the Kawars, a primitive hill tribe of the Central Provinces in India, “the sword, the gun, the axe, the spear have each a special deity, and in fact in the Bangawan, the tract where the wilder Kawars dwell, it is believed that every article of household furniture is the residence of a spirit, and that if any one steals or injures it without the owner’s leave the spirit will bring some misfortune on him in revenge. Theft is said to be unknown among them, partly on this account and partly perhaps because no one has much property worth stealing.”[33.2] In Ceylon, when a person wishes to protect his fruit-trees from thieves, he hangs up certain grotesque figures round the orchard and dedicates it to the devils. After that no native will dare to touch the fruit; even the owner himself will not venture to use it till the charm has been removed by a priest, who naturally receives some of the fruit for his trouble.[33.3] The Indians of Cumana in South America surrounded their plantations with a single cotton thread, and this was safeguard enough; for it was believed that any trespasser would soon die. The Juris of Brazil adopt the same simple means of stopping gaps in their fences.[33.4]

[Sidenote: Property in Annam protected by ghosts and curses.] The Annamites in the interior of Tonquin believe that the ghosts of young girls who have been buried in a corner of the dwelling act as a vigilant police; if thieves have made their way into the house and are preparing to depart with their booty, they hear the voice of a ghost enumerating the things on which they have laid hands, and in a panic they drop them and take to flight.[33.5] But if in spite of all an Annamite should chance to be robbed, he can easily recover the stolen property as follows. With a clod of earth taken from the kitchen floor, a pinch of vermilion, the white of an egg, and a little alcohol he makes a ball, which stands for the head of the thief. This he puts in the fire on {34} the hearth, and having lit some incense sticks he pronounces the following incantation: “On such a day of such a month of such a year So-and-so was robbed of various things. The name of the thief is unknown. I pray the guardian-spirit of the kitchen to hold the rascal’s head in the fire that it may burn.” After that, if the thief does not restore the stolen property, he will be a dead man within a month.[34.1]

[Sidenote: Thieves cursed in Nias.] Similarly in Nias, an island to the west of Sumatra, when a thief cannot be found he is cursed, and to give weight to the curse a dog is burned alive. While the animal is expiring in torments, the man who has been robbed expresses his wish that the thief may likewise die in agony; and they say that thieves who have been often cursed do die screaming.[34.2] [Sidenote: Thieves cursed among the Sea Dyaks of Borneo.] Curses are also employed for the same purpose with excellent effect by the Sea Dyaks of Borneo. On this point a missionary bears the following testimony. “With an experience of nearly twenty years in Borneo, during which I came into contact with thousands of the people, I have known of only two instances of theft among the Dyaks. One was a theft of rice. The woman who lost the rice most solemnly and publicly cursed the thief, whoever it might be. The next night the rice was secretly left at her door. The other was a theft of money. In this case, too, the thief was cursed. The greater part of the money was afterwards found returned to the box from which it had been abstracted. Both these incidents show the great dread the Dyak has of a curse. Even an undeserved curse is considered a terrible thing, and, according to Dyak law, to curse a person for no reason at all is a fineable offence.

“A Dyak curse is a terrible thing to listen to. I have only once heard a Dyak curse, and I am sure I do not want to do so again. I was travelling in the Saribas district, and at that time many of the Dyaks there had gone in for coffee-planting; indeed, several of them had started coffee plantations on a small scale. A woman told me that some one had over and over again stolen the ripe coffee-berries from her plantation. Not only were the ripe berries stolen, but the thief had carelessly picked many of the young berries and {35} thrown them on the ground, and many of the branches of the plants had been broken off. In the evening, when I was seated in the public part of the house with many Dyak men and women round me, we happened to talk about coffee-planting. The woman was present, and told us of her experiences, and how her coffee had been stolen by some thief, who, she thought, must be one of the inmates of the house. Then she solemnly cursed the thief. She began in a calm voice, but worked herself up into a frenzy. We all listened horror-struck, and no one interrupted her. She began by saying what had happened, and how these thefts had gone on for some time. She had said nothing before, hoping that the thief would mend his ways; but the matter had gone on long enough, and she was going to curse the thief, as nothing, she felt sure, would make him give up his evil ways. She called on all the spirits of the waters and the hills and the air to listen to her words and to aid her. She began quietly, but became more excited as she went on. She said something of this kind:

[Sidenote: Curses on a man thief.] “‘If the thief be a man, may he be unfortunate in all he undertakes! May he suffer from a disease that does not kill him, but makes him helpless--always in pain--and a burden to others. May his wife be unfaithful to him, and his children become as lazy and dishonest as he is himself. If he go out on the war-path, may he be killed, and his head smoked over

the enemy's fire. If he be boating, may his boat be swamped and may he be drowned. If he be out fishing, may an alligator kill him suddenly, and may his relatives never find his body. If he be cutting down a tree in the jungle, may the tree fall on him and crush him to death. May the gods curse his farm so that he may have no crops, and have nothing to eat, and when he begs for food, may he be refused, and die of starvation.

[Sidenote: Curses on a woman thief.] "'If the thief be a woman, may she be childless, or if she happen to be with child let her be disappointed, and let her child be still-born, or, better still, let her die in childbirth. May her husband be untrue to her, and despise her and ill-treat her. May her children all desert her if she live to grow old. May she suffer from such diseases as are peculiar to women, and may her eyesight grow dim as the years go {36} on, and may there be no one to help her or lead her about when she is blind.'

"I have only given the substance of what she said; but I shall never forget the silence and the awed faces of those who heard her. I left the house early next morning, so I do not know what was the result of her curse--whether the thief confessed or not."[36.1]

[Sidenote: Thieves cursed in ancient Greece.] The ancient Greeks seem to have made a very liberal use of curses as a cheap and effective mode of protecting property, which dispenses the injured party from resorting to the tedious, expensive, and too often fruitless formalities of the law. These curses they inscribed on tablets of lead and other materials and deposited either in the place which was to be protected from depredation or in the temple of the god to whose tender mercies the criminal was committed. For example, in a sacred precinct dedicated to Demeter, Persephone, Pluto and other deities of a stern and inflexible temper at Cnidus, a number of leaden tablets were found inscribed with curses which consigned the malefactors of various sorts to the vengeance of the two Infernal Goddesses, Demeter and her daughter. "May he or she never find Persephone propitious!" is the constantly repeated burden of these prayers; and in some of them the sinner is not only excommunicated in this world but condemned to eternal torments in the world hereafter. Often the persons who launched these curses were ladies. One irate dame consigns to perdition the thief who had stolen her bracelet or the defaulter who had failed to send back her underclothes.[36.2] Another curse, engraved on a marble slab found at Smyrna, purports that if any man should steal one of the sacred vessels of a certain goddess or injure her sacred fish, he may die a painful death, devoured by the fishes.[36.3] Sometimes, apparently, these Greek imprecations {37} were as effective in reclaiming sinners as Dyak curses are to this day. Thus we read of a curious dedication to a lunar deity of Asia Minor, by name Men Aziottenos, which declares how one Artemidorus, having been reviled by a couple of rude fellows, cursed them in a votive tablet, and how one of the culprits, having been punished by the god, made a propitiatory offering and mended his wicked ways.[37.1] [Sidenote: Landmarks protected by gods and curses.] To prevent people from encroaching on their neighbours' land by removing the boundary stones, the Greeks committed landmarks to the special protection of the great god Zeus;[37.2] and Plato dwells with unction on the double punishment, divine and human, to which the sinner exposed himself who dared to tamper with these sacred stones.[37.3] The Romans went even further, for they created a god for the sole purpose of looking after landmarks, and he must have had his hands very full if he executed all the curses which were levelled not only at every man who shifted his neighbour's boundary stone, but even at the oxen which he employed to plough up his neighbour's land.[37.4] The Hebrew code of Deuteronomy pronounced a solemn curse on such as removed their neighbour's landmarks;[37.5] and Babylonian kings exhausted their imagination in pouring out a flood of imprecations against the abandoned wretch who thus set at naught the rights of property in land.[37.6] King Nebuchadnezzar in particular, before he was turned out to grass, appears to have distinguished himself by the richness and variety of his execrations, if we may judge by a specimen of them which has survived. A brief extract from this masterpiece may serve to illustrate the king's style of minatory eloquence. Referring to the bold bad man, "be it shepherd or governor, or agent or regent, levy master or magistrate," whosoever he might be, who "for all days to {38} come, for the future of human habitations," should dare to tamper with the land which his Majesty had just marked out, "Ninib, lord of boundaries and boundary-stones, tear out his boundary stone. Gula, great lady, put lingering illness into his body, that dark and light red blood he may pour out like water. Ishtar, lady of countries, whose fury is a flood, reveal difficulties to him, that he escape not from misfortune. Nusku, mighty lord, powerful burner, the god, my creator, be his evil demon and may he burn his root. Whoever removes this stone, in the dust hides it, burns it with fire, casts it into water, shuts it up in an enclosure, causes a fool, a deaf man, an idiot to take it, places it in an invisible place, may the great gods, who upon this stone are mentioned by their names, curse him with an evil curse, tear out his foundation and destroy his seed."[38.1]

[Sidenote: Superstition as an ally of the rights of private property in Africa.] In Africa also superstition is a powerful ally of the rights of private property. Thus the Balonda place beehives on high trees in the forest and protect them against thieves by tying a charm or "piece of medicine" round the tree-trunks. This proves a sufficient protection. "The natives," says Livingstone, "seldom rob each other, for all believe that certain medicines can inflict disease and death; and though they consider that these are only known to a

few, they act on the principle that it is best to let them all alone. The gloom of these forests strengthens the superstitious feelings of the people. In other quarters, where they are not subjected to this influence, I have heard the chiefs issue proclamations to the effect, that real witchcraft medicines had been placed at certain gardens from which produce had been stolen; the thieves having risked the power of the ordinary charms previously placed there."[38.2]

[Sidenote: The Wanika of East Africa.] The Wanika of East Africa "believe in the power and efficacy of charms and amulets, and they wear them in great variety; legs, arms, neck, waist, hair, and every part of the body are laden with them, either for the cure or prevention of disease; for the expulsion or repulsion of evil spirits; and to keep at bay snakes, wild animals, and every other evil. {39} They hang painted calabashes from the baobab at their hut doors to keep away thieves; shells, dolls, eggs scratched over with Arabic characters by the _Wana Chuoni_ (sons of the book) of the coast, are placed about their plantations and in their fruit-trees, and they believe that death would overtake a thief who should disregard them. A charm bound to the leg of a fowl is ample protection for the village. There is no doubt that, superstitious as the people are, they dread running great risks for the sake of small gains, and so these charms answer their purpose."[39.1] [Sidenote: The Boloki of the Congo.] Among the Boloki of the Upper Congo, when a woman finds that the cassava roots, which she keeps soaking in a water-hole, are being stolen, she takes a piece of gum copal, and fixing it in the cleft of a split stick she puts it on the side of the hole, while at the same time she calls down a curse on the thief. If the thief is a man, he will henceforth have no luck in fishing; if she is a woman, she will have no more success in farming.[39.2] The Ekoi of Southern Nigeria protect their farms against thieves by bundles of palm leaves to which they give the name of _okpata_. Should any one steal from a farm thus protected, he will fall sick and will not recover unless he gives a certain dance, to which the name of _okpata_ is also applied.[39.3]

[Sidenote: Guardian spirits (_damzogs_) of property in Darfur.] In the mountains of Marrah, a district of Darfur, houses, goods, and cattle are protected against thieves by certain fierce and dangerous guardian-spirits called _damzogs_, which can be bought like watch dogs. Under the guardianship of such a spiritual protector the sheep and cows are left free to wander at will; for if any one were rash enough to attempt to steal or kill one of the beasts, his hand with the knife in it would remain sticking fast to the animal's throat till the owner came and caught the rascal. An Arab merchant, travelling in Darfur, received from a friend the following account of the way to procure one of these useful guardians. "At the time when I first began to trade, my friend, I often heard that _damzogs_ could be bought and sold, and that to procure one I must apply to the owner of a _damzog_, and {40} discuss the price with him. When the bargain is concluded, it is necessary to give a large gourd of milk to the seller, who takes it to his house, where are his _damzogs_. On entering he salutes them, and goes and hangs up his vase to a hook, saying,--'One of my friends--such a one--very rich, is in fear of robbers, and asks me to supply him with a guardian. Will one of you go and live in his house? There is plenty of milk there, for it is a house of blessing, and the proof thereof is, that I bring you this _kara_ of milk.' The _damzogs_ at first refuse to comply with the invitation. 'No, no,' say they, 'not one of us will go.' The master of the hut conjures them to comply with his desires, saying, 'Oh! let the one that is willing descend into the _kara_.' He then retires a little, and presently one of the _damzogs_ is heard to flop into the milk, upon which he hastens and claps upon the vase a cover made of date-leaves. Thus stopped up he unhooks the _kara_, and hands it over to the buyer, who takes it away and hangs it on the wall of his hut, and confides it to the care of a slave or of a wife, who every morning comes and takes it, emptying out the milk, washing it and replenishing it, and hanging it up again. From that time forward the house is safe from theft or loss." The merchant's informant, the Shereef Ahmed Bedawee, had himself purchased one of these guardian spirits, who proved most vigilant and efficient in the discharge of his duties; indeed his zeal was excessive, for he not only killed several slaves who tried to rob his master, but did summary execution on the Shereef's own son, when the undutiful young man essayed to pilfer from his father's shop. This was too much for the Shereef; he invited a party of friends to assist him in expelling the inflexible guardian. They came armed with guns and a supply of ammunition, and by raking the shop with repeated volleys of musketry they at last succeeded in putting the spirit to flight.[40.1]

[Sidenote: The curses of smiths and potters.] Amongst the Nandi of British East Africa nobody dares to steal anything from a smith; for if he did, the smith would heat his furnace, and as he blew the bellows to make {41} the flames roar he would curse the thief so that he would die. And in like manner among these people, with whom the potters are women, nobody dares to filch anything from a potter; for next time she heated her wares the potter would curse him, saying, "Burst like a pot, and may thy house become red," and the thief so cursed would die.[41.1] [Sidenote: Charms to protect property in West Africa.] In Loango, when a man is about to absent himself from home for a considerable time he protects his hut by placing a charm or fetish before it, consisting perhaps of a branch with some bits of broken pots or trash of that sort; and we are told that even the most determined robber would not dare to cross a threshold defended by these mysterious signs.[41.2] On the coast of Guinea fetishes are sometimes inaugurated for the purpose of detecting and punishing certain kinds of theft; and not only the culprit himself, but any person who knows of his crime and fails to give information is liable to be punished by the fetish. When such a fetish is instituted, the whole community is warned

of it, so that he who transgresses thereafter does so at his peril. For example, a fetish was set up to prevent sheep-stealing and the people received warning in the usual way. Shortly afterwards a slave, who had not heard of the law, stole a sheep and offered to divide it with a friend. The friend had often before shared with him in similar enterprises, but the fear of the fetish was now too strong for him; he informed on the thief, who was brought to justice and died soon after of a lingering and painful disease. Nobody in the country ever doubted but that the fetish had killed him.[41.3] Among the Ewe-speaking tribes of the Slave Coast in West Africa houses and household property are guarded by amulets (_võ-sesao_), which derive their virtue from being consecrated or belonging to the gods. The crops, also, in solitary glades of the forest are left under the protection of such amulets, generally fastened to long sticks in some conspicuous position; and so guarded they are quite safe from pillage. By the side of the paths, too, may be seen food and palm-wine {42} lying exposed for sale with nothing but a charm to protect them; a few cowries placed on each article indicate its price. Yet no native would dare to take the food or the wine without depositing its price; for he dreads the unknown evil which the god who owns the charm would bring upon him for thieving.[42.1] In Sierra Leone charms, called _greegrees_, are often placed in plantations to deter people from stealing, and it is said that "a few old rags placed upon an orange tree will generally, though not always, secure the fruit as effectually as if guarded by the dragons of the Hesperides. When any person falls sick, if, at the distance of several months, he recollects having stolen fruit, etc., or having taken it _softly_ as they term it, he immediately supposes _wangka_ has caught him, and to get cured he must go or send to the person whose property he had taken, and make to him whatever recompense he demands."[42.2]

[Sidenote: Charms to protect property in the West Indies.] Superstitions of the same sort have been transported by the negroes to the West Indies, where the name for magic is _obi_ and the magician is called the _obeah_ man. There also, we are told, the stoutest-hearted negroes "tremble at the very sight of the ragged bundle, the bottle or the egg-shells, which are stuck in the thatch or hung over the door of a hut, or upon the branch of a plantain tree, to deter marauders.… When a negro is robbed of a fowl or a hog, he applies directly to the _Obeah_-man or woman; it is then made known among his fellow blacks, that _obi_ is set for the thief; and as soon as the latter hears the dreadful news, his terrified imagination begins to work, no resource is left but in the superior skill of some more eminent _Obeah_-man of the neighbourhood, who may counteract the magical operations of the other; but if no one can be found of higher rank and ability; or if, after gaining such an ally, he should still fancy himself affected, he presently falls into a decline, under the incessant horror of impending calamities. The slightest painful sensation in the head, the bowels, or {43} any other part, any casual loss or hurt, confirms his apprehensions, and he believes himself the devoted victim of an invisible and irresistible agency. Sleep, appetite and cheerfulness forsake him; his strength decays, his disturbed imagination is haunted without respite, his features wear the settled gloom of despondency: dirt, or any other unwholesome substance, becomes his only food, he contracts a morbid habit of body, and gradually sinks into the grave."[43.1] Superstition has killed him.

[Sidenote: Conclusion.] Similar evidence might doubtless be multiplied, but the foregoing cases suffice to shew that among many peoples and in many parts of the world superstitious fear has operated as a powerful motive to deter men from stealing. If that is so, then my second proposition may be regarded as proved, namely, that among certain races and at certain times superstition has strengthened the respect for private property and has thereby contributed to the security of its enjoyment.

IV. MARRIAGE

{44}

[Sidenote: Superstition as a prop of sexual morality.] I pass now to my third proposition, which is, that among certain races and at certain times superstition has strengthened the respect for marriage, and has thereby contributed to a stricter observance of the rules of sexual morality both among the married and the unmarried. That this is true will appear, I think, from the following instances.

[Sidenote: Adultery or fornication supposed by the Karens to blight the crops.] Among the Karens of Burma "adultery, or fornication, is supposed to have a powerful influence to injure the crops. Hence, if there have been bad crops in a village for a year or two, and the rains fail, the cause is attributed to secret sins of this character, and they say the God of heaven and earth is angry with them on this account; and all the villagers unite in making an offering to appease him." [Sidenote: Pig's blood used to expiate the crime.] And when a case of adultery or fornication has come to light, "the elders decide that the transgressors must buy a hog, and kill it. Then the woman takes one foot of the hog, and the man takes another, and they scrape out furrows in the ground with each foot, which they fill with the blood of the hog. They next scratch the ground with their hands and pray: 'God of heaven and earth, God of the mountains and hills, I have destroyed the productiveness of the country. Do not be angry with me, do not hate me; but have mercy on me, and compassionate me. Now I repair the mountains, now I heal the hills, and the streams and the lands. May there

be no failure of crops, may there be no unsuccessful labours, or unfortunate efforts in my country. Let them be dissipated to the foot of the horizon. Make thy paddy fruitful, thy rice abundant. Make the vegetables to flourish. {45} If we cultivate but little, still grant that we may obtain a little.' After each has prayed thus, they return to the house and say they have repaired the earth."[45.1] Thus, according to the Karens adultery and fornication are not simply moral offences which concern no one but the culprits and their families: they physically affect the course of nature by blighting the earth and destroying its fertility; hence they are public crimes which threaten the very existence of the whole community by cutting off its food supplies at the root. But the physical injury which these offences do to the soil can be physically repaired by saturating it with pig's blood.

[Sidenote: Disastrous effects ascribed to sexual crime in Assam, Bengal, and Annam.] Some of the tribes of Assam similarly trace a connexion between the crops and the behaviour of the human sexes; for they believe that so long as the crops remain ungarnered, the slightest incontinence would ruin all.[45.2] Again, the inhabitants of the hills near Rajamahal in Bengal imagine that adultery, undetected and unexpiated, causes the inhabitants of the village to be visited by a plague or destroyed by tigers or other ravenous beasts. To prevent these evils an adulteress generally makes a clean breast. Her paramour has then to furnish a hog, and he and she are sprinkled with its blood, which is supposed to wash away their sin and avert the divine wrath. When a village suffers from plague or the ravages of wild beasts, the people religiously believe that the calamity is a punishment for secret immorality, and they resort to a curious form of divination to discover the culprits, in order that the crime may be duly expiated.[45.3] The Khasis of Assam are divided into a number of clans which are exogamous, that is to say, no man may marry a woman of his own clan. Should a man be found to cohabit with a woman of his own clan, it is treated as incest and is believed to cause great disasters; the people will be struck by lightning or killed by tigers, the women will die in child-bed, and {46} so forth. The guilty couple are taken by their clansmen to a priest and obliged to sacrifice a pig and a goat; after that they are made outcasts, for their offence is inexpiable.[46.1] The Orang Glai, a savage tribe in the mountains of Annam, similarly suppose that illicit love is punished by tigers, which devour the sinners. If a girl is found with child, her family offers a feast of pigs, fowls, and wine to appease the offended spirits.[46.2]

[Sidenote: Similar views held by the Battas of Sumatra.] The Battas of Sumatra in like manner think that if an unmarried woman is with child, she must be given in marriage at once, even to a man of lower rank; for otherwise the people will be infested with tigers, and the crops in the fields will not be abundant. They also believe that the adultery of married women causes a plague of tigers, crocodiles, or other wild beasts. The crime of incest, in their opinion, would blast the whole harvest, if the wrong were not speedily repaired. Epidemics and other calamities that affect the whole people are almost always traced by them to incest, by which is to be understood any marriage that conflicts with their customs.[46.3] The natives of Nias, an island to the west of Sumatra, imagine that heavy rains are caused by the tears of a god weeping at the commission of adultery or fornication. The punishment for these crimes is death. The two delinquents, man and woman, are buried in a narrow grave with only their heads projecting above ground; then their throats are stabbed with a spear or cut with a knife, and the grave is filled up. Sometimes, it is said, they are buried alive. However, the judges are not always incorruptible and the injured family not always inaccessible to the allurement of gain; and pecuniary compensation is sometimes accepted as a sufficient salve for wounded honour. But if the wronged man is a chief, the culprits must surely die. As a consequence, perhaps, of this severity, the crimes {47} of adultery and fornication are said to be far less frequent in Nias than in Europe.[47.1]

[Sidenote: Similar views among the tribes of Borneo.] Similar views prevail among many tribes in Borneo. Thus in regard to the Sea Dyaks we are told by Archdeacon Perham that "immorality among the unmarried is supposed to bring a plague of rain upon the earth, as a punishment inflicted by _Petara_. [Sidenote: Excessive rains thought by the Dyaks to be caused by sexual offences.] It must be atoned for with sacrifice and fine. In a function which is sometimes held to procure fine weather, the excessive rain is represented as the result of the immorality of two young people. _Petara_ is invoked, the offenders are banished from their home, and the bad weather is said to cease. Every district traversed by an adulterer is believed to be accursed of the gods until the proper sacrifice has been offered."[47.2] When rain pours down day after day and the crops are rotting in the fields, these Dyaks come to the conclusion that some people have been secretly indulging in lusts of the flesh; so the elders lay their heads together and adjudicate on all cases of incest and bigamy, and purify [Sidenote: Blood of pigs shed to expiate incest and unchastity.] the earth with the blood of pigs, which appears to these savages, as sheep's blood appeared to the ancient Hebrews, to possess the valuable property of atoning for moral guilt. Not long ago the offenders, whose lewdness had thus brought the whole country into danger, would have been punished with death or at least slavery. A Dyak may not marry his first cousin unless he first performs a special ceremony called _bergaput_ to avert evil consequences from the land. The couple repair to the water-side, fill a small pitcher with their personal ornaments, and sink it in the river; or instead of a jar they fling a chopper and a plate into the water. A pig {48} is then sacrificed on the bank, and its carcase, drained of blood, is thrown in after the jar. Next the pair are pushed into the

water by their friends and ordered to bathe together. Lastly, a joint of bamboo is filled with pig's blood, and the couple perambulate the country and the villages round about, sprinkling the blood on the ground. After that they are free to marry. This is done, we are told, for the sake of the whole country, in order that the rice may not be blasted by the marriage of cousins.[48.1] Again, we are informed that the Sibuyaus, a Dyak tribe of Sarawak, are very careful of the honour of their daughters, because they imagine that if an unmarried girl is found to be with child it is offensive to the higher powers, who, instead of always chastising the culprits, punish the tribe by visiting its members with misfortunes. Hence when such a crime is detected they fine the lovers and sacrifice a pig to appease the angry powers and to avert the sickness or other calamities that might follow. Further, they inflict fines on the families of the couple for any severe accident or death by drowning that may have happened at any time within a month before the religious atonement was made; for they regard the families of the culprits as responsible for these mishaps. The fines imposed for serious or fatal accidents are heavy; for simple wounds they are lighter. With the fear of these fines before their eyes parents keep a watchful eye on the conduct of their daughters. Among the Dyaks of the Batang Lupar river the chastity of the unmarried girls is not so strictly guarded; but in respectable families, when a daughter proves frail, they sacrifice a pig and sprinkle its blood on the doors to wash away the sin.[48.2] The Hill Dyaks of Borneo abhor incest and do not allow the marriage even of cousins. In 1846 the Baddat Dyaks complained to Mr. Hugh Low that one of their chiefs had disturbed the peace and prosperity of the village by marrying his own granddaughter. Since that disastrous event, they said, no bright day had blessed their territory; rain and darkness alone prevailed, and unless the plague-spot were {49} removed, the tribe would soon be ruined. The old sinner was degraded from office, but apparently allowed to retain his wife; and the domestic brawls between this ill-assorted couple gave much pain to the virtuous villagers.[49.1]

[Sidenote: Incest punished with death by the pagan tribes of Borneo.] Among the pagan tribes of Borneo in general, but of Sarawak in particular, "almost all offences are punished by fines only. Of the few offences which are felt to require a heavier punishment, the one most seriously regarded is incest. For this offence, which is held to bring grave peril to the whole house, especially the danger of starvation through failure of the _padi_ crop, two punishments have been customary. If the guilt of the culprits is perfectly clear, they are taken to some open spot on the river-bank at some distance from the house. There they are thrown together upon the ground and a sharpened bamboo stake is driven through their bodies, so that they remain pinned to the earth. The bamboo, taking root and growing luxuriantly on this spot, remains as a warning to all who pass by; and, needless to say, the spot is looked on with horror and shunned by all men. The other method of punishment is to shut up the offenders in a strong wicker cage and to throw them into the river. This method is resorted to as a substitute for the former one, owing to the difficulty of getting any one to play the part of executioner and to drive in the stake, for this involves the shedding of the blood of the community. The kind of incest most commonly committed is the connection of a man with an adopted daughter, and (possibly on account of this frequency) this is the kind which is most strongly reprobated…. The punishment of the incestuous couple does not suffice to ward off the danger brought by them upon the community. The household must be purified with the blood of pigs and fowls; the animals used are the property of the offenders or of their family; and in this way a fine is imposed. When any calamity threatens or falls upon a house, especially a great rising of the river which threatens to sweep away the house or the tombs of the household, the Kayans are led to suspect that incestuous intercourse in their own or in neighbouring houses has taken place; and they look round for evidences of it, and sometimes detect a case which otherwise would {50} have remained hidden. It seems probable that there is some intimate relation between this belief and the second of the two modes of punishment described above; but we have no direct evidence of such connection. All the other peoples also, except the Punans, punish incest with death. Among the Sea Dyaks the most common form of incest is that between a youth and his aunt, and this is regarded at least as seriously as any other form."[50.1]

[Sidenote: Evil and confusion supposed by the Dyaks to be wrought by fornication.] Nor is it the heinous crime of incest alone which in the opinion of the Sea Dyaks endangers the whole community. The same effect is supposed to follow whenever an unmarried woman is found with child and cannot or will not name her seducer. "The greatest disgrace," we are told, "is attached to a woman found in a state of pregnancy, without being able to name her husband; and cases of self-poisoning, to avoid the shame, are not of unusual occurrence. If one be found in this state, a fine must be paid of pigs and other things. Few even of the chiefs will come forward without incurring considerable responsibility. A pig is killed, which nominally becomes the father, for want, it is supposed, of another and better one. Then the surrounding neighbours have to be furnished with a share of the fine to banish the _Jabu_, which exists after such an event. If the fine be not forthcoming, the woman dare not move out of her room, for fear of being molested, as she is supposed to have brought evil (_kudi_) and confusion upon the inhabitants and their belongings."[50.2]

[Sidenote: Similar beliefs and customs among the tribes of Dutch Borneo.] The foregoing accounts refer especially to the tribes of Borneo under British rule; but similar ideas and customs prevail among the kindred tribes of Dutch Borneo. Thus the Kayans or Bahaus in the interior of the island believe that adultery is punished by the spirits, who visit the whole tribe with failure of the crops

and other misfortunes. Hence in order to avert these evil consequences from the innocent members of the tribe, the two culprits, with all their possessions, are first placed on a gravel bank in the middle of the river, in order to isolate or, in electrical {51} language, to insulate them and so prevent the moral or rather physical infection from spreading. Then pigs and fowls are killed, and with the blood priestesses smear the property of the guilty pair in order to disinfect it. Finally, the two are placed on a raft, with sixteen eggs, and allowed to drift down stream. They may save themselves by plunging into the water and swimming ashore; but this is perhaps a mitigation of an older sentence of death by drowning, for young people still shower long grass stalks, representing spears, at the shamefaced and dripping couple.[51.1] Certain it is, that some Dyak tribes used to punish incest by fastening the man and woman in separate baskets laden with stones and drowning them in the river. By incest they understood the cohabitation of parents with children, of brothers with sisters, and of uncles and aunts with nieces and nephews. A Dutch resident had much difficulty in saving the life of an uncle and niece who had married each other; finally he procured their banishment to a distant part of Borneo.[51.2] The Blu-u Kayans, another tribe in the interior of Borneo, believe that an intrigue between an unmarried pair is punished by the spirits with failure of the harvest, of the fishing, and of the hunt. Hence the delinquents have to appease the wrath of the spirits by sacrificing a pig and a certain quantity of rice.[51.3] In Pasir, a district of Eastern Borneo, incest is thought to bring dearth, epidemics, and all sorts of evils on the land.[51.4] In the island of Ceram a man convicted of unchastity has to smear every house in the village with the blood of a pig and a fowl: this is supposed to wipe out his guilt and ward off misfortunes from the village.[51.5]

[Sidenote: Failure of the crops and other disasters thought to be caused by incest in Celebes.] When the harvest fails in Southern Celebes, the Macassars and Bugineese regard it as a sure sign that incest has been committed and that the spirits are angry. In the years 1877 and 1878 it happened that the west monsoon did not {52} blow and that the rice crop in consequence came to nothing; moreover many buffaloes died of a murrain. At the same time there was in the gaol at Takalar a prisoner, who had been formerly accused of incest. Some of the people of his district begged the Dutch governor to give the criminal up to them, for according to the general opinion the plagues would never cease till the guilty man had received the punishment he deserved. All the governor's powers of persuasion were needed to induce the petitioners to return quietly to their villages; and when the prisoner, having served his time, was released shortly afterwards, he was, at his own request, given an opportunity of sailing away to another land, as he no longer felt safe in his own country.[52.1] [Sidenote: Disastrous effects supposed to follow from shedding the blood of incestuous couples on the ground.] Even when the incestuous couple has been brought to justice, their blood may not be shed; for the people think that, were the ground to be polluted by the blood of such criminals, the rivers would dry up and the supply of fish would run short, the harvest and the produce of the gardens would miscarry, edible fruits would fail, sickness would be rife among cattle and horses, civil strife would break out, and the country would suffer from other widespread calamities. Hence the punishment of the guilty is such as to avoid the spilling of their blood: usually they are tied up in a sack and thrown into the sea to drown. Yet they get on their journey to eternity the necessary provisions, consisting of a bag of rice, salt, dried fish, coco-nuts, and other things, among which three quids of betel are not forgotten.[52.2] We can now perhaps understand why the Romans used to sew up a parricide in a sack with a dog, a cock, a viper, and an ape for company, and fling him into the sea. They probably feared to defile the soil of Italy by spilling upon it the blood of such a miscreant.[52.3] Amongst the Tomori of Central Celebes {53} a person guilty of incest is throttled; no drop of his blood may fall on the ground, for if it did, the rice would never grow again. The union of uncle with niece is regarded by these people as incest, but it can be expiated by an offering. A garment of the man and one of the woman are laid on a copper vessel; the blood of a sacrificed animal, either a goat or a fowl, is allowed to drip on the garments, and then the vessel with its contents is set floating down the river.[53.1] Among the Tololaki, another tribe of Central Celebes, persons who have defiled themselves with incest are shut up in a basket and drowned. No drop of their blood may be spilt on the ground, for that would hinder the earth from ever bearing fruit again.[53.2] Among the Bare'e-speaking Toradjas of Central Celebes in general the penalty for incest, that is for the sexual intercourse of parents with children or of brothers with sisters, is death. But whereas the death-sentence for adultery is executed with a spear or a sword, the death-sentence for incest is usually executed among the inland tribes by clubbing or throttling; for were the blood of the culprits to drip on the ground, the earth would be rendered barren. The people on the coast put the guilty pair in a basket, weight it with stones, and fling it into the sea. This prescribed manner of putting the incestuous to death, we are informed, makes the execution very grievous. However, the writers who furnish us with these particulars and who have lived among the people on terms of intimacy for many years, add that "incest seldom occurs, or rather the cases that come to light are very few."[53.3] In some districts of Central Celebes, the marriage of cousins, provided they are children of two sisters, is forbidden under pain of death; the people think that such an alliance would anger the spirits, and that the rice and maize harvests would fail. Strictly speaking, two such cousins who have committed the {54} offence should be tied together, weighted with stones, and thrown into water to drown. In practice, however, the culprits are spared and their sin expiated by shedding the blood of a buffalo or a goat. The blood is mixed with water and sprinkled on the rice-fields or

poured on the maize-fields, no doubt in order to appease the angry spirits and restore its fertility to the tilled land. The natives of these districts believe that were a brother and sister to commit incest, the ground on which the tribe dwells would be swallowed up. If such a crime takes place, the guilty pair are tied together, their feet weighted with stones, and thrown into the sea.[54.1]

[Sidenote: Excessive rains, earthquakes, and volcanic eruptions supposed to be produced by incest in Halmahera.] When it rains in torrents, the Galelareese of Halmahera, another large East Indian island, say that brother and sister, or father and daughter, or in short some near kinsfolk are having illicit relations with each other, and that every human being must be informed of it, for then only will the rain cease to descend. The superstition has repeatedly caused blood relations to be accused, rightly or wrongly, of incest. Further, the people think that alarming natural phenomena, such as a violent earthquake or the eruption of a volcano, are caused by crimes of the same sort. Persons charged with such offences are brought to Ternate; it is said that formerly they were often drowned on the way or, on being haled thither, were condemned to be thrown into the volcano.[54.2] In the Banggai Archipelago, to the east of Celebes, earthquakes are explained as punishments inflicted by evil spirits for indulgence in illicit love.[54.3]

[Sidenote: Breaches of sexual morality thought to blight the fruits of the earth and otherwise disturb the course of nature in Africa.] In some parts of Africa, also, it is believed that breaches of sexual morality disturb the course of nature, particularly by blighting the fruits of the earth; and probably such views {55} are much more widely diffused in that continent than the scanty and fragmentary evidence at our disposal might lead us to suppose. Thus, the negroes of Loango, in West Africa, imagine that the commerce of a man with an immature girl is punished by God with drought and consequent famine until the transgressors expiate their transgression by dancing naked before the king and an assembly of the people, who throw hot gravel and bits of glass at the pair as they run the gauntlet. The rains in that country should fall in September, but in 1898 there was a long drought, and when the month of December had nearly passed, the sun-scorched stocks of the fruitless Indian corn shook their rustling leaves in the wind, the beans lay shrivelled and black on the ruddy soil, and the shoots of the sweet potato had flowered and withered long ago. The people cried out against their rulers for neglecting their duty to the primeval powers of the earth; the priests of the sacred groves had recourse to divination and discovered that God was angry with the land on account of the immorality of certain persons unknown, who were not observing the traditions and laws of their God and country. The feeble old king had fled, but the slave who acted as regent in his room sent word to the chiefs that there were people in their towns who were the cause of God's wrath. So every chief called his subjects together and caused enquiries to be made, and then it was discovered that three girls had broken the customs of their country; for they were with child before they had passed through what is called the paint-house, that is, before they had been painted red and secluded for a season in token that they had attained to the age of puberty. The people were incensed and endeavoured to punish or even kill the three girls; and the English writer who has recorded the case has thought it worth while to add that on the very morning when the culprits were brought before the magistrate rain fell.[55.1] Amongst the Bavili of Loango, who are divided into totemic clans, no man is allowed to marry a woman of his mother's clan; and God is {56} believed to punish a breach of this marriage law by withholding the rains in their due season.[56.1] Similar notions of the blighting influence of sexual crime appear to be entertained by the Nandi of British East Africa; for we are told that when a warrior has got a girl with child, she "is punished by being put in Coventry, none of her girl friends being allowed to speak to or look at her until after the child is born and buried. [Sidenote: Sexual purity required of those who handle corn or enter a granary.] She is also regarded with contempt for the rest of her life and may never look inside a granary for fear of spoiling the corn."[56.2] Among the Basutos in like manner "while the corn is exposed to view, all defiled persons are carefully kept from it. If the aid of a man in this state is necessary for carrying home the harvest, he remains at some distance while the sacks are filled, and only approaches to place them upon the draught oxen. He withdraws as soon as the load is deposited at the dwelling, and under no pretext can he assist in pouring the corn into the basket in which it is preserved."[56.3] The nature of the defilement which thus disqualifies a man from handling the corn is not mentioned, but we may conjecture that unchastity would fall under this general head. For amongst the Basutos after a child is born a fresh fire has to be kindled in the dwelling by the friction of wood, and this must be done by a young man of chaste habits; it is believed that an untimely death awaits him who should dare to discharge this holy office after having lost his innocence.[56.4] In Morocco whoever enters a granary must first remove his slippers and must be sexually clean. Were an unclean person to enter, the people believe not only that the grain would lose its blessed influence (_baraka_), but that he himself would fall ill. A Berber told Dr. Westermarck {57} that he had suffered from painful boils through entering a granary in a state of uncleanness.[57.1] The same rule applies in Morocco to a vegetable garden. Only the sexually clean may enter it, otherwise both the vegetables and the person entering would be the worse for it.[57.2]

[Sidenote: Incest supposed by the Dinkas to be punished with sterility.] The Dinkas of the Upper Nile believe that incest angers the ancestral spirits (_jok_), who punish the girl by making her barren. Even should she marry, she will have no children until she has confessed her sin, and atonement has been made for it. Her lover must provide a bullock for sacrifice. His father kills the animal,

and the girl's father takes some of the contents of the large intestine and smears it on his daughter's abdomen and on that of her guilty partner. Thus the taint of sin is removed, and the woman is rendered capable of bearing children.[57.3] The Maloulekes and Hlengoues, two tribes of Southern Africa to the north of the Thonga, think that if a young man gets a girl, who is not his wife, with child, people will die in the village. Hence, when the girl's pregnancy is discovered, the lover has to provide a girl by way of fine.[57.4]

[Sidenote: Incest enjoined in certain cases as a mode of ensuring good luck.] It is very remarkable, however, that among tribes which strongly disapprove of incestuous relations in general, the act of incest is nevertheless positively enjoined in certain circumstances as a mode of ensuring good luck. Thus in the Thonga tribe of South-Eastern Africa, round about Delagoa Bay, there is a class of men who devote themselves to the business of hunting hippopotamuses on the rivers. In the pursuit of their trade they observe a number of curious superstitions which have been handed down among them for generations from father to son. For example, they inoculate themselves with a certain drug which is supposed to endow them with such a power over the hippopotamuses that when the hunter wounds one of them the animal cannot go far away and the man can track and {58} despatch it. During the day the hunter fishes in the river, keeping his eye all the time on the unwieldy monsters disporting themselves in the water or lumbering through the thickets on the banks. [Sidenote: Incest of Thonga hippopotamus hunter with his daughter.] "When he sees that the propitious season has come and when he is ready to undertake a hunting expedition of one month, he first calls his own daughter to his hut and has sexual relations with her. This incestuous act, which is strongly taboo in ordinary life, has made of him a 'murderer': he has killed something at home; he has acquired the courage for doing great deeds on the river. Henceforth he will have no sexual relations with his wives during the whole campaign. On the same night, immediately after the act, he starts with his sons; they close the drift where the beasts leave the river by putting a canoe across the track." Meantime the hippopotamuses are browsing in the forest or trampling down the crops of the fields in their clumsy fashion. As they come trooping back to the river they are stopped by the canoe in the path, and while they are examining the strange obstacle, the hunters, lying in ambush, dart their spears into the thick hides of the beasts. The handles of the spears are loosely attached to the blades, but connected with them by a long string, so that when the wounded monster, crashing irresistibly in his rage through the thicket, plunges into the river and sinks out of sight in the water, the handle of the spear becomes detached from the blade and floats like a buoy on the surface, shewing the direction taken by the beast. As soon as the hunter has thrown his spear he runs home to tell his wife. She must at once shut herself up in the hut and remain perfectly quiet, without eating or drinking or crushing her mealies; for were she to do any of these things, the wounded hippopotamus would shew fight and might kill her husband, whereas if she keeps quiet, the animal will be quiet too. All the hunters in the village are then called up, and embarking in a canoe, paddle away after their prey, whose retreat is marked by the bobbing of the spear-handle on the surface of the water and the occasional emergence of a great flat snout to breathe. When the beast has been despatched, and the carcase landed on the bank, it is turned on its back and the hunter creeps between its legs {59} from behind and along its belly and chest as far as the mouth. Then he goes away. By this ceremony the man is supposed to take upon himself the defilement, possibly the nature, of the animal, so that in future when he meets hippopotamuses the animals will not perceive him to be a man but will mistake him for an hippopotamus; and thus he will be able to slaughter the deluded creatures with impunity.[59.1]

[Sidenote: Suggested explanation of the Thonga practice.] So far as we can guess at the meaning of these curious rites, their general intention seems to be to identify the hunter and his family with the game which he hunts in order to give him full power over the animals. This intention is manifested in the behaviour of the hunter's wife while the hippopotamus is wounded; she so far identifies herself with the animal that whatever she does he is supposed to do. If she goes about her work briskly and refreshes herself with food and drink, the hippopotamus also will be brisk and refreshed, and will give warm work to his pursuers; whereas if she keeps perfectly still, the animal will make no resistance but follow the hunters like a sheep to the slaughter. Perhaps the same train of thought partially explains the incest which the hunter has to commit with his own daughter before he sets out for the chase. Can it be that by this violence done to his offspring he is supposed to acquire power over the beast? It may be so, yet it is difficult to see why the violence should take this particular form, and why, on the principles of homoeopathic or imitative magic, a pretence of wounding and killing the girl with a spear would not have served his turn better.

[Sidenote: Incest prescribed among the Antambahoaka of Madagascar.] Another tribe of savages who imagine that in certain circumstances incest is the road to fortune are the Antambahoaka of South-Eastern Madagascar. Before setting out for the chase or the fishing or war or other enterprise, every Antambahoaka arranges to have sexual relations with his sister or with his nearest female relation; he thinks in this way to ensure the success of his expedition.[59.2] What the {60} exact train of thought may be which prompts these exceptional and deliberate aberrations from the usual rules of morality, it is difficult to understand; I mention the facts because they apparently contradict the ordinary savage view of conduct, and so far help us to perceive how little as yet we

really know about the inmost workings of the savage mind.

[Sidenote: Similar beliefs as to the disastrous effect of sexual crimes among the civilized peoples of antiquity.] Leaving out of account these remarkable and as yet not fully explained exceptions to the rule,[60.1] we may say generally that among many savage races breaches of the marriage laws are believed to draw down on the community public calamities of the most serious character, and that in particular they are thought to blast the fruits of the earth through excessive rain or excessive drought. Traces of similar beliefs may perhaps be detected among the civilized races of antiquity. [Sidenote: The Hebrews.] Thus among the Hebrews we read how Job, passionately protesting his innocence before God, declares that he is no adulterer; "For that," says he, "were an heinous crime; yea it were an iniquity to be punished by the judges: for it is a fire that consumeth unto Destruction, and would root out all mine increase."[60.2] In this passage the Hebrew word translated "increase" commonly means "the produce of the earth";[60.3] and if we give the word its usual sense here, then Job affirms adultery to be destructive of the fruits of the ground, which is precisely what many savages still believe. This interpretation of his words is strongly confirmed by two narratives in Genesis, where we read how Sarah, Abraham's {61} wife, was taken by a king into his harem, and how thereafter God visited the king and his household with great plagues, especially by closing up the wombs of the king's wife and his maid-servants so that they bare no children. It was not till the king had discovered and confessed his sin, and Abraham had prayed God to forgive him, that the king's women again became fruitful.[61.1] These narratives seem to imply that adultery, even when it is committed in ignorance, is a cause of plague and especially of sterility among women. Again, in Leviticus, after a long list of sexual crimes, we read:[61.2] "Defile not ye yourselves in any of these things: for in all these the nations are defiled which I cast out from before you: and the land is defiled: therefore I do visit the iniquity thereof upon it, and the land vomiteth out her inhabitants." This passage seems to imply that the land itself was somehow physically affected by sexual transgressions in such a way that it could no longer support the inhabitants. [Sidenote: The Greeks.] Apparently the ancient Greeks entertained a similar view of the wasting effect of incest; for according to Sophocles the land of Thebes suffered from blight, pestilence, and the sterility both of women and cattle under the reign of Oedipus, who had unwittingly slain his father and married his mother; the country was emptied of its inhabitants, and the Delphic oracle declared that the only way to restore prosperity to it was to banish the sinner.[61.3] No doubt the poet and his hearers set down these public calamities in part to the guilt of parricide which rested on Oedipus; but probably they also laid much of the evil at the door of the incest which he had committed with his mother. [Sidenote: The Romans.] In the reign of the emperor Claudius a Roman noble was accused of incest with his sister. He committed suicide, his sister was banished, and the emperor ordered that certain ancient ceremonies derived from the laws of King Servius Tullius should be performed, and that expiation should be made by the pontiffs at the sacred grove of Diana.[61.4] As Diana appears to have been a goddess of fertility in general and of the {62} fruitfulness of women in particular,[62.1] the expiation for incest offered at her sanctuary may perhaps be accepted as evidence that the Romans, like other peoples, attributed to sexual immorality a tendency to blast the fruits both of the earth and of the womb.

[Sidenote: Blighting effect attributed to incest by the ancient Irish.] According to an ancient Irish legend Munster was afflicted in the third century of our era with a failure of the crops and other misfortunes. When the nobles enquired into the matter, they learned that these calamities were the result of an incest which the king had committed with his sister. In order to put an end to the evil they demanded of the king his two sons, the fruit of this unholy union, that they might consume them with fire and cast their ashes into the running stream.[62.2] Again, Irish legend relates that Cairbre Musc "had two sons by his sister. Her name was Duben, and theirs were Corc and Cormac respectively. The children were twins, and the story of their birth is no less strange than that of Dylan and Llew, for one of them was found to have nipped off his brother's ears before his birth. The crime of their parents caused the crops to fail, which, according to the idea prevalent in ancient Ireland, was its natural result, and Cairbre was obliged to confess his guilt to the nobles of his realm, who, when the children were born, ordered them to be burnt, that the incest might not remain in the land. 'Give me,' said Cairbre's druid, 'that _Corc_[62.3] there, that I may place him outside Erinn, so that the incest may not be within it.' Corc was given to the druid, and the latter, with his wife, whose name was Bói, took him to an island. They had a white cow with red ears, and an ablution was performed by them every morning on Corc, placed on the cow's back; so in a year's time to the day the cow sprang away from them into the sea, and she became a rock in it; to wit, the heathenism of the boy had entered into her. _Bó Búi_, or Bói's Cow, is the name of the rock, and _Inis Búi_, or Bói's Isle, that of the island. The boy was {63} afterwards brought back into Erinn. Such is the story how Corc was purged of the virulence of his original sin, and the scene is one of the three islets called the Bull, the Cow and the Calf, not far from Dursey Island, in the gulf called Kenmare River."[63.1]

[Sidenote: Thus sexual irregularities are often supposed to endanger the whole community.] Thus it appears that in the opinion of many peoples sexual irregularities, whether of the married or the unmarried, are not merely moral offences which affect only the few persons immediately concerned; they are believed to involve the whole people in danger and disaster either directly by a sort of

magical influence or indirectly by rousing the wrath of gods to whom these acts are offensive. Nay they are often supposed to strike a blow at the very existence of the community by blighting the fruits of the earth and thereby cutting off the food supply. Wherever these superstitions prevail, it is obvious that public opinion and public justice will treat sexual offences with far greater severity than is meted out to them by peoples who, like most civilized nations, regard such misdemeanours as matters of private rather than of public concern, as sins rather than crimes, which may perhaps affect the eternal welfare of the individual sinner in a life hereafter, but which do not in any way imperil the temporal welfare of the innocent community as a whole. [Sidenote: Hence the extreme rigour with which sexual crimes have been punished by many races.] And conversely, wherever we find that incest, adultery, and fornication are treated by the community with extreme rigour, we may reasonably infer that the original motive for such treatment was superstition; in other words, that wherever a tribe or nation, not content with leaving these transgressions to be avenged by the injured parties, has itself punished them with exceptional severity, the reason for doing so has probably been a belief that the effect of all such delinquencies is to disturb the course of nature and thereby to endanger the whole people, who accordingly must protect themselves by effectually disarming and, if necessary, exterminating the delinquents. [Sidenote: Ancient codes.] This may explain, for example, why the Indian Laws of Manu decreed that an adulteress should be devoured by dogs in a public place, and that an adulterer should be roasted to death on a red-hot iron {64} bed;[64.1] why the Babylonian code of Hammurabi sentenced an adulterous couple to be strangled and cast into the river; and why the same code punished incest with a mother by burning both the culprits.[64.2] On the same supposition we can understand the severity of the punishments meted out to certain sexual offences by the Mosaic law. Thus, for example, under it an adulteress and her paramour were sentenced to death:[64.3] a woman who at marriage was found not to be a maid was stoned:[64.4] the unchaste daughter of a priest was burned with fire;[64.5] and if a man married a woman and her daughter, he and they were in like manner doomed to the flames.[64.6]

[Sidenote: Rigorous penalties inflicted in Africa.] Many African tribes repress sexual crimes by rigorous penalties, or did so until their moral standard was modified by contact with Europeans. [Sidenote: The Baganda, their punishments for breaches of sexual morality.] Among the Baganda of Central Africa, “though death was usually the punishment inflicted for adultery, an offender’s life would sometimes be spared, and he be fined two women, if he were able to pay them; the culprit was, however, maimed; he lost a limb, or had an eye gouged out, and showed by his maimed condition that he had been guilty of a crime. A slave taken in adultery with one of his master’s wives was invariably put to death. Women were compelled by torture to name their seducers; if the accused man denied the charge, the woman was asked to describe some personal peculiarity of his, or some mark on his body which could be identified; then if the man was found to have the peculiarity, he was either fined or put to death. In order to arrive at the truth, a man who denied a charge made against him was sometimes stretched out with his arms and feet tied to stakes driven firmly into the ground, a piece of barkcloth was then fastened about his private parts, and set smouldering. As soon as the fire reached his body, the pain became too great {65} to bear, and the man would own himself guilty in order to be released from torture. He would then be either killed or fined. An adulterer was called a murderer (_musi_), because he was looked upon as a man who deliberately set about to compass the death of the woman’s husband; either directly, for he would go armed to visit the woman, and if he was disturbed, he would not hesitate to strike; or indirectly, by offending the fetiches. Men knew that, if they were caught in the act of adultery, the penalty would be death, unless they were related to the person wronged, in which case the latter might be willing to accept a fine, and might content himself with mutilating the culprit. The worst consequence to the injured husband was the anger of his fetiches and gods, whose custodian was his wife. By her action the wife had involved her husband in their displeasure; he was thus left exposed to the malice of any enemy, and his danger was increased in the time of war, because the gods had withdrawn their protection from him.”[65.1] Thus among the Baganda adultery was regarded not simply as a civil offence but as a sin, which brought down the anger of the gods, not as we might expect, on the adulterer, but on the injured husband. Further, the Baganda were divided into a number of totemic clans, and members of any one clan were strictly prohibited from marrying or having sexual relations with each other. “Sexual intercourse with a member of the same clan (_kive_), or with a woman of the mother’s clan, was punished by the death of both parties, because they were considered to have brought the god’s displeasure on the whole clan.”[65.2]

[Sidenote: Fornication, adultery, and incest severely punished by other African tribes.] Among the Basoga, who border on the Baganda to the east, when a man got a virgin with child, the guilty couple used to be dragged off to the River Ntakwe; there stones were tied to their ankles and legs, and, along with a sacrificial sheep, they were thrown into the water and drowned. However, this rigorous penalty was abolished and a fine substituted before the country came under British rule.[65.3] Among the Kavirondo, who border on the Basoga to the {66} east, “until quite recently adultery on the part of a wife was punished with death, and death equally was meted out to young men and girls who were found guilty of fornication. It was thought a shameful thing if a girl was not found to be a virgin on her wedding day.”[66.1] Among the Nandi, who border on the Kavirondo to the north-east, “incest, intercourse with a

step-mother, step-daughter, cousin or other near relation, is punished by what is known as _injoket_. A crowd of people assemble outside the house of the culprit, who is dragged out, and the punishment is inflicted by the women, all of whom, both young and old, strip for the occasion. The man is flogged, his houses and crops destroyed, and some of his stock confiscated."[66.2] Among the Barea, a tribe on the borders of Abyssinia, when a single woman, whether maid or widow, is found with child, she is strangled by her father or brother, and the same punishment is inflicted on her seducer; the child of their unlawful union is stabbed. This custom is rigorously carried out, except when the seducer is a noble and his paramour a vassal; in that case both are spared, but the infant is killed.[66.3] Among the Beni Amer, another tribe of the same region, an unmarried girl found pregnant is put to death by her own brother, whatever her rank, and the seducer is killed by his own brother; the child also is slain. But the law is not so severe on a widow or divorced wife who is detected in a slip; her seducer has only to pay a fine; but the child is buried alive. The Beni Amer will not suffer a bastard to live.[66.4] Among the Anyanja of British Central Africa adultery was punished by drowning and shooting. If one of the culprits was a chief's wife, she was tied to her paramour, and the pair were then thrown into a river to drown or left in the open space of the village to die of hunger and exposure. A man who had committed a rape was bound, weighted with stones, and cast into the lake.[66.5] Among the Awemba of Northern Rhodesia, {67} when a husband detected his wife in the act of adultery, he killed both her and her partner in guilt. For such execution he might not be indicted for murder or manslaughter. He would merely return the blood-stained spear to the woman's father, who by his words in the marriage ceremony, "You shall spear the man who lusts after your wife," was estopped from taking vengeance for the death of his daughter. If the husband spared the erring couple and the wife was again taken in adultery, the villagers themselves decreed the punishment. The unfaithful wife and her lover were dragged outside the village and impaled on sharp stakes amid the taunts and jeers of the bystanders, who only desisted from their mockery when death had stilled the writhing agony of the sufferers.[67.1] "The Hottentots," says an old writer, "allow not marriages between first or second cousins. They have a traditionary law, which ordains, that both man and woman, so near to each other in blood, who shall be convicted of joining together either in marriage or fornication, shall be cudgel'd to death. This law, they say, has prevail'd through all the generations of 'em; and that they execute it at once, upon a conviction, without any regard to wealth, power or affinity."[67.2]

[Sidenote: Incest and adultery severely punished in the East Indies.] We have seen that in the East Indies sexual crimes, particularly incest, adultery, and fornication, are often viewed with grave displeasure because they are believed to draw down the wrath of the higher powers on the whole community. Hence it is natural that such offences should be treated as high treason and the offenders punished with death. A common punishment is drowning. For example, when incest between a parent and a child or between a brother and a sister has been detected among the Kubus, a primitive aboriginal tribe of Sumatra, the culprits are enclosed in a large fish-trap, made of rattan or bamboo, and sunk in a deep pool of the river. However, they are not pinioned; nay, they are even furnished with a tin knife, and {68} if they can cut their way out of the trap, rise through the bubbling water to the surface, and swim ashore, they are allowed to live.[68.1] In the island of Bali incest and adultery are punished by drowning; the criminals are sewed up in a sack half-filled with stones and rice and cast into the sea. A like doom is incurred by a woman who marries a man of a lower caste; but sometimes she dies a more dreadful death, being burnt alive. [Sidenote: Modes of execution adopted which avoid the shedding of blood.] Both modes of execution may be adopted in order to avoid shedding the blood of the sinners; for in Bali, the ordinary way of despatching a criminal is to stab him to the heart with a creese (kris) or crooked Malay sword.[68.2] In the island of Celebes, as we saw, the blood of persons who have been guilty of certain sexual crimes is believed to blast the ground on which it falls;[68.3] so that it is natural in their case to resort to a bloodless mode of execution such as drowning or burning. In Mamoedjoe, a district on the west coast of Celebes, the incest of a father with his daughter or of a brother with his sister is punished by binding the culprits hand and foot, weighting them with stones, and flinging them into the sea.[68.4] Among the Bugineese of Southern Celebes persons of princely rank who have committed this crime are placed on a raft of bamboos and set floating away out to sea.[68.5] [Sidenote: Persons guilty of incest buried alive.] In Semendo, a district of Sumatra, the punishment for incest and murder used to be to bury the criminals alive. Before they were led to their doom, it was customary for the villagers to feast them, every family killing a fowl for the purpose. Then the whole population escorted the culprits to their grave outside the village and saw the earth shovelled in upon them. In the year 1864, at the village of Tandjong Imam, this doom was executed on a man and his deceased wife's sister, with whom he had been detected in an intrigue. "Great was my emotion and indignation," said the humane Dutch governor, {69} "when I stood by the grave of these poor wretches along with the unworthy chiefs who had sat on the bench of justice during the enforced absence of Pangeran Anom and pronounced this sentence. I told them in plain language that judges who pronounced such a sentence of death on grounds so trivial (the request of the family concerned) deserved themselves to undergo the same punishment." The Dutch Government has since issued stringent orders that no one henceforth is to be buried alive, and has threatened with death any person who shall dare to disregard its orders.[69.1] The same punishment for incest is, or used to be, inflicted by the Pasemhers, another tribe of Sumatra, but more merciful than the people of Semendo they

gave the culprits at least a chance for their life. The guilty pair were bound back to back and buried in a deep hole, but from the mouth of each a hollow bamboo communicated with the upper air; and if when the grave was opened after seven days the wretches were found to have survived a prolonged agony far worse than death, they were granted their life.[69.2] Nor was even this dreadful fate the worst that could befall the sinner who broke the rules of sexual morality in Sumatra. [Sidenote: Adulterers killed and eaten.] The Battas or Bataks of Central Sumatra condemned an adulterer to be killed and eaten; strictly speaking he should be speared to death first and eaten afterwards, but as the injured husband and his friends were commonly the judges and executioners, it sometimes happened that, passion proving too strong for a strict adherence to the letter of the law, they cut the flesh from his living body, ate it, and drank his blood, before it occurred to them to terminate his sufferings by a spear-thrust. However, an adulterer occasionally escaped with his life on the payment of a fine, always provided that his accomplice was not the wife of a chief; for in that case there was no help for it but he must be killed and eaten.[69.3]

Even trivial misdemeanours or acts which we should {70} deem perfectly innocent may draw condign punishment on the thoughtless, the imprudent, the light-hearted in the Indian Archipelago. [Sidenote: Extreme severity of the code of sexual morality in Lombok.] Thus we read that in the island of Lombok “the men are exceedingly jealous and very strict with their wives. A married woman may not accept a cigar or a sirih leaf from a stranger under pain of death. I was informed that some years ago one of the English traders had a Balinese woman of good family living with him--the connexion being considered quite honourable by the natives. During some festival this girl offended against the law by accepting a flower or some such trifle from another man. This was reported to the Rajah (to some of whose wives the girl was related), and he immediately sent to the Englishman’s house ordering him to give the woman up as she must be ‘krissed.’ In vain he begged and prayed, and offered to pay any fine the Rajah might impose, and finally refused to give her up unless he was forced to do so. This the Rajah did not wish to resort to, as he no doubt thought he was acting as much for the Englishman’s honour as for his own; so he appeared to let the matter drop. But some time afterwards he sent one of his followers to the house, who beckoned the girl to the door, and then saying, ‘The Rajah sends you this,’ stabbed her to the heart. More serious infidelity is punished still more cruelly, the woman and her paramour being tied back to back and thrown into the sea, where some large crocodiles are always on the watch to devour the bodies. One such execution took place while I was at Ampanam, but I took a long walk into the country to be out of the way till it was all over.”[70.1]

[Sidenote: The severity of the code based at bottom on superstition.] As the Malay peoples of the Indian Archipelago, from whom the foregoing examples are drawn, have reached a fair level of culture, it might perhaps be thought that the extreme severity with which they visit offences against their code of sexual morality springs from an excessive refinement of feeling rather than from a crude superstition; and no doubt it may well happen that extreme sensitiveness on the point of honour, of which the Malays are susceptible, contributes in many cases to sharpen the sword of justice {71} and add fresh force to the stroke. Yet under this delicacy of sentiment there appears to lie a deep foundation of superstition, as we may see by the extraordinary and disastrous influence which in the opinion of these people sexual crime exerts, not so much on the criminals themselves, as on the whole realm of nature, drawing down deluges of rain from the clouds till the crops rot in the fields, shaking the solid earth beneath men’s feet, and blowing up into flames the slumbering fires of the volcano, till the sky is darkened at noon by a black canopy of falling ashes and illumined at night by the sullen glow of the molten lava shot forth from the subterranean furnace.[71.1] [Sidenote: A similar severity in sexual matters observed among the Australian aborigines, the lowest of existing savages.] And however much an over-refinement of feeling may be invoked to explain the more than Puritanical severity of the Malay moral code in sexual matters, no such explanation can be applied to the like emotion of horror which similar offences excite among the savage aborigines of Australia, the lowest and the least refined probably of all the races of men about whom we possess accurate information. These rude savages also treated with rigorous severity all breaches of that widely ramified network of prohibitions in which throughout the Australian continent, before it fell under English rule, the two sexes lived immeshed. The whole community of a tribe or nation was commonly subdivided into a number of minute bodies, which we are accustomed to call classes or clans according to the principle on which they were variously constituted. No man might marry a woman of his own class or clan, and in most tribes his freedom of choice was still further limited by complex rules of marriage and descent which excluded him from seeking a wife in many more subdivisions of the tribe, and sometimes compelled him to look for her only in one out of them all. And the ordinary penalty for any violation of these rules was death. The offender was lucky who escaped with his life and a body more or less riddled with spear wounds. [Sidenote: Severe punishments inflicted for sexual offences among the aborigines of Victoria.] Thus one who knew the aborigines of Victoria well in the old days, before they were first contaminated and then destroyed by contact with European civilization, tells us that “no marriage or betrothal is permitted without the approval {72} of the chiefs of each party, who first ascertain that no ‘flesh’ relationship exists, and even then their permission must be rewarded by presents. So strictly are the laws of marriage carried out, that, should any signs of affection and courtship be observed between those of ‘one flesh,’ the brothers, or

male relatives of the woman beat her severely; the man is brought before the chief, and accused of an intention to fall into the same flesh, and is severely reprimanded by the tribe. If he persists, and runs away with the object of his affections, they beat and 'cut his head all over'; and if the woman was a consenting party she is half killed. If she dies in consequence of her punishment, her death is avenged by the man's receiving an additional beating from her relatives. No other vengeance is taken, as her punishment is legal. A child born under such conditions is taken from the parents, and handed over to the care of its grandmother, who is compelled to rear it, as no one else will adopt it. It says much for the morality of the aborigines and their laws that illegitimacy is rare, and is looked upon with such abhorrence that the mother is always severely beaten by her relatives, and sometimes put to death and burned. Her child is occasionally killed and burned with her. The father of the child is also punished with the greatest severity, and occasionally killed. Should he survive the chastisement inflicted upon him, he is always shunned by the woman's relatives, and any efforts to conciliate them with gifts are spurned, and his presents are put in the fire and burned. Since the advent of the Europeans among them, the aborigines have occasionally disregarded their admirable marriage laws, and to this disregard they attribute the greater weakness and unhealthiness of their children."[72.1]

[Sidenote: Severe punishments inflicted for sexual offences in the Wakelbura tribe of Queensland.] Again, in the Wakelbura tribe of eastern Queensland the law was extremely strict as to unlawful connexions or elopements between persons too nearly related to each other. Such persons might be, for example, those whom we call cousins both on the father's and the mother's side, as well as those who belonged to a forbidden class. If such a man {73} carried off a woman who had been betrothed to another, he would be pursued not only by the male relations of the woman and of her betrothed husband, but also by the men of his own tribal subdivision, whom he had outraged by his breach of the marriage law; and wherever they overtook him, he would have to fight them all. His own brothers would challenge him to fight by throwing boomerangs or other weapons at him; and if he did not accept the challenge, they would turn on the woman and cripple or kill her with their weapons, unless she could escape into the bush. Nay, the woman's own mother would cut and perhaps slay her with her own hands. Sooner or later the ravisher had to engage in single combat with the man he had injured. Both were fully armed with shield, spear, boomerang and knife. When they had exhausted their missiles, they closed on each other with their knives, a dense ring of blacks generally forming round the combatants to see fair play. In such a fight the man who had broken the tribal law always came off worst; for even if he got the better of his adversary, the other men and even his own brothers would attack him and probably gash him with their knives. Fatal stabs were sometimes given in these fights, but more usually, it would seem, the onlookers interfered and wrested the weapons from the two combatants before they proceeded to extremities. In any case the woman who had eloped was terribly mauled with knives, and if she survived the ordeal was restored to the man whom she had deserted.[73.1]

[Sidenote: Severe punishment inflicted for sexual offences among the aborigines of other parts of Australia.] Among the tribes in the central parts of North-West Queensland, if a man eloped with a single woman whom he might lawfully marry, but who for any reason was forbidden to him by the tribal council, he had on returning to camp with his wife to run the gauntlet of the outraged community, who hacked his buttocks and shoulders with knives, beat his head and limbs with sticks and boomerangs, and pricked the fleshy parts of his thighs with spears, taking care, however, not to inflict fatal injuries, lest they should incur blood revenge. But if the woman with whom the man had eloped {74} was of a class into which he might not marry, both the culprits were put to death, the relations on both sides tacitly consenting to the execution.[74.1] In the Yuin tribe of New South Wales, if a man eloped with a woman of his own tribal subdivision, all the men would pursue him; and if he refused to give the woman up, the sorcerer of the place would probably say to his men, "This man has done very wrong, you must kill him"; whereupon somebody would thrust a spear into him, his relatives not interfering lest the same fate should befall them.[74.2] The same punishment was inflicted for the same offence by the Wotjobaluk tribe of North-Western Victoria; but their western neighbours, the Mukjarawaint tribe, not content with killing the guilty man, cut off the flesh off his thighs and upper arms, roasted and ate it, his own brother partaking of the cannibal meal. As for the rest of the body, they chopped it up small and left it lying on a log. The same custom is said to have been observed by the Jupagalk tribe.[74.3] Among many tribes of Western Australia, as well as of other parts of that continent, persons who bear the same class-name may not marry. Any such marriage is regarded as incest and rigorously punished. For example, "the union of Boorong and Boorong is to the natives the union of brother and sister, although there may be no real blood relationship between the pair, and a union of that kind is looked upon with horror, and the perpetrators very severely punished and separated, and if the crime is repeated they are both killed."[74.4] On the other side of the continent the Kamilaroi of New South Wales similarly inflicted condign punishment on both the culprits who persisted in marrying each other contrary to the tribal law; the male relations of the man killed him, and the female relations of the woman killed her. [Sidenote: Penalty of death inflicted for the crime of speaking to a mother-in-law.] The Kamilaroi of the Gwydir River went further; they {75} killed any man who so much as spoke to or held any communication with his mother-in-law,[75.1] for one of the most stringent laws of savage etiquette is that

which prohibits any direct social intercourse between a man and his wife's mother. The law has been variously explained,[75.2] but a large body of evidence points to the conclusion that this custom of mutual avoidance is simply a precaution to prevent improper relations between the two. Hence a brief consideration of it is appropriate in this place; for to all appearance the custom, though it may be wholesome and beneficial in practice, has originated purely in superstition. But before giving my reasons for thinking so it may be well, for the sake of those who are unfamiliar with savage etiquette, to illustrate the practice itself by a few examples.[75.3]

[Sidenote: The custom of avoiding a mother-in-law and other relations by marriage among the Boloki of the Congo.] Speaking of the Boloki, a Bantu tribe of the Upper Congo, an experienced missionary, the Rev. John H. Weeks, writes as follows: "Perhaps this will be the best place in which to make a few remarks on the mother-in-law. She and her son-in-law may never look on each other's face. I have often heard a man say, 'So-and-so, your mother-in-law is coming,' and the person addressed would run into my house and hide himself until his wife's mother had gone by. They can sit at a little distance from each other, with their backs to one another, and talk over affairs when necessary. _Bokilo_ means mother-in-law, daughter-in-law, brother-in-law, father-in-law, sister of mother-in-law, brother of father-in-law, wife of wife's brother, and in fact any relation-in-law. _Bokilo_, the noun, is derived from _kila_ = to forbid, prohibit, taboo, and indicates that all bearing the relationship of {76} _bokilo_ can have no intimate relationship with one another, for it is regarded as incestuous; and it is according to native ideas just as wrong for a daughter-in-law to speak or look at her husband's father, as for the son-in-law to speak or look at his wife's mother. Some have told me that this was to guard against all possibility of cohabitation, 'For a person you never look at you never desire.' Others have said, 'Well, don't you see, my wife came from her womb.' I am strongly inclined to the opinion that the former is the real reason."[76.1]

From this statement it appears that a man and his wife's mother are not the only persons who are bound to avoid each other in society; the same rule of social avoidance is incumbent on a man and his son's wife, and on many other persons of opposite sex who are connected with each other by marriage; and in regard to all such persons it is held that any intimate relationship between them would be incestuous. Hence we see, what is important to bear in mind, that the rule of social avoidance incumbent on a man and his wife's mother is by no means solitary of its kind, and cannot be considered apart from a large number of similar rules of avoidance observed between other persons. [Sidenote: The custom of avoiding relations by marriage among the Batamba of Busoga.] The same large extension of the rule appears in the customs of the Batamba, a Bantu tribe of Busoga, a country on the north side of the Lake Victoria Nyanza. A Catholic missionary, who has laboured among the Batamba for nine years, describes their practice in this matter as follows:--

"There is a very strange custom which may be considered here. If a son marries or if a daughter does the same, then if they are grown up, from the day the son or daughter marries, the mother, father of both parties, the brothers and sisters of both parties are not allowed to sleep under the same roof. If a man marries, then he builds a house for himself, and should his parents live with him, or his brothers and sisters, then they must have a separate house near by. They are not forbidden to go in and visit him or her, but are not allowed to sleep there. The reason is this. They say that otherwise sickness is caused, and this {77} is called _endivade ya buko_, the sickness of relationship, literally taken. The sickness is called _bujugumiro_, trembling, from the verb _kujugumira_, to shiver or tremble. This cannot be got out of their heads, and no amount of talking or arguing will convince them of the opposite. I have attended many cases of this disease and I have not known one to recover.

"Again, the father and mother of the bride and bridegroom, the aunts and uncles of bride and bridegroom may no more shake hands or touch in any way the bride and bridegroom, or else the same disease, _bujugumiro_, will follow. Of course much less will they commit themselves between each other for the fear of the same reason. And it is never heard of that a brother and sister, aunt and nephew, niece and uncle have ever committed themselves seriously. They are so afraid of the disease they say will follow, that, as a man here over seventy years of age tells me, he has never in his whole life heard of such a misbehaviour. The people say, '_Jekiyinzika_ = it is impossible for such a thing to happen.' And no doubt one is struck with the care they take. The disease following does not come as a punishment from the gods, but they say, '_Endwada ejja yokka_, the illness comes by itself.'"[77.1]

[Sidenote: Avoidance of blood relations as well as of connexions by marriage.] From the foregoing account it appears that among the Batamba the rules of social avoidance are observed between blood-relations of opposite sexes, such as brothers and sisters, uncles and nieces, aunts and nephews, as well as between connexions by marriage. This is a further extension of the rule of social avoidance which it is important to bear in mind. We shall recur to it presently. For our present purpose it deserves also to be noticed that breaches of the custom are believed to be punished by a disease of trembling or shivering, which, though it probably springs purely from the imagination of the culprits, nevertheless appears to be always fatal. Further, we learn that the mere apprehension of this disease acts as a most efficient check upon improper relations between persons who are connected with each other by blood or marriage.

[Sidenote: The custom of avoiding mother-in-law and own daughter among the Akamba of British East Africa.] Among the Akamba, a Bantu tribe of British East Africa, {78} "if a man meets his mother-in-law in the road they both hide their faces and pass by in the bush on opposite sides of the path. If a man did not observe this custom and at any time wanted to marry another wife, it would prove a serious stigma, and parents would have nothing to do with him. Moreover, if a wife heard that her husband had stopped and spoken to her mother in the road, she would leave him. If a man has business he wishes to discuss with his mother-in-law, he goes to her hut at night, and she will talk to him from behind the partition in the hut.… If a girl of the age of puberty meets her father in the road, she hides as he passes, nor can she ever go and sit near him in the village until the day comes when he tells her that it has been arranged for her to marry a certain man. After marriage she does not avoid her father in any way."[78.1] Thus among the Akamba a man must avoid his own marriageable, but unmarried, daughter exactly as he avoids his wife's mother; but the custom of avoidance ceases when his daughter marries. This extension of the rule to a man's own daughter, and its limitation to the time during which the girl is nubile but single, are most significant, and point plainly to a fear of improper relations between father and daughter. To that point we shall return shortly.

[Sidenote: The custom of avoiding parents-in-law among various tribes of Central and East Africa.] Among the Bakerewe, a Bantu people inhabiting a large and fertile island in Lake Victoria Nyanza, "the wife, whether the first (_omukuru_) or the last (_omwenga_), must always belong to a family other than that of the husband, for marriages are not contracted between relations. Never in any case will the new household establish itself in the immediate neighbourhood of the wife's parents. The reason is that the son-in-law (_omukwerima_) and his mother-in-law (_mazara_), according to their customs, may not see each other nor look upon each other; hence in order not to run the risk of breaking a rule to which everybody attaches grave importance, they go as far away as possible."[78.2] Among some tribes of Eastern Africa which formerly acknowledged the suzerainty of the sultan of Zanzibar, before a young couple had children {79} they might meet neither their father-in-law nor their mother-in-law. To avoid them they must make a long roundabout. But if they could not do that, they must throw themselves on the ground and hide their faces till the father-in-law or mother-in-law had passed by.[79.1]

[Sidenote: The custom of avoiding parents-in-law among the tribes of British Central Africa and Northern Rhodesia.] Among the Anyanja, a Bantu people of British Central Africa, "a man used never to speak to his mother-in-law till after the birth of his first son. Neither a man nor his wife will eat in company of their mother or father-in-law until after birth of a child. If a man sees his mother-in-law eat, he has insulted her and is expected to pay damages. If a man meets his mother-in-law coming along the road and does not recognise her, she will fall down on the ground as a sign, when he will run away. In the same way a father-in-law will signal to his daughter-in-law; the whole idea being that they are unworthy to be noticed till they have proved that they can beget children."[79.2] However, if a wife should prove barren for three years, the rules of avoidance between the young couple and their parents-in-law cease to be observed.[79.3] Hence the custom of avoidance among these people is associated in some way with the wife's fertility. So among the Awemba, a Bantu tribe of Northern Rhodesia, "if a young man sees his mother-in-law coming along the path, he must retreat into the bush and make way for her, or if she suddenly comes upon him he must keep his eyes fixed on the ground, and only after a child is born may they converse together."[79.4] Among the Angoni, another Bantu tribe of British Central Africa, it would be a gross breach of etiquette if a man were to enter his son-in-law's house; he may come within ten paces of the door, but no nearer. A woman may not even approach her son-in-law's house, and she is never allowed to speak to him. Should they meet accidentally on a path, the son-in-law gives way and makes a circuit to avoid encountering his mother-in-law face to face.[79.5] Here then we {80} see that a man avoids his son-in-law as well as his mother-in-law, though not so strictly.

[Sidenote: The custom of avoiding mother-in-law and wife of wife's brother among the Thonga of Delagoa Bay.] Among the Thonga, a Bantu tribe about Delagoa Bay, when a man meets his mother-in-law or her sister on the road, he steps out of the road into the forest on the right hand side and sits down. She does the same. Then they salute each other in the usual way by clapping their hands. After that they may talk to each other. When a man is in a hut, his mother-in-law dare not enter it, but must sit down outside without seeing him. So seated she may salute him, "Good morning, son of So-and-so." But she would not dare to pronounce his name. However, when a man has been married many years, his mother-in-law has less fear of him, and will even enter the hut where he is and speak to him. But among the Thonga the woman whom a man is bound by custom to avoid most rigidly is not his wife's mother, but the wife of his wife's brother. If the two meet on a path, they carefully avoid each other; he will step out of the way and she will hurry on, while her companions, if she has any, will stop and chat with him. She will not enter the same boat with him, if she can help it, to cross a river. She will not eat out of the same dish. If he speaks to her, it is with constraint and embarrassment. He will not enter her hut, but will crouch at the door and address her in a voice trembling with emotion. Should there be no one else to bring him food, she will do it reluctantly, watching his hut and putting the food inside the door when he is

absent. It is not that they dislike each other, but that they feel a mutual, a mysterious fear.[80.1] However, among the Thonga, the rules of avoidance between connexions by marriage decrease in severity as time passes. The strained relations between a man and his wife's mother in particular become easier. He begins to call her "Mother" and she calls him "Son." This change even goes so far that in some cases the man may go and dwell in the village of his wife's parents, especially if he has children and the children are grown up.[80.2] Again, among the Ovambo, a Bantu {81} people of German South-West Africa, a man may not look at his future mother-in-law while he talks with her, but is bound to keep his eyes steadily fixed on the ground. In some cases the avoidance is even more stringent; if the two meet unexpectedly, they separate at once. But after the marriage has been celebrated, the social intercourse between mother-in-law and son-in-law becomes easier on both sides.[81.1]

[Sidenote: The custom of avoiding the mother-in-law among other than the Bantu tribes of Africa.] Thus far our examples of ceremonial avoidance between mother-in-law and son-in-law have been drawn from Bantu tribes. But in Africa the custom, though apparently most prevalent and most strongly marked among peoples of the great Bantu stock, is not confined to them. Among the Masai of British East Africa, "mothers-in-law and their sons-in-law must avoid one another as much as possible; and if a son-in-law enters his mother-in-law's hut she must retire into the inner compartment and sit on the bed, whilst he remains in the outer compartment; they may then talk. Own brothers-in-law and sisters-in-law must also avoid one another, though this rule does not apply to half-brothers-in-law and sisters-in-law."[81.2] So, too, among the Bogos, a tribe on the outskirts of Abyssinia, a man never sees the face of his mother-in-law and never pronounces her name; the two take care not to meet.[81.3] Among the Donaglas a husband after marriage "lives in his wife's house for a year, without being allowed to see his mother-in-law, with whom he enters into relations only on the birth of his first son."[81.4] In Darfur, when a youth has been betrothed to a girl, however intimate he may have been with her parents before, he ceases to see them until the ceremony has taken place, and even avoids them in the street. They, on their part, hide their faces, if they happen to meet him unexpectedly.[81.5]

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[Sidenote: The custom of avoiding relations by marriage in Sumatra and New Guinea.] To pass now from Africa to other parts of the world, among the Looboos, a primitive tribe in the tropical forests of Sumatra, custom forbids a woman to be in her father-in-law's company and a man to be in his mother-in-law's society. For example, if a man meets his daughter-in-law, he should cross over to the other side of the road to let her pass as far as possible from him; but if the way is too narrow, he takes care in time to get out of it. But no such reserve is prescribed between a father-in-law and his son-in-law, or between a mother-in-law and her daughter-in-law.[82.1] Among the Bukaua, a Melanesian tribe of German New Guinea, the rules of avoidance between persons connected by marriage are very stringent; they may not touch each other or mention each other's names. But contrary to the usual practice the avoidance seems to be quite as strict between persons of the same sex as between males and females. At least the writer who reports the custom illustrates it chiefly by the etiquette which is observed between a man and his daughter's husband. When a man eats in presence of his son-in-law, he veils his face; but if nevertheless his son-in-law should see his open mouth, the father-in-law is so ashamed that he runs away into the wood. If he gives his son-in-law anything, such as betel or tobacco, he will never put it in his hand, but pours it on a leaf, and the son-in-law fetches it away. If father-in-law and son-in-law both take part in a wild boar hunt, the son-in-law will abstain from seizing or binding the boar, lest he should chance to touch his father-in-law. If, however, through any accident their hands or backs should come into contact, the father-in-law is extremely horrified, and a dog must be at once killed, which he gives to his son-in-law for the purpose of wiping out the stain on his honour. If the two should ever fall out about anything, the son-in-law will leave the village and his wife, and will stay away in some other place till his father-in-law, for his daughter's sake, calls him back. A man in like manner will never touch his sister-in-law.[82.2]

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[Sidenote: The custom of avoiding relations by marriage among the Indian tribes of America.] Among the low savages of the Californian peninsula a man was not allowed for some time to look into the face of his mother-in-law or of his wife's other near relations; when these women were present he had to step aside or hide himself.[83.1] Among the Indians of the Isla del Malhado in Florida a father-in-law and mother-in-law might not enter the house of their son-in-law, and he on his side might not appear before his father-in-law and his relations. If they met by accident they had to go apart to the distance of a bowshot, holding their heads down and their eyes turned to the earth. But a woman was free to converse with the father and mother of her husband.[83.2] Among the Indians of Yucatan, if a betrothed man saw his future father-in-law or mother-in-law at a distance, he turned away as quickly as possible, believing that a meeting with them would prevent him from begetting children.[83.3] Among the Arawaks of British Guiana a man may never see the face of his wife's mother. If she is in the house with him, they must be separated by a screen or partition-wall; if she travels with him in a canoe, she steps in first, in order that she may turn her back to him.[83.4] Among

the Caribs “the women never quit their father’s house, and in that they have an advantage over their husbands in as much as they may talk to all sorts of people, whereas the husband dare not converse with his wife’s relations, unless he is dispensed from this observance either by their tender age or by their intoxication. They shun meeting them and make great circuits for that purpose. If they are surprised in a place where they cannot help meeting, the person addressed turns his face another way so as not to be obliged to see the person, whose voice he is compelled to hear.”[83.5] {84} Among the Araucanian Indians of Chili a man’s mother-in-law refuses to speak to or even to look at him during the marriage festivity, and “the point of honour is, in some instances, carried so far, that for years after the marriage the mother never addresses her son-in-law face to face; though with her back turned, or with the interposition of a fence or a partition, she will converse with him freely.”[84.1]

[Sidenote: The custom of avoiding relations by marriage cannot be separated from the similar custom of avoiding relations by blood; both are probably precautions to prevent improper relations between the sexes.] It would be easy to multiply examples of similar customs of avoidance between persons closely connected by marriage, but the foregoing may serve as specimens. Now in order to determine the meaning of such customs it is very important to observe that similar customs of avoidance are practised in some tribes not merely between persons connected with each other by marriage, but also between the nearest blood relations of different sexes, namely, between parents and children and between brothers and sisters;[84.2] and the customs are so alike that it seems difficult or impossible to separate them and to offer one explanation of the avoidance of connexions by marriage and another different explanation of the avoidance of blood relations. Yet this is what is done by some who attempt to explain the customs of avoidance; or rather they confine their attention wholly to connexions by marriage, or even to mothers-in-law alone, while they completely ignore blood relations, although in point of fact it is the avoidance of blood relations which seems to furnish the key to the problem of such avoidances in general. The true explanation of all such customs of avoidance appears to be, as I have already indicated, that they are precautions designed to remove the temptation to sexual intercourse between persons whose marriage union is for any reason repugnant to the moral sense of the community. This explanation, while it has been rejected by theorists at home, {85} has been adopted by some of the best observers of savage life, whose opinion is entitled to carry the greatest weight.[85.1]

[Sidenote: Mutual avoidance of mother and son, of father and daughter, and of brother and sister among the Battas.] That a fear of improper intimacy even between the nearest blood relations is not baseless among races of a lower culture seems proved by the testimony of a Dutch missionary in regard to the Battas or Bataks of Sumatra, a people who have attained to a fairly high degree of barbaric civilization. The Battas “observe certain rules of avoidance in regard to near relations by blood or marriage; and we are informed that such avoidance springs not from the strictness but from the looseness of their moral practice. A Batta, it is said, assumes that a solitary meeting of a man with a woman leads to an improper intimacy between them. But at the same time he believes that incest or the sexual intercourse of near relations excites the anger of the gods and entails calamities of all sorts. Hence near relations are obliged to avoid each other lest they should succumb to temptation. A Batta, for example, would think it shocking were a brother to escort his sister to an evening party. Even in the presence of others a Batta brother and sister feel embarrassed. If one of them comes into the house, the other will go away. Further, a man may never be alone in the house with his daughter, nor a mother with her son. A man may never speak to his mother-in-law nor a woman to her father-in-law. The Dutch missionary who reports these customs adds that he is sorry to say that from what he knows of the Battas he believes the maintenance of most of these rules to be very necessary. For the same reason, he tells us, as soon as Batta lads have reached the age of puberty they are no longer allowed to sleep in the family house but are sent away to pass the night in a separate building (_djambon_); and similarly as soon as a man loses his wife by death he is excluded from the house.”[85.2]

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[Sidenote: Mutual avoidance of mother and son and of brother and sister among the Melanesians.] In like manner among the Melanesians of the Banks’ Islands and the New Hebrides a man must not only avoid his mother-in-law; from the time when he reaches or approaches puberty and has begun to wear clothes instead of running about naked, he must avoid his mother and sisters, and he may no longer live in the same house with them; he takes up his quarters in the clubhouse of the unmarried males, where he now regularly eats and sleeps. He may go to his father’s house to ask for food, but if his sister is within he must go away before he eats; if she is not there, he may sit down near the door and eat. If by chance brother and sister meet in the path, she runs away or hides. If a boy, walking on the sands, perceives footprints which he knows to be those of his sister, he will not follow them, nor will she follow his. This mutual avoidance lasts through life. Not only must he avoid the persons of his sisters, but he may not pronounce their names or even use a common word which happens to form part of any one of their names. In like manner his sisters eschew the use of his name and of all words which form part of it. Strict, too, is a boy’s reserve towards his mother from the

time when he begins to wear clothes, and the reserve increases as he grows to manhood. It is greater on her side than on his. He may go to the house and ask for food and his mother may bring it out for him, but she will not give it to him; she puts it down for him to take. If she calls to him to come, she speaks to him in the plural, in a more distant manner; “Come ye,” she says, not “Come thou.” If they talk together she sits at a little distance and turns away, for she is shy of her grown-up son. “The meaning of all this,” as Dr. Codrington observes, “is obvious.”[86.1] [Sidenote: Mutual avoidance of a man and his mother-in-law among the Melanesians.] When a Melanesian man of the Banks’ Islands marries, he is bound in like manner to avoid his mother-in-law. “The rules of avoidance are very strict and minute. As regards the avoidance of the person, a man will not come near his wife’s mother; the avoidance is mutual; if the two chance to meet in a path, the woman will step out of it and stand with her back turned till he has gone by, or perhaps if it be more {87} convenient he will move out of the way. At Vanua Lava, in Port Patteson, a man would not follow his mother-in-law along the beach, nor she him, until the tide had washed out the footsteps of the first traveller from the sand. At the same time a man and his mother-in-law will talk at a distance.”[87.1]

[Sidenote: It is significant that mutual avoidance between blood relations of opposite sexes begins at or near puberty.] It seems obvious that these Melanesian customs of avoidance are the same, and must be explained in the same way whether the woman whom a man shuns is his wife’s mother or his own mother or his sister. Now it is highly significant that just as among the Akamba of East Africa the mutual avoidance of father and daughter only begins when the girl has reached puberty, so among the Melanesians the mutual avoidance of a boy on the one side and of his mother and sisters on the other only begins when the boy has reached or approached puberty. Thus in both peoples the avoidance between the nearest blood relations only commences at the dangerous age when sexual connexion on both sides begins to be possible. It seems difficult, therefore, to evade the conclusion that the mutual avoidance is adopted for no other reason than to diminish as far as possible the chances of sexual unions which public opinion condemns as incestuous. But if that is the reason why a young Melanesian boy, on the verge of puberty, avoids his own mother and sisters, it is natural and almost necessary to infer that it is the same reason which leads him, as a full-grown and married man, to eschew the company of his wife’s mother.

[Sidenote: Mutual avoidance of mother and son, of father and daughter, and of brother and sister in the Caroline Islands.] Similar customs of avoidance between mothers and sons, between fathers and daughters, and between brothers and sisters are observed by the natives of the Caroline Islands, and the writer who records them assigns the fear of incest as the motive for their observance. “The prohibition of marriage,” he says, “and of sexual intercourse between kinsfolk of the same tribe is regarded by the Central Caroline natives as a divine ordinance; its breach is therefore, in their opinion, punished by the higher powers with sickness or death. The law influences in a characteristic way the whole social life of the islanders, for efforts {88} are made to keep members of families of different sexes apart from each other even in their youth. Unmarried men and boys, from the time when they begin to speak, may therefore not remain by night in the huts, but must sleep in the _fel_, the assembly-house. In the evening their meal (_âkot_) is brought thither to them by their mothers or sisters. Only when a son is sick may his mother receive him in the hut and tend him there. On the other hand entrance to the assembly-house (_fel_) is forbidden to women and girls except on the occasion of the _pwarik_ festival; whereas female members of other tribes are free to visit it, although, so far as I could observe, they seldom make use of the permission. Unmarried girls sleep in the huts with their parents.

“These restrictions, which custom and tradition have instituted within the family, find expression also in the behaviour of the members of families toward each other. The following persons, namely, have to be treated with respect--the daughters by their father, the sons by their mother, the brothers by their sisters. In presence of such relations, as in the presence of a chief, you may not stand, but must sit down; if you are obliged on narrow paths to pass by one of them you must first obtain permission and then do it in a stooping or creeping posture. You allow them everywhere to go in front; you also avoid to drink out of the vessel which they have just used; you do not touch them, but keep always at a certain distance from them; the head especially is deemed sacred.”[88.1]

[Sidenote: Mutual avoidance of male and female cousins in some tribes.] In all these cases the custom of mutual avoidance is observed by persons of opposite sex who, though physically capable of sexual union, are forbidden by tradition and public opinion to have any such commerce with each other. Thus far the blood relations whom a man is forbidden to marry and compelled to avoid, are his own mother, his own daughter, and his own sisters. But to this list some people add a man’s female cousins or at least certain of them; for many races draw a sharp line of distinction between cousins according {89} as they are children of two brothers or of two sisters or of a brother and a sister, and while they permit or even prefer marriage with certain cousins, they absolutely forbid marriage with certain others. Now, it is highly significant that some tribes which forbid a man to marry certain of his cousins also compel him to adopt towards them the same attitude of social reserve which in the same or other tribes a man is

obliged to observe towards his wife's mother, his own mother, and his own sisters, all of whom in like manner he is forbidden to marry. [Sidenote: Mutual avoidance of male and female cousins in New Ireland.] Thus among the tribes in the central part of New Ireland (New Mecklenburg) a male and a female cousin, the children of a brother and a sister respectively, are most strictly forbidden by custom to marry each other; indeed this prohibition is described as the most stringent of all; the usual saying in regard to such relations is, "The cousin is holy" (_i tábu ra kókup_). Now, in these tribes a man is not merely forbidden to marry his female cousin, the daughter of his father's sister or of his mother's brother; he must also avoid her socially, just as in other tribes a man must avoid his wife's mother, his own mother, his own daughter, and his own sisters. The cousins may not approach each other, they may not shake hands or even touch each other, they may not give each other presents, they may not mention each other's names; but they are allowed to speak to each other at a distance of some paces. These rules of avoidance, these social barriers erected between cousins, the children of a brother and a sister respectively, are interpreted most naturally and simply as precautions intended to obviate the danger of a criminal intercourse between persons whose sexual union would be regarded by public opinion with deep displeasure. Indeed the Catholic missionary, to whom we are indebted for the information, assumes this interpretation of the rules as if it were too obvious to call for serious discussion. He says that all the customs of avoidance "are observed as outward symbols of this prohibition of marriage"; and he adds that "were the outward sign of the prohibition of marriage, to which the natives cleave with genuine obstinacy, abolished or even weakened, there would be an immediate danger of the natives contracting such {90} marriages."[90.1] It seems difficult for a rational man to draw any other inference. If any confirmation were needed, it would be furnished by the fact that among these tribes of New Ireland brothers and sisters are obliged to observe precisely the same rules of mutual avoidance, and that incest between brother and sister is a crime which is punished with hanging; they may not come near each other, they may not shake hands, they may not touch each other, they may not give each other presents; but they are allowed to speak to each other at a distance of some paces. And the penalty for incest with a daughter is also death by hanging.[90.2]

[Sidenote: Mutual avoidance of certain male and female cousins among the Baganda; marriage or sexual intercourse forbidden between these cousins under pain of death.] Amongst the Baganda of Central Africa in like manner a man was forbidden under pain of death to marry or have sexual intercourse with his cousin, the daughter either of his father's sister or of his mother's brother; and such cousins might not approach each other, nor hand each other anything, nor enter the same house, nor eat out of the same dish. Were cousins to break these rules of social avoidance, in other words, if they were to approach each other or hand each other anything, it was believed that they would fall ill, that their hands would tremble, and that they would be unfit for any work.[90.3] Here, again, the prohibition of social intercourse was in all probability merely a precaution against sexual intercourse, for which the penalty was death. And the same may be said of the similar custom of avoidance which among these same Baganda a man had to observe towards his wife's mother. "No man might see his mother-in-law, or speak face to face with her; she covered her face, if she passed her son-in-law, and he gave her the path and made a detour, if he saw her coming. If she was in the house, he might not enter, but he was allowed to speak to her from a distance. This was said to be because he had seen her daughter's nakedness. If a son-in-law accidentally {91} saw his mother-in-law's breasts, he sent her a barkcloth in compensation, to cover herself, lest some illness, such as tremor, should come upon him. The punishment for incest was death; no member of a clan would shield a person guilty thereof; the offender was disowned by the clan, tried by the chief of the district, and put to death."[91.1]

[Sidenote: Marriage between certain cousins forbidden among some South African tribes but allowed among others.] The prohibition of marriage with certain cousins appears to be widespread among African peoples of the Bantu stock. Thus in regard to the Bantus of South Africa we read that "every man of a coast tribe regarded himself as the protector of those females whom we would call his cousins, second cousins, third cousins, and so forth, on the father's side, while some had a similar feeling towards the same relatives on the mother's side as well, and classified them all as sisters. Immorality with one of them would have been considered incestuous, something horrible, something unutterably disgraceful. Of old it was punished by the death of the male, and even now a heavy fine is inflicted upon him, while the guilt of the female must be atoned by a sacrifice performed with due ceremony by the tribal priest, or it is believed a curse will rest upon her and her issue…. In contrast to this prohibition the native of the interior almost as a rule married the daughter of his father's brother, in order, as he said, to keep property from being lost to his family. This custom more than anything else created a disgust and contempt for them by the people of the coast, who term such intermarriages the union of dogs, and attribute to them the insanity and idiocy which in recent times has become prevalent among the inland tribes."[91.2]

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[Sidenote: Marriage between cousins allowed in some African tribes on condition that an expiatory sacrifice is offered.] Among the Thonga, a Bantu tribe about Delagoa Bay, marriages between cousins are as a rule prohibited, and it is believed that such unions are unfruitful. However, custom permits cousins to marry each other on condition that they perform an expiatory ceremony which is supposed to avert the curse of barrenness from the wife. A goat is sacrificed, and the couple are anointed with the green liquid extracted from the half-digested grass in the animal's stomach. Then a hole is cut in the goat's skin and through this hole the heads of the cousins are inserted. The goat's liver is then handed to them, quite raw, through the hole in the skin, and they must tear it out with their teeth without using a knife. Having torn it out, they eat it. The word for liver (_shibindji_) also means "patience," "determination." So they say to the couple, "You have acted with strong determination. Eat the liver now! Eat it in the full light of the day, not in the dark! It will be an offering to the gods." Then the family priest prays, saying: "You, our gods, So-and-so, look! We have done it in the daylight. It has not been done by stealth. Bless them, give them children!" When he has done praying, the assistants take all the half-digested grass from the goat's stomach and place it on the wife's head, saying, "Go and bear children!"[92.1] Among the Wagogo of German East Africa marriage is forbidden between cousins who are the children of two brothers or of two sisters, but is permitted between cousins who are the children of a brother and sister respectively. However, in this case it is usual for the wife's father to kill a sheep and put on a leather armlet, made presumably from the sheep's skin; otherwise it is supposed that the marriage would be unfruitful.[92.2] Thus the Wagogo, like the Thonga, imagine that the marriage of cousins is doomed to infertility unless an expiatory sacrifice is offered and a peculiar use made of the victim's skin. Again, the Akikuyu of British East Africa forbid the marriage of cousins and second cousins, the children and grandchildren of brothers and sisters. If such persons {93} married, they would commit a grave sin, and all their children would surely die; for the curse or ceremonial pollution (_thahu_) incurred by such a crime cannot be purged away. Nevertheless it sometimes happens that a man unwittingly marries a first or second cousin; for instance, if a part of the family moves away to another district, it may come about that a man makes the acquaintance of a girl and marries her before he discovers the relationship. In such a case, where the sin has been committed unknowingly, the curse can be averted by the performance of an expiatory rite. The elders take a sheep and place it on the woman's shoulders; there it is killed and the intestines taken out. Then the elders solemnly sever the intestines with a sharp splinter of wood taken from a bush of a certain sort (_mukeo_), "and they announce that they are cutting the clan _kutinyarurira_, by which they mean that they are severing the bond of relationship which exists between the pair. A medicine man then comes and purifies the couple."[93.1] In all these cases we may assume with a fair degree of probability that the old prohibition of marriage between cousins is breaking down, and that the expiatory sacrifice offered when such a marriage does take place is merely a salve to the uneasy conscience of those who commit or connive at a breach of the ancient taboo.

[Sidenote: The mutual avoidance of male and female cousins is probably a precaution against a criminal intimacy between them.] Thus the prohibition of marriage between cousins, and the rules of ceremonial avoidance observed in some tribes between persons who stand in that relationship to each other, appear both to spring from a belief, right or wrong, in the injurious effects of such unions and from a desire to avoid them. The mutual avoidance of the cousins is merely a precaution to prevent a closer and more criminal intimacy between them. If that is so, it furnishes a confirmation of the view that all the customs of ceremonial avoidance between blood relations or connexions by marriage of opposite sexes are based simply on a fear of incest.

[Sidenote: The mutual avoidance between a man and his wife's relations seems to be partly grounded on a fear of rendering the wife infertile.] The theory is perhaps confirmed by the observation that in some tribes the avoidance between a man and his {94} wife's mother lasts only until he has had a child by his wife;[94.1] while in others, though avoidance continues longer, it gradually wears away with time as the man and woman advance in years,[94.2] and in others, again, it is observed only between a man and his future mother-in-law, and comes to an end with his marriage.[94.3] These customs suggest that in the minds of the people who practise them there is a close connexion between the avoidance of the wife's relations and the dread of an infertile marriage. The Indians of Yucatan, as we saw, believe that if a betrothed man were to meet his future mother-in-law or father-in-law, he would thereby lose the power of begetting children. Such a fear seems to be only an extension by false analogy of that belief in the disastrous consequences of illicit sexual relations which we dealt with in an earlier part of this chapter,[94.4] and of which we shall have more to say presently.[94.5] From thinking, rightly or wrongly, that sexual intercourse between certain persons is fraught with serious dangers, the savage jumped to the conclusion that social intercourse between them may be also perilous by virtue of a sort of physical infection acting through simple contact or even at a distance; or if, in many cases, he did not go so far as to suppose that for a man merely to see or touch his mother-in-law sufficed to blast the fertility of his wife's womb, yet he may have thought, with much better reason, that intimate social converse between him and her might easily lead to something worse, and that to guard against such a possibility it was best to raise a strong barrier of etiquette between them. It is not, of course, to be supposed that these rules of avoidance were the result of deliberate legislation; rather they were the spontaneous and gradual growth of

feelings and thoughts of which the savages themselves perhaps had no clear consciousness. In what precedes I have merely attempted to sum up in language intelligible to civilized man the outcome of a long course of moral and social evolution.

These considerations perhaps obviate to some extent the only serious difficulty which lies in the way of the theory {95} here advocated. [Sidenote: The mutual avoidance between persons of the same sex was probably an extension by false analogy of the mutual avoidance between persons of different sexes.] If the custom of avoidance was adopted in order to guard against the danger of incest, how comes it that the custom is often observed towards persons of the same sex, for example, by a man towards his father-in-law as well as towards his mother-in-law? The difficulty is undoubtedly serious: the only way of meeting it that I can suggest is the one I have already indicated. We may suppose that the deeply rooted beliefs of the savage in the fatal effects of marriage between certain classes of persons, whether relations by blood or connexions by marriage, gradually spread in his mind so as to embrace the relations between men and men as well as between men and women; till he had worked himself into the conviction that to see or touch his father-in-law, for example, was nearly or quite as dangerous as to touch or have improper relations with his mother-in-law. It is no doubt easy for us to detect the flaw in this process of reasoning; but we should beware of casting stones at the illogical savage, for it is possible or even probable that many of our own cherished convictions are no better founded.

[Sidenote: The custom of mutual avoidance between near relations has probably had the effect of checking the practice of inbreeding.] Viewed from this standpoint the customs of ceremonial avoidance among savages assume a serious aspect very different from the appearance of arbitrariness and absurdity which they are apt to present to the civilized observer who does not look below the surface of savage society. So far as these customs have helped, as they probably have done, to suppress the tendency to inbreeding, that is, to the marriage of near relations, we must conclude that their effect has been salutary, if, as many eminent biologists hold, long-continued inbreeding is injurious to the stock, whether animal or vegetable, by rendering it in the end infertile.[95.1] However, men of science are as yet by no means agreed as to the results of consanguineous marriages, and a living authority on the subject has recently closed a review of the evidence as follows: “When we take into account such evidence as there is from animals and plants, and such studies as those of Huth,[95.2] and {96} the instances and counter-instances of communities with a high degree of consanguinity, we are led to the conclusion that the prejudices and laws of many peoples against the marriage of near kin rest on a basis not so much biological as social.”[96.1] Whatever may be the ultimate verdict of science on this disputed question, it will not affect the result of the present enquiry, which merely affirms the deep and far-reaching influence which in the long course of human history superstition has exercised on morality. Whether the influence has on the whole been for good or evil does not concern us. It suffices for our purpose to shew that superstition has been a crutch to morality, whether to support it in the fair way of virtue or to precipitate it into the miry pit of vice. To return to the point from which we wandered into this digression, we must leave in suspense the question whether the Australian savages were wise or foolish who forbade a man under pain of death to speak to his mother-in-law.

[Sidenote: Other examples of the severe punishment of sexual crime.] I will conclude this part of my subject with a few more instances of the extreme severity with which certain races have visited what they deemed improper connexions between the sexes.

[Sidenote: The Indians of Brazil.] Among the Indians who inhabited the coast of Brazil near Rio de Janeiro about the middle of the sixteenth century, a married woman who gave birth to an illegitimate child was either killed or abandoned to the caprice of the young men who could not afford to keep a wife. Her child was buried alive; for they said that were he to grow up he would only serve to perpetuate his mother’s disgrace; he would not be allowed to go to war with the rest for fear of the misfortunes and disasters he might draw down upon them, and no one would eat any food, whether venison, fish, or what not, which the miserable outcast had touched.[96.2] [Sidenote: The natives of Ruanda.] In Ruanda, a district of Central Africa, down to recent years any unmarried woman who was got with child used to be put to death with her baby, whether born or unborn. A spot at the mouth of the Akanyaru river was the place of execution, {97} where the guilty women and their innocent offspring were hurled into the water. As usual, this Puritanical strictness of morality has been relaxed under European influence; illegitimate children are still killed, but their mothers escape with the fine of a cow.[97.1] [Sidenote: The Saxons.] Among the Saxons down to the days of St. Boniface the adulteress or the maiden who had dishonoured her father’s house was compelled to hang herself, was burned, and her paramour hung over the blazing pile; or she was scourged or cut to pieces with knives by all the women of the village till she was dead.[97.2] [Sidenote: The Southern Slavs.] Among the Slav peoples of the Balkan peninsula women convicted of immoral conduct used to be stoned to death. About the year 1770 a young betrothed couple were thus executed near Cattaro in Dalmatia, because the girl was found to be with child. The youth offered to marry her, and the priest begged that the sentence of death might be commuted to perpetual banishment; but the people declared that they would not have a bastard born among them; and the two fathers of the

luckless couple threw the first stones at them. When Miss M. Edith Durham related this case to some Montenegrin peasantry, they all said that in the old days stoning was the proper punishment for unchaste women; the male paramours were shot by the relations of the girls whom they had seduced. When “that modern Messalina,” Queen Draga of Servia, was murdered, a decent peasant woman remarked that “she ought to be under the cursed stone heap” (_pod prokletu gomilu_). The country-folk of Montenegro, who heard the news of the murder from Miss Durham, “looked on it as a cleansing--a casting out of abominations--and genuinely believed that Europe would commend the deed, and that the removal of this sinful woman would bring prosperity to the land.”[97.3] Even down to the second half of the {98} nineteenth century in cases of seduction among the Southern Slavs the people proposed to stone both the culprits to death.[98.1] This happened, for example, in Herzegovina in the year 1859, when a young man named Milutin seduced or (to be more exact) was seduced by three unmarried girls and got them all with child. The people sat in judgment upon the sinners, and, though an elder proposed to stone them all, the court passed a milder sentence. The young man was to marry one of the girls, to rear the infants of the other two as his legitimate children, and next time there was a fight with the Turks he was to prove his manhood by rushing unarmed upon the enemy and wresting their weapons from them, alive or dead. The sentence was fulfilled to the letter, though many years passed before the culprit could carry out the last part of it. However, his time came in 1875, when Herzegovina revolted against the Turks. Then Milutin ran unarmed upon a regiment of the enemy and found among the Turkish bayonets a hero’s death.[98.2] Even now the Old Catholics among the South Slavs believe that a village in which a seducer is not compelled to marry his victim will be punished with hail and excessive rain. For this article of faith, however, they are ridiculed by their enlightened Catholic neighbours, who hold the far more probable view that thunder and lightning are caused by the village priest to revenge himself for unreasonable delays in the payment of his salary. A heavy hail-storm has been known to prove almost fatal to the local incumbent, who was beaten within an inch of his life by his enraged parishioners.[98.3]

[Sidenote: Inference from the severe punishments inflicted for sexual offences.] It is difficult to believe that in these and similar cases the community would inflict such severe punishment for sexual offences if it did not believe that its own safety, and not merely the interest of a few individuals, was imperilled thereby.

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[Sidenote: Why should illicit relations between the sexes be thought to disturb the balance of nature?] If now we ask why illicit relations between the sexes should be supposed to disturb the balance of nature and particularly to blast the fruits of the earth, a partial answer may be conjecturally suggested. It is not enough to say that such relations are displeasing to the gods, who punish indiscriminately the whole community for the sins of a few. For we must always bear in mind that the gods are creations of man’s fancy; he fashions them in human likeness, and endows them with tastes and opinions which are merely vast cloudy projections of his own. To affirm, therefore, that something is a sin because the gods will it so, is only to push the enquiry one stage farther back and to raise the further question, Why are the gods supposed to dislike and punish these particular acts? [Sidenote: The reason why the gods of savages are supposed to punish sexual crimes so severely may perhaps be found in a mistaken belief that irregularities of the human sexes prevent the reproduction of edible animals and plants and thereby strike a fatal blow at the food supply.] In the case with which we are here concerned, the reason why so many savage gods prohibit adultery, fornication, and incest under pain of their severe displeasure may perhaps be found in the analogy which many savage men trace between the reproduction of the human species and the reproduction of animals and plants. The analogy is not purely fanciful, on the contrary it is real and vital; but primitive peoples have given it a false extension in a vain attempt to apply it practically to increasing the food supply. They have imagined, in fact, that by performing or abstaining from certain sexual acts they thereby directly promoted the reproduction of animals and the multiplication of plants.[99.1] All such acts and abstinences, it is obvious, are purely superstitious and wholly fail to effect the desired {100} result. They are not religious but magical; that is, they compass their end, not by an appeal to the gods, but by manipulating natural forces in accordance with certain false ideas of physical causation. In the present case the principle on which savages seek to propagate animals and plants is that of magical sympathy or imitation: they fancy that they assist the reproductive process in nature by mimicking or performing it among themselves. Now in the evolution of society such efforts to control the course of nature directly by means of magical rites appear to have preceded the efforts to control it indirectly by appealing to the vanity and cupidity, the good-nature and pity of the gods; in short, magic seems to be older than religion.[100.1] In most races, it is true, the epoch of unadulterated magic, of magic untinged by religion, belongs to such a remote past that its existence, like that of our ape-like ancestors, can be a matter of inference only; almost everywhere in history and the world we find magic and religion side by side, at one time allies, at another enemies, now playing into each other’s hands, now cursing, objurgating, and vainly attempting to exterminate one another. On the whole the lower intelligences cling closely, though secretly, to magic, while the higher intelligences have discerned the vanity of its pretensions and turned to religion instead. The result has been that beliefs and rites which were purely magical in origin often contract in course of time a religious character; they

are modified in accordance with the advance of thought, they are translated into terms of gods and spirits, whether good and beneficent, or evil and malignant. We may surmise, though we cannot prove, that a change of this sort has come over the minds of many races with regard to sexual morality. At some former time, perhaps, straining a real analogy too far, they believed that those relations of the human sexes which for any reason they regarded as right and natural had a tendency to promote sympathetically the propagation of animals and plants and thereby to ensure a supply of food for the community; while on the contrary they may have imagined that those relations of the human sexes which for any reason {101} they deemed wrong and unnatural had a tendency to thwart and impede the propagation of animals and plants and thereby to diminish the common supply of food.

[Sidenote: Such a belief would account both for the horror with which many savages regard such crimes, and for the severity with which they punish them.] Such a belief, it is obvious, would furnish a sufficient motive for the strict prohibition of what were deemed improper relations between men and women; and it would explain the deep horror and detestation with which sexual irregularities are viewed by many, though certainly not by all, savage tribes. For if improper relations between the human sexes prevent animals and plants from multiplying, they strike a fatal blow at the existence of the tribe by cutting off its supply of food at the roots. No wonder, therefore, that wherever such superstitions have prevailed the whole community, believing its very existence to be put in jeopardy by sexual immorality, should turn savagely on the culprits, and beat, burn, drown or otherwise exterminate them in order to rid itself of so dangerous a pollution. And when with the advance of knowledge men began to perceive the mistake they had made in imagining that the commerce of the human sexes could affect the propagation of animals and plants, they would still through long habit be so inured to the idea of the wickedness of certain sexual relations that they could not dismiss it from their minds, even when they discerned the fallacious nature of the reasoning by which they had arrived at it. The old practice would therefore stand, though the old theory had fallen: the old rules of sexual morality would continue to be observed, but if they were to retain the respect of the community, it was necessary to place them on a new theoretical basis. That basis, in accordance with the general advance of thought, was supplied by religion. Sexual relations which had once been condemned as wrong and unnatural because they were supposed to thwart the natural multiplication of animals and plants and thereby to diminish the food supply, would now be condemned because it was imagined that they were displeasing to gods or spirits, those stalking-horses which savage man rigs out in the cast-off clothes of his still more savage ancestors. The moral practice would therefore remain the same, though its theoretical basis had been shifted from magic to religion. In this or some such way as this {102} we may conjecture that the Karens, Dyaks, and other savages reached those curious conceptions of sexual immorality and its consequences which we have been considering. But from the nature of the case the development of moral theory which I have sketched is purely hypothetical and hardly admits of verification.

[Sidenote: But the reason why savages came to regard certain sexual relations as irregular and immoral remains obscure.] However, even if we assume for a moment that the savages in question reached their present view of sexual immorality in the way I have surmised, there still remains the question, How did they originally come to regard certain relations of the sexes as immoral? For clearly the notion that such immorality interferes with the course of nature must have been secondary and derivative: people must on independent grounds have concluded that certain relations between men and women were wrong and injurious before they extended the conclusion by false analogy to nature. The question brings us face to face with the deepest and darkest problem in the history of society, the problem of the origin of the laws which still regulate marriage and the relations of the sexes among civilized nations; for broadly speaking the fundamental laws which we recognize in these matters are recognized also by savages, with this difference, that among many savages the sexual prohibitions are far more numerous, the horror excited by breaches of them far deeper, and the punishment inflicted on the offenders far sterner than with us. The problem has often been attacked, but never solved. Perhaps it is destined, like so many riddles of that Sphinx which we call nature, to remain for ever insoluble. At all events this is not the place to broach so intricate and profound a discussion. I return to my immediate subject.

[Sidenote: Sexual immorality is thought by many savages to injure the delinquents themselves, their offspring, and their innocent spouses.] In the opinion of many savages the effect of sexual immorality is not merely to disturb, directly or indirectly, the course of nature by blighting the crops, causing the earth to quake, volcanoes to vomit fire, and so forth: the delinquents themselves, their offspring, or their innocent spouses are supposed to suffer in their own persons for the sin that has been committed. Thus among the Baganda of Central Africa “adultery was also regarded as a danger to children; it was thought that women who were guilty of it {103} during pregnancy caused the child to die, either prior to birth, or at the time of birth. Sometimes the guilty woman would herself die in childbed; or, if she was safely delivered, she would have a tendency to devour her child, and would have to be guarded lest she should kill it.”[103.1] “When there was a case of retarded delivery, the relatives attributed it to adultery; they made the woman confess the name of the man with whom she had had intercourse, and if she died, her husband was fined by the members of her clan, for they said: ‘We did not give our daughter to you for the purpose of adultery, and you should have guarded

her.’ In most cases, however, the medicine-men were able to save the woman’s life, and upon recovery she was upbraided, and the man whom she accused was heavily fined.”[103.2] The Baganda thought that the infidelity of the father as well as of the mother endangered the life of the child. For “it was also supposed that a man who had sexual intercourse with any woman not his wife, during the time that any one of his wives was nursing a child, would cause the child to fall ill, and that unless he confessed his guilt and obtained from the medicine-man the necessary remedies to cancel the evil results, the child would die.”[103.3] The common childish ailment which was thought to be caused by the adultery of the father or mother was called _amakiro_, and its symptoms were well recognized: they consisted of nausea and general debility, and the only cure for them was a frank confession by the guilty parent and the performance of a magical ceremony by the medicine-man.[103.4]

[Sidenote: Disastrous effects of adultery on adulteress and her child.] Similar views as to the disastrous effects of adultery on mother and child seem to be widespread among Bantu tribes. Thus among the Awemba of Northern Rhodesia, when both mother and child die in childbirth, great horror is expressed by all, who assert that the woman must assuredly have committed adultery with many men to suffer such a fate. They exhort her even with her last breath to name the {104} adulterer; and whoever is mentioned by her is called the “murderer” (_musoka_) and has afterwards to pay a heavy fine to the injured husband. Similarly if the child is born dead and the mother survives, the Awemba take it for granted that the woman has been unfaithful to her husband, and they ask her to name the murderer of her child, that is, the man whose guilty love has been the death of the babe.[104.1] In like manner the Thonga, a Bantu tribe of South Africa, about Delagoa Bay, are of opinion that if a woman’s travail pangs are unduly prolonged or she fails to bring her offspring to the birth, she must certainly have committed adultery, and they insist upon her making a clean breast as the only means of ensuring her delivery; should she suppress the name even of one of several lovers with whom she may have gone astray, the child cannot be born. So convinced are the women of the sufferings which adultery, if unacknowledged, entails on the guilty mother in childbed, that a woman who knows her child to be illegitimate will privately confess her sin to the midwife before she is actually brought to bed, in the hope thereby of alleviating and shortening her travail pangs.[104.2] [Sidenote: Sympathetic relation between an adulterer and the injured husband.] Further, the Thonga believe that adultery establishes a physical relationship of mutual sympathy between the adulterer and the injured husband such that the life of the one is in a manner bound up with the life of the other; indeed this relationship is thought to arise between any two men who have had sexual connexion with the same woman. As a native put it to a missionary, “They have met together in one life through the blood of that woman; they have drunk from the same pool.” To express it otherwise, they have formed a blood covenant with each other through the woman as intermediary. “This establishes between them a most curious mutual dependence: should one of them be ill, the other must not visit him; the patient might die. If he runs a thorn into his foot, the other must not help him to extract it. It is taboo. The wound would not heal. If he dies, his rival must not assist at his mourning or he would die {105} himself.” Hence if a man has committed adultery, as sometimes happens, with one of his father’s younger wives, and the father dies, his undutiful son may not take the part which would otherwise fall to him in the funeral rites; indeed should he attempt to attend the burial, his relations would drive him away in pity, lest by this mark of respect and perhaps of remorse he should forfeit his life.[105.1] [Sidenote: Injurious effects of adultery on the innocent husband, wife, or child.] In like manner the Akikuyu of British East Africa believe that if a son has adulterous intercourse with one of his father’s wives, the innocent father, not the guilty young scapegrace, contracts a dangerous pollution (_thahu_), the effect of which is to make him ill and emaciated or to break out into sores or boils, and even in all probability to die, if the danger is not averted by the timely intervention of a medicine-man.[105.2] The Anyanja of British Central Africa believe that if a man commits adultery while his wife is with child, she will die; hence on the death of his wife the widower is often roundly accused of having killed her by his infidelity.[105.3] Without going so far as this, the Masai of German East Africa hold that if a father were to touch his infant on the day after he had been guilty of adultery, the child would fall sick.[105.4] According to the Akamba of British East Africa, if a woman after giving birth to a child is false to her husband before her first menstruation, the child will surely die.[105.5] [Sidenote: Injurious effects of incest on the offspring.] The Akamba are also of opinion that if a woman is guilty of incest with her brother she will be unable to bring to the birth the seed which she has conceived by him. In that case the man must purge his sin by bringing a big goat to the elders, and the woman is ceremonially smeared with the contents of the {106} animal’s stomach.[106.1] Among the Washamba of German East Africa it happened that a married woman lost three children, one after the other, by death. A diviner being called in to ascertain the cause of this calamity, attributed it to incest of which she had been accidentally guilty with her father.[106.2]

[Sidenote: Wife’s infidelity at home thought to endanger the absent husband in the chase or the war.] Again, it appears to be a common notion with savages that the infidelity of a wife prevents her husband from killing game, and even exposes him to imminent risk of being himself killed or wounded by wild beasts. This belief is entertained by the Wagogo and other peoples of East Africa, by the Moxos Indians of Bolivia, and by Aleutian hunters of sea-otters. In such cases any mishap that befalls the husband

during the chase is set down by him to the score of his wife's misconduct at home; he returns in wrath and visits his ill-luck on the often innocent object of his suspicions even, it may be, to the shedding of her blood.[106.3] While the Huichol Indians of Mexico are away seeking for a species of cactus which they regard as sacred, their women at home are bound to be strictly chaste; otherwise they believe that they would be visited with illness and would endanger the success of the men's expedition.[106.4] An old writer on Madagascar tells us that though Malagasy women are voluptuous they will not allow themselves to be drawn into an intrigue while their husbands are absent at the wars, for they believe that infidelity at such a time would cause the absent spouse to be wounded or slain.[106.5] The Baganda of Central Africa held similar views as to the fatal effect which a wife's adultery at home might have on her absent husband at the wars; they thought that the gods resented her misconduct and withdrew their favour and protection from her warrior spouse, thus punishing the innocent instead of the guilty. Indeed, it was believed that {107} if a woman were even to touch a man's clothing while her husband was away with the army, it would bring misfortune on her husband's weapon, and might even cost him his life. The gods of the Baganda were most particular about women strictly observing the taboos during their husbands' absence and having nothing to do with other men all that time. On his return from the war a man tested his wife's fidelity by drinking water from a gourd which she handed to him before he entered his house. If she had been unfaithful to him during his absence, the water was supposed to make him ill; hence should it chance that he fell sick after drinking the draught, his wife was at once clapped into the stocks and tried for adultery; and if she confessed her guilt and named her paramour, the offender was heavily fined or even put to death.[107.1] Similarly among the Bangala or the Boloki of the Upper Congo, "when men went to fight distant towns their wives were expected not to commit adultery with such men as were left in the town, or their husbands would receive spear wounds from the enemy. The sisters of the fighters would take every precaution to guard against the adultery of their brothers' wives while they were on the expedition."[107.2] So among the Haida Indians of the Queen Charlotte Islands, while the men were away at the wars, their wives "all slept in one house to keep watch over each other; for, if a woman were unfaithful to her husband while he was with a war-party, he would probably be killed."[107.3] If only King David had held this belief he might have contented himself with a single instead of a double crime, and need not have sent his Machiavellian order to put the injured husband in the forefront of the battle.[107.4]

[Sidenote: Injurious effect of wife's infidelity on her husband.] The Zulus imagine that an unfaithful wife who touches her husband's furniture without first eating certain herbs causes him to be seized with a fit of coughing of which he soon dies. Moreover, among the Zulus "a man who has {108} had criminal intercourse with a sick person's wife is prohibited from visiting the sick-chamber; and, if the sick person is a woman, any female who has committed adultery with her husband must not visit her. They say that, if these visits ever take place, the patient is immediately oppressed with a cold perspiration and dies. This prohibition was thought to find out the infidelities of the women and to make them fear discovery."[108.1] [Sidenote: African chiefs thought to be injuriously affected by the incontinence of their subjects.] For a similar reason, apparently, during the sickness of a Caffre chief his tribe was bound to observe strict continence under pain of death.[108.2] The notion seems to have been that any act of incontinence would through some sort of magical sympathy prove fatal to the sick chief. The Ovakumbi, a tribe in the south of Angola, think that the carnal intercourse of young people under the age of puberty would cause the king to die within the year, if it were not severely punished. The punishment for such a treasonable offence used to be death.[108.3] Similarly, in the kingdom of Congo, when the sacred pontiff, called the Chitomé, was going his rounds throughout the country, all his subjects had to live strictly chaste, and any person found guilty of incontinence at such times was put to death without mercy. They thought that universal chastity was essential to the preservation of the life of the pontiff, whom they revered as the head of their religion and their common father. Accordingly when he was abroad he took care to warn his faithful subjects by a public crier, that no man might plead ignorance as an excuse for a breach of the law.[108.4]

[Sidenote: Injurious effects of adultery on the adulteress.] Speaking of the same region of West Africa, an old writer tells us that "conjugal chastity is singularly respected among these people; adultery is placed in the list of the greatest crimes. By an opinion generally received, the women are persuaded that if they were to render themselves guilty of infidelity, the greatest misfortunes would overwhelm {109} them, unless they averted them by an avowal made to their husbands, and in obtaining their pardon for the injury they might have done."[109.1] [Sidenote: Dangerous pollution supposed to be incurred by unchastity.] The Looboos of Sumatra think that an unmarried young woman who has been got with child falls thereby into a dangerous state called _looï_, which is such that she spreads misfortune wherever she goes. Hence when she enters a house, the people try to drive her out by force.[109.2] Amongst the Sulka of New Britain unmarried people who have been guilty of unchastity are believed to contract thereby a fatal pollution (_sle_) of which they will die, if they do not confess their fault and undergo a public ceremony of purification. Such persons are avoided: no one will take anything at their hands: parents point them out to their children and warn them not to go near them. The infection which they are supposed to spread is apparently physical rather than moral in its nature; for

special care is taken to keep the paraphernalia of the dance out of their way, the mere presence of persons so polluted being thought to tarnish the paint on the instruments. Men who have contracted this dangerous taint rid themselves of it by drinking sea-water mixed with shredded coco-nut and ginger, after which they are thrown into the sea. Emerging from the water they put off the dripping clothes which they wore during their state of defilement and cast them away. This purification is believed to save their lives, which otherwise must have been destroyed by their unchastity.[109.3] Among the Buduma of Lake Chad, in Central Africa, at the present day “a child born out of wedlock is looked on as a disgrace, and must be drowned. If this is not done, great misfortunes {110} will happen to the tribe. All the men will fall sick, and the women, cows and goats will become barren.”[110.1]

[Sidenote: Conclusion.] These examples may suffice to shew that among many races sexual immorality, whether in the form of adultery, fornication, or incest, is believed of itself to entail, naturally and inevitably, without the intervention of society, most serious consequences not only on the culprits themselves, but also on the community, often indeed to menace the very existence of the whole people by destroying the food supply. I need hardly remind you that all these beliefs are entirely baseless; no such consequences flow from such acts; in short, the beliefs in question are a pure superstition. Yet we cannot doubt that wherever this superstition has existed it must have served as a powerful motive to deter men from adultery, fornication, and incest. If that is so, then I think I have proved my third proposition, which is, that among certain races and at certain times superstition has strengthened the respect for marriage, and has thereby contributed to the stricter observance of the rules of sexual morality both among the married and the unmarried.

V. RESPECT FOR HUMAN LIFE

{111}

[Sidenote: Superstition as a prop to the security of human life.] I pass now to my fourth and last proposition, which is, that among certain races and at certain times superstition has strengthened the respect for human life and has thereby contributed to the security of its enjoyment.

[Sidenote: The fear of ghosts.] The particular superstition which has had this salutary effect is the fear of ghosts, especially the ghosts of the murdered. The fear of ghosts is widespread, perhaps universal, among savages; it is hardly extinct among ourselves. If it were extinct, some learned societies might put up their shutters. Dead or alive, the fear of ghosts has certainly not been an unmixed blessing. Indeed it might with some show of reason be maintained that no belief has done so much to retard the economic and thereby the social progress of mankind as the belief in the immortality of the soul; for this belief has led race after race, generation after generation, to sacrifice the real wants of the living to the imaginary wants of the dead. The waste and destruction of life and property which this faith has entailed are enormous and incalculable. [Sidenote: Disastrous consequences entailed by the fear of the dead.] Without entering into details I will illustrate by a single example the disastrous economic, political, and moral consequences which flow from that systematic destruction of property which the fear of the dead has imposed on many races. Speaking of the Patagonians, the well-informed and intelligent traveller d’Orbigny observes: “They have no laws, no punishments inflicted on the guilty. Each lives as he pleases, and the greatest thief is the most highly esteemed, because he is the most dexterous. A motive {112} which will always prevent them from abandoning the practice of theft, and at the same time will always present an obstacle to their ever forming fixed settlements, is the religious prejudice which, on the death of one of their number, obliges them to destroy his property. A Patagonian, who has amassed during the whole of his life an estate by thieving from the whites or exchanging the products of the chase with neighbouring tribes, has done nothing for his heirs; all his savings are destroyed with him, and his children are obliged to rebuild their fortunes afresh,--a custom which, I may observe in passing, is found also among the Tamanaques of the Orinoco, who ravage the field of the deceased and cut down the trees which he has planted;[112.1] and among the Yuracares, who abandon and shut up the house of the dead, regarding it as a profanation to gather a single fruit from the trees of his field. It is easy to see that with such customs they can nourish no real ambition since their needs are limited to themselves; it is one of the causes of their natural indolence and is a motive which, so long as it exists, will always impede the progress of their civilization. Why should they trouble themselves about the future when they have nothing to hope from it? The present is all in all in their eyes, and their only interest is individual; the son will take no care of his father’s herd, since it will never come into his possession; he busies himself only with his own affairs and soon turns his thoughts to looking after himself and getting a livelihood. This custom has certainly something to commend it from the moral point of view in so far as it destroys all the motives for that covetousness in heirs which is too often to be seen in our cities. The desire or the hope of a speedy death of their parents cannot exist, since the parents leave absolutely nothing to their children; but on the other hand, if the Patagonians had preserved hereditary properties, they would without doubt have been to-day in possession of numerous herds, and would

necessarily have been more formidable to the whites, since their power in that case would have been more than doubled, whereas their present habits will infallibly leave them in a stationary state, from which nothing but a radical change {113} will be able to deliver them."[113.1] Thus poverty, indolence, improvidence, political weakness, and all the hardships of a nomadic life are the miserable inheritance which the fear of the dead entails on these wretched Indians. Heavy indeed is the toll which superstition exacts from all who pass within her gloomy portal.

[Sidenote: Fear of the ghosts of the slain a check on murder.] But I am not here concerned with the disastrous and deplorable consequences, the unspeakable follies and crimes and miseries, which have flowed in practice from the theory of a future life. My business at present is with the more cheerful side of the subject, with the wholesome, though groundless, terror which ghosts, apparitions, and spectres strike into the breasts of hardened ruffians and desperadoes. So far as such persons reflect at all and regulate their passions by the dictates of prudence, it seems plain that a fear of ghostly retribution, of the angry spirit of their victim, must act as a salutary restraint on their disorderly impulses; it must reinforce the dread of purely secular punishment and furnish the choleric and malicious with a fresh motive for pausing before they imbrue their hands in blood. This is so obvious, and the fear of ghosts is so notorious, that both might perhaps be taken for granted, especially at this late hour of the evening. But for the sake of completeness I will mention a few illustrative facts, taking them almost at random from distant races in order to indicate the wide diffusion of this particular superstition. I shall try to shew that while all ghosts are feared, the ghosts of slain men are especially dreaded by their slayers.

[Sidenote: Ancient Greek belief as to the anger of a ghost at his slayer.] The ancient Greeks believed that the soul of any man who had just been killed was angry with his slayer and troubled him; hence even an involuntary homicide had to {114} depart from his country for a year until the wrath of the dead man had cooled down; nor might the slayer return until sacrifice had been offered and ceremonies of purification performed. If his victim chanced to be a foreigner, the homicide had to shun the country of the dead man as well as his own.[114.1] The legend of the matricide Orestes, how he roamed from place to place pursued and maddened by the ghost of his murdered mother, reflects faithfully the ancient Greek conception of the fate which overtakes the murderer at the hands of the ghost.[114.2]

[Sidenote: Among the Greeks a manslayer was dreaded and shunned because he was thought to be haunted by the angry and dangerous ghost of his victim.] But it is important to observe that not only does the hag-ridden homicide go in terror of his victim's ghost; he is himself an object of fear and aversion to the whole community on account of the angry and dangerous spirit which dogs his steps. It was probably more in self-defence than out of consideration for the manslayer that Attic law compelled him to quit the country. This comes out clearly from the provisions of the law. For in the first place, on going into banishment the homicide had to follow a prescribed road:[114.3] obviously it would have been hazardous to let him stray about the country with a wrathful ghost at his heels. In the second place, if another charge was brought against a banished homicide, he was allowed to return to Attica to plead in his defence, but he might not set foot on land; he had to speak from a ship, and even the ship might not cast anchor or put out a gangway. The judges avoided all contact with the culprit, for they judged the case sitting or standing on the shore.[114.4] Plainly the intention of this rule was literally to insulate the slayer, lest by touching Attic earth even indirectly through the anchor or the gangway he should blast it by a sort of electric shock, as we might say; though doubtless the Greeks would have said that the blight was wrought by contact with the ghost, by a sort of effluence of death. For the same reason if such a man, sailing the {115} sea, happened to be wrecked on the coast of the country where his crime had been committed, he was allowed to camp on the shore till a ship came to take him off, but he was expected to keep his feet in sea-water all the time,[115.1] evidently to neutralise the ghostly infection and prevent it from spreading to the soil. For the same reason, when the turbulent people of Cynaetha in Arcadia had perpetrated a peculiarly atrocious massacre and had sent envoys to Sparta, all the Arcadian states through which the envoys took their way ordered them out of the country; and after their departure the Mantineans purified themselves and their belongings by sacrificing victims and carrying them round the city and the whole of their land.[115.2] So when the Athenians had heard of a massacre at Argos, they caused purificatory offerings to be carried round the public assembly.[115.3]

[Sidenote: The legend of Orestes reflects the Greek horror of a manslayer.] No doubt the root of all such observances was a fear of the dangerous ghost which haunts the murderer and against which the whole community as well as the homicide himself must be on its guard. The Greek practice in these respects is clearly mirrored in the legend of Orestes; for it is said that the people of Troezen would not receive him in their houses until he had been purified of his guilt,[115.4] that is, until he had been rid of his mother's ghost. The Akikuyu of British East Africa think that if a man who has killed another comes and sleeps at a village and eats with a family in their hut, the persons with whom he has eaten contract a dangerous pollution which might prove fatal to them were it not removed in time by a medicine-man. The very skin on which the homicide slept has absorbed the taint and might infect any

one else who slept on it. So a medicine-man is sent for to purify the hut and its occupants.[115.5] [Sidenote: Manslayers purged of the stain of human blood by being smeared with the blood of pigs.] The {116} Greek mode of purifying a homicide was to kill a sucking pig and wash the hands of the guilty man in its blood: until this ceremony had been performed the manslayer was not allowed to speak.[116.1] Among the hill-tribes near Rajamahal in Bengal, if two men quarrel and blood be shed, the one who cut the other is fined a hog or a fowl, "the blood of which is sprinkled over the wounded person, to purify him, and to prevent his being possessed by a devil."[116.2] In this case the blood-sprinkling is avowedly intended to prevent the man from being haunted by a spirit; only it is not the aggressor but his victim who is supposed to be in danger and therefore to stand in need of purification. We have seen that among these and other savage tribes pig's blood is sprinkled on persons and things as a mode of purifying them from the pollution of sexual crimes.[116.3] Among the Cameroon negroes in West Africa accidental homicide can be expiated by the blood of an animal. The relations of the slayer and of the slain assemble. An animal is killed, and every person present is smeared with its blood on his face and breast. They think that the guilt of manslaughter is thus atoned for, and that no punishment will overtake the homicide.[116.4] In Car Nicobar a man possessed by devils is cleansed of them by being rubbed all over with pig's blood and beaten with leaves. The devils are supposed to be thus swept off like flies from the man's body to the leaves, which are then folded up and tied tightly with a special kind of string. A professional exorciser administers the beating, and at every stroke with the leaves he falls down with his face on the floor and calls out in a squeaky {117} voice, "Here is a devil." This ceremony is performed by night; and before daybreak all the packets of leaves containing the devils are thrown into the sea.[117.1] The Greeks similarly used laurel leaves as well as pig's blood in purificatory ceremonies.[117.2] In all such cases we may assume that the purification was originally conceived as physical rather than as moral, as a sort of detergent which washed, swept, or scraped the ghostly or demoniacal pollution from the person of the ghost-haunted or demon-possessed man. The motive for employing blood in these rites of cleansing is not clear. Perhaps the purgative virtue ascribed to it may have been based on the notion that the offended spirit accepts the blood as a substitute for the blood of the man or woman.[117.3] However, it is doubtful whether this explanation could cover all the cases in which blood is sprinkled as a mode of purification. Certainly it is odd, as the sage Heraclitus long ago remarked, that blood-stains should be thought to be removed by blood-stains, as if a man who had been bespattered with mud should think to cleanse himself by bespattering himself with more mud.[117.4] But the ways of man are wonderful and sometimes past finding out.

[Sidenote: The matricide Orestes is said to have recovered his wits by biting off one of his own fingers.] There was a curious story that after Orestes had gone mad through murdering his mother he recovered his wits by biting off one of his own fingers; the Furies of his murdered mother, which had appeared black to him before, appeared white as soon as he had mutilated himself in this way: it was as if the taste of his own blood sufficed to avert or disarm the wrathful ghost.[117.5] A hint of the way in which the blood may have been supposed to produce this result is furnished by the practice of some savages. [Sidenote: Manslayers commonly taste their victims' blood in order not to be haunted by their ghosts.] The Indians of Guiana believe that an avenger of blood who has slain his man must go mad unless he tastes the blood of his victim; the notion apparently is that the ghost drives him crazy, {118} just as the ghost of Clytemnestra did to Orestes, who was also, be it remembered, an avenger of blood. In order to avert this consequence the Indian manslayer resorts on the third night to the grave of his victim, pierces the corpse with a sharp-pointed stick, and withdrawing it sucks the blood of the murdered man. After that he goes home with an easy mind, satisfied that he has done his duty and that he has nothing more to fear from the ghost.[118.1] A similar custom was observed by the Maoris in battle. When a warrior had slain his foe in combat, he tasted his blood, believing that this preserved him from the avenging spirit (_atua_) of his victim; for they imagined that "the moment a slayer had tasted the blood of the slain, the dead man became a part of his being and placed him under the protection of the _atua_ or guardian-spirit of the deceased."[118.2] Thus in the opinion of these savages, by swallowing a portion of their victim they made him a part of themselves and thereby converted him from an enemy into an ally; they established, in the strictest sense of the words, a blood-covenant with him. The Aricara Indians also drank the blood of their slain foes and proclaimed the deed by the mark of a red hand on their faces.[118.3] The motive for this practice may have been, as with the Maoris, a desire to appropriate and so disarm the ghost of an enemy. In antiquity some of the Scythians used to drink the blood of the first foes they killed; and they also tasted the blood of the friends with whom they made a covenant, for "they take that to be the surest pledge of good faith."[118.4] [Sidenote: Homicides supposed to go mad unless they taste the blood of their victim.] The motive of the two customs was probably the same. "To the present day, when a person of another tribe has been slain by a Nandi, the blood must be carefully washed off the spear or sword into a cup made of grass, and drunk by the slayer. If this is not done it is thought that the man will become frenzied."[118.5] So {119} among some tribes of the Lower Niger "it is customary and necessary for the executioner to lick the blood that is on the blade"; moreover "the custom of licking the blood off the blade of a sword by which a man has been killed in war is common to all these tribes, and the explanation given me by the Ibo, which is generally accepted, is, that if this was not done, the act of killing would so affect the strikers as to cause them to run amok

among their own people; because the sight and smell of blood render them absolutely senseless as well as regardless of all consequences. And this licking the blood is the only sure remedy, and the only way in which they can recover themselves."[119.1] So, too, among the Shans of Burma "it was the curious custom of executioners to taste the blood of their victims, as they believed if this were not done illness and death would follow in a short time. In remote times Shan soldiers always bit the bodies of men killed by them in battle."[119.2] Strange as it may seem, this truly savage superstition exists apparently in Italy to this day. There is a widespread opinion in Calabria that if a murderer is to escape he must suck his victim's blood from the reeking blade of the dagger with which he did the deed.[119.3] We can now perhaps understand why the matricide Orestes was thought to have recovered his wandering wits as soon as he had bitten off one of his fingers. By tasting his own blood, which was also that of his victim, since she was his mother, he might be supposed to form a blood-covenant with the ghost and so to convert it from a foe into a friend.
[Sidenote: Various precautions taken by manslayers against the ghosts of their victims.] The Kabyles of North Africa think that if a murderer leaps seven times over his victim's grave within three or seven days of the murder, he will be quite safe. Hence the fresh grave of a murdered man is carefully guarded.[119.4] The Lushai {120} of North-Eastern India believe that if a man kills an enemy the ghost of his victim will haunt him and he will go mad, unless he performs a certain ceremony which will make him master of the dead man's soul in the other world. The ceremony includes the sacrifice of an animal, whether a pig, a goat, or a mithan.[120.1] Among the Awemba of Northern Rhodesia, "according to a superstition common among Central African tribes, unless the slayers were purified from blood-guiltiness they would become mad. On the night of return no warrior might sleep in his own hut, but lay in the open _nsaka_ in the village. The next day, after bathing in the stream and being anointed with lustral medicine by the doctor, he could return to his own hearth, and resume intercourse with his wife."[120.2] In all such cases the madness of the slayer is probably attributed to the ghost of the slain, which has taken possession of him.

[Sidenote: The custom of secluding and purifying homicides is intended to protect them against the angry spirits of the slain, which are thought to madden their slayers.] That the Greek practice of secluding and purifying a homicide was essentially an exorcism, in other words, that its aim was to ban the dangerous ghost of his victim, is rendered practically certain by the similar rites of seclusion and purification which among many savage tribes have to be observed by victorious warriors with the avowed intention of securing them against the spirits of the men whom they have slain in battle. These rites I have illustrated elsewhere,[120.3] but a few cases may be quoted here by way of example. Thus among the Basutos "ablution is especially performed on return from battle. It is absolutely necessary that the warriors should rid themselves, as soon as possible, of the blood they have shed, or the shades of their victims would pursue them incessantly, and disturb their slumbers. They go in a procession, and in full armour, to the nearest stream. At the moment they enter the water a diviner, placed higher up, throws some purifying substances into the current."[120.4] According to another account of the Basuto custom, "warriors {121} who have killed an enemy are purified. The chief has to wash them, sacrificing an ox in the presence of the whole army. They are also anointed with the gall of the animal, which prevents the ghost of the enemy from pursuing them any farther."[121.1] Among the Thonga, a Bantu tribe of South Africa, about Delagoa Bay, "to have killed an enemy on the battle-field entails an immense glory for the slayers; but that glory is fraught with great danger. They have killed…. So they are exposed to the mysterious and deadly influence of the _nuru_ and must consequently undergo a medical treatment. What is the _nuru_? _Nuru_, the spirit of the slain which tries to take its revenge on the slayer. It haunts him and may drive him into insanity: his eyes swell, protrude and become inflamed. He will lose his head, be attacked by giddiness (_ndzululwan_) and the thirst for blood may lead him to fall upon members of his own family and to stab them with his assagay. To prevent such misfortunes, a special medication is required: the slayers must _lurulula tiyimpì ta bu_, take away the _nuru_ of their sanguinary expedition…. In what consists this treatment? The slayers must remain for some days at the capital. They are taboo. They put on old clothes, eat with special spoons, because their hands are 'hot,' and off special plates (_mireko_) and broken pots. They are forbidden to drink water. Their food must be cold. The chief kills oxen for them; but if the meat were hot it would make them swell internally 'because they are hot themselves, they are defiled (_ba na nsila_).' If they eat hot food, the defilement would enter into them. 'They are black (_ntima_). This black must be removed.' During all this time sexual relations are absolutely forbidden to them. They must not go home, to their wives. In former times the Ba-Ronga used to tattoo them with special marks from one eyebrow to the other. Dreadful medicines were inoculated in the incisions, and there remained pimples 'which gave them the appearance of a buffalo when it frowns.' After some days a medicine-man comes to purify them, 'to remove their black.' There seem to be various means of doing it, according to Mankhelu. Seeds of all kinds are put into a {122} broken pot and roasted, together with drugs and _psanyi_[122.1] of a goat. The slayers inhale the smoke which emanates from the pot. They put their hands into the mixture and rub their limbs with it, especially the joints…. Insanity threatening those who shed blood might begin early. So, already on the battle-field, just after their deed, warriors are given a preventive dose of the medicine by those who have killed on previous occasions…. The period of seclusion having been concluded by the final purification, all the implements used by the slayers during these days, and their old garments, are tied together and hung by a string to a tree, at some distance from the

capital, where they are left to rot."[122.2]

[Sidenote: With some savages temporary insanity seems to be really caused by the sight or even thought of blood.] The accounts of the madness which is apt to befall slayers seem too numerous and too consistent to be dismissed as pure fictions of the savage imagination. However we may reject the native explanation of such fits of frenzy, the reports point to a real berserker fury or unbridled thirst for blood which comes over savages when they are excited by combat, and which may prove dangerous to friends as well as to foes. The question is one on which students of mental disease might perhaps throw light. Meantime it deserves to be noticed that even the people who have staid at home and have taken no share in the bloody work are liable to fall into a state of frenzy when they hear the war-whoops which proclaim the approach of the victorious warriors with their ghastly trophies. Thus we are told that among the Bare'e-speaking Toradjas of Central Celebes, when these notes of triumph were heard in the distance the whole population of the village would turn out to meet and welcome the returning braves. At the mere sound some of those who had remained at home, especially women, would be seized with a frenzy, and rushing forth would bite the severed heads of the slain foes, and they were not to be brought to their senses till they had drunk palm wine or water out of the skulls. If the warriors returned empty-handed, these {123} furies would fall upon them and bite their arms. There was a regular expression for this state of temporary insanity excited by the sight or even the thought of human blood; it was called _merata lamoanja_ or _merata raoa_, "the spirit is come over them," by which was probably meant that the madness was caused by the ghosts of the slaughtered foes. When any of the warriors themselves suffered from this paroxysm of frenzy, they were healed by eating a piece of the brains or licking the blood of the slain.[123.1]

[Sidenote: Means taken by manslayers in Africa to rid themselves of the ghosts of their victims.] Among the Bantu tribes of Kavirondo, in British East Africa, when a man has killed an enemy in warfare he shaves his head on his return home, and his friends rub a medicine, which generally consists of cow's dung, over his body to prevent the spirit of the slain man from troubling him.[123.2] Here cow's dung serves these negroes as a detergent of the ghost, just as pig's blood served the ancient Greeks. Among the Wawanga, about Mount Elgon in British East Africa, "a man returning from a raid, on which he has killed one of the enemy, may not enter his hut until he has taken cow-dung and rubbed it on the cheeks of the women and children of the village and purified himself by the sacrifice of a goat, a strip of skin from the forehead of which he wears round the right wrist during the four following nights."[123.3] With the Ja-Luo of Kavirondo the custom is somewhat different. Three days after his return from the fight the warrior shaves his head. But before he may enter his village he has to hang a live fowl, head uppermost, round his neck; then the bird is decapitated and its head left hanging round his neck. Soon after his return a feast is made for the slain man, in order that his ghost may not haunt his slayer.[123.4] In some of these cases the slayer shaves his head, precisely as the matricide Orestes is said to have shorn his hair when he came to his senses.[123.5] From this Greek tradition we may infer with some probability that the hair of Greek homicides, {124} like that of these African warriors, was regularly cropped as one way of ridding them of the ghostly infection. Among the Ba-Yaka, a Bantu people of the Congo Free State, "a man who has been killed in battle is supposed to send his soul to avenge his death on the person of the man who killed him; the latter, however, can escape the vengeance of the dead by wearing the red tail-feathers of the parrot in his hair, and painting his forehead red."[124.1] Perhaps, as I have suggested elsewhere, this costume is intended to disguise the slayer from his victim's ghost.[124.2] [Sidenote: Precautions taken by the Natchez Indians.] Among the Natchez Indians of North America young braves who had taken their first scalps were obliged to observe certain rules of abstinence for six months. They might not sleep with their wives nor eat flesh; their only food was fish and hasty-pudding. If they broke these rules they believed that the soul of the man they had killed would work their death by magic.[124.3]

[Sidenote: Ghosts of the slain dreaded by the Kai of German New Guinea.] The Kai of German New Guinea stand in great fear of the ghosts of the men whom they have slain in war. On their way back from the field of battle or the scene of massacre they hurry in order to be safe at home or in the shelter of a friendly village before nightfall; for all night long the spirits of the dead are believed to dog the footsteps of their slayers, in the hope of coming up with them and recovering the lost portions of their souls which adhere with the clots of their blood to the spears and clubs that dealt them the death-blow. Only so can these poor restless ghosts find rest and peace. Hence the slayers are careful not to bring back the blood-stained weapons with them into the village; for that would be the first place where the ghosts would look for them. They hide them, therefore, in the forest at a safe distance from the village, where the ghosts can never find them; and when the spirits are weary of the fruitless search, they go away back to their dead bodies lying, it may be, among the blackened ruins of their {125} desolated home. Then the victors come forth, and taking up the weapons from their hiding-places, wash them clean of blood and bring them back to the village.[125.1] But "as more or less of the soul-stuff of their slain foes always sticks to the victors, none of their people may touch them after their return to the village. They are strictly shunned by their friends for several days. People go shyly out of their way. If any one in the village gets a pain in his

stomach, it is assumed that he has sat down on the place of one of the warriors. If somebody complains of toothache, he must have eaten a fruit which had been touched by one of the combatants. All the leavings of the men's food must be most carefully put out of the way, lest a pig should get at them, for that would be the death of the animal. Therefore the remains of their meals are burnt or buried. The warriors themselves cannot suffer much from the soul-stuff of the foes, because they treat themselves with the disinfecting sap of a creeper. But even so they are not secure against all the dangers that threaten them from this quarter."[125.2]

[Sidenote: Customs observed by manslayers in British New Guinea.] Among the tribes at the mouth of the Wanigela River, in British New Guinea, "a man who has taken life is considered to be impure until he has undergone certain ceremonies: as soon as possible after the deed he cleanses himself and his weapon. This satisfactorily accomplished, he repairs to his village and seats himself on the logs of sacrificial staging. No one approaches him or takes any notice whatever of him. A house is prepared for him which is put in charge of two or three small boys as servants. He may eat only toasted bananas, and only the centre portion of them--the ends being thrown away. On the third day of his seclusion a small feast is prepared by his friends, who also fashion some new perineal bands for him. This is called _ivi poro_. The next day the man dons all his best ornaments and badges for taking life, and sallies forth fully armed and parades the village. The next day a hunt is organised, and a kangaroo selected from the game captured. It is cut open and the spleen and liver rubbed over the back of the man. He then walks solemnly down to the {126} nearest water, and standing straddle-legs in it washes himself. All young untried warriors swim between his legs. This is supposed to impart his courage and strength to them. The following day, at early dawn, he dashes out of his house, fully armed, and calls aloud the name of his victim. Having satisfied himself that he has thoroughly scared the ghost of the dead man, he returns to his house. The beating of flooring boards and the lighting of fires is also a certain method of scaring the ghost. A day later his purification is finished. He can then enter his wife's house."[126.1] In this last case the true nature of such so-called purifications is clearly manifest: they are in fact rites of exorcism observed for the purpose of banning a dangerous spirit.

[Sidenote: Customs observed by murderers among the Omaha Indians.] Amongst the Omaha Indians of North America a murderer whose life was spared by the kinsmen of his victim had to observe certain stringent rules for a period which varied from two to four years. He must walk barefoot, and he might eat no warm food, nor raise his voice, nor look around. He had to pull his robe around him and to keep it tied at the neck, even in warm weather; he might not let it hang loose or fly open. He might not move his hands about, but had to keep them close to his body. He might not comb his hair, nor might it be blown about by the wind. No one would eat with him, and only one of his kindred was allowed to remain with him in his tent. When the tribe went hunting, he was obliged to pitch his tent about a quarter of a mile from the rest of the people, "lest the ghost of his victim should raise a high wind which might cause damage."[126.2] The reason here alleged for banishing the murderer from the camp of the hunters gives the clue to all the other restrictions laid on him: he was haunted by the ghost and therefore dangerous; hence people kept aloof from him, just as they are said to have done from the ghost-ridden Orestes.

Among the Chinook Indians of Oregon and Washington, "when a person has been killed, an old man who has a {127} guardian spirit is asked to work over the murderer. [Sidenote: Ceremonies observed by homicides among the Chinook Indians.] The old man takes coal and mixes it with grease. He puts it on to the face of the murderer. He gives him a head ring of cedar bark. Cedar bark is also tied around his ankles and knees and around his wrists. For five days he does not drink water. He does not sleep, and does not lie down. He always stands. At night he walks about and whistles on bone whistles. He always says '_ä ä ä_.' For five days he does not wash his face. Then on the next morning the old man washes his face. He takes off that coal. He removes the black paint from his face. He puts red paint on his face. A little coal is mixed with the red paint. The old man puts this again on to his face. Sometimes this is done by an old man, sometimes by an old woman. The cedar bark which was tied to his legs and arms is taken off and buckskin straps are tied around his arms and his legs. Now, after five days he is given water. He is given a bucket, out of which he drinks. Now food is roasted for him, until it is burned. When it is burned black it is given to him. He eats standing. He takes five mouthsful, and no more. After thirty days he is painted with new red paint. Good red paint is taken. Now he carries his head ring and his bucket to a spruce tree and hangs it on top of the tree. Then the tree will dry up. People never eat in company of a murderer. He never eats sitting, but always standing. When he sits down to rest he kneels on one leg. The murderer never looks at a child and must not see people while they are eating."[127.1] All these measures are probably intended to rid the murderer of the clinging ghost of his victim, and to keep him in quarantine till the riddance has been effected.

[Sidenote: Ghosts of slain kinsfolk, fellow-townsmen, and fellow-clansfolk especially dreaded.] While the spirit of a murdered man is thus feared by everybody, it is natural that it should be specially dreaded by those against whom for any reason he may be conceived to bear a grudge. For example, among the Yabim of German New Guinea, when the relations of a murdered man have accepted a bloodwit instead of avenging his death, they must allow the family of the victim to mark them with chalk on the brow.

Were this {128} not done, the ghost of their dead kinsman might come and trouble them for not doing their duty by him; he might drive away their pigs or loosen their teeth.[128.1] The ghosts of murdered kinsfolk and neighbours are naturally more formidable than those of foreigners and strangers; for their wrath is hotter and they have more opportunities of wreaking their anger on the hard-hearted friends who either did them to death with their own hands or left their blood unavenged. Indeed some people only fear the wraiths of such persons, and regard with indifference all other ghosts, let them mow and gibber as much as they like. Thus among the Boloki of the Upper Congo "a homicide is not afraid of the spirit of the man he has killed when the slain man belongs to any of the neighbouring towns, as disembodied spirits travel in a very limited area only; but when he kills a man belonging to his own town he is filled with fear lest the spirit shall do him some harm. There are no special rites that he can observe to free himself from these fears, but he mourns for the slain man as though he were a member of his own family. He neglects his personal appearance, shaves his head, fasts for a certain period, and laments with much weeping."[128.2] Again, a Kikuyu man does not incur ceremonial pollution (_thahu_) by the slaughter of a man of another tribe, nor even of his own tribe, provided his victim belongs to another clan; but if the slain man is a member of the same clan as his slayer, the case is grave indeed. However, it is possible by means of a ceremony to bind over the ghost to keep the peace. For this purpose the murderer and the oldest surviving brother of his victim are seated facing each other on two trunks of banana trees; here they are solemnly fed by two elders with vegetable food of all kinds, which has been provided for the purpose by their mothers and sprinkled with the contents of the stomach of a sacrificed sheep. Next day the elders proceed to the sacred {129} fig-tree (_mugumo_), which plays a great part in the religious rites of the Akikuyu. There they sacrifice a pig and deposit some of the fat, the intestines, and the more important bones at the foot of the tree, while they themselves feast on the more palatable parts of the animal. They think that the ghost of the murdered man will visit the tree that very night in the outward shape of a wild cat and consume the meat, and that this offering will prevent him from returning to the village and troubling the inhabitants.[129.1]

[Sidenote: Ghosts of the slain dreaded by the Toradjas of Central Celebes.] The Bare'e-speaking Toradjas of Central Celebes are greatly concerned about the souls of men who have been slain in battle. They appear to think that men who have been killed in war instead of dying by disease have not exhausted their vital energy and that therefore their departed spirits are more powerful than the common ruck of ghosts; and as on account of the unnatural manner of their death they cannot be admitted into the land of souls they continue to prowl about the earth, furious with the foes who have cut them off untimely in the prime of manhood, and demanding of their friends that they shall wage war on the enemy and send forth an expedition every year to kill some of them. If the survivors pay no heed to this demand of the bloodthirsty ghosts, they themselves are exposed to the vengeance of these angry spirits, who pay out their undutiful friends and relatives by visiting them with sickness and death. Hence with the Toradjas war is a sacred duty in which every member of the community is bound to bear a part; even women and children, who cannot wage real war, must wage mimic warfare at home by hacking with bamboo swords at an old skull of the enemy, while with their shrill voices they utter the war-whoop.[129.2] Thus among these people, as among many more tribes of savages, a belief in the immortality of {130} the soul has been one of the most fruitful causes of bloodshed by keeping up a perpetual state of war between neighbouring communities, who dare not make peace with each other for fear of mortally offending the spirits of the dead.[130.1]

[Sidenote: Ghosts of all who have died violent deaths are dangerous. How the Karens propitiate such ghosts.] But, whether friends or foes, the ghosts of all who have died a violent death are in a sense a public danger; for their temper is naturally soured and they are apt to fall foul of the first person they meet without nicely discriminating between the innocent and the guilty. The Karens of Burma, for example, think that the spirits of all such persons go neither to the upper regions of bliss nor to the nether world of woe, but linger on earth and wander about invisible. They make men sick to death by stealing their souls. Accordingly these vampire-like beings are exceedingly dreaded by the people, who seek to appease their anger and repel their cruel assaults by propitiatory offerings and the most earnest prayers and supplications.[130.2] They put red, yellow, and white rice in a basket and leave it in the forest, saying: "Ghosts of such as died by falling from a tree, ghosts of such as died of hunger or thirst, ghosts of such as died by the tiger's tooth or the serpent's fang, ghosts of the murdered dead, ghosts of such as died of small-pox or cholera, ghosts of dead lepers, O ill-treat us not, seize not upon our persons, do us no harm. O stay here in this wood. We will bring hither red rice, yellow rice, and white rice for your subsistence."[130.3]

[Sidenote: The angry ghosts of the slain are sometimes forcibly driven away with noise and clamour.] However, it is not always by fair words and propitiatory offerings that the community attempts to rid itself of these invisible but dangerous intruders. People sometimes resort to more forcible measures. "Once," says a traveller among the Indians of North America, "on approaching in the night a village of Ottawas, I found all the inhabitants in confusion: they were all busily engaged in raising noises of the loudest and most inharmonious kind. Upon inquiry, I found that a battle had been lately fought between the Ottawas and the Kickapoos, and that the object of all this noise was to prevent the ghosts of the departed combatants {131} from entering the village."[131.1] Again,

after the North American Indians had burned and tortured a prisoner to death, they used to run through the village, beating the walls, the furniture, and the roofs of the huts with sticks and yelling at the pitch of their voices to drive away the angry ghost of the victim, lest he should seek to avenge the injuries done to his scorched and mutilated body.[131.2] Similarly among the Papuans of Doreh in Dutch New Guinea, when a murder has been committed in the village, the inhabitants assemble for several evenings successively and shriek and shout to frighten away the ghost, in case he should attempt to come back.[131.3] The Yabim, a tribe in German New Guinea, believe that “the dead can both help and harm, but the fear of their harmful influence is predominant. Especially the people are of opinion that the ghost of a slain man haunts his murderer and brings misfortune on him. Hence it is necessary to drive away the ghost with shrieks and the beating of drums. The model of a canoe laden with taro and tobacco is got ready to facilitate his departure.”[131.4] So when the Bukaua of German New Guinea have won a victory over their fo

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PRIMITIVE CULTURE

PRIMITIVE CULTURE

RESEARCHES INTO THE DEVELOPMENT OF MYTHOLOGY, PHILOSOPHY, RELIGION, LANGUAGE, ART, AND CUSTOM

BY EDWARD B. TYLOR, D.C.L., LL.D., F.R.S.

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“Ce n’est pas dans les possibilités, c’est dans l’homme même qu’il faut étudier l’homme: il ne s’agit pas d’imaginer ce qu’il auroit pû ou dû faire, mais de regarder ce qu’il fait.”—DE BROSSES.

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ANIMISM (_continued_).

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Having thus traced upward from the lower levels of culture the opinions of mankind as to the souls, spirits, ghosts, or phantoms, considered to belong to men, to the lower animals, to plants, and to things, we are now prepared to investigate one of the great religious doctrines of the world, the belief in the soul’s continued existence in a Life after Death. Here let us once more call to mind the consideration which cannot be too strongly put forward, that the doctrine of a Future Life as held by the lower races is the all but necessary outcome of savage Animism. The evidence that the lower races believe the figures of the dead seen in dreams and visions to be their surviving souls, not only goes far to account for the comparative universality of their belief in the continued existence of the soul after the death of the body, but it gives the key to many of their speculations on the nature of this existence, speculations rational enough from the savage point of view, though apt to seem far-fetched absurdities to moderns in their much changed intellectual condition. The belief in a Future Life falls into two main divisions. Closely connected and even largely overlapping one another, both world-wide in their distribution, both ranging back in time to periods of unknown antiquity, both deeply rooted in the lowest strata of human life which lie open to our observation, these two doctrines have in the modern world passed into wonderfully different conditions. The one is the theory of the Transmigration of Souls, which has indeed risen from its lower stages to establish itself among the huge religious communities of Asia, great in history, enormous even in present mass, yet arrested and as it seems henceforth unprogressive in development; but the more highly educated world has rejected the ancient belief, and it now only survives in Europe in dwindling remnants. Far different has been the history of the other doctrine, that of the independent existence of the personal soul after the death of the body, in a Future Life. Passing onward through change after change in the condition of the human race, modified and renewed in its long ethnic course, this great belief may be traced from its crude and primitive manifestations among savage races to its establishment in the heart of modern religion, where the faith in a future existence forms at once an inducement to goodness, a sustaining hope through suffering and across the fear of death, and an answer to the perplexed problem of the allotment of happiness and misery in this present world, by the expectation of another

world to set this right.

In investigating the doctrine of Transmigration, it will be well first to trace its position among the lower races, and afterwards to follow its developments, so far as they extend in the higher civilization. The temporary migration of souls into material substances, from human bodies down to morsels of wood and stone, is a most important part of the lower psychology. But it does not relate to the continued existence of the soul after death, and may be more conveniently treated of elsewhere, in connexion with such subjects as dæmoniacal possession and fetish-worship. We are here concerned with the more permanent tenancy of souls for successive lives in successive bodies.

Permanent transition, new birth, or re-incarnation of human souls in other human bodies, is especially considered to take place by the soul of a deceased person animating the body of an infant. It is recorded by Brebeuf that the Hurons, when little children died, would bury them by the wayside, that their souls might enter into mothers passing by, and so be born again.[1] In North-West America, among the Tacullis, we hear of direct transfusion of soul by the medicine-man, who, putting his hands on the breast of the dying or dead, then holds them over the head of a relative and blows through them; the next child born to this recipient of the departed soul is animated by it, and takes the rank and name of the deceased.[2] The Nutka Indians not without ingenuity accounted for the existence of a distant tribe speaking the same language as themselves, by declaring them to be the spirits of their dead.[3] In Greenland, where the wretched custom of abandoning and even plundering widows and orphans was tending to bring the whole race to extinction, a helpless widow would seek to persuade some father that the soul of a dead child of his had passed into a living child of hers, or _vice versâ_, thus gaining for herself a new relative and protector.[4] It is mostly ancestral or kindred souls that are thought to enter into children, and this kind of transmigration is therefore from the savage point of view a highly philosophical theory, accounting as it does so well for the general resemblance between parents and children, and even for the more special phenomena of atavism. In North-West America, among the Koloshes, the mother sees in a dream the deceased relative whose transmitted soul will give his likeness to the child;[5] and in Vancouver's Island in 1860 a lad was much regarded by the Indians because he had a mark like the scar of a gun-shot wound on his hip, it being believed that a chief dead some four generations before, who had such a mark, had returned.[6] In Old Calabar, if a mother loses a child, and another is born soon after, she thinks the departed one to have come back.[7] The Wanika consider that the soul of a dead ancestor animates a child, and this is why it resembles its father or mother;[8] in Guinea a child bearing a strong resemblance, physical or mental, to a dead relative, is supposed to have inherited his soul;[9] and the Yorubas, greeting a new-born infant with the salutation, 'Thou art come!' look for signs to show what ancestral soul has returned among them.[10] Among the Khonds of Orissa, births are celebrated by a feast on the seventh day, and the priest, divining by dropping rice-grains in a cup of water, and judging from observations made on the person of the infant, determines which of his progenitors has reappeared, and the child generally at least among the northern tribes receives the name of that ancestor.[11] In Europe the Lapps repeat an instructive animistic idea just noticed in America; the future mother was told in a dream what name to give her child, this message being usually given by the very spirit of the deceased ancestor, who was about to be incarnate in her.[12] Among the lower races generally the renewal of old family names by giving them to new-born children may always be suspected of involving some such thought. The following is a curious pair of instances from the two halves of the globe. The New Zealand priest would repeat to the infant a long list of names of its ancestors, fixing upon that name which the child by sneezing or crying when it was uttered, was considered to select for itself; while the Cheremiss in Russia would shake the baby till it cried, and then repeat names to it, till it chose itself one by leaving off crying.[13]

The belief in the new human birth of the departed soul, which has even led West African negroes to commit suicide when in distant slavery, that they may revive in their own land, in fact amounts among several of the lower races to a distinct doctrine of an earthly resurrection. One of the most remarkable forms which this belief assumes is when dark-skinned races, wanting some reasonable theory to account for the appearance among them of human creatures of a new strange sort, the white men, and struck with their pallid deathly hue combined with powers that seem those of superhuman spiritual beings, have determined that the manes of their dead must have come back in this wondrous shape. The aborigines of Australia have expressed this theory in the simple formula, 'Blackfellow tumble down, jump up Whitefellow.' Thus a native who was hanged years ago at Melbourne expressed in his last moments the hopeful belief that he would jump up Whitefellow, and have lots of sixpences. The doctrine has been current among them since early days of European intercourse, and in accordance with it they habitually regarded the Englishmen as their own deceased kindred, come back to their country from an attachment to it in a former life. Real or imagined likeness completed the delusion, as when Sir George Grey was hugged and wept over by an old woman who found in him a son she had lost, or when a convict, recognized as a deceased relative, was endowed anew with the land he had possessed during his former life. A similar theory may be traced northward by the Torres Islands to New Caledonia, where the natives thought the white men to be the spirits of the dead who bring sickness, and assigned this as their reason for wishing to kill white men.[14] In Africa, again, the belief is

found among the Western negroes that they will rise again white, and the Bari of the White Nile, believing in the resurrection of the dead on earth, considered the first white people they saw as departed spirits thus come back.[15]

Next, the lower psychology, drawing no definite line of demarcation between souls of men and of beasts, can at least admit without difficulty the transmission of human souls into the bodies of the lower animals. A series of examples from among the native tribes of America will serve well to show the various ways in which such ideas are worked out. The Ahts of Vancouver's Island consider the living man's soul able to enter into other bodies of men and animals, going in and out like the inhabitant of a house. In old times, they say, men existed in the forms of birds, beasts, and fishes, or these had the spirits of the Indians in their bodies; some think that after death they will pass again into the bodies of the animals they occupied in this former state.[16] In an Indian district of North-West California, we find natives believing the spirits of their dead to enter into bears, and travellers have heard of a tribe begging the life of a wrinkle-faced old she grizzly bear as the recipient of the soul of some particular grandam, whom they fancied the creature to resemble.[17] So, among the Esquimaux, a traveller noticed a widow who was living for conscience' sake upon birds, and would not touch walrus-meat, which the angekok had forbidden her for a time, because her late husband had entered into a walrus.[18] Among other North American tribes, we hear of the Powhatans refraining from doing harm to certain small wood-birds which received the souls of their chiefs;[19] of Huron souls turning into turtle-doves after the burial of their bones at the Feast of the Dead;[20] of that pathetic funeral rite of the Iroquois, the setting free a bird on the evening of burial, to carry away the soul.[21] In Mexico, the Tlascalans thought that after death the souls of nobles would animate beautiful singing birds, while plebeians passed into weasels and beetles and such like vile creatures.[22] So, in Brazil, the Içannas say that the souls of the brave will become beautiful birds, feeding on pleasant fruits, but cowards will be turned into reptiles.[23] Among the Abipones we hear of certain little ducks which fly in flocks at night, uttering a mournful hiss, and which fancy associates with the souls of the dead;[24] while in Popayan it is said that doves were not killed, as inspired by departed souls.[25] Lastly, transmigration into brutes is also a received doctrine in South America as when a missionary heard a Chiriquane woman of western Brazil say of a fox, 'May not that be the spirit of my dead daughter?'[26]

In Africa, again, mention is made of the Maravi thinking that the souls of bad men became jackals, and of good men snakes.[27] The Zulus, while admitting that a man may turn into a wasp or lizard, work out in the fullest way the idea of the dead becoming snakes, a creature whose change of skin has so often been associated with the thought of resurrection and immortality. It is especially certain green or brown harmless snakes, which come gently and fearlessly into houses, which are considered to be 'amatongo' or ancestors, and therefore are treated respectfully, and have offerings of food given them. In two ways, the dead man who has become a snake can still be recognized; if the creature is one-eyed, or has a scar or some other mark, it is recognized as the 'itongo' of a man who was thus marked in life; but if he had no mark the 'itongo' appears in human shape in dreams, thus revealing the personality of the snake.[28] In Guinea, monkeys found near a graveyard are supposed to be animated by the spirits of the dead, and in certain localities monkeys, crocodiles, and snakes, being thought men in metempsychosis, are held sacred.[29] It is to be borne in mind that notions of this kind may form in barbaric psychology but a portion of the wide doctrine of the soul's future existence. For a conspicuous instance of this, let us take the system of the Gold-Coast negroes. They believe that the 'kla' or 'kra,' the vital soul, becomes at death a 'sisa' or ghost, which can remain in the house with the body, plague the living, and cause sickness, till it departs or is driven by the sorcerer to the bank of the River Volta, where the ghosts build themselves houses and dwell. But they can and do come back from this Land of Souls. They can be born again as souls in new human bodies, and a soul who was poor before will now be rich. Many will not come back as men, but will become animals. To an African mother who has lost her child, it is a consolation to say, 'He will come again.'[30]

In higher levels of culture, the theory of re-embodiment of the soul appears in strong and varied development. Though seemingly not received by the early Aryans, the doctrine of migration was adopted and adapted by Hindu philosophy, and forms an integral part of that great system common to Brahmanism and Buddhism, wherein successive births or existences are believed to carry on the consequences of past and prepare the antecedents of future life. To the Hindu the body is but the temporary receptacle of the soul, which, 'bound in the chains of deeds' and 'eating the fruits of past actions,' promotes or degrades itself along a series of embodiments in plant, beast, man, deity. Thus all creatures differ rather in degree than kind, all are akin to man, an elephant or ape or worm may once have been human, and may become human again, a pariah or barbarian is at once low-caste among men and high-caste among brutes. Through such bodies migrate the sinful souls which desire has drawn down from primal purity into gross material being; the world where they do penance for the guilt incurred in past existences is a huge reformatory, and life is the long grievous process of developing evil into good. The rules are set forth in the book of Manu how souls endowed with the quality of goodness acquire divine nature, while souls governed by passion take up the human state, and souls sunk in darkness are degraded to brutes. Thus the range of migration stretches downward from gods and saints, through holy ascetics, Brahmans,

nymphs, kings, counsellors, to actors, drunkards, birds, dancers, cheats, elephants, horses, Sudras, barbarians, wild beasts, snakes, worms, insects, and inert things. Obscure as the relation mostly is between the crime and its punishment in a new life, there may be discerned through the code of penal transmigration an attempt at appropriateness of penalty, and an intention to punish the sinner wherein he sinned. For faults committed in a previous existence men are afflicted with deformities, the stealer of food shall be dyspeptic, the scandal-monger shall have foul breath, the horse-stealer shall go lame, and in consequence of their deeds men shall be born idiots, blind, deaf and dumb, mis-shaped, and thus despised of good men. After expiation of their wickedness in the hells of torment, the murderer of a Brahman may pass into a wild beast or pariah; he who adulterously dishonours his guru or spiritual father shall be a hundred times re-born as grass, a bush, a creeper, a carrion bird, a beast of prey; the cruel shall become blood-thirsty beasts; stealers of grain and meat shall turn into rats and vultures; the thief who took dyed garments, kitchen-herbs, or perfumes, shall become accordingly a red partridge, a peacock, or a musk-rat. In short, 'in whatever disposition of mind a man accomplishes such and such an act, he shall reap the fruit in a body endowed with such and such a quality.'[31] The recognition of plants as possible receptacles of the transmigrating spirit well illustrates the conception of souls of plants. The idea is one known to lower races in a district of the world which has been under Hindu influence. Thus we hear among the Dayaks of Borneo of the human soul entering the trunks of trees, where it may be seen damp and blood-like, but no longer personal and sentient, or of its being re-born from an animal which has eaten of the bark, flower, or fruit;[32] and the Santals of Bengal are said to fancy that uncharitable men and childless women are eaten eternally by worms and snakes, while the good enter into fruit-bearing trees.[33] But it is an open question how far these and the Hindu ideas of vegetable transmigration can be considered as independent. A curious commentary on the Hindu working out of the conception of plant-souls is to be found in a passage in a 17th-century work, which describes certain Brahmans of the Coromandel Coast as eating fruits, but being careful not to pull the plants up by the roots, lest they should dislodge a soul; but few, it is remarked, are so scrupulous as this, and the consideration has occurred to them that souls in roots and herbs are most vile and abject bodies, so that if dislodged they may become better off by entering into the bodies of men or beasts.[34] Moreover, the Brahmanic doctrine of souls transmigrating into inert things has in like manner a bearing on the savage theory of object-souls.[35]

Buddhism, like the Brahmanism from which it seceded, habitually recognized transmigration between superhuman and human beings and the lower animals, and in an exceptional way recognized a degradation even into a plant or a thing. How the Buddhist mind elaborated the doctrine of metempsychosis, may be seen in the endless legends of Gautama himself undergoing his 550 births, suffering pain and misery through countless ages to gain the power of freeing sentient beings from the misery inherent in all existence. Four times he became Maha Brahma, twenty times the dewa Sekra, and many times or few he passed through such stages as a hermit, a king, a rich man, a slave, a potter, a gambler, a curer of snake bites, an ape, an elephant, a bull, a serpent, a snipe, a fish, a frog, the dewa or genius of a tree. At last, when he became the supreme Buddha, his mind, like a vessel overflowing with honey, overflowed with the ambrosia of truth, and he proclaimed his triumph over life:—

'Painful are repeated births. O house-builder! I have seen thee, Thou canst not build again a house for me. Thy rafters are broken Thy roof-timbers are shattered. My mind is detached, I have attained to the extinction of desire.'

Whether the Buddhists receive the full Hindu doctrine of the migration of the individual soul from birth to birth, or whether they refine away into metaphysical subtleties the notion of continued personality, they do consistently and systematically hold that a man's life in former existences is the cause of his now being what he is, while at this moment he is accumulating merit or demerit whose result will determine his fate in future lives. Memory, it is true, fails generally to recall these past births, but memory, as we know, stops short of the beginning even of this present life. When King Bimsara's feet were burned and rubbed with salt by command of his cruel son that he might not walk, why was this torture inflicted on a man so holy? Because in a previous birth he had walked near a dagoba with his slippers on, and had trodden on a priest's carpet without washing his feet. A man may be prosperous for a time on account of the merit he has received in former births, but if he does not continue to keep the precepts, his next birth will be in one of the hells, he will then be born in this world as a beast, afterwards as a preta or sprite; a proud man may be born again ugly with large lips, or as a demon or a worm. The Buddhist theory of 'karma' or 'action,' which controls the destiny of all sentient beings, not by judicial reward and punishment, but by the inflexible result of cause into effect, wherein the present is ever determined by the past in an unbroken line of causation, is indeed one of the world's most remarkable developments of ethical speculation.[36]

Within the classic world, the ancient Egyptians were described as maintaining a doctrine of migration, whether by successive embodiments of the immortal soul through creatures of earth, sea, and air, and back again to man, or by the simpler judicial penalty which sent back the wicked dead to earth as unclean beasts.[37] The pictures and hieroglyphic sentences of the Book of the Dead, however, do not afford the necessary confirmation for these statements, even the mystic transformations of the soul not being of

the nature of transmigrations. Thus it seems that the theological centre whence the doctrine of moral metempsychosis may have spread over the ancient cultured religions, must be sought elsewhere than in Egypt. In Greek philosophy, great teachers stood forth to proclaim the doctrine in a highly developed form. Plato had mythic knowledge to convey of souls entering such new incarnations as their glimpse of real existence had made them fit for, from the body of a philosopher or a lover down to the body of a tyrant and usurper; of souls transmigrating into beasts and rising again to man according to the lives they led; of birds that were light-minded souls; of oysters suffering in banishment the penalty of utter ignorance. Pythagoras is made to illustrate in his own person his doctrine of metempsychosis, by recognizing where it hung in Here's temple the shield he had carried in a former birth, when he was that Euphorbos whom Menelaos slew at the siege of Troy. Afterwards he was Hermotimos, the Klazomenian prophet whose funeral rites were so prematurely celebrated while his soul was out, and after that, as Lucian tells the story, his prophetic soul passed into the body of a cock. Mikyllos asks this cock to tell him about Troy—were things there really as Homer said? But the cock replies, 'How should Homer have known, O Mikyllos? When the Trojan war was going on, he was a camel in Baktria!'[38]

In the later Jewish philosophy, the Kabbalists took up the doctrine of migration, the _gilgul_ or 'rolling on' of souls, and maintained it by that characteristic method of Biblical interpretation which it is good to hold up from time to time for a warning to the mystical interpreters of our own day. The soul of Adam passed into David, and shall pass into the Messiah, for are not these initials in the very name of Ad(a)m, and does not Ezekiel say that 'my servant David shall be their prince for ever.' Cain's soul passed into Jethro, and Abel's into Moses, and therefore it was that Jethro gave Moses his daughter to wife. Souls migrate into beasts and birds and vermin, for is not Jehovah 'the lord of the spirits of all flesh'? and he who has done one sin beyond his good works shall pass into a brute. He who gives a Jew unclean meat to eat, his soul shall enter into a leaf, blown to and fro by the wind; 'for ye shall be as an oak whose leaf fadeth;' and he who speaks ill words, his soul shall pass into a dumb stone, as did Nabal's, 'and he became a stone.'[39] Within the range of Christian influence the Manichæans appear as the most remarkable exponents of the metempsychosis. We hear of their ideas of sinners' souls transmigrating into beasts, the viler according to their crimes; that he who kills a fowl or rat will become a fowl or rat himself; that souls can pass into plants rooted in the ground, which thus have not only life but sense; that the souls of reapers pass into beans and barley, to be cut down in their turn, and thus the elect were careful to explain to the bread when they ate it, that it was not they who reaped the corn it was made of; that the souls of the auditors, that is, the spiritually low commonalty who lived a married life, would pass into melons and cucumbers, to finish their purification by being eaten by the elect. But these details come to us from the accounts of bitter theological adversaries, and the question is, how much of them did the Manichæans really and soberly believe? Allowing for exaggeration and constructive imputation, there is some reason to consider the account at least founded on fact. The Manichæans appear to have recognized a wandering of imperfect souls, whether or not their composite religion may with its Zarathustrian and Christian elements have also absorbed in so Indian a shape the doctrine of purification of souls by migration into animals and plants.[40] In later times, the doctrine of metempsychosis has been again and again noticed in a district of South-Western Asia. William of Ruysbroek speaks of the notion of souls passing from body to body as general among the mediæval Nestorians, even a somewhat intelligent priest consulting him as to the souls of brutes, whether they could find refuge elsewhere so as not to be compelled to labour after death. Rabbi Benjamin of Tudela records in the 12th century of the Druses of Mount Hermon: 'They say that the soul of a virtuous man is transferred to the body of a new-born child, whereas that of the vicious transmigrates into a dog, or some other animal.' Such ideas indeed, seem not yet extinct in the modern Druse nation. Among the Nassairi, also, transmigration is believed in as a penance and purification: we hear of migration of unbelievers into camels, asses, dogs, or sheep, of disobedient Nassairi into Jews, Sunnis, or Christians, of the faithful into new bodies of their own people, a few such changes of 'shirt' (i.e. body), bringing them to enter paradise or become stars.[41] An instance of the belief within the limits of modern Christian Europe may be found among the Bulgarians, whose superstition is that Turks who have never eaten pork in life will become wild boars after death. A party assembled to feast on a boar has been known to throw it all away, for the meat jumped off the spit into the fire, and a piece of cotton was found in the ears, which the wise man decided to be a piece of the ci-devant Turk's turban.[42] Such cases, however, are exceptional. Metempsychosis never became one of the great doctrines of Christendom, though not unknown in mediæval scholasticism, and though maintained by an eccentric theologian here and there into our own times. It would be strange were it not so. It is in the very nature of the development of religion that speculations of the earlier culture should dwindle to survivals, yet be again and again revived. Doctrines transmigrate, if souls do not; and metempsychosis, wandering along the course of ages, came at last to animate the souls of Fourier and Soame Jenyns.[43]

Thus we have traced the theory of metempsychosis in stage after stage of the world's civilization, scattered among the native races of America and Africa, established in the Asiatic nations, especially where elaborated by the Hindu mind into its system of ethical philosophy, rising and falling in classic and mediæval Europe, and lingering at last in the modern world as an intellectual crotchet,

of little account but to the ethnographer who notes it down as an item of evidence for his continuity of culture. What, we may well ask, was the original cause and motive of the doctrine of transmigration? Something may be said in answer, though not at all enough for full explanation. The theory that ancestral souls return, thus imparting their own likeness of mind and body to their descendants and kindred, has been already mentioned and commended as in itself a very reasonable and philosophical hypothesis, accounting for the phenomenon of family likeness going on from generation to generation. But why should it have been imagined that men's souls could inhabit the bodies of beasts and birds? As has been already pointed out, savages not unreasonably consider the lower animals to have souls like their own, and this state of mind makes the idea of a man's soul transmigrating into a beast's body at least seem possible. But it does not actually suggest the idea. The view stated in a previous chapter as to the origin of the conception of soul in general, may perhaps help us here. As it seems that the first conception of souls may have been that of the souls of men, this being afterwards extended by analogy to the souls of animals, plants, &c., so it may seem that the original idea of transmigration was the straightforward and reasonable one of human souls being re-born in new human bodies, where they are recognized by family likenesses in successive generations. This notion may have been afterwards extended to take in re-birth in bodies of animals, &c. There are some well-marked savage ideas which will fit with such a course of thought. The half-human features and actions and characters of animals are watched with wondering sympathy by the savage, as by the child. The beast is the very incarnation of familiar qualities of man; and such names as lion, bear, fox, owl, parrot, viper, worm, when we apply them as epithets to men, condense into a word some leading feature of a human life. Consistently with this, we see in looking over details of savage transmigration that the creatures often have an evident fitness to the character of the human beings whose souls are to pass into them, so that the savage philosopher's fancy of transferred souls offered something like an explanation of the likeness between beast and man. This comes more clearly into view among the more civilized races who have worked out the idea of transmigration into ethical schemes of retribution, where the appropriateness of the creatures chosen is almost as manifest to the modern critic as it could have been to the ancient believer. Perhaps the most graphic restoration of the state of mind in which the theological doctrine of metempsychosis was worked out in long-past ages, may be found in the writings of a modern theologian whose spiritualism often follows to the extreme the intellectual tracks of the lower races. In the spiritual world, says Emanuel Swedenborg, such persons as have opened themselves for the admission of the devil and acquired the nature of beasts, becoming foxes in cunning, &c., appear also at a distance in the proper shape of such beasts as they represent in disposition.[44] Lastly, one of the most notable points about the theory of transmigration is its close bearing upon a thought which lies very deep in the history of philosophy, the development-theory of organic life in successive stages. An elevation from the vegetable to the lower animal life, and thence onward through the higher animals to man, to say nothing of superhuman beings, does not here require even a succession of distinct individuals, but is brought by the theory of metempsychosis within the compass of the successive vegetable and animal lives of a single being.

Here a few words may be said on a subject which cannot be left out of sight, connecting as it does the two great branches of the doctrine of future existence, but which it is difficult to handle in definite terms, and much more to trace historically by comparing the views of lower and higher races. This is the doctrine of a bodily renewal or resurrection. To the philosophy of the lower races it is by no means necessary that the surviving soul should be provided with a new body, for it seems itself to be of a filmy or vaporous corporeal nature, capable of carrying on an independent existence like other corporeal creatures. Savage descriptions of the next world are often such absolute copies of this, that it is scarcely possible to say whether the dead are or are not thought of as having bodies like the living; and a few pieces of evidence of this class are hardly enough to prove the lower races to hold original and distinct doctrines of corporeal resurrection.[45] Again, attention must be given to the practice, so common among low and high races, of preserving relics of the dead, from mere morsels of bone up to whole mummified bodies. It is well known that the departed soul is often thought apt to revisit the remains of the body, as is seen in the well-known pictures of the Egyptian funeral ritual. But the preservation of these remains, even where it thus involves a permanent connexion between body and soul, does not necessarily approach more closely to a bodily resurrection.[46] In discussing the closely allied doctrine of metempsychosis, I have described the theory of the soul's transmigration into a new human body as asserting in fact an earthly resurrection. From the same point of view, a bodily resurrection in Heaven or Hades is technically a transmigration of the soul. This is plain among the higher races, in whose religion these doctrines take at once clearer definition and more practical import. There are some distinct mentions of bodily resurrection in the Rig Veda: the dead is spoken of as glorified, putting on his body (tanu); and it is even promised that the pious man shall be born in the next world with his entire body (sarvatanû). In Brahminism and Buddhism, the re-births of souls in bodies to inhabit heavens and hells are simply included as particular cases of transmigration. The doctrine of the resurrection appears far back in the religion of Persia, and is thence supposed to have passed into late Jewish belief.[47] In early Christianity, the conception of bodily resurrection is developed with especial strength and fulness in the Pauline doctrine. For an explicit interpretation of this doctrine, such as commended itself to the minds of later theologians, it is instructive to cite the remarkable

passage of Origen, where he speaks of ‘corporeal matter, of which matter, in whatever quality placed, the soul always has use, now indeed carnal, but afterwards indeed subtler and purer, which is called spiritual.’[48]

Passing from these metaphysical doctrines of civilized theology, we now take up a series of beliefs higher in practical moment, and more clearly conceived in savage thought. There may well have been, and there may still be, low races destitute of any belief in a Future State. Nevertheless, prudent ethnographers must often doubt accounts of such, for this reason, that the savage who declares that the dead live no more, may merely mean to say that they are dead. When the East African is asked what becomes of his buried ancestors, the ‘old people,’ he can reply that ‘they are ended,’ yet at the same time he fully admits that their ghosts survive.[49] In an account of the religious ideas of the Zulus, taken down from a native, it is explicitly stated that Unkulunkulu the Old-Old-One said that people ‘were to die and never rise again,’ and that he allowed them to ‘die and rise no more.’[50] Knowing so thoroughly as we now do the theology of the Zulus, whose ghosts not only survive in the under-world, but are the very deities of the living, we can put the proper sense to these expressions. But without such information, we might have mistaken them for denials of the soul’s existence after death. This objection may even apply to one of the most formal denials of a future life ever placed on record among an uncultured race, a poem of the Dinka tribe of the White Nile, concerning Dendid the Creator:—

‘On the day when Dendid made all things, He made the sun; And the sun comes forth, goes down, and comes again: He made the moon; And the moon comes forth, goes down, and comes again: He made the stars; And the stars come forth, go down, and come again: He made man; And man comes forth, goes down into the ground, and comes no more.’

It is to be remarked, however, that the close neighbours of these Dinka, the Bari, believe that the dead do return to live again on earth, and the question arises whether it is the doctrine of bodily resurrection, or the doctrine of the surviving ghost-soul, that the Dinka poem denies. The missionary Kaufmann says that the Dinka do not believe the immortality of the soul, that they think it but a breath, and with death all is over; Brun-Rollet’s contrary authority goes to prove that they do believe in another life; both leave it an open question whether they recognize the existence of surviving ghosts.[51]

Looking at the religion of the lower races as a whole, we shall at least not be ill-advised in taking as one of its general and principal elements the doctrine of the soul’s Future Life. But here it is needful to explain, to limit, and to reserve, lest modern theological ideas should lead us to misconstrue more primitive beliefs. In such enquiries the phrase ‘immortality of the soul’ is to be avoided as misleading. It is doubtful how far the lower psychology entertains at all an absolute conception of immortality, for past and future fade soon into utter vagueness as the savage mind quits the present to explore them, the measure of months and years breaks down even within the narrow span of human life, and the survivor’s thought of the soul of the departed dwindles and disappears with the personal memory that kept it alive. The doctrine of the surviving soul may indeed be treated as common to all known races, though its acceptance is not unanimous. In savage as in civilized life, dull and careless natures ignore a world to come as too far off, while sceptical intellects are apt to reject its belief as wanting proof. There are even statements on record of whole classes being formally excluded from future life. This may be a matter of social pride. In the Tonga Islands, according to Mariner, it was held that the chiefs and nobles would live hereafter in the happy island of Bolotu, but that the souls of the common people would die with their bodies. So Captain John Smith relates as to the belief of the Virginians, that the chiefs went after death beyond the sunset mountains, there to dance and sing with their predecessors, ‘but the common people they suppose shall not live after death.’ In the record of a missionary examination of the Nicaraguans, they are made to state their belief that if a man lived well, his soul would ascend to dwell among the gods, but if ill it would perish with the body, and there would be an end of it.[52] None of these accounts, however, agree with what is known of the religion of kindred peoples, Polynesian, Algonquin, or Aztec. But granted that the soul survives the death of the body, instance after instance from the records of the lower culture shows this soul to be regarded as a mortal being, liable like the body itself to accident and death. The Greenlanders pitied the poor souls who must pass in winter or in storm the dreadful mountain where the dead descend to reach the other world, for then a soul is like to come to harm, and die the other death where there is nothing left, and this is to them the dolefullest thing of all.[53] Thus the Fijians tell of the fight which the ghost of a departed warrior must wage with the soul-killing Samu and his brethren; this is the contest for which the dead man is armed by burying the war-club with his corpse, and if he conquers, the way is open for him to the judgment-seat of Ndengei, but if he is wounded, his doom is to wander among the mountains, and if killed in the encounter he is cooked and eaten by Samu and his brethren. But the souls of unmarried Fijians will not even survive to stand this wager of battle; such try in vain to steal at low water round to the edge of the reef past the rocks where Nangananga, destroyer of wifeless souls, sits laughing at their hopeless efforts, and asking them if they think the tide will never flow again, till at last the rising flood drives the shivering ghosts to the beach, and Nangananga dashes them in pieces on the great black stone, as one shatters rotten firewood.[54] Such, again, were the tales told by the Guinea negroes of the life or death of departed souls. Either the great priest before whom they must appear after death

would judge them, sending the good in peace to a happy place, but killing the wicked a second time with the club that stands ready before his dwelling; or else the departed shall be judged by their god at the river of death, to be gently wafted by him to a pleasant land if they have kept feasts and oaths and abstained from forbidden meats, but if not, to be plunged into the river by the god, and thus drowned and buried in eternal oblivion.[55] Even common water can drown a negro ghost, if we may believe the missionary Cavazzi's story of the Matamba widows being ducked in the river or pond to drown off the souls of their departed husbands, who might still be hanging about them, clinging closest to the best-loved wives. After this ceremony, they went and married again.[56] From such details it appears that the conception of some souls suffering extinction at death or dying a second death, a thought still as heretofore familiar to speculative theology, is not unknown in the lower culture.

The soul, as recognized in the philosophy of the lower races, may be defined as an ethereal surviving being, conceptions of which preceded and led up to the more transcendental theory of the immaterial and immortal soul, which forms part of the theology of higher nations. It is principally the ethereal surviving soul of early culture that has now to be studied in the religions of savages and barbarians and the folk-lore of the civilized world. That this soul should be looked on as surviving beyond death is a matter scarcely needing elaborate argument. Plain experience is there to teach it to every savage; his friend or his enemy is dead, yet still in dream or open vision he sees the spectral form which is to his philosophy a real objective being, carrying personality as it carries likeness. This thought of the soul's continued existence is, however, but the gateway into a complex region of belief. The doctrines which, separate or compounded, make up the scheme of future existence among particular tribes, are principally these: the theories of lingering, wandering, and returning ghosts, and of souls dwelling on or below or above the earth in a spirit-world, where existence is modelled upon the earthly life, or raised to higher glory, or placed under reversed conditions, and lastly, the belief in a division between happiness and misery of departed souls, by a retribution for deeds done in life, determined in a judgment after death.

'All argument is against it; but all belief is for it,' said Dr. Johnson of the apparition of departed spirits. The doctrine that ghost-souls of the dead hover among the living is indeed rooted in the lowest levels of savage culture, extends through barbaric life almost without a break, and survives largely and deeply in the midst of civilization. From the myriad details of travellers, missionaries, historians, theologians, spiritualists, it may be laid down as an admitted opinion, as wide in distribution as it is natural in thought, that the two chief hunting-grounds of the departed soul are the scenes of its fleshly life and the burial place of its body. As in North America the Chickasaws believed that the spirits of the dead in their bodily shape moved about among the living in great joy; as the Aleutian islanders fancied the souls of the departed walking unseen among their kindred, and accompanying them in their journeys by sea and land; as Africans think that souls of the dead dwell in their midst, and eat with them at meal times; as Chinese pay their respects to kindred spirits present in the hall of ancestors;[57] so multitudes in Europe and America live in an atmosphere that swarms with ghostly shapes—spirits of the dead, who sit over against the mystic by his midnight fire, rap and write in spirit-circles, and peep over girls' shoulders as they scare themselves into hysterics with ghost-stories. Almost throughout the vast range of animistic religion, we shall find the souls of the departed hospitably entertained by the survivors on set occasions, and manes-worship, so deep and strong among the faiths of the world, recognizes with a reverence not without fear and trembling those ancestral spirits which, powerful for good or ill, manifest their presence among mankind. Nevertheless death and life dwell but ill together, and from savagery onward there is recorded many a device by which the survivors have sought to rid themselves of household ghosts. Though the unhappy savage custom of deserting houses after a decease may often be connected with other causes, such as horror or abnegation of all things belonging to the dead, there are cases where it appears that the place is simply abandoned to the ghost. In Old Calabar it was customary for the son to leave his fathers' house to decay, but after two years he might rebuild it, the ghost being thought by that time to have departed;[58] the Hottentots abandoned the dead man's house, and were said to avoid entering it lest the ghost should be within;[59] the Yakuts let the hut fall in ruins where any one had expired, thinking it the habitation of demons;[60] the Karens were said to destroy their villages to escape the dangerous neighbourhood of departed souls.[61] Such proceedings, however, scarcely extend beyond the limits of barbarism, and only a feeble survival of the old thought lingers on into civilization, where from time to time a haunted house is left to fall in ruins, abandoned to a ghostly tenant who cannot keep it in repair. But even in the lowest culture we find flesh holding its own against spirit, and at higher stages the householder rids himself with little scruple of an unwelcome inmate. The Greenlanders would carry the dead out by the window, not by the door, while an old woman, waving a firebrand behind, cried 'piklerrukpok!' i.e., 'there is nothing more to be had here!';[62] the Hottentots removed the dead from the hut by an opening broken out on purpose, to prevent him from finding the way back;[63] the Siamese, with the same intention, break an opening through the house wall to carry the coffin through, and then hurry it at full speed thrice round the house;[64] in Russia the Chuwashes fling a red-hot stone after the corpse is carried out, for an obstacle to bar the soul from coming back;[65] so Brandenburg peasants pour out a pail of water at the door after the coffin, to prevent the ghost from walking; and Pomeranian mourners returning from the churchyard leave behind the straw from the hearse that the

wandering soul may rest there, and not come back so far as home.[66] In the ancient and mediæval world, men habitually invoked supernatural aid beyond such material shifts as these, calling in the priest to lay or banish intruding ghosts, nor is this branch of the exorcist's art even yet forgotten. There is, and always has been, a prevalent feeling that disembodied souls, especially such as have suffered a violent or untimely death, are baneful and malicious beings. As Meiners suggests in his 'History of Religions,' they were driven unwillingly from their bodies, and have carried into their new existence an angry longing for revenge. No wonder that mankind should so generally agree that if the souls of the dead must linger in the world at all, their fitting abode should be not the haunts of the living but the resting-places of the dead.

After all, it scarcely seems to the lower animistic philosophy that the connexion between body and soul is utterly broken by death. Various wants may keep the soul from its desired rest, and among the chief of these is when its mortal remains have not had the funeral rites. Hence the deep-lying belief that the ghosts of such will walk. Among some Australian tribes the 'ingna,' or evil spirits, human in shape, but with long tails and long upright ears, are mostly souls of departed natives, whose bodies were left to lie unburied or whose death the avenger of blood did not expiate, and thus they have to prowl on the face of the earth, and about the place of death, with no gratification but to harm the living.[67] In New Zealand, the ideas were to be found that the souls of the dead were apt to linger near the bodies, and that the spirits of men left unburied or killed in battle and eaten, would wander; and the bringing such malignant souls to dwell within the sacred burial-enclosure was a task for the priest to accomplish with his charms.[68] Among the Iroquois of North America the spirit also stays near the body for a time, and 'unless the rites of burial were performed, it was believed that the spirits of the dead hovered for a time upon the earth, in a state of great unhappiness. Hence their extreme solicitude to procure the bodies of the slain in battle.'[69] Among Brazilian tribes, the wandering shadows of the dead are said to be considered unresting till burial.[70] In Turanian regions of North Asia, the spirits of the dead who have no resting-place in earth are thought of as lingering above ground, especially where their dust remains.[71] South Asia has such beliefs: the Karens say that the ghosts who wander on earth are not the spirits of those who go to Plu, the land of the dead, but of infants, of such as died by violence, of the wicked, and of those who by accident have not been buried or burned;[72] the Siamese fear as unkindly spirits the souls of such as died a violent death or were not buried with the proper rites, and who desiring expiation, invisibly terrify their descendants.[73] Nowhere in the world had such thoughts a stronger hold than in classic antiquity, where it was the most sacred of duties to give the body its funeral rites, that the shade should not flit moaning near the gates of Hades, nor wander in the dismal crowd along the banks of Acheron.[74] An Australian or a Karen would have taken in the full significance of the fatal accusation against the Athenian commanders, that they abandoned the bodies of their dead in the sea-fight of Arginousai. The thought is not unknown to Slavonic folk-lore: 'Ha! with the shriek the spirit flutters from the mouth, flies up to the tree, from tree to tree, hither and thither till the dead is burned.'[75] In mediæval Europe the classic stories of ghosts that haunt the living till laid by rites of burial pass here and there into new legends, where, under a changed dispensation, the doleful wanderer now asks Christian burial in consecrated earth.[76] It is needless to give here elaborate details of the world-wide thought that when the corpse is buried, exposed, burned, or otherwise disposed of after the accepted custom of the land, the ghost accompanies its relics. The soul stays near the Polynesian or the American Indian burial-place; it dwells among the twigs and listens joyfully to the singing birds in the trees where Siberian tribes suspend their dead; it lingers by the Samoyed's scaffolded coffin; it haunts the Dayak's place of burial or burning; it inhabits the little soul-hut above the Malagasy grave, or the Peruvian house of sun-dried bricks; it is deposited in the Roman tomb (animamque sepulchro condimus); it comes back for judgment into the body of the later Israelite and the Moslem; it inhabits, as a divine ancestral spirit, the palace-tombs of the old classic and new Asiatic world; it is kept down by the huge cairn raised over Antar's body lest his mighty spirit should burst forth, by the iron nails with which the Cheremiss secures the corpse in its coffin, by the stake that pins down the suicide's body at the four-cross way. And through all the changes of religious thought from first to last in the course of human history, the hovering ghosts of the dead make the midnight burial-ground a place where men's flesh creeps with terror. Not to discuss here the general subject of funeral rites of mankind, of which only part of the multifarious details are directly relevant to the present purpose, a custom may be selected which is admirably adapted for the study of animistic religion, at once from the clear conception it gives of the belief in disembodied souls present among the living, and from the distinct line of ethnographic continuity in which it may be traced onward from the lower to the higher culture. This is the custom of Feasts of the Dead.

Among the funeral offerings described in the last chapter of which the purpose more or less distinctly appears to be that the departed soul shall take them away in some ghostly or ideal manner, or that they shall by some means be conveyed to him in his distant spirit-home, there are given supplies of food and drink. But the feasts of the dead with which we are now concerned are given on a different principle; they are, so to speak, to be consumed on the premises. They are set out in some proper place, especially near the tombs or in the dwelling-houses, and there the souls of the dead come and satisfy themselves. In North

America, among Algonquins who held that one of a man's two souls abides with the body after death, the provisions brought to the grave were intended for the nourishment of this soul; tribes would make offerings to ancestors of part of any dainty food, and an Indian who fell by accident into the fire would believe that the spirits of his ancestors pushed him in for neglecting to make due offerings.[77] The minds of the Hurons were filled with fancies not less lifelike than this. It seemed to them that the dead man's soul, in his proper human figure, walked in front of the corpse as they carried it to the burial-ground, there to dwell till the great feast of the dead; but meanwhile it would come and walk by night in the village, and eat the remnants in the kettles, wherefore some would not eat of these, nor touch the food at funeral feasts—though some indeed would eat all.[78] In Madagascar, the elegant little upper chamber in King Radama's mausoleum was furnished with a table and two chairs, and a bottle of wine, a bottle of water, and two tumblers were placed there conformably with the ideas entertained by most of the natives, that the ghost of the departed monarch might occasionally visit the resting-place of his body, meet with the spirit of his father, and partake of what he was known to be fond of in his lifetime.[79] The Wanika of East Africa set a coco-nut shell full of rice and tembo near the grave for the 'koma' or shade, which cannot exist without food and drink.[80] In West Africa the Efik cook food and leave it on the table in the little shed or 'devil-house' near the grave, and thither not only the spirit of the deceased, but the spirits of the slaves sacrificed at his funeral, come to partake of it.[81] Farther south, in the Congo district, the custom has been described of making a channel into the tomb to the head or mouth of the corpse, whereby to send down month by month the offerings of food and drink.[82]

Among rude Asiatic tribes, the Bodo of North-East India thus celebrate the last funeral rites. The friends repair to the grave, and the nearest of kin to the deceased, taking an individual's usual portion of food and drink, solemnly presents it to the dead with these words, 'Take and eat, heretofore you have eaten and drunk with us, you can do so no more; you were one of us, you can be so no longer; we come no more to you, come you not to us.' Thereupon each of the party breaks off a bracelet of thread put on his wrist for this purpose, and casts it on the grave, a speaking symbol of breaking the bond of fellowship, and 'next the party proceed to the river and bathe, and having thus lustrated themselves, they repair to the banquet and eat, drink, and make merry as though they never were to die.'[83] With more continuance of affection, Naga tribes of Assam celebrate their funeral feasts month by month, laying food and drink on the graves of the departed.[84] In the same region of the world, the Kol tribes of Chota Nagpur are remarkable for their pathetic reverence for their dead. When a Ho or Munda has been burned on the funeral pile, collected morsels of his bones are carried in procession with a solemn, ghostly, sliding step, keeping time to the deep-sounding drum, and when the old woman who carries the bones on her bamboo tray lowers it from time to time, then girls who carry pitchers and brass vessels mournfully reverse them to show that they are empty; thus the remains are taken to visit every house in the village, and every dwelling of a friend or relative for miles, and the inmates come out to mourn and praise the goodness of the departed; the bones are carried to all the dead man's favourite haunts, to the fields he cultivated, to the grove he planted, to the threshing-floor where he worked, to the village dance-room where he made merry. At last they are taken to the grave, and buried in an earthen vase upon a store of food, covered with one of those huge stone slabs which European visitors wonder at in the districts of the aborigines in India. Besides these, monumental stones are set up outside the village to the memory of men of note; they are fixed on an earthen plinth, where the ghost, resting in its walks among the living, is supposed to sit shaded by the pillar. The Kheriahs have collections of these monuments in the little enclosures round their houses, and offerings and libations are constantly made at them. With what feelings such rites are celebrated may be judged from this Ho dirge:—

'We never scolded you; never wronged you; Come to us back! We ever loved and cherished you; and have lived long together Under the same roof; Desert it not now! The rainy nights, and the cold blowing days, are coming on; Do not wander here! Do not stand by the burnt ashes; come to us again! You cannot find shelter under the peepul, when the rain comes down. The saul will not shield you from the cold bitter wind. Come to your home! It is swept for you, and clean; and we are there who loved you ever; And there is rice put for you; and water; Come home, come home, come to us again!'

Among the Kol tribes this kindly hospitality to ancestral souls passes on into the belief and ceremony of full manes-worship: votive offerings are made to the 'old folks' when their descendants go on a journey, and when there is sickness in the family it is generally they who are first propitiated.[85] Among Turanian races, the Chuwash put food and napkins on the grave, saying, 'Rise at night and eat your fill, and there ye have napkins to wipe your mouths!' while the Cheremiss simply said, 'That is for you, ye dead, there ye have food and drink!' In this Tatar region we hear of offerings continued year after year, and even of messengers sent back by a horde to carry offerings to the tombs of their forefathers in the old land whence they had emigrated.[86]

Details of this ancient rite are to be traced from the level of these rude races far upward in civilization. South-East Asia is full of it, and the Chinese may stand as its representative. He keeps his coffined parent for years, serving him with meals as if alive. He summons ancestral souls with prayer and beat of drum to feed on the meat and drink set out on special days when they are thought

to return home. He even gives entertainments for the benefit of destitute and unfortunate souls in the lower regions, such as those of lepers and beggars. Lanterns are lighted to show them the way, a feast is spread for them, and with characteristic fancy, some victuals are left over for any blind or feeble spirits who may be late, and a pail of gruel is provided for headless souls, with spoons for them to put it down their throats with. Such proceedings culminate in the so-called Universal Rescue, now and then celebrated, when a little house is built for the expected visitors, with separate accommodation and bath-rooms for male and female ghosts.[87] The ancient Egyptian would set out his provision of cakes and trussed ducks on reed scaffolds in the tomb, or would even keep the mummy in the house to be present as a guest at the feast, σ■νδειπνον κα■ συμπ■την ■ποι■σατο, as Lucian says.[88] The Hindu, as of old, offers to the dead the funeral cakes, places before the door the earthen vessels of water for him to bathe in, of milk for him to drink, and celebrates at new and full moon the solemn presentation of rice-cakes made with ghee, with its attendant ceremonies so important for the soul's release from its twelvemonth's sojourn with Yama in Hades, and its transition to the Heaven of the Pitaras, the Fathers.[89] In the classic world such rites were represented by funeral feasts and oblations of food.[90]

In Christian times there manifests itself that interesting kind of survival which, keeping up the old ceremony in form, has adapted its motive to new thoughts and feelings. The classic funeral oblations became Christian, the silicernium was succeeded by the feast held at the martyr's tomb. Faustus inveighs against the Christians for carrying on the ancient rites: 'Their sacrifices indeed ye have turned into love-feasts, their idols into martyrs whom with like vows ye worship; ye appease the shades of the dead with wine and meals, ye celebrate the Gentiles' solemn days with them, such as calends and solstices,—of their life certainly ye have changed nought,'[91] and so forth. The story of Monica shows how the custom of laying food on the tomb for the manes passed into the ceremony, like to it in form, of setting food and drink to be sanctified by the sepulchre of a Christian saint. Saint-Foix, who wrote in the time of Louis XIV., has left us an account of the ceremonial after the death of a King of France, during the forty days before the funeral when his wax effigy lay in state. They continued to serve him at meal-times as though still alive, the officers laid the table, and brought the dishes, the maître d'hôtel handed the napkin to the highest lord present to be presented to the king, a prelate blessed the table, the basins of water were handed to the royal arm-chair, the cup was served in its due course, and grace was said in the accustomed manner, save that there was added to it the De Profundis.[92] Spaniards still offer bread and wine on the tombs of those they love, on the anniversary of their decease.[93] The conservative Eastern Church still holds to ancient rite. The funeral feast is served in Russia, with its tables for the beggars, laden with fish pasties and bowls of shchi and jugs of kvas, its more delicate dinner for friends and priests, its incense and chants of 'everlasting remembrance'; and even the repetition of the festival on the ninth, and twentieth, and fortieth day are not forgotten. The offerings of saucers of kutiya or kolyvo are still made in the church; this used to be of parboiled wheat and was deposited over the body, it is now made of boiled rice and raisins, sweetened with honey. In their usual mystic fashion, the Orthodox Christians now explain away into symbolism this remnant of primitive offering to the dead: the honey is heavenly sweetness, the shrivelled raisins will be full beauteous grapes, the grain typifies the resurrection, 'that which thou sowest is not quickened except it die.'[94]

In the calendar of many a people, differing widely as they may in race and civilization, there are to be found special yearly festivals of the dead. Their rites are much the same as those performed on other days for individuals; their season differs in different districts, but seems to have particular associations with harvest-time and the fall of the year, and with the year's end as reckoned at midwinter or in early spring.[95] The Karens make their annual offerings to the dead in the 'month of shades,' that is, December;[96] the Kocch of North Bengal every year at harvest-home offer fruits and a fowl to deceased parents;[97] the Barea of East Africa celebrate in November the feast of Thiyot, at once a feast of general peace and merry-making, of thanksgiving for the harvest, and of memorial for the deceased, for each of whom a little pot-full of beer is set out two days, to be drunk at last by the survivors;[98] in West Africa we hear of the feast of the dead at the time of yam-harvest;[99] at the end of the year the Haitian negroes take food to the graves for the shades to eat, 'manger zombi,' as they say.[100] The Roman Feralia and Lemuralia were held in February and May.[101] In the last five or ten days of their year the Zoroastrians hold their feasts for departed relatives, when souls come back to the world to visit the living, and receive from them offerings of food and clothing.[102] The custom of setting empty seats at the St. John's Eve feast, for the departed souls of kinsfolk, is said to have lasted on in Europe to the seventeenth century. Spring is the season of the time-honoured Slavonic rite of laying food on the graves of the dead. The Bulgarians hold a feast in the cemetery on Palm Sunday, and, after much eating and drinking, leave the remains upon the graves of their friends, who, they are persuaded, will eat them during the night. In Russia such scenes may still be watched on the two appointed days called Parents' Days. The higher classes have let the rite sink to prayer at the graves of lost relatives, and giving alms to the beggars who flock to the cemeteries. But the people still 'howl' for the dead, and set out on their graves a handkerchief for a tablecloth, with gingerbread, eggs, curd-tarts, and even vodka, on it; when the weeping is over, they eat up the food, especially commemorating the dead in Russian manner by partaking of his favourite dainty, and if he were fond of a glass, the vodka is sipped with the ejaculation, 'The

Kingdom of Heaven be his! He loved a drink, the deceased!'[103] When Odilo, Abbot of Cluny, at the end of the tenth century, instituted the celebration of All Souls' Day (November 2),[104] he set on foot one of those revivals which have so often given the past a new lease of life. The Western Church at large took up the practice, and round it there naturally gathered surviving remnants of the primitive rite of banquets to the dead. The accusation against the early Christians, that they appeased the shades of the dead with feasts like the Gentiles, would not be beside the mark now, fifteen hundred years later. On the eve of All Souls' begins, within the limits of Christendom, a commemoration of the dead which combines some touches of pathetic imagination with relics of savage animism scarcely to be surpassed in Africa or the South Sea Islands. In Italy the day is given to feasting and drinking in honour of the dead, while skulls and skeletons in sugar and paste form appropriate children's toys. In Tyrol, the poor souls released from purgatory fire for the night may come and smear their burns with the melted fat of the 'soul light' on the hearth, or cakes are left for them on the table, and the room is kept warm for their comfort. Even in Paris the souls of the departed come to partake of the food of the living. In Brittany the crowd pours into the churchyard at evening, to kneel bareheaded at the graves of dead kinsfolk, to fill the hollow of the tombstone with holy water, or to pour libations of milk upon it. All night the church bells clang, and sometimes a solemn procession of the clergy goes round to bless the graves. In no household that night is the cloth removed, for the supper must be left for the souls to come and take their part, nor must the fire be put out, where they will come to warm themselves. And at last, as the inmates retire to rest, there is heard at the door a doleful chant—it is the souls, who, borrowing the voices of the parish poor, have come to ask the prayers of the living.[105]

If we ask how the spirits of the dead are in general supposed to feed on the viands set before them, we come upon difficult questions, which will be met with again in discussing the theory of sacrifice. Even where the thought is certainly that the departed soul eats, this thought may be very indefinite, with far less of practical intention in it than of childish make-believe. Now and then, however, the sacrificers themselves offer closer definitions of their meaning. The idea of the ghost actually devouring the material food is not unexampled. Thus, in North America, Algonquin Indians considered that the shadow-like souls of the dead can still eat and drink, often even telling Father Le Jeune that they had found in the morning meat gnawed in the night by the souls. More recently, we read that some Potawatomis will leave off providing the supply of food at the grave if it lies long untouched, it being concluded that the dead no longer wants it, but has found a rich hunting-ground in the other world.[106] In Africa, again, Father Cavazzi records of the Congo people furnishing their dead with supplies of provisions, that they could not be persuaded that souls did not consume material food.[107] In Europe the Esths, offering food for the dead on All Souls', are said to have rejoiced if they found in the morning that any of it was gone.[108] A less gross conception is that the soul consumes the steam or savour of the food, or its essence or spirit. It is said to have been with such purpose that the Maoris placed food by the dead man's side, and some also with him in the grave.[109] The idea is well displayed among the natives in Mexican districts, where the souls who came to the annual feast are described as hovering over and smelling the food set out for them, or sucking out its nutritive quality.[110] The Hindu entreats the manes to quaff the sweet essence of the offered food; thinking on them, he slowly sets the dish of rice before the Brahmans, and while they silently eat the hot food, the ancestral spirits take their part of the feast.[111] At the old Slavonic meals for the dead, we read of the survivors sitting in silence and throwing morsels under the table, fancying that they could hear the spirits rustle, and see them feed on the smell and steam of the viands. One account describes the mourners at the funeral banquet inviting in the departed soul thought to be standing outside the door, and every guest throwing morsels and pouring drink under the table, for him to refresh himself. What lay on the ground was not picked up, but was left for friendless and kinless souls. When the meal was over, the priest rose from table, swept out the house, and hunted out the souls of the dead 'like fleas,' with these words, 'Ye have eaten and drunken, souls, now go, now go!'[112] Many travellers have described the imagination with which the Chinese make such offerings. It is that the spirits of the dead consume the impalpable essence of the food, leaving behind its coarse material substance, wherefore the dutiful sacrificers, having set out sumptuous feasts for ancestral souls, allow them a proper time to satisfy their appetite, and then fall to themselves.[113] The Jesuit Father Christoforo Borri suggestively translates the native idea into his own scholastic phraseology. In Cochin China, according to him, people believed 'that the souls of the dead have need of corporeal sustenance and maintenance, wherefore several times a year, according to their custom, they make splendid and sumptuous banquets, children to their deceased parents, husbands to their wives, friends to their friends, waiting a long while for the dead guest to come and sit down at table to eat.' The missionaries argued against this proceeding, but were met by ridicule of their ignorance, and the reply 'that there were two things in the food, one the substance, and the other the accidents of quantity, quality, smell, taste, and the like. The immaterial souls of the dead, taking for themselves the substance of the food, which being immaterial is food suited to the incorporeal soul, left only in the dishes the accidents which corporeal senses perceive; for this the dead had no need of corporeal instruments, as we have said.' Thereupon the Jesuit proceeds to remark, as to the prospect of conversion of these people, 'it may be judged from the distinction they make between the accidents and the substance of the food which they prepare for the dead,' that it will not be very difficult to prove to them the mystery of the

Eucharist.[114] Now to peoples among whom prevails the rite of feasts of the dead, whether they offer the food in mere symbolic pretence, or whether they consider the souls really to feed on it in this spiritual way (as well as in the cases inextricably mixed up with these, where the offering is spiritually conveyed away to the world of spirits), it can be of little consequence what becomes of the gross material food. When the Kafir sorcerer, in cases of sickness, declares that the shades of ancestors demand a particular cow, the beast is slaughtered and left shut up for a time for the shades to eat, or for its spirit to go to the land of shades, and then is taken out to be eaten by the sacrificers.[115] So, in more civilized Japan, when the survivors have placed their offering of unboiled rice and water in a hollow made for the purpose in a stone of the tomb, it seems to them no matter that the poor or the birds really carry off the grain.[116]

Such rites as these are especially exposed to dwindle in survival. The offerings of meals and feasts to the dead may be traced at their last stage into mere traditional ceremonies, at most tokens of affectionate remembrance of the dead, or works of charity to the living. The Roman Feralia in Ovid's time were a striking example of such transition, for while the idea was recognized that the ghosts fed upon the offerings, 'nunc posito pascitur umbra cibo,' yet there were but 'parva munera,' fruits and grains of salt, and corn soaked in wine, set out for their meal in the middle of the road. 'Little the manes ask, the pious thought stands instead of the rich gift, for Styx holds no greedy gods:'—

'Parva petunt manes. Pietas pro divite grata est Munere. Non avidos Styx habet ima deos. Tegula porrectis satis est velata coronis, Et sparsae fruges, parcaque mica salis, Inque mero mollita ceres, violaeque solutae: Haec habeat media testa relicta via. Nec majora veto. Sed et his placabilis umbra est.'[117]

Still farther back, in old Chinese history, Confucius had been called on to give an opinion as to the sacrifices to the dead. Maintainer of all ancient rites as he was, he stringently kept up this, 'he sacrificed to the dead as if they were present,' but when he was asked if the dead had knowledge of what was done or no, he declined to answer the question; for if he replied yes, then dutiful descendants would injure their substance by sacrifices, and if no, then undutiful children would leave their parents unburied. The evasion was characteristic of the teacher who expressed his theory of worship in this maxim, 'to give oneself earnestly to the duties due to men, and, while respecting spiritual beings, to keep aloof from them, may be called wisdom.' It is said that in our own time the Taepings have made a step beyond Confucius; they have forbidden the sacrifices to the spirits of the dead, yet keep up the rite of visiting their tombs on the customary day, for prayer and the renewal of vows.[118] How funeral offerings may pass into commemorative banquets and feasts to the poor, has been shown already. If we seek in England for vestiges of the old rite of funeral sacrifice, we may find a lingering survival into modern centuries, doles of bread and drink given to the poor at funerals, and 'soul-mass cakes' which peasant girls perhaps to this day beg for at farmhouses with the traditional formula,

'Soul, soul, for a soul cake, Pray you, mistress, a soul cake.'[119]

Were it not for our knowledge of the intermediate stages through which these fragments of old custom have come down, it would seem far-fetched indeed to trace their origin back to the savage and barbaric times of the institution of feasts of departed souls.

Footnote 1:

Brebeuf in 'Rel. des Jés. dans la Nouvelle France,' 1636, p. 130; Charlevoix, 'Nouvelle France,' vol. vi. p. 75. See Brinton, p. 253.

Footnote 2:

Waitz, vol. iii. p. 195, see p. 213. Morse, 'Report on Indian Affairs,' p. 345.

Footnote 3:

Mayne, 'British Columbia,' p. 181.

Footnote 4:

Cranz, 'Grönland,' pp. 248, 258, see p. 212. See also Turner, 'Polynesia,' p. 353; Meiners, vol. ii. p. 793.

Footnote 5:

Bastian, 'Psychologie,' p. 28.

Footnote 6:

Bastian, ‘Zur vergl. Psychologie,’ in Lazarus and Steinthal’s ‘Zeitschrift,’ vol. v. p. 160, &c., also Papuas and other races.

Footnote 7:

Burton, ‘W. & W. fr. W. Afr.’ p. 376.

Footnote 8:

Krapf, ‘E. Afr.’ p. 201.

Footnote 9:

J. L. Wilson, ‘W. Afr.’ p. 210; see also R. Clarke, ‘Sierra Leone,’ p. 159.

Footnote 10:

Bastian, l. c.

Footnote 11:

Macpherson, p. 72; also Tickell in ‘Journ. As. Soc. Bengal,’ vol. ix. pp. 793, &c.; Dalton in ‘Tr. Eth. Soc.’ vol. vi. p. 22 (similar rite of Mundas and Oraons).

Footnote 12:

Klemm, ‘C. G.’ vol. iii. p. 77; K. Leems, ‘Lapper,’ c. xiv.

Footnote 13:

R. Taylor, ‘New Zealand,’ p. 284; see Shortland, ‘Traditions,’ p. 145; Turner, ‘Polynesia,’ p. 353; Bastian, ‘Mensch,’ vol. ii. p. 279; see also p. 276 (Samoyeds). Compare Charlevoix, ‘Nouvelle France,’ vol. v. p. 426; Steller, ‘Kamtschatka,’ p. 353; Kracheninnikow, ii. 117. See Plath, ‘Rel. der alten Chinesen,’ ii. p. 98.

Footnote 14:

Grey, ‘Australia,’ vol. i. p. 301, vol. ii. p. 363 (native’s accusation against some foreign sailors who had assaulted him, ‘_djanga_ Taal-wurt kyle-gut bomb-gur,’—‘one of the dead struck Taal-wurt under the ear,’ &c. The word _djanga_ = the dead, the spirits of deceased persons (see Grey, ‘Vocab. of S. W. Australia’), had come to be the usual term for a European). Lang, ‘Queensland,’ pp. 34, 336; Bonwick, ‘Tasmanians,’ p. 183; Scherzer, ‘Voy. of Novara,’ vol. iii. p. 34; Bastian, ‘Psychologie,’ p. 222, ‘Mensch,’ vol. iii. pp. 362-3, and in Lazarus and Steinthal’s ‘Zeitschrift,’ l. c.; Turner, ‘Polynesia,’ p. 424.

Footnote 15:

Römer, ‘Guinea,’ p. 85; Brun-Rollet, ‘Nil Blanc,’ &c. p. 234.

Footnote 16:

Sproat, ‘Savage Life,’ ch. xviii., xix., xxi. Souls of the dead appear in dreams, either in human or animal forms, p. 174. See also Brinton, p. 145.

Footnote 17:

Schoolcraft, ‘Indian Tribes,’ part iii. p. 113.

Footnote 18:

Hayes, ‘Arctic Boat Journey,’ p. 198.

Footnote 19:

Brinton, ‘Myths of New World,’ p. 102.

Footnote 20:

Brebeuf in ‘Rel. des Jés.’ 1636, p. 104.

Footnote 21:

Morgan, ‘Iroquois,’ p. 174.

Footnote 22:

Clavigero, ‘Messico,’ vol. ii. p. 5.

Footnote 23:

Martius, ‘Ethnog. Amer.’ vol. i. p. 602; Markham in ‘Tr. Eth. Soc.’ vol. iii. p. 195.

Footnote 24:

Dobrizhoffer, ‘Abipones,’ vol. ii. pp. 74, 270.

Footnote 25:

Coreal in Brinton, l. c. See also J. G. Müller, pp. 139 (Natchez), 223 (Caribs), 402 (Peru).

Footnote 26:

Chomé in ‘Lettres Edif.’ vol. viii.; see also Martius, vol. i. p. 446.

Footnote 27:

Waitz, vol. ii. p. 419 (Maravi).

Footnote 28:

Callaway, ‘Rel. of Amazulu,’ p. 196, &c.; Arbousset and Daumas, p. 237.

Footnote 29:

J. L. Wilson, ‘W. Afr.’ pp. 210, 218. See also Brun-Rollet, pp. 200, 234; Meiners, vol. i. p. 211.

Footnote 30:

Steinhauser in ‘Mag. der Evang. Miss.’ Basel, 1856, No. 2, p. 135.

Footnote 31:

Manu, xi. xii. Ward, ‘Hindoos,’ vol. i. p. 164, vol. ii. pp. 215, 347-52.

Footnote 32:

St. John, ‘Far East,’ vol. i. p. 181; Perelaer, ‘Ethnog. Beschr. der Dajaks,’ p. 17.

Footnote 33:

Hunter, ‘Rural Bengal,’ p. 210. See also Shaw in ‘As. Res.’ vol. iv. p. 46 (Rajmahal tribes).

Footnote 34:

Abraham Roger, ‘La Porte Ouverte,’ Amst. 1670, p. 107.

Footnote 35:

Manu, xii. 9: ‘çarîrajaih karmmadoshaih yâti sthâvaratâm narah’—‘for crimes done in the body, the man goes to the inert (motionless) state;’ xii. 42, ‘sthâvarâh krimakîtâçcha matsyâh sarpâh sakachhapâh paçavaçcha mrigaschaiva jaghanyâ tâmasî gatih’—‘inert (motionless) things, worms and insects, fish, serpents, tortoises and beasts and deer also are the last dark form.’

Footnote 36:

Köppen, ‘Religion des Buddha,’ vol. i. pp. 35, 289, &c., 318; Barthélemy Saint-Hilaire, ‘Le Bouddha et sa Religion,’ p. 122; Hardy, ‘Manual of Budhism,’ pp. 98, &c., 180, 318, 445, &c.

Footnote 37:

Herod. ii. 123, see Rawlinson’s Tr.; Plutarch. De Iside 31, 72; Wilkinson, ‘Ancient Eg.’ vol. ii. ch. xvi.

Footnote 38:

Plat. Phædo, Timæus, Phædrus, Repub.; Diog. Laert. Empedokles xii.; Pindar. Olymp. ii. antistr. 4; Ovid. Metam. xv. 160; Lucian. Somn. 17, &c. Philostr. Vit. Apollon. Tyan. See also Meyer’s Conversations-Lexicon, art. ‘Seelenwanderung.’ For re-birth in old Scandinavia, see Helgakvidha, iii., in ‘Edda.’

Footnote 39:

Eisenmenger, part ii. p. 23, &c.

Footnote 40:

Beausobre, ‘Hist. de Manichée,’ &c., vol. i. pp. 245-6, vol. ii. pp. 496-9; G. Flügel, ‘Mani.’ See Augustin. Contra Faust.; De Hæres.; De Quantitate Animæ.

Footnote 41:

Gul. de Rubruquis in ‘Rec. des Voy. Soc. de Géographie de Paris,’ vol. iv. p. 356. Benjamin of Tudela, ed. and tr. by Asher, Hebrew 22, Eng. p. 62. Niebuhr, ‘Reisebeschr. nach Arabien,’ &c., vol. ii. pp. 438-443; Meiners, vol. ii. p. 796.

Footnote 42:

St. Clair and Brophy, ‘Bulgaria,’ p. 57. Compare the tenets of the Russian sect of Dukhobortzi, in Haxthausen, ‘Russian Empire,’ vol. i. p. 288, &c.

Footnote 43:

Since the first publication of the above remark, M. Louis Figuier has supplied a perfect modern instance by his book, entitled ‘Le Lendemain de la Mort,’ translated into English as ‘The Day after Death: Our Future Life according to Science.’ His attempt to revive the ancient belief, and to connect it with the evolution-theory of modern naturalists, is carried out with more than Buddhist elaborateness. Body is the habitat of soul, which goes out when a man dies, as one forsakes a burning house. In the course of development, a soul may migrate through bodies stage after stage, zoophyte and oyster, grasshopper and eagle, crocodile and dog, till it arrives at man, thence ascending to become one of the superhuman beings or angels who dwell in the planetary ether, and thence to a still higher state, the secret of whose nature M. Figuier does not endeavour to penetrate, ‘because our means of investigation fail at this point.’ The ultimate destiny of the more glorified being is the Sun; the pure spirits who form its mass of burning gases, pour out germs and life to start the course of planetary existence. (Note to 2nd edition.)

Footnote 44:

Swedenborg, ‘The True Christian Religion,’ 13. Compare the notion attributed to the followers of Basilides the Gnostic, of men whose souls are affected by spirits or dispositions as of wolf, ape, lion, or bear, wherefore their souls bear the properties of these, and imitate their deeds (Clem. Alex. Stromat. ii. c. 20).

Footnote 45:

See J. G. Müller, ‘Amer. Urrel.’ p. 208 (Caribs); but compare Rochefort, p. 429. Steller, ‘Kamtschatka,’ p. 269, Castrén, ‘Finnische Mythologie,’ p. 119.

Footnote 46:

For Egyptian evidence see the funeral papyri and translations of the ‘Book of the Dead.’ Compare Brinton, ‘Myths of New World,’ p. 254, &c.

Footnote 47:

Aryan evidence in ‘Rig-Veda,’ x. 14, 8; xi. 1, 8; Manu, xii. 16-22; Max Müller, ‘Todtenbestattung,’ pp. xii. xiv.; ‘Chips,’ vol. i. p. 47; Muir in ‘Journ. As. Soc. Bengal,’ vol. i. 1865, p. 306; Spiegel, ‘Avesta’; Haug, ‘Essays on the Parsis.’

Footnote 48:

Origen, De Princip. ii. 3, 2: ‘materiæ corporalis, cujus materiæ anima usum semper habet, in qualibet qualitate positæ, nunc quidem carnali, postmodum vero subtiliori et puriori, quæ spiritalis appellatur.’

Footnote 49:

Burton, ‘Central Africa,’ vol. ii. p. 345.

Footnote 50:

Callaway, ‘Rel. of Amazulu,’ p. 84.

Footnote 51:

Kaufmann, ‘Schilderungen aus Centralafrika,’ p. 124; G. Lejean in ‘Rev. des Deux Mondes,’ Apr. 1, 1860, p. 760; see Brun-Rollet, ‘Nil Blanc,’ pp. 100, 234. A dialogue by the missionary Beltrame (1859-60), in Mitterutzner, ‘Dinka-Sprache,’ p. 57, ascribes to the Dinkas ideas of heaven and hell, which, however, show Christian influence.

Footnote 52:

Mariner, ‘Tonga Is.’ vol. ii. p. 136; John Smith, ‘Descr. of Virginia,’ 33; Oviedo, ‘Nicaragua,’ p. 50. The reference to the Laos in Meiners, vol. ii. p. 760, is worthless.

Footnote 53:

Cranz, ‘Grönland,’ p. 259.

Footnote 54:

Williams, ‘Fiji,’ vol. i. p. 244. See ‘Journ. Ind. Archip.’ vol. iii. p. 113 (Dayaks). Compare wasting and death of souls in depths of Hades, Taylor, ‘New Zealand,’ p. 232.

Footnote 55:

Bosman, ‘Guinea’ in Pinkerton, vol. xvi. p. 401. See also Waitz, ‘Anthropologie,’ vol. ii. p. 191 (W. Afr.); Callaway, ‘Rel. of Amazulu,’ p. 355.

Footnote 56:

Cavazzi, ‘Congo, Matamba, et Angola,’ lib. i. p. 270. See also Liebrecht in ‘Zeitschr. für Ethnologie,’ vol. v. p. 96 (Tartary, Scandinavia, Greece).

Footnote 57:

Schoolcraft, ‘Indian Tribes,’ part i. p. 310; Bastian, ‘Psychologie,’ pp. 111, 193; Doolittle, ‘Chinese,’ vol. i. p. 235.

Footnote 58:

Bastian, ‘Mensch,’ vol. ii. p. 323.

Footnote 59:

Kolben, p. 579.

Footnote 60:

Billings, p. 125.

Footnote 61:

Bastian, ‘Oestl. Asien.’ vol. i. p. 145; Cross, l.c., p. 311. For other cases of desertion of dwellings after a death, possibly for the same motive, see Bourien, ‘Tribes of Malay Pen.’ in ‘Tr. Eth. Soc.’ vol. iii. p. 82; Polack, ‘M. of New Zealanders,’ vol. i. pp. 204, 216; Steiler, ‘Kamtschatka,’ p. 271. But the Todas say that the buffaloes slaughtered and the hut burnt at the funeral are transferred to the spirit of the deceased in the next world; Shortt in ‘Tr. Eth. Soc.’ vol. vii. p. 247. See Waitz, vol. iii. p. 199.

Footnote 62:

Egede, ‘Greenland,’ p. 152; Cranz, p. 300.

Footnote 63:

Bastian, ‘Mensch,’ vol. ii. p. 323; see pp. 329, 363.

Footnote 64:

Bowring, ‘Siam,’ vol. i. p. 122; Bastian, ‘Oestl. Asien.’ vol. iii. p. 258.

Footnote 65:

Castrén, ‘Finn. Myth.’ p. 120.

Footnote 66:

Wuttke, ‘Volksaberglaube,’ pp. 213-17. Other cases of taking out the dead by a gap made on purpose: Arbousset and Daumas, p. 502 (Bushmen); Magyar, p. 351 (Kimbunda); Moffat, p. 307 (Bechuanas); Waitz, vol. iii. p. 199 (Ojibwas);—their motive is probably that the ghost may not find its way back by the door.

Footnote 67:

Oldfield in ‘Tr. Eth. Soc.’ vol. iii. pp. 228, 236, 245.

Footnote 68:

Taylor, ‘New Zealand,’ p. 221; Schirren, p. 91; see Turner, ‘Polynesia,’ p. 233.

Footnote 69:

Morgan, ‘League of Iroquois,’ p. 174.

Footnote 70:

J. G. Müller, p. 286.

Footnote 71:

Castrén, ‘Finn. Myth.’ p. 126.

Footnote 72:

Cross in ‘Journ. Amer. Or. Soc.’ vol. iv. p. 309; Mason in ‘Journ. As. Soc. Bengal,’ 1865, part ii. p. 203. See also J. Anderson, ‘Exp. to W. Yunnan,’ pp. 126, 131 (Shans).

Footnote 73:

Bastian, ‘Psychologie,’ pp. 51, 99-101.

Footnote 74:

Lucian. De Luctu. See Pauly, ‘Real. Encyclop.’ and Smith, ‘Dic. of Gr. and Rom. Ant.’ s.v. ‘inferi.’

Footnote 75:

Hanusch, ‘Slaw. Myth.’ p. 277.

Footnote 76:

Calmet, vol. ii. ch. xxxvi.; Brand, vol. iii. p. 67.

Footnote 77:

Charlevoix, ‘Nouvelle France,’ vol. vi. p. 75; Schoolcraft, ‘Indian Tribes,’ part i. pp. 39, 83; part iv. p. 65; Tanner’s ‘Narr.’ p. 293.

Footnote 78:

Brebeuf in ‘Rel. des Jés.’ 1636, p. 104.

Footnote 79:

Ellis, ‘Madagascar,’ vol. i. pp. 253, 364. See Taylor, ‘New Zealand,’ p. 220.

Footnote 80:

Krapf, ‘E. Afr.’ p. 150.

Footnote 81:

T. J. Hutchinson, p. 206.

Footnote 82:

Cavazzi, ‘Congo, &c.’ lib. i. p. 264. So in ancient Greece, Lucian. Charon, 22.

Footnote 83:

Hodgson, ‘Abor. of India,’ p. 180.

Footnote 84:

‘Journ. Ind. Archip.’ vol. ii. p. 235.

Footnote 85:

Tickell in ‘Journ. As. Soc. Bengal,’ vol. ix. p. 795; Dalton, ibid. 1866, part ii. p. 153, &c.; and in ‘Tr. Eth. Soc.’ vol. vi. p. 1, &c.; Latham, ‘Descr. Eth.’ vol. ii. p. 415, &c.

Footnote 86:

Bastian, ‘Psychologie,’ p. 62; Castrén, ‘Finn. Myth.’ p. 121.

Footnote 87:

Doolittle, ‘Chinese,’ vol. i. p. 173, &c.; vol. ii. p. 91, &c.; Meiners, vol. i. p. 306.

Footnote 88:

Wilkinson, ‘Ancient Eg.’ vol. ii. p. 362; Lucian. De Luctu, 21.

Footnote 89:

Manu, iii.; Colebrooke, ‘Essays,’ vol. i. p. 161, &c.; Pictet, ‘Origines Indo-Europ.’ part ii. p. 600; Ward, ‘Hindoos,’ vol. ii. p. 332.

Footnote 90:

Pauly, ‘Real-Encyclop.’ s.v. ‘funus.’; Smith’s ‘Dic.’ s.v. ‘funus.’ See Meiners, vol. i. pp. 305-19.

Footnote 91:

Augustin. contra Faustum, xx. 4; De Civ. Dei, viii. 27; conf. vi. 2. See Beausobre, vol. ii. pp. 633, 685; Bingham, xx. c. 7.

Footnote 92:

Saint-Foix, ‘Essais Historiques sur Paris,’ in ‘Œuvres,’ vol. iv. p. 147, &c.

Footnote 93:

Lady Herbert, ‘Impressions of Spain,’ p. 8.

Footnote 94:

H. C. Romanoff, ‘Rites and Customs of Greco-Russian Church,’ p. 249; Ralston, ‘Songs of the Russian People,’ pp. 135, 320; St. Clair and Brophy, ‘Bulgaria,’ p. 77; Brand, ‘Pop. Ant.’ vol. i. p. 115.

Footnote 95:

Beside the accounts of annual festivals of the dead cited here, see the following:—Santos, ‘Ethiopia,’ in Pinkerton, vol. xvi. p. 685 (Sept.); Brasseur, ‘Mexique,’ vol. iii. pp. 23, 522, 528 (Aug., Oct., Nov.); Rivero and Tschudi, ‘Peru,’ p. 134 (Peruvian feast dated as Nov. 2 in coincidence with All Souls’, but this reckoning is vitiated by confusion of seasons of N. and S. hemisphere, see J. G. Müller, p. 389; moreover, the Peruvian feast may have been originally held at a different date, and transferred, as happened elsewhere, to the ‘Spanish All Souls’); Doolittle, ‘Chinese,’ vol. ii. pp. 44, 62 (esp. Apr.); Caron, ‘Japan,’ in Pinkerton, vol. vii. p. 629 (Aug.).

Footnote 96:

Mason, ‘Karens,’ l. c. p. 238.

Footnote 97:

Hodgson, ‘Abor. of India,’ p. 147.

Footnote 98:

Munzinger, ‘Ostafr. Stud.’ p. 473.

Footnote 99:

Waitz, vol. ii. p. 194.

Footnote 100:

G. D’Alaux in ‘Rev. des Deux Mondes,’ May 15, 1852, p. 76.

Footnote 101:

Ovid. Fast. ii. 533; v. 420.

Footnote 102:

Spiegel, ‘Avesta,’ vol. ii. p. ci.; Alger, p. 137.

Footnote 103:

Hanusch, ‘Slaw. Myth.’ pp. 374, 408; St. Clair and Brophy, ‘Bulgaria,’ p. 77; Romanoff, ‘Greco-Roman Church,’ p. 255.

Footnote 104:

Petrus Damianus, ‘Vita S. Odilonis,’ in the Bollandist ‘Acta Sanctorum,’ Jan. 1, has the quaint legend attached to the new ordinance. An island hermit dwelt near a volcano, where souls of the wicked were tormented in the flames. The holy man heard the officiating demons lament that their daily task of new torture was interfered with by the prayers and alms of devout persons leagued against them to save souls, and especially they complained of the Monks of Cluny. Thereupon the hermit sent a message to Abbot Odilo, who carried out the work to the efficacy of which he had received such perfect spiritual testimony, by decreeing that November 2, the day after All Saints’, should be set apart for services for the departed.

Footnote 105:

Bastian, ‘Mensch,’ vol. ii. p. 336. Meiners, vol. i. p. 316; vol. ii. p. 290. Wuttke, ‘Deutsche Volksaberglaube,’ p. 216. Cortet, ‘Fêtes Religieuses,’ p. 233; ‘Westminster Rev.’ Jan. 1860; Hersart de la Villemarqué, ‘Chants de la Bretagne,’ vol. ii. p. 307.

Footnote 106:

Le Jeune in ‘Rel. des Jés.’ 1634, p. 16; Waitz, vol. iii. p. 195.

Footnote 107:

Cavazzi, ‘Congo,’ &c., book i. 265.

Footnote 108:

Grimm, ‘D. M.’ p. 865, but not so in the account of the Feast of the Dead in Boecler, ‘Ehsten Abergl. Gebr.’ (ed. Kreutzwald), p. 89. Compare Martius, ‘Ethnog. Amer.’ vol. i. p. 345 (Gês). The following passage from a spiritualist journal, ‘The Medium,’ Feb. 9, 1872, shows this primitive notion curiously surviving in modern England. ‘Every time we sat at dinner, we had not only spirit-voices calling to us, but spirit-hands touching us; and last evening, as it was his farewell, they gave us a special manifestation, unasked for and unlooked for. He sitting at the right hand of me, a vacant chair opposite to him began moving, and, in answer to whether it would have some dinner, said “Yes.” I then asked it to select what it would take, when it chose _croquets des pommes de terre_ (a French way of dressing potatoes, about three inches long and two wide. I will send you one that you may see it). I was desired to put this on the chair, either in a tablespoon or on a plate. I placed it in a tablespoon, thinking that probably the plate might be broken. In a few seconds I was told that it was eaten, and looking, found the half of it gone, with the marks showing the teeth.’ (Note to 2nd ed.)

Footnote 109:

Taylor, ‘New Zealand,’ p. 220, see 104.

Footnote 110:

Brasseur, ‘Mexique,’ vol. iii. p. 24.

Footnote 111:

Colebrooke, ‘Essays,’ vol. i. p. 163, &c.; Manu. iii.

Footnote 112:

Hanusch, ‘Slaw. Myth.’ p. 408; Hartknoch, ‘Preussen,’ part i. p. 187.

Footnote 113:

Doolittle, ‘Chinese,’ vol. ii. pp. 33, 48; Meiners, vol. i. p. 318.

Footnote 114:

Borri, ‘Relatione della Nuova Missione della Comp. di Giesu,’ Rome, 1631, p. 208; and in Pinkerton, vol. ix. p. 822, &c.

Footnote 115:

Grout, ‘Zulu Land,’ p. 140; see Callaway, ‘Rel. of Amazulu,’ p. 11.

Footnote 116:

Caron, ‘Japan,’ vol. vii. p. 629; see Turpin, ‘Siam,’ ibid. vol. ix. p. 590.

Footnote 117:

Ovid. Fast. ii. 533.

Footnote 118:

Legge, ‘Confucius,’ pp. 101-2, 130; Bunsen, ‘God in History,’ p. 271.

Footnote 119:

Brand, ‘Pop. Ant.’ vol. i. p. 392, vol. ii. p. 289.

CHAPTER XIII. ANIMISM (_continued_).

Journey of the Soul to the Land of the Dead—Visits by the Living to the Regions of Departed Souls—Connexion of such legends with myths of Sunset: the Land of the Dead thus imagined as in the West—Realization of current religious ideas, whether of savage or civilized theology, in narratives of visits to the Regions of Souls—Localization of the Future Life—Distant earthly region: Earthly Paradise, Isles of the Blest—Subterranean Hades or Sheol—Sun, Moon, Stars—Heaven—Historical course of belief as to such localization—Nature of Future Life—Continuance-theory, apparently original, belongs especially to the lower races—Transitional theories—Retribution-theory, apparently derived, belongs especially to the higher races—Doctrine of Moral Retribution as developed in the higher culture—Survey of Doctrine of Future State, from savage to civilized stages—Its practical effect on the sentiment and conduct of Mankind.

The departure of the dead man's soul from the world of living men, its journey to the distant land of spirits, the life it will lead in its new home, are topics on which the lower races for the most part hold explicit doctrines. When these fall under the inspection of a modern ethnographer, he treats them as myths; often to a high degree intelligible and rational in their origin, consistent and regular in their structure, but not the less myths. Few subjects have aroused the savage poet's mind to such bold and vivid imagery as the thought of the hereafter. Yet also a survey of its details among mankind displays in the midst of variety a regular recurrence of episode which brings the ever-recurring question, how far is this correspondence due to transmission of the same thought from tribe to tribe, and how far to similar but independent development in distant lands?

From the savage state up into the midst of civilization, the comparison may be carried through. Low races and high, in region after region, can point out the very spot whence the flitting souls start to travel toward their new home. At the extreme western cape of Vanua Levu, a calm and solemn place of cliff and forest, the souls of the Fijian dead embark for the judgement-seat of Ndengei, and thither the living come in pilgrimage, thinking to see their ghosts and gods.[120] The Baperi of South Africa will venture to creep a little way into their cavern of Marimatlé, whence men and animals came forth into the world, and whither souls return at death.[121] In Mexico the cavern of Chalchatongo led to the plains of paradise, and the Aztec name of Mictlan, 'Land of the Dead,' now Mitla, keeps up the remembrance of another subterranean temple which opened the way to the sojourn of the blessed.[122] How naturally a dreary place, fit rather for the dead than the living, suggests the thought of an entrance to the land of the departed, is seen in the fictitious travels known under the name of Sir John Mandevill, where the description of the Vale Perilous, adapted from the terrible valley which Friar Odoric had seen full of corpses and heard resound with strange noise of drums, has this appropriate ending: 'This vale es full of deuilles and all way has bene; and men saise in that cuntree that thare es ane entree to hell.'[123] In more genuine folklore, North German peasants still remember on the banks of the swampy Drömling the place of access to the land of departed souls.[124] To us Englishmen the shores of lake Avernus, trodden daily by our tourists, are more familiar than the Irish analogue of the place, Lough Derg, with its cavern entrance of St. Patrick's Purgatory leading down to the awful world below. The mass of mystic details need not be repeated here of the soul's dread journey by caverns and rocky paths and weary plains, over steep and slippery mountains, by frail bark or giddy bridge across gulfs or rushing rivers, abiding the fierce onset of the soul-destroyer or the doom of the stern guardian of the other world. But before describing the spirit-world which is the end of the soul's journey, let us see what the proof is which sustains the belief in both. The lower races claim to hold their doctrines of the future life on strong tradition, direct revelation, and even personal experience. To them the land of souls is a discovered country, from whose bourne many a traveller returns.

Among the legendary visits to the world beyond the grave, there are some that seem pure myth, without a touch of real personal history. Ojibwa, the eponymic hero of his North American tribe, as one of his many exploits descended to the subterranean world of departed spirits, and came up again to earth.[125] When the Kamchadals were asked how they knew so well what happens to men after death, they could answer with their legend of Haetsh the first man. He died and went down into the world below, and a long while after came up again to his former dwelling, and there, standing above by the smoke-hole, he talked down to his kindred in the house and told them about the life to come; it was then that his two daughters whom he had left below followed him in anger and smote him so that he died a second time, and now he is chief in the lower world, and receives the Italmen when they die and rise anew.[126] Thus, again, in the great Finnish epic, the Kalewala, one great episode is Wainamoinen's visit to the land of the dead. Seeking the last charm-words to build his boat, the hero travelled with quick steps week after week through bush and wood till he came to the Tuonela river, and saw before him the island of Tuoni the god of death. Loudly he called to Tuoni's daughter to bring the ferry-boat across:—

‘She, the virgin of Manala, She, the washer of the clothing, She, the wringer of the linen, By the river of Tuonela, In the under-world Manala, Spake in words, and this their meaning, This their answer to the hearer:— “Forth the boat shall come from hither, When the reason thou hast given That hath brought thee to Manala, Neither slain by any sickness, Nor by Death dragged from the living, Nor destroyed by other ending.”’

Wainamoinen replies with lying reasons. Iron brought him, he says, but Tuoni’s daughter answers that no blood drips from his garment; Fire brought him, he says, but she answers that his locks are unsinged, and at last he tells his real mission. Then she ferries him over, and Tuonetar the hostess brings him beer in the two-eared jug, but Wainamoinen can see the frogs and worms within and will not drink, for it was not to drain Manala’s beer-jug he had come. He lay in the bed of Tuoni, and meanwhile they spread the hundred nets of iron and copper across the river that he might not escape; but he turned into a reed in the swamp, and as a snake crept through the meshes:—

‘Tuoni’s son with hooked fingers Iron-pointed hooked fingers Went to draw his nets at morning— Salmon-trout he found a hundred, Thousands of the little fishes, But he found no Wainamoinen, Not the old friend of the billows. Then the ancient Wainamoinen, Come from out of Tuoni’s kingdom, Spake in words, and this their meaning, This their answer to the hearer:— “Never mayst thou, God of goodness, Never suffer such another Who of self-will goes to Mana, Thrusts his way to Tuoni’s kingdom. Many they who travel thither, Few who thence have found the home-way, From the houses of Tuoni From the dwellings of Manala.”’[127]

It is enough to name the familiar classic analogues of these mythic visits to Hades,—the descent of Dionysos to bring back Semele, of Orpheus to bring back his beloved Eurydike, of Herakles to fetch up the three-headed Kerberos at the command of his master Eurystheus; above all, the voyage of Odysseus to the ends of the deep-flowing Ocean, to the clouded city of Kimmerian men, where shining Helios looks not down with his rays, and deadly night stretches always over wretched mortals,—thence they passed along the banks to the entrance of the land where the shades of the departed, quickened for a while by the taste of sacrificial blood, talked with the hero and showed him the regions of their dismal home.[128]

The scene of the descent into Hades is in very deed enacted day by day before our eyes, as it was before the eyes of the ancient myth-maker, who watched the sun descend to the dark under-world, and return at dawn to the land of living men. These heroic legends lie in close-knit connexion with episodes of solar myth. It is by the simplest poetic adaptation of the Sun’s daily life, typifying Man’s life in dawning beauty, in mid-day glory, in evening death, that mythic fancy even fixed the belief in the religions of the world, that the Land of Departed Souls lies in the Far West or the World Below. How deeply the myth of the Sunset has entered into the doctrine of men concerning a Future State, how the West and the Under-World have become by mere imaginative analogy Regions of the Dead, how the quaint day-dreams of savage poets may pass into honoured dogmas of classic sages and modern divines,—all this the crowd of details here cited from the wide range of culture stand to prove.

Moreover, visits from or to the dead are matters of personal experience and personal testimony. When in dream or vision the seer beholds the spirits of the departed, they give him tidings from the other world, or he may even rise and travel thither himself, and return to tell the living what he has seen among the dead. It is sometimes as if the traveller’s material body went to visit a distant land, and sometimes all we are told is that the man’s self went, but whether in body or in spirit is a mere detail of which the story keeps no record. Mostly, however, it is the seer’s soul which goes forth, leaving his body behind in ecstasy, sleep, coma, or death. Some of these stories, as we trace them on from savage into civilized times, are no doubt given in good faith by the visionary himself, while others are imitations of these genuine accounts.[129] Now such visions are naturally apt to reproduce the thoughts with which the seer’s mind was already furnished. Every idea once lodged in the mind of a savage, a barbarian, or an enthusiast, is ready thus to be brought back to him from without. It is a vicious circle; what he believes he therefore sees, and what he sees he therefore believes. Beholding the reflexion of his own mind like a child looking at itself in a glass, he humbly receives the teaching of his second self. The Red Indian visits his happy hunting-grounds, the Tongan his shadowy island of Bolotu, the Greek enters Hades and looks on the Elysian Fields, the Christian beholds the heights of Heaven and the depths of Hell.

Among the North American Indians, and especially the Algonquin tribes, accounts are not unusual of men whose spirits, travelling in dreams or in the hallucinations of extreme illness to the land of the dead, have returned to reanimate their bodies, and tell what they have seen. Their experiences have been in great measure what they were taught in early childhood to expect, the journey along the path of the dead, the monstrous strawberry at which the jebi-ug or ghosts refresh themselves, but which turns to red rock at the touch of their spoons, the bark offered them for dried meat and great puff-balls for squashes, the river of the dead with its snake-bridge or swinging log, the great dog standing on the other side, the villages of the dead beyond.[130] The Zulus of our own day tell of men who have gone down by holes in the ground into the underworld, where mountains and rivers and all things are as

here above, and where a man may find his kindred, for the dead live in their villages, and may be seen milking their cattle, which are the cattle killed on earth and come to life anew. The Zulu Umpengula, who told one of these stories to Dr. Callaway, remembered when he was a boy seeing an ugly little hairy man called Uncama, who once, chasing a porcupine that ate his mealies, followed it down a hole in the ground into the land of the dead. When he came back to his home on earth he found that he had been given up for dead himself, his wife had duly burnt and buried his mats and blankets and vessels, and the wondering people at sight of him again shouted the funeral dirge. Of this Zulu Dante it used to be continually said, 'There is the man who went to the underground people.'[131] One of the most characteristic of these savage narratives is from New Zealand. This story, which has an especial interest from the reminiscence it contains of the gigantic extinct Moa, and which may be repeated at some length as an illustration of the minute detail and lifelike reality which such visionary legends assume in barbaric life, was told to Mr. Shortland by a servant of his named Te Wharewera. An aunt of this man died in a solitary hut near the banks of Lake Rotorua. Being a lady of rank she was left in her hut, the door and windows were made fast, and the dwelling was abandoned, as her death had made it tapu. But a day or two after, Te Wharewera with some others paddling in a canoe near the place at early morning saw a figure on the shore beckoning to them. It was the aunt come to life again, but weak and cold and famished. When sufficiently restored by their timely help, she told her story. Leaving her body, her spirit had taken flight toward the North Cape, and arrived at the entrance of Reigna. There, holding on by the stem of the creeping akeake-plant, she descended the precipice, and found herself on the sandy beach of a river. Looking round, she espied in the distance an enormous bird, taller than a man, coming towards her with rapid strides. This terrible object so frightened her, that her first thought was to try to return up the steep cliff; but seeing an old man paddling a small canoe towards her she ran to meet him, and so escaped the bird. When she had been safely ferried across she asked the old Charon, mentioning the name of her family, where the spirits of her kindred dwelt. Following the path the old man pointed out, she was surprised to find it just such a path as she had been used to on earth; the aspect of the country, the trees, shrubs, and plants were all familiar to her. She reached the village and among the crowd assembled there she found her father and many near relations; they saluted her, and welcomed her with the wailing chant which Maoris always address to people met after long absence. But when her father had asked about his living relatives, and especially about her own child, he told her she must go back to earth, for no one was left to take care of his grandchild. By his orders she refused to touch the food that the dead people offered her, and in spite of their efforts to detain her, her father got her safely into the canoe, crossed with her, and parting gave her from under his cloak two enormous sweet potatoes to plant at home for his grandchild's especial eating. But as she began to climb the precipice again, two pursuing infant spirits pulled her back, and she only escaped by flinging the roots at them, which they stopped to eat, while she scaled the rock by help of the akeake-stem, till she reached the earth and flew back to where she had left her body. On returning to life she found herself in darkness, and what had passed seemed as a dream, till she perceived that she was deserted and the door fast, and concluded that she had really died and come to life again. When morning dawned, a faint light entered by the crevices of the shut-up house, and she saw on the floor near her a calabash partly full of red ochre mixed with water; this she eagerly drained to the dregs, and then feeling a little stronger, succeeded in opening the door and crawling down to the beach, where her friends soon after found her. Those who listened to her tale firmly believed the reality of her adventures, but it was much regretted that she had not brought back at least one of the huge sweet-potatoes, as evidence of her visit to the land of spirits.[132] Races of North Asia[133] and West Africa[134] have in like manner their explorers of the world beyond the grave.

Classic literature continues the series. Lucian's graphic tales represent the belief of their age, if not of their author. His Eukrates looks down the chasm into Hades, and sees the dead reclining on the asphodel in companies of kinsfolk and friends; among them he recognizes Sokrates with his bald head and pot-belly, and also his own father, dressed in the clothes he was buried in. Then Kleodemos caps this story with his own, how when he was sick, on the seventh day when his fever was burning like a furnace, every one left him, and the doors were shut. Then there stood before him an all-beauteous youth in a white garment, who led him through a chasm into Hades, as he knew by seeing Tantalos and Tityos and Sisyphos; and bringing him to the court of judgement, where were Aiakos and the Fates and the Erinyes, the youth set him before Pluto the King, who sat reading the names of those whose day of life was over. But Pluto was angry, and said to the guide, 'This one's thread is not run out, that he should depart, but bring me Demylos the coppersmith, for he is living beyond the spindle.' So Kleodemos came back to himself free from his fever and announced that Demylos, who was a sick neighbour, would die; and accordingly a little while after there was heard the cry of the mourners wailing for him.[135] Plutarch's stories, told more seriously, are yet one in type with the mocking Lucian's. The wicked, pleasure-seeking Thespesios lies three days as dead, and revives to tell his vision of the world below. One Antyllos was sick, and seemed to the doctors to retain no trace of life; till, waking without sign of insanity, he declared that he had been indeed dead, but was ordered back to life, those who brought him being severely chidden by their lord, and sent to fetch Nikander instead, a well-known currier, who was accordingly taken with a fever, and died on the third day.[136] Such stories, old and new, are current

among the Hindus at this day. A certain man's soul, for instance, is carried to the realm of Yama by mistake for a namesake, and is sent back in haste to regain his body before it is burnt; but in the meanwhile he has a glimpse of the hideous punishments of the wicked, and of the glorious life of those who had mortified the flesh on earth, and of suttee-widows now sitting in happiness by their husbands.[137] Mutatis mutandis these tales reappear in Christian mythology, as when Gregory the Great records that a certain nobleman named Stephen died, who was taken to the region of Hades, and saw many things he had heard before but not believed; but when he was set before the ruler there presiding, he sent him back, saying that it was this Stephen's neighbour—Stephen the smith—whom he had commanded to be brought; and accordingly the one returned to life, and the other died.[138]

The thought of human visitors revealing the mysteries of the world beyond the grave, which indeed took no slight hold on Christian belief, attached itself in a remarkable way to the doctrine of Christ's descent into Hades. This dogma had so strongly established itself by the end of the 4th century, that Augustine could ask, 'Quis nisi infidelis negaverit fuisse apud inferos Christum?'[139] A distinct statement of the dogma was afterwards introduced into the symbol commonly called the 'Apostles' Creed:' 'Descendit ad inferos,' 'Descendit ad inferna,' 'He descended into hell.'[140] The Descent into Hades, which had the theological use of providing a theory of salvation applicable to the saints of the old covenant, imprisoned in the limbo of the fathers, is narrated in full in the apocryphal Gospel of Nicodemus, and is made there to rest upon a legend which belongs to the present group of human visits to the other world. It is related that two sons of Simeon, named Charinus and Leucius, rose from their tombs at the Resurrection, and went about silently and prayerfully among men, till Annas and Caiaphas brought them into the synagogue, and charged them to tell of their raising from the dead. Then, making the sign of the cross upon their tongues, the two asked for parchment and wrote their record. They had been set with all their fathers in the depths of Hades, when on a sudden there appeared the colour of the sun like gold, and a purple royal light shining on them; then the patriarchs and prophets, from Adam to Simeon and John the Baptist, rejoicing proclaimed the coming of the light and the fulfilment of the prophecies; Satan and Hades wrangled in strife together; in vain the brazen gates were shut with their iron bars, for the summons came to open the gates that the king of glory may come in, who hath broken the gates of brass and cut the bars of iron in sunder; then the mighty Lord broke the fetters and visited them who sat in darkness and the shadow of death; Adam and his righteous children were delivered from Hades, and led into the glorious grace of Paradise.[141]

Dante, elaborating in the 'Divina Commedia' the conceptions of paradise, purgatory, and hell familiar to the actual belief of his age, describes them once more in the guise of a living visitor to the land of the dead. Echoes in mediæval legend of such exploring expeditions to the world below still linger faintly in the popular belief of Europe. It has been thus with St. Patrick's Purgatory,[142] the cavern in the island of Lough Derg, in the county Donegal, which even in the seventeenth century O'Sullevan could describe first and foremost in his 'Catholic History' as 'the greatest of all memorable things of Ireland.' Mediæval visits to the other world were often made in the spirit. But like Ulysses, Wainamoinen, and Dante, men could here make the journey in body, as did Sir Owain and the monk Gilbert. When the pilgrim had spent fifteen days in prayer and fasting in the church, and had been led with litanies and sprinkling of holy water to the entrance of the purgatory, and the last warnings of the monks had failed to turn him from his venture, the door was closed upon him, and if found next morning, he could tell the events of his awful journey—how he crossed the narrow bridge that spans the river of death, how he saw the hideous torments of hell, and approached the joys of paradise. Sir Owain, one of King Stephen's knights, went thither in penance for his life of violence and rapine, and this was one of the scenes he beheld in purgatory:—

'There come develes other mony mo, And badde the knygth with hem to go, And ladde him into a fowle contreye, Where ever was nygth and never day, For hit was derke and wonther colde: Yette was there never man so bolde, Hadde he never so mony clothes on, But he wolde be colde as ony stone. Wynde herde he none blowe, But faste hit frese bothe hye and lowe. They browgte him to a felde full brode, Overe suche another never he yode, For of the lengthe none ende he knewe Thereover algate he moste nowe. As he wente he herde a crye, He wondered what hit was, and why, He syg ther men and wymmen also That lowde cryed, for hem was woo. They leyen thykke on every londe, Faste nayled bothe fote and honde With nayles glowyng alle of brasse: They ete the erthe so wo hem was; Here face was nayled to the grownde. "Spare," they cryde, "a lytylle stounde." The develes wolde hem not spare: To hem peyne they thowgte yare.'

When Owain had seen the other fields of punishment, with their fiery serpents and toads, and the fires where sinners were hung up by their offending members, and roasted on spits, and basted with molten metal, and turned about on a great wheel of fire, and when he had passed the Devil's Mouth over the awful bridge, he reached the fair white glassy wall of the Earthly Paradise, reaching upward and upward, and saw before him the beautiful gate, whence issued a ravishing perfume. Then he soon forgot his pains and sorrows.

‘As he stode, and was so fayne, Hym thowgth ther come hym agayne A swyde fayr processyoun Of alle manere menne of relygyoun, Fayre vestementes they hadde on, So ryche syg he never none. Myche joye hym thowgte to se Bysshopes yn here dygnité; Ilkone wente other be and be, Every man yn his degré. He syg ther monkes and chanones, And freres with newe shavene crownes; Ermytes he saw there amonge, And nonnes with fulle mery songe; Persones, prestes, and vycaryes; They made fulle mery melodyes. He syg ther kynges and emperoures, And dukes that had casteles and toures, Erles and barones fele, That some tyme hadde the worldes wele. Other folke he syg also, Never so mony as he dede thoo. Wymmen he syg ther that tyde: Myche was the joye ther on every syde: For alle was joye that with hem ferde, And myche solempnyté he herde.’

The procession welcomed Owain, and led him about, showing him the beauties of that country:—

‘Hyt was grene, and fulle of flowres Of mony dyvers colowres; Hyt was grene on every syde, As medewus are yn someres tyde. Ther were trees growyng fulle grene Fulle of fruyte ever more, y wene; For ther was frwyte of mony a kynde, Such yn the londe may no mon fynde. Ther they have the tree of lyfe, Theryn ys myrthe, and never stryfe; Frwyte of wysdom also ther ys, Of the whyche Adam and Eve dede amysse: Other manere frwytes ther were fele, And alle manere joye and wele. Moche folke he syg ther dwelle, There was no tongue that mygth hem telle; Alle were they cloded yn ryche wede, What cloth hit was he kowthe not rede.

There was no wronge, but ever rygth, Ever day and nevere nygth. They shone as brygth and more clere Than ony sonne yn the day doth here.’

The poem, in fifteenth-century English, from which these passages are taken, is a version of the original legend of earlier date, and as such contrasts with a story really dating from early in the fifteenth century—William Staunton’s descent into Purgatory, where the themes of the old sincerely-believed visionary lore are fading into moral allegory, and the traveller sees the gay gold and silver collars and girdles burning into the wearer’s flesh, and the jags that men were clothed in now become adders and dragons, sucking and stinging them, and the fiends drawing down the skin of women’s shoulders into pokes, and smiting into their heads with burning hammers their gay chaplets of gold and jewels turned to burning nails, and so forth. Late in this fifteenth century, St. Patrick’s Purgatory fell into discredit, but even the destruction of the entrance-building, in 1479, by Papal order, did not destroy the ideal road. About 1693, an excavation on the spot brought to light a window with iron stanchions; there was a cry for holy water to keep the spirits from breaking out from prison, and the priest smelt brimstone from the dark cavity below, which, however, unfortunately turned out to be a cellar. In still later times, the yearly pilgrimage of tens of thousands of votaries to the holy place has kept up this interesting survival from the lower culture, whereby a communication may still be traced, if not from Earth to Hades, at least from the belief of the New Zealander to that of the Irish peasant.

To study and compare the ideal regions where man has placed the abodes of departed souls is not an unprofitable task. True, geography has now mapped out into mere earth and water the space that lay beyond the narrower sea and land known to the older nations, and astronomy no longer recognizes the flat earth trodden by men as being the roof of subterranean halls, nor the sky as being a solid firmament, shutting out men’s gaze from strata or spheres of empyræan regions beyond. Yet if we carry our minds back to the state of knowledge among the lower races, we shall not find it hard to understand the early conceptions as to the locality of the regions beyond the grave. They are no secrets of high knowledge made known to sages of old; they are the natural fancies which childlike ignorance would frame in any age. The regularity with which such conceptions repeat themselves over the world bears testimony to the regularity of the processes by which opinion is formed among mankind. At the same time, the student who carefully compares them will find in them a perfect illustration of an important principle, widely applicable to the general theory of the formation of human opinion. When a problem has presented itself to mankind at large, susceptible of a number of solutions about equally plausible, the result is that the several opinions thus produced will be found lying scattered in country after country. The problem here is, given the existence of souls of the dead who from time to time visit the living, where is the home of these ghosts? Why men in one district should have preferred the earth, in another the under-world, in another the sky, as the abode of departed souls, is a question often difficult to answer. But we may at least see how again and again the question was taken in hand, and how out of the three or four available answers some peoples adopted one, some another, some several at once. Primitive theologians had all the world before them where to choose their place of rest for the departed, and they used to the full their speculative liberty.

Firstly, when the land of souls is located on the surface of the earth, there is choice of fit places among wild and cloudy precipices, in secluded valleys, in far-off plains and islands. In Borneo, Mr. St. John visited the heaven of the Idaan race, on the summit of Kina Balu, and the native guides, who feared to pass the night in this abode of spirits, showed the traveller the moss on which the souls

of their ancestors fed, and the footprints of the ghostly buffaloes that followed them. On Gunung Danka, a mountain in West Java, there is such another ‘Earthly Paradise.’ The Sajira who dwell in the district indeed profess themselves Mohammedans, but they secretly maintain their old belief, and at death or funeral they enjoin the soul in solemn form to set aside the Moslem Allah, and to take the way to the dwelling-place of his own forefathers’ souls:—

‘Step up the bed of the river, and cross the neck of land, Where the aren trees stand in a clump, and the pinangs in a row, Thither direct thy steps, Laillah being set aside.’

Mr. Jonathan Rigg had lived ten years among these people, and knew them well, yet had never found out that their paradise was on this mountain. When at last he heard of it, he made the ascent, finding on the top only a few river-stones, forming one of the balai, or sacred cairns, common in the district. But the popular belief, that a tiger would devour the chiefs who permitted a violation of the sacred place, soon received the sort of confirmation which such beliefs receive everywhere, for a tiger killed two children a few days later, and the disaster was of course ascribed to Mr. Rigg’s profanation.[143] The Chilians said that the soul goes westward over the sea to Gulcheman, the dwelling-place of the dead beyond the mountains; life, some said, was all pleasure there, but others thought that part would be happy and part miserable.[144] Hidden among the mountains of Mexico lay the joyous garden-land of Tlalocan, where maize, and pumpkins, and chilis, and tomatos never failed, and where abode the souls of children sacrificed to Tlaloc, its god, and the souls of such as died by drowning or thunderstroke, or by leprosy or dropsy, or other acute disease.[145] A survival of such thought may be traced into mediæval civilization, in the legends of the Earthly Paradise, the fire-girt abode of saints not yet raised to highest bliss, localized in the utmost East of Asia, where earth stretches up towards heaven.[146] When Columbus sailed west-ward across the Atlantic to seek ‘the new heaven and the new earth’ he had read of in Isaiah, he found them, though not as he sought. It is a quaint coincidence that he found there also, though not as he sought it, the Earthly Paradise which was another main object of his venturous quest. The Haitians described to the white men their Coaibai, the paradise of the dead, in the lovely Western valleys of their island, where the souls hidden by day among the cliffs came down at night to feed on the delicious fruit of the mamey-trees, of which the living ate but sparingly, lest the souls of their friends should want.[147]

Secondly, there are Australians who think that the spirit of the dead hovers awhile on earth and goes at last toward the setting sun, or westward over the sea to the island of souls, the home of his fathers. Thus these rudest savages have developed two thoughts which we meet with again and again far onward in the course of culture—the thought of an island of the dead, and the thought that the world of departed souls is in the West, whither the Sun descends at evening to his daily death.[148] Among the North American Indians, when once upon a time an Algonquin hunter left his body behind and visited the land of souls in the sunny south, he saw before him beautiful trees and plants, but found he could walk right through them. Then he paddled in the canoe of white shining stone across the lake where wicked souls perish in the storm, till he reached the beautiful and happy island where there is no cold, no war, no bloodshed, but the creatures run happily about, nourished by the air they breathe.[149] Tongan legend says that, long ago, a canoe returning from Fiji was driven by stress of weather to Bolotu, the island of gods and souls lying in the ocean north-west of Tonga. That island is larger than all theirs together, full of all finest fruits and loveliest flowers, that fill the air with fragrance, and come anew the moment they are plucked; birds of beauteous plumage are there, and hogs in plenty, all immortal save when killed for the gods to eat, and then new living ones appear immediately to fill their places. But when the hungry crew of the canoe landed, they tried in vain to pluck the shadowy bread-fruit, they walked through unresisting trees and houses, even as the souls of chiefs who met them walked unchecked through their solid bodies. Counselled to hasten home from this land of no earthly food, the men sailed to Tonga, but the deadly air of Bolotu had infected them, and they soon all died.[150]

Such ideas took strong hold on classic thought, in the belief in a paradise in the Fortunate Islands of the far Western Ocean. Hesiod in the ‘Works and Days’ tells of the half-gods of the Fourth Age, between the Age of Bronze and the Age of Iron. When death closed on this heroic race, Zeus granted them at the ends of Earth a life and home, apart from man and far from the immortals. There Kronos reigns over them, and they dwell careless in the Islands of the Happy, beside deep-eddying Ocean—blest heroes, for whom the grain-giving field bears, thrice blooming yearly, the honey-sweet fruit:—

‘■νθ’ ■τοι το■ς μ■ν θαν■του τ■λος ■μφεκ■λυψε· Τοῖς δ■ δ■χ’ ■νθρ■πον β■οτον κα■ ■θ■ ■π■σσας Ζε■ς Κρον■δες κατ■νασσε πατ■ρ ■ς πε■ρατα γα■ες, Τηλο■ ■π’ ■θαν■τον· το■σιν Κρ■νος ■μβασιλε■ει· Κα■ το■ μ■ν να■ουσιν ■κηδ■α θυμ■ν ■χοντες ■ν μακ■ρον ν■σοισι παρ’ ■κεαν■ν βαθυδ■νεν, ■λβιοι ■ροες, το■σιν μελιεδ■α καρπ■ν Τρ■ς ■τεος θ■λλοντα φ■ρει ζε■δωρος ■ρουρα.’[151]

These Islands of the Blest, assigned as the abode of blessed spirits of the dead, came indeed to be identified with the Elysian Fields. Thus Pindar sings of steadfast souls, who through three lives on either side have endured free from injustice; then they pass by the road of Zeus to the tower of Kronos, where the ocean breezes blow round the islands of the happy, blazing with golden flowers of land and water. Thus, also, in the famous hymn of Kallistratos in honour of Harmodios and Aristogeiton, who slew the tyrant Hipparchos:—

'Φ■λταθ' ■ρμ■δ■, ο■ τι πω τ■θνηκας Ν■σοις δ' ■ν μακ■ρων σε φασ■ν εἶναι, ■να περ ποδ■κες ■χιλλε■ς, Τυδε■δεν τε φασ■ τ■ν ■σθλ■ν Διομ■δεα.'[152]

This group of legends has especial interest to us Englishmen, who ourselves dwell, it seems, on such an island of the dead. It is not that we or our country are of a more ghostly nature than others, but the idea is geographical we are dwellers in the region of the setting sun, the land of death. The elaborate account by Procopius, the historian of the Gothic War, dates from the 6th century. The island of Brittia, according to him, lies opposite the mouths of the Rhine, some 200 stadia off, between Britannia and Thule, and on it dwell three populous nations, the Angles, Frisians, and Britons. (By Brittia, it appears, he means our Great Britain, his Britannia being the coast-land from modern Brittany to Holland, and his Thule being Scandinavia.) In the course of his history it seems to him needful to record a story, mythic and dreamlike as he thinks, yet which numberless men vouch for as having been themselves witnesses by eye and ear to its facts. This story is that the souls of the departed are conveyed across the sea to the island of Brittia. Along the mainland coast are many villages, inhabited by fishermen and tillers of the soil and traders to this island in their vessels. They are subject to the Franks, but pay no tribute, having from of old had to do by turns the burdensome service of transporting the souls. Those on duty for each night stay at home till they hear a knocking at the doors, and a voice of one unseen calling them to their work. Then without delay rising from their beds, compelled by some unknown power they go down to the beach, and there they see boats, not their own but others, lying ready but empty of men. Going on board and taking the oars, they find that by the burden of the multitude of souls embarked, the vessel lies low in the water, gunwale under within a finger's breadth. In an hour they are at the opposite shore, though in their own boats they would hardly make the voyage in a night and day. When they reach the island, the vessel becomes empty, till it is so light that only the keel touches the waves. They see no man on the voyage, no man at the landing, but a voice is heard that proclaims the name and rank and parentage of each newly arrived passenger, or if women, those of their husbands. Traces of this remarkable legend seem to have survived, thirteen centuries later, in that endmost district of the Britannia of Procopius which still keeps the name of Bretagne. Near Raz, where the narrow promontory stretches westward into the ocean, is the 'Bay of Souls' (boé ann anavo); in the commune of Plouguel the corpse is taken to the churchyard, not by the shorter road by land, but in a boat by the 'Passage de l'Enfer,' across a little arm of the sea; and Breton folk-lore holds fast to the legend of the Curé de Braspar, whose dog leads over to Great Britain the souls of the departed, when the wheels of the soul-car are heard creaking in the air. These are but mutilated fragments, but they seem to piece together with another Keltic myth, told by Macpherson in the last century, the voyage of the boat of heroes to Flath-Innis, Noble Island, the green island home of the departed, which lies calm amid the storms far in the Western Ocean. With full reason, also, Mr. Wright traces to the situation of Ireland in the extreme West its especial association with legends of descents to the land of shades. Claudian placed at the extremity of Gaul the entrance where Ulysses found a way to Hades—

'Est locus extremum qua pandit Gallia litus, Oceani prætentus aquis, ubi fertur Ulysses,' &c.

No wonder that this spot should have been since identified with St. Patrick's Purgatory, and that some ingenious etymologist should have found in the name of 'Ulster' a corruption of 'Ulyssisterra,' and a commemoration of the hero's visit.[153]

Thirdly, the belief in a subterranean Hades peopled by the ghosts of the dead is quite common among the lower races. The earth is flat, say the Italmen of Kamchatka, for if it were round, people would fall off; it is the wrong side of another heaven, which covers another earth below, whither the dead will go down to their new life, and so, as Steller says, their mundane system is like a tub with three bottoms.[154] In North America, the Tacullis held that the soul goes after death into the bowels of the earth, whence it can come back in human shape to visit friends.[155] In South America, Brazilian souls travel down to the world below in the West, and Patagonian souls will depart to enjoy eternal drunkenness in the caves of their ancestral deities.[156] The New Zealander who says 'The sun has returned to Hades' (kua hoki mai te Ra ki te Rua), simply means that it has set. When a Samoan Islander dies, the host of spirits that surround the house, waiting to convey his soul away, set out with him crossing the land and swimming the sea, to the entrance of the spirit-world. This is at the westernmost point of the westernmost island, Savaii, and there one may see the two circular holes or basins where souls descend, chiefs by the bigger and plebeians by the smaller, into the regions of the under-world. There below is a heaven, earth, and sea, and people with real bodies, planting, fishing, cooking, as in the present life; but at night their bodies become like a confused collection of fiery sparks, and in this state during the hours of darkness they come up to revisit

their former abodes, retiring at dawn to the bush or to the lower regions.[157] For the state of thought on this subject among rude African tribes, it is enough to cite the Zulus, who at death will descend to live in Hades among their ancestors, the 'Abapansi,' the 'people underground.'[158] Among rude Asiatic tribes, such an example may be taken from the Karens. They are not quite agreed where Plu, the land of the dead, is situate; it may be above the earth or beyond the horizon. But the dominant and seemingly indigenous opinion is that it is below the earth. When the sun sets on earth, it rises in the Karen Hades, and when it sets in Hades it rises in this world. Here, again, the familiar belief of the European peasant is found; the spirits of the dead may come up from the land of shades by night, but at daybreak must return.[159]

Such ideas, developed by uncultured races, may be followed up in various detail, through the stage of religion represented by the Mexican and Peruvian nations,[160] into higher ranges of culture. The Roman Orcus was in the bowels of the earth, and when the 'lapis manalis,' the stone that closed the mouth of the world below, was moved away on certain solemn days, the ghosts of the dead came up to the world above, and partook of the offerings of their friends.[161] Among the Greeks, the Land of Hades was in the world below, nor was the thought unknown that it was the sunset realm of the Western god (πρ■ς ■σπ■ρου θεο■). What Hades seemed like to the popular mind, Lucian thus describes:—'The great crowd, indeed, whom the wise call "idiots," believing Homer and Hesiod, and the other myth-makers about these things, and setting up their poetry as a law, have supposed a certain deep place under the earth, Hades, and that it is vast, and roomy, and gloomy, and sunless, and how thought to be lighted up so as to behold every one within, I know not.'[162] In the ancient Egyptian doctrine of the future life, modelled on solar myth, the region of the departed combines the under-world and the west, Amenti; the dead passes the gate of the setting sun to traverse the roads of darkness, and behold his father Osiris; and with this solar thought the Egyptian priests, representing in symbolic ceremony the scenes of the other world, carried the corpse in the sacred boat across to the burial-place, on the western side of the sacred lake.[163] So, too, the cavernous Sheol of the Israelites, the shadowy region of departed souls, lay deep below the earth. Through the great Aryan religious systems, Brahmanism, Zarathustrism, Buddhism, and onward into the range of Islam and of Christianity, subterranean hells of purgatory or punishment make the doleful contrast to heavens of light and glory.

It is, however, a point worthy of special notice that the conception of hell as a fiery abyss, so familiar to the religions of the higher civilization, is all but unknown to savage thought, so much so that if met with, its genuineness is doubtful. Captain John Smith's 'History of Virginia,' published in 1624, contains two different accounts of the Indians' doctrine of a future life. Smith's own description is of a land beyond the mountains, toward sunset, where chiefs and medicine-men in paint and feathers shall smoke, and sing, and dance with their forefathers, while the common people have no life after death, but rot in their graves. Heriot's description is of tabernacles of the gods to which the good are taken up to perpetual happiness, while the wicked are carried to 'Popogusso,' a great pit which they think to be at the furthest parts of the world where the sun sets, and there burn continually.[164] Now knowing so much as we do of the religion of the Algonquins, to whom these Virginians belonged, we may judge that while the first account is genuinely native, though perhaps not quite correctly understood, the second was borrowed by the Indians from the white men themselves. Yet even here the touch of solar myth is manifest, and the description of the fiery abyss in the region of sunset may be compared with one from our own country, in the Anglo-Saxon dialogue of Saturn and Solomon. 'Saga me forhwan byth seo sunne read on æfen? Ic the secge, forthon heo locath on helle.—Tell me, why is the sun red at even? I tell thee, because she looketh on hell.'[165] To the same belief belongs another striking mythic feature. The idea of volcanos being mouths of the under-world seems not unexampled among the lower races, for we hear of certain New Zealanders casting their dead down into a crater.[166] But in connexion with the thought of a gehenna of fire and brimstone, Vesuvius, Etna, and Hecla had spiritual as well as material terrors to the mind of Christendom, for they were believed to be places of purgatory or the very mouths of the pit where the souls of the damned were cast down.[167] The Indians of Nicaragua used in old times to offer human sacrifices to their volcano Masaya, flinging the corpses into the crater, and in later years, after the conversion of the country, we hear of Christian confessors sending their penitents to climb the mountain, and (as a glimpse of hell) to look down upon the molten lava.[168]

Fourthly, in old times and new, it has come into men's minds to fix upon the sun and moon as abodes of departed souls. When we have learnt from the rude Natchez of the Mississippi and the Apalaches of Florida that the sun is the bright dwelling of departed chiefs and braves, and have traced like thoughts on into the theologies of Mexico and Peru, then we may compare these savage doctrines with Isaac Taylor's ingenious supposition in his 'Physical Theory of Another Life,'—the sun of each planetary system is the house of the higher and ultimate spiritual corporeity, and the centre of assembly to those who have passed on the planets their preliminary era of corruptible organization. Or perhaps some may prefer the Rev. Tobias Swinden's book, published in the last century, and translated into French and German, which proved the sun to be hell, and its dark spots gatherings of damned souls.[169] And when in South America the Saliva Indians have pointed out the moon, their paradise where no mosquitos are, and the Guaycurus have shown it as the home of chiefs and medicine-men deceased, and the Polynesians of Tokelau in like manner

have claimed it as the abode of departed kings and chiefs, then these pleasant fancies may be compared with Plutarch's description of the virtuous souls who after purification in the middle space gain their footing on the moon, and there are crowned as victors.[170] The converse notion of the moon as the seat of hell, has been elaborated in profoundest bathos by Mr. M. F. Tupper:

'I know thee well, O Moon, thou cavern'd realm, Sad Satellite, thou giant ash of death, Blot on God's firmament, pale home of crime, Scarr'd prison-house of sin, where damned souls Feed upon punishment. Oh, thought sublime, That amid night's black deeds, when evil prowls Through the broad world, thou, watching sinners well, Glarest o'er all, the wakeful eye of—Hell!'

Skin for skin, the brown savage is not ill matched in such speculative lore with the white philosopher.

Fifthly, as Paradise on the face of the earth, and Hades beneath it where the sun goes down, are regions whose existence is asserted or not denied by savage and barbaric science, so it is with Heaven. Among the examples which display for us the real course of knowledge among mankind, and the real relation which primitive bears to later culture, the belief in the existence of a firmament is one of the most instructive. It arises naturally in the minds of children still, and in accordance with the simplest childlike thought, the cosmologies of the North American Indians[171] and the South Sea Islanders[172] describe their flat earth arched over by the solid vault of heaven. Like thoughts are to be traced on through such details as the Zulu idea that the blue heaven is a rock encircling the earth, inside which are the sun, moon, and stars, and outside which dwell the people of heaven; the modern negro's belief that there is a firmament stretched above like a cloth or web; the Finnish poem which tells how Ilmarinen forged the firmament of finest steel, and set in it the moon and stars.[173] The New Zealander, with his notion of a solid firmament, through which the waters can be let down on earth through a crack or hole from the reservoir of rain above, could well explain the passage in Herodotus concerning that place in North Africa where, as the Libyans said, the sky is pierced, as well as the ancient Jewish conception of a firmament of heaven, 'strong as a molten mirror,' with its windows through which the rain pours down in deluge from the reservoirs above, windows which late Rabbinical literature tells us were made by taking out two stars.[174] In nations where the theory of the firmament prevails, accounts of bodily journeys or spiritual ascents to heaven are in general meant not as figure, but as fact. Among the lower races, the tendency to localize the region of departed souls above the sky seems less strong than that which leads them to place their world of the dead on or below the earth's surface. Yet some well-marked descriptions of a savage Heaven are on record, the following, and others to be cited presently. Even some Australians seem to think of going up to the clouds at death, to eat and drink, and hunt and fish as here.[175] In North America, the Winnebagos placed their paradise in the sky, where souls travel along that 'Path of the Dead' which we call the Milky Way; and working out the ever-recurring solar idea, the modern Iroquois speak of the soul going upward and westward, till it comes out on the beauteous plains of heaven, with people and trees and things as on earth.[176] In South America the Guarayos, representatives in some sort of the past condition of the Guarani race, worship Tamoi the Grandfather, the Ancient of Heaven; he was their first ancestor, who lived among them in old days and taught them to till the ground; then rising to heaven in the East he disappeared, having promised to be the helper of his people on earth, and to transport them, when they died, from the top of a sacred tree into another life, where they shall find their kindred and have hunting in plenty, and possess all that they possessed on earth; therefore it is that the Guarayos adorn their dead, and burn their weapons for them, and bury them with their faces to the East, whither they are to go.[177] Among American peoples whose culture rose to a higher level than that of these savage tribes, we hear of the Peruvian Heaven, the glorious 'Upper World,' and of the temporary abode of Aztec warriors on heavenly wooded plains, where the sun shines when it is night on earth, wherefore it was a Mexican saying that the sun goes at evening to lighten the dead.[178] What thoughts of heaven were in the minds of the old Aryan poets, this hymn from the Rig-Veda may show:—

'Where there is eternal light, in the world where the sun is placed, in that immortal imperishable world place me, O Soma! Where king Vaivasvata reigns, where the secret place of heaven is, where these mighty waters are, there make me immortal! Where life is free, in the third heaven of heavens, where the worlds are radiant, there make me immortal! Where wishes and desires are, where the place of the bright sun is, where there is freedom and delight, there make me immortal! Where there is happiness and delight, where joy and pleasure reside, where the desires of our desire are attained, there make me immortal!'[179]

In such bright vague thoughts from the poet's religion of nature, or in cosmic schemes of ancient astronomy, with their artificial glories of barbaric architecture exaggerated in the skies, or in the raptures of mystic vision, or in the calmer teaching of the theologic doctrine of a future life, descriptions of realms of blessed souls in heaven are to be followed through the religions of the Brahman, the Buddhist, the Parsi, the later Jew, the Moslem, and the Christian.

For the object, not of writing a handbook of religions, but of tracing the relation which the religion of savages bears to the religion of cultured nations, these details are enough to show the general line of human thought regarding the local habitations of departed

souls. It seems plain from the most cursory inspection of these various localizations, however much we may consider them as inherited or transmitted from people to people in the complex movements of theological history, that they are at any rate not derived from any single religion accepted among ancient or primæval men. They bear evident traces of independent working out in the varied definition of the region of souls, as on earth among men, on earth in some distant country, below the earth, above or beyond the sky. Similar ideas of this kind are found in different lands, but this similarity seems in large measure due to independent recurrence of thoughts so obvious. Not less is independent fancy compatible with the ever-recurring solar myth in such ideas, placing the land of Death in the land of Evening or of Night, and its entrance at the gates of Sunset. Barbaric poets of many a distant land must have gazed into the West to read the tale of Life and Death, and tell it of Man. If, however, we look more closely into the stages of intellectual history to which these theories of the Future World belong, it will appear that the assignment of the realm of departed souls to the three great regions, Earth, Hades, Heaven, has not been uniform. Firstly, the doctrine of a land of souls on Earth belongs widely and deeply to savage culture, but dwindles in the barbaric stage, and survives but feebly into the mediæval. Secondly, the doctrine of a subterranean Hades holds as large a place as this in savage belief, and has held it firmly along the course of higher religions, where, however, this under-world is looked on less and less as the proper abode of the dead, but rather as the dismal place of purgatory and hell. Lastly, the doctrine of a Heaven, floored upon a firmament, or placed in the upper air, seems in early savage belief less common than the other two, but yields to neither of them in its vigorous retention by the thought of modern nations. These local theories appear to be taken, firstly and mostly, in the most absolute literal sense, and although, under the influence of physical science, much that was once distinctly-meant philosophy has now passed among theologians into imagery and metaphor, yet at low levels of knowledge the new canons of interpretation find little acceptance, and even in modern Europe the rude cosmology of the lower races in no small measure retains its place.

Turning now to consider the state of the departed in these their new homes, we have to examine the definitions of the Future Life which prevail through the religions of mankind. In these doctrines there is much similarity caused by the spreading of established beliefs into new countries, and also much similarity that is beyond what such transmission can account for. So there is much variety due to local colour and circumstance, and also much variety beyond the reach of such explanation. The main causes of both similarity and variety seem to lie far deeper, in the very origin and inmost meaning of the doctrines. The details of the future life, among the lower races and upwards, are no heterogeneous mass of arbitrary fancies. Classified, they range themselves naturally round central ideas, in groups whose correspondence seems to indicate the special course of their development. Amongst the pictures into which this world has shaped its expectations of the next, two great conceptions are especially to be discerned. The one is that the future life is, as it were, a reflexion of this; in a new world, perhaps of dreamy beauty, perhaps of ghostly gloom, men are to retain their earthly forms and their earthly conditions, to have around them their earthly friends, to possess their earthly property, to carry on their earthly occupations. The other is that the future life is a compensation for this, where men's conditions are re-allotted as the consequence, and especially as the reward or punishment, of their earthly life. The first of these two ideas we may call (with Captain Burton) the 'continuance-theory,' contrasting with it the second as the 'retribution-theory.' Separately or combined, these two doctrines are the keys of the subject, and by grouping typical examples under their two headings, it will be possible to survey systematically man's most characteristic schemes of his life beyond the grave.

To the doctrine of Continuance belongs especially the savage view of the spirit-land, that it is as the dream-land where the souls of the living so often go to visit the souls of the dead. There the soul of the dead Karen, with the souls of his axe and cleaver, builds his house and cuts his rice; the shade of the Algonquin hunter hunts souls of beaver and elk, walking on the souls of his snow-shoes over the soul of the snow; the fur-wrapped Kamchadal drives his dog-sledge; the Zulu milks his cows and drives his cattle to kraal; South American tribes live on, whole or mutilated, healthy or sick, as they left this world, leading their old lives, and having their wives with them again, though indeed, as the Araucanians said, they have no more children, for they are but souls.[180] Soul-land is dream-land in its shadowy unreal pictures, for which, nevertheless, material reality so plainly furnished the models, and it is dream-land also in its vivid idealization of the soberer thoughts and feelings of waking life.

'There was a time when meadow, grove, and stream, The earth, and every common sight, To me did seem Apparell'd in celestial light, The glory and the freshness of a dream.'

Well might the Mohawk Indian describe the good land of paradise, as he had seen it in a dream. The shade of the Ojibwa follows a wide and beaten path that leads toward the West, he crosses a deep and rapid water, and reaching a country full of game and all things the Indian covets, he joins his kindred in their long lodge.[181] So, on the southern continent, the Bolivian Yuracarés will go, all of them, to a future life where there will be plenty of hunting, and Brazilian forest-tribes will find a pleasant forest full of calabash-trees and game, where the souls of the dead will live happily in company.[182] The Greenlanders hoped that their

souls—pale, soft, disembodied forms which the living could not grasp—would lead a life better than that of earth, and never ceasing. It might be in heaven, reached by the rainbow, where the souls pitch their tents round the great lake rich in fish and fowl, the lake whose waters above the firmament overflowing make rain on earth, and if its banks broke, there would be another deluge. But gaining the most and best of their living from the depths of the sea, they were also apt to think the land of Torngarsuk to be below the sea or earth, and to be entered by the deep holes in the rocks. Perpetual summer is there, ever beauteous sunshine, and no night, good water and superfluity of birds and fish, seals and reindeer to be caught without difficulty, or found alive seething in a great kettle.[183] In the Kimbunda country of South-West Africa, souls live on in 'Kalunga,' the world where it is day when it is night here; and with plenty of food and drink, and women to serve them, and hunting and dancing for pastime, they lead a life which seems a corrected edition of this.[184] On comparison of these pictures of the future life with such as have expressed the longings of more cultured nations, there appear indeed different details, but the principle is ever the same—the idealization of earthly good. The Norseman's ideal is sketched in the few broad touches which show him in Walhalla, where he and the other warriors without number ride forth arrayed each morning and hew each other on Odin's plain, till the slain have been 'chosen' as in earthly battle, and meal-tide comes, and slayers and slain mount and ride home to feast on the everlasting boar, and drink mead and ale with the Æsir.[185] To understand the Moslem's mind, we must read the two chapters of the Koran where the Prophet describes the faithful in the garden of delights, reclining on their couches of gold and gems, served by children ever young, with bowls of liquor whose fumes will not rise into the drinkers' heads, living among the thornless lotus-trees and date-palms loaded to the ground, feasting on the fruits they love and the meat of the rarest birds, with the houris near them with beautiful black eyes, like pearls in the shell, where no idle or wicked speech is heard, but only the words 'Peace, Peace.'

'They who fear the judgment of God shall have two gardens. Which of the benefits of God will ye deny? Adorned with groves. Which of the benefits of God will ye deny? In each of them shall spring two fountains. Which of the benefits of God will ye deny? In each of them shall grow two kinds of fruits. Which of the benefits of God will ye deny? They shall lie on carpets brocaded with silk and embroidered with gold; the fruits of the two gardens shall be near, easy to pluck. Which of the benefits of God will ye deny? There shall be young virgins with modest looks, unprofaned by man or jinn. Which of the benefits of God will ye deny? They are like jacinth and coral. Which of the benefits of God will ye deny? What is the recompence of good, if not good? Which of the benefits of God will ye deny?' &c.[186]

With these descriptions of Paradise idealized on secular life, it is interesting to compare others which bear the impress of a priestly caste, devising a heaven after their manner. We can almost see the faces of the Jewish rabbis settling their opinions about the high schools in the firmament of heaven, where Rabbi Simeon ben Yochai and the great Rabbi Eliezer teach Law and Talmud as they taught when they were here below, and masters and learners go prosing on with the weary old disputations of cross question and crooked answer that pleased their souls on earth.[187] Nor less suggestively do the Buddhist heavens reflect the minds of the ascetics who devised them. As in their thoughts sensual pleasure seemed poor and despicable in comparison with mystic inward joy, rising and rising till consciousness fades in trance, so, above their heavens of millions of years of mere divine happiness, they raised other ranges of heavens where sensual pain and pleasure cease, and enjoyment becomes intellectual, till at a higher grade even bodily form is gone, and after the last heaven of 'Neither-consciousness-nor-unconsciousness' there follows Nirwâna, as ecstasy passes into swoon.[188]

But the doctrine of the continuance of the soul's life has another and a gloomier side. There are conceptions of an abode of the dead characterized not so much by dreaminess as by ghostliness. The realm of shades, especially if it be a cavern underground, has seemed a dim and melancholy place to the dwellers in this 'white world,' as the Russian calls the land of the living. One description of the Hurons tells how the other world, with its hunting and fishing, its much-prized hatchets and robes and necklaces, is like this world, yet day and night the souls groan and lament.[189] Thus the region of Mictlan, the subterranean land of Hades whither the general mass of the Mexican nation, high and low, expected to descend from the natural death-bed, was an abode looked forward to with resignation, but scarcely with cheerfulness. At the funeral the survivors were bidden not to mourn too much, the dead was reminded that he had passed and suffered the labours of this life, transitory as when one warms himself in the sun, and he was bidden to have no care or anxiety to return to his kinsfolk now that he has departed for ever and aye, for his consolation must be that they too will end their labours, and go whither he has gone before.[190] Among the Basutos, where the belief in a future life in Hades is general, some imagine in this underworld valleys ever green, and herds of hornless speckled cattle owned by the dead; but it seems more generally thought that the shades wander about in silent calm, experiencing neither joy nor sorrow. Moral retribution there is none.[191] The Hades of the West African seems no ecstatic paradise, to judge by Captain Burton's description: 'It was said of the old Egyptians that they lived rather in Hades than upon the banks of the Nile. The Dahomans declare that this world is man's plantation, the next is his home,—a home which, however, no one visits of his own accord. They of course

own no future state of rewards and punishment: there the King will be a King, and the slave a slave for ever. Ku-to-men, or Deadman's land, the Dahoman's other but not better world, is a country of ghosts, of umbræ, who, like the spirits of the nineteenth century in Europe, lead a quiet life, except when by means of mediums they are drawn into the drawing-rooms of the living.' With some such hopeless expectation the neighbours of the Dahomans, the Yorubas, judge the life to come in their simple proverb that 'A corner in this world is better than a corner in the world of spirits.'[192] The Finns, who feared the ghosts of the departed as unkind, harmful beings, fancied them dwelling with their bodies in the grave, or else, with what Castrén thinks a later philosophy, assigned them their dwelling in the subterranean Tuonela. Tuonela was like this upper earth, the sun shone there, there was no lack of land and water, wood and field, tilth and meadow, there were bears and wolves, snakes and pike, but all things were of a hurtful, dismal kind, the woods dark and swarming with wild beasts, the water black, the cornfields bearing seed of snakes' teeth, and there stern pitiless old Tuoni, and his grim wife and son with the hooked fingers with iron points, kept watch and ward over the dead lest they should escape.[193] Scarce less dismal was the classic ideal of the dark realm below, whither the shades of the dead must go to join the many gone before (■ς πλε■νων ■κ■σθαι; penetrare ad plures; andare tra i più). The Roman Orcus holds the pallid souls, rapacious Orcus, sparing neither good nor bad. Gloomy is the Greek land of Hades, dark dwelling of the images of departed mortals, where the shades carry at once their living features and their dying wounds, and glide and cluster and whisper, and lead the shadow of a life. Like the savage hunter on his ghostly prairie, the great Orion still bears his brazen mace, still chases over the meadows of asphodel the flying beasts he slew of yore in the lonely mountains. Like the rude African of to-day, the swift-footed Achilles scorns such poor, thin, shadowy life; rather would he serve a mean man upon earth than be lord of all the dead.

'Truly, oxen and goodly sheep may be taken for booty, Tripods, too, may be bought, and the yellow beauty of horses; But from the fence of the teeth when once the soul is departed, Never cometh it back, regained by plunder or purchase.'[194]

Where and what was Sheol, the dwelling of the ancient Jewish dead? Of late years the Biblical critic has no longer to depend on passages of the Old Testament for realizing its conception, so plainly is it connected with the seven-circled Irkalla of the Babylonian-Assyrian religion, the gloomy subterranean abode whence there is no return for man, though indeed the goddess Isthar passed through its seven gates, and came back to earth from her errand of saving all life from destruction. In the history of religions, few passages are more instructive than those in which the prophets of the Old Testament recognize the ancestral connexion of their own belief with the national religions of Babylon-Assyria, as united in the doctrine of a gloomy prison of ghosts, through whose gates Jew and Gentile alike must pass. Sheol (■■■■ from ■■■) is, as its name implies, a cavernous recess, yet it is no mere surface-grave or tomb, but an under-world of awful depth: 'High as Heaven, what doest thou? deeper than Sheol, what knowest thou?' Asshur and all her company, Elam and all her multitude, the mighty fallen of the uncircumcised, lie there. The great king of Babylon must go down:—

'Sheol from beneath is moved because of thee, to meet thee at thy coming: He rouseth for thee the mighty dead, all the great chiefs of the earth; He maketh to rise up from their thrones, all the kings of the nations. All of them shall accost thee, and shall say unto thee: Art thou, even thou too, became weak as we? Art thou made like unto us?'

To the Greek Septuagint, _Sheol_ was _Hades_, and for this the Coptic translators had their long-inherited Egyptian name of _Amenti_, while the Vulgate renders it as _Infernus_, the lower regions. The Gothic Ulfilas, translating the Hades of the New Testament, could use _Halja_ in its old German sense of the dim shadowy home of the dead below the earth; and the corresponding word _Hell_, if this its earlier sense be borne in mind, fairly translates Sheol and Hades in the English version of the Old and New Testament, though the word has become misleading to uneducated ears by being used also in the sense of Gehenna, the place of torment. The early Hebrew historians and prophets, holding out neither the hope of everlasting glory nor the fear of everlasting agony as guiding motives for man's present life, lay down little direct doctrine of a future state, yet their incidental mentions justify the translators who regard Sheol as Hades. Sheol is a special locality where dead men go to their dead ancestors: 'And Isaac gave up the ghost, and died, and was gathered unto his people ... and his sons Esau and Jacob buried him.' Abraham, though not even buried in the land of his forefathers, is thus 'gathered unto his people;' and Jacob has no thought of his body being laid with Joseph's body, torn by wild beasts in the wilderness, when he says, 'I shall go down to my son mourning to Sheol ('ε■ς ■δου' in the LXX., 'èpesët èàmenti' in the Coptic, 'in infernum' in the Vulgate). The rephaim, the 'shades' of the dead, who dwell in Sheol, love not to be disturbed from their rest by the necromancer; 'And Samuel said to Saul, why hast thou disquieted me to bring me up?' Yet their quiet is contrasted in a tone of sadness with the life on earth; 'Whatsoever thy hand findeth to do, do it with thy might; for there is no work, nor device, nor knowledge, nor wisdom, in Sheol, whither thou goest.'[195] Such thoughts of the life of the shades below did not disappear when, in the later years of the Jewish nation, the great change in the doctrine of the future life

passed in so large a measure over the Hebrew mind, their earlier thoughts of ghostly continuance giving place to the doctrines of resurrection and retribution. The ancient ideas have even held their place on into Christian thought, in pictures like that of the Limbus Patrum, the Hades where Christ descended to set free the patriarchs.

The Retribution-theory of the future life comprises in a general way the belief in different grades of future happiness, especially in different regions of the other world allotted to men according to their lives in this. This doctrine of retribution is, as we have already seen, far from universal among mankind, many races recognizing the idea of a spirit outliving the body, without considering the fate of this spirit to depend at all upon the conduct of the living man. The doctrine of retribution indeed hardly seems an original part of the doctrine of the future life. On the contrary, if we judge that men in a primitive state of culture arrived at the notion of a surviving spirit, and that some races, but by no means all, afterwards reached the further stage of recognizing a retribution for deeds done in the body, this theory will not, so far as I know, be discountenanced by facts.[196] Even among the higher savages, however, a connexion between man's life and his happiness or misery after death is often held as a definite article of theology, and thence it is to be traced onward through barbaric religions, and into the very heart of Christianity. Yet the grounds of good and evil in the future life are so far from uniform among the religions of the world, that they may differ widely within what is considered one and the same creed. The result is more definite than the cause, the end than the means. Men who alike look forward to a region of unearthly happiness beyond the grave, hope to reach that happy land by roads so strangely different, that the path of life which leads one nation to eternal bliss may seem to the next the very descent into the pit. In noticing among savage and barbaric peoples the qualifications which determine future happiness, we may with some distinctness define these as being excellence, valour, social rank, religious ordinance. On the whole, however, in the religions of the lower range of culture, unless where they may have been affected by contact with higher religions, the destiny of the man after death seems hardly to turn on judicial reward or punishment for his moral conduct in life. Such difference as is made between the future conditions of different classes of souls, seems more often to belong to a remarkable intermediate doctrine, standing between the earlier continuance-theory and the later retribution-theory. The idea of the next life being similar to this seems to have developed into the idea that what gives prosperity and renown here will give it also there, so that earthly conditions carry on their contrasts into the changed world after death. Thus a man's condition after death will be a result of, rather than a compensation or retribution for, his condition during life. A comparison of doctrines held at various stages of culture may justify a tentative speculation as to their actual sequence in history, favouring the opinion that through such an intermediate stage the doctrine of simple future existence was actually developed into the doctrine of future reward and punishment, a transition which for deep import to human life has scarcely its rival in the history of religion.

The effect of earthly rank on the future life, as looked at by the lower races, brings out this intermediate stage in bold relief. Mere transfer from one life to another makes chiefs and slaves here chiefs and slaves hereafter, and this natural doctrine is very usual. But there are cases in which earthly caste is exaggerated into utter difference in the life to come. The aerial paradise of Raiatea, with its fragrant ever-blooming flowers, its throngs of youths and girls all perfection, its luxurious feasts and merrymakings, were for the privileged orders of Areois and chiefs who could pay the priests their heavy charges, but hardly for the common populace. This idea reached its height in the Tonga islands, where aristocratic souls would pass to take their earthly rank and station in the island paradise of Bolotu, while plebeian souls, if indeed they existed, would die with the plebeian bodies they dwelt in.[197] In Vancouver's Island, the Ahts fancied Quawteaht's calm sunny plenteous land in the sky as the resting-place of high chiefs, who live in one great house as the Creator's guests, while the slain in battle have another to themselves. But otherwise all Indians of low degree go deep down under the earth to the land of Chay-her, with its poor houses and no salmon and small deer, and blankets so small and thin that when the dead are buried the friends often bury blankets with them, to send them to the world below with the departed soul.[198] The expectation of royal dignity in the life after death, distinct from the fate of ordinary mortals, comes well into view among the Natchez of Louisiana, where the sun-descended royal family would in some way return to the Sun; thus also in the mightier empire of Peru, where each sun-descended Inca, feeling the approach of death, announced to his assembled vassals that he was called to heaven to rest with his father the Sun.[199] But in the higher religions, the change in this respect from the doctrine of continuance to the doctrine of retribution is wonderful in its completeness. The story of that great lady who strengthened her hopes of future happiness by the assurance, 'They will think twice before they refuse a person of my condition,' is a mere jest to modern ears. Yet, like many other modern jest, it is only an archaism which in an older stage of culture had in it nothing ridiculous.

To the happy land of Torngarsuk the Great Spirit, says Cranz, only such Greenlanders came as have been valiant workers, for other ideas of virtue they have none; such as have done great deeds, taken many whales and seals, borne much hardship, been drowned at sea, or died in childbirth.[200] Thus Charlevoix says of the Indians further south, that their claim to hunt after death on the prairies of eternal spring is to have been good hunters and warriors here. Lescarbot, speaking of the belief among the Indians of Virginia that after death the good will be at rest and the wicked in pain, remarks that their enemies are the wicked and

themselves the good, so that in their opinion they are after death much at their ease, and principally when they have well defended their country and slain their enemies.[201] So Jean de Lery said of the rude Tubinambas of Brazil, that they think the souls of such as have lived virtuously, that is to say, who have well avenged themselves and eaten many of their enemies, will go behind the great mountains and dance in beautiful gardens with the souls of their fathers, but the souls of the effeminate and worthless, who have not striven to defend their country, will go to Aygnan the Evil Spirit, to incessant torments.[202] More characteristic and probably more genuinely native than most of these expectations, is that of the Caribs, that the braves of their nation should go after death to happy islands, where all good fruits grow wild, there to spend their time in dancing and feasting, and to have their enemies the Arawaks for slaves; but the cowards who feared to go to war should go to serve the Arawaks, dwelling in their waste and barren lands beyond the mountains.[203]

The fate of warriors slain in battle is the subject of two singularly contrasted theories. We have elsewhere examined the deep-lying belief that if a man's body be wounded or mutilated, his soul will arrive in the same state in the other world. Perhaps it is some such idea of the soul being injured with the body by a violent death, that leads the Mintira of the Malay Peninsula, though not believing in a future reward and punishment, to exclude from the happy paradise of 'Fruit Island' (Pulo Bua) the souls of such as die a bloody death, condemning them to dwell on 'Red Land' (Tana Mera), a desolate barren place, whence they must even go to the fortunate island to fetch their food.[204] In North America, the idea is mentioned among the Hurons that the souls of the slain in war live in a band apart, neither they nor suicides being admitted to the spirit-villages of their tribe. A belief ascribed to certain Indians of California may be cited here, though less as a sample of real native doctrine than to illustrate that borrowing of Christian ideas which so often spoils such evidence for ethnological purposes. They held, it is said, that Niparaya, the Great Spirit, hates war, and will have no warriors in his paradise, but that his adversary Wac, shut up for rebellion in a great cave, takes thither to himself the slain in battle.[205] On the other hand, the thought which shows out in such bold relief in the savage mind, that courage is virtue, and battle and bloodshed the hero's noblest pursuit, leads naturally to a hope of glory for his soul when his body has been slain in fight. Such expectation was not strange in North America, to that Indian tribe, for instance, who talked of the Great Spirit walking in the moonlight on his island in Lake Superior, whither slain warriors will go to him to take their pleasure in the chace.[206] The Nicaraguans declared that men who died in their houses went underground, but the slain in war went to serve the gods in the east, where the sun comes from. This corresponds in part with a remarkable threefold contrast of the future life among their Aztec kinsfolk. Mictlan, the Hades of the general dead, and Tlalocan, the Earthly Paradise, reached by certain special and acute ways of death, have been mentioned here already. But the souls of warriors slain in battle or sacrificed as captives, and of women who died in child-birth, were transported to the heavenly plains; there the heroes, peeping through the holes in their bucklers pierced by arrows in earthly fight, watched the Sun arise and saluted him with shout and clash of arms, and at noon the mothers received him with music and dance to escort him on his western way.[207] In such wise, to the old Norseman, to die the 'straw-death' of sickness or old age was to go down into the dismal loathly house of Hela the Death-goddess; if the warrior's fate on the field of battle were denied him, and death came to fetch him from a peaceful couch, yet at least he could have the scratch of the spear, Odin's mark, and so contrive to go with a blood-stained soul to the glorious Walhalla. Surely then if ever, says a modern writer, the kingdom of heaven suffered violence, and the violent took it by force.[208] Thence we follow the idea onward to the battle-fields of holy war, where the soldier earned with his blood the unfading crown of martyrdom, and Christian and Moslem were urged in mutual onset and upheld in agony by the glimpse of paradise opening to receive the slayer of the infidel.

Such ideas, current among the lower races as to the soul's future happiness or misery, do not seem, setting aside some exceptional points, to be thoughts adopted or degraded from doctrines of cultured nations. They rather belong to the intellectual stratum in which they are found. If so, we must neither ignore nor exaggerate their standing in the lower ethics. 'The good are good warriors and hunters,' said a Pawnee chief; whereupon the author who mentions the saying remarks that this would also be the opinion of a wolf, if he could express it.[209] Nevertheless, if experience has led societies of savage men to fix on certain qualities, such as courage, skill, and industry, as being virtues, then many moralists will say that such a theory is not only ethical, but lying at the very foundation of ethics. And if these savage societies further conclude that such virtues obtain their reward in another world as in this, then their theories of future happiness and misery, destined for what they call good and bad men, may be looked on in this sense as belonging to morality, though at no high stage of development. But many or most writers, when they mention morality, assume a narrower definition of it. This must be borne in mind in appreciating what is meant by the statements of several well-qualified ethnologists, who have, in more or less degree, denied a moral character to the future retribution as conceived in savage religion. Mr. Ellis, describing the Society Islanders, at least gives an explicit definition. When he tried to ascertain whether they connected a person's condition in a future state with his disposition and conduct in this, he never could learn that they expected in the world of spirits any difference in the treatment of a kind, generous, peaceful man, and that of a cruel, parsimonious,

quarrelsome one.[210] This remark, it seems to me, applies to savage religion far and wide. Dr. Brinton, commenting on the native religions of America, draws his line in a somewhat different place. Nowhere, he says, was any well-defined doctrine that moral turpitude was judged and punished in the next world. No contrast is discoverable between a place of torments and a realm of joy; at the worst but a negative castigation awaited the liar, the coward, or the niggard.[211] Professor J. G. Müller, in his 'American Religions,' yet more pointedly denies any 'ethical meaning' in the contrasts of the savage future life, and looks upon what he well calls its 'light-side' and 'shadow-side' not as recompensing earthly virtue and vice, but rather as carrying on earthly conditions in a new existence.[212]

The idea that admission to the happier region depends on the performance of religious rites and the giving of offerings, seems scarcely known to the lowest savages. It is worth while, however, to notice some statements which seem to mark its appearance at the level of high savagery or low barbarism. Thus in the Society Islands, though the destiny of man's spirit to the region of night or to elysium was irrespective of moral character, we hear of neglect of rites and offerings as being visited by the displeasure of deities.[213] In Florida, the belief of the Sun-worshipping people of Achalaque was thus described: those who had lived well, and well served the Sun, and given many gifts to the poor in his honour, would be happy after death and be changed into stars, whereas the wicked would be carried to a destitute and wretched existence among mountain precipices, where fierce wild beasts have their dens.[214] According to Bosman, the souls of Guinea negroes reaching the river of death must answer to the divine judge how they have lived; have they religiously observed the holy days dedicated to their god, have they abstained from all forbidden meats and kept their vows inviolate, they are wafted across to paradise; but if they have sinned against these laws they are plunged in the river and there drowned for ever.[215] Such statements among peoples at these stages of culture are not frequent, and perhaps not very valid as accounts of original native doctrine. It is in the elaborate religious systems of more organized nations, in modern Brahmanism and Buddhism, and degraded forms of Christianity, that the special adaptation of the doctrine of retribution to the purposes of priestcraft and ceremonialism has become a commonplace of missionary reports.

It is well not to speak too positively on a subject so difficult and doubtful as this of the history of the belief in future retribution. Careful criticism of the evidence is above all necessary. For instance, we have to deal with several statements recorded among low races, explicitly assigning reward or punishment to men after death, according as they were good or bad in life. Here the first thing to be done is to clear up, if possible, the question whether the doctrine of retribution may have been borrowed from some more cultured neighbouring religion, as the very details often show to have been the case. Examples of direct adoption of foreign dogmas on this subject are not uncommon in the world. When among the Dayaks of Borneo it is said that a dead man becomes a spirit and lives in the jungle, or haunts the place of burial or burning, or when some distant mountain-top is pointed to as the abode of spirits of departed friends, it is hardly needful to question the originality of ideas so characteristically savage. But one of these Dayak tribes, burning the dead, says that 'as the smoke of the funeral pile of a good man rises, the soul ascends with it to the sky, and that the smoke from the pile of a wicked man descends, and his soul with it is borne down to the earth, and through it to the regions below.'[216] Did not this exceptional idea come into the Dayak's mind by contact with Hinduism? In Orissa, again, Khond souls have to leap across the black unfathomable river to gain a footing on the slippery Leaping Rock, where Dinga Pennu, the judge of the dead, sits writing his register of all men's daily lives and actions, sending virtuous souls to become blessed spirits, keeping back wicked ones and sending them to suffer their penalties in new births on earth.[217] Here the striking myth of the leaping rock is perfectly savage, but the ideas of a judgment, moral retribution, and transmigration, may have come from the Hindus of the plains, as the accompanying notion of the written book unquestionably did. Dr. Mason is no doubt right in taking as the indigenous doctrine of the Karens their notion of an under-world where the ghosts of the dead live on as here, while he sets down to Hindu influence the idea of Tha-ma, the judge of the dead (the Hindu Yama), as allotting their fate according to their lives, sending those who have done deeds of merit to heaven, those who have done wickedness to hell, and keeping in Hades the neither good nor bad.[218] How the theory of moral retribution may be superposed on more primitive doctrines of the future life, comes remarkably into view in Turanian religion. Among the Lapps, Jabme-Aimo, the subterranean 'home of the dead' below the earth, where the departed have their cattle and follow their livelihood like Lapps above, though they are richer, wiser, stronger folk, and also Saivo-Aimo, a yet happier 'home of the gods,' are conceptions thoroughly in the spirit of the lower culture. But in one account the subterranean abode becomes a place of transition, where the dead stay awhile, and then with bodies renewed are taken up to the Heaven-god, or if misdoers, are flung into the abyss. Castrén is evidently right in rejecting this doctrine as not native, but due to Catholic influence. So, at the end of the 16th Rune of the Finnish Kalewala, which tells of Wainamoinen's visit to the dismal land of the dead, there is put into the hero's mouth a second speech, warning the children of men to harm not the innocent, for sad payment is in Tuoni's dwelling—the bed of evil-doers is there, with its glowing red-hot stones below and its canopy of snakes above. But the same critic condemns this moral 'tag,' as a later addition to the genuine heathen picture of Manala, the under-world of the dead.[219] Nor did

Christianity scorn to borrow details from the religions it abolished. The narrative of a mediæval visit to the other world would be incomplete without its description of the awful Bridge of Death; Acheron and Charon's bark were restored to their places in Tartarus by the visionary and the poet; the wailing of sinful souls might be heard as they were hammered white-hot in Vulcan's smithies; and the weighing of good and wicked souls, as we may see it figured on every Egyptian mummy-case, now passed into the charge of St. Paul and the Devil.[220]

The foregoing considerations having been duly weighed, it remains to call attention to the final problem, at what state of religious history the full theological doctrine of judicial retribution and moral compensation in a future life may have arisen. It is hard, however, to define where this development takes place even at a barbaric stage of culture. Thus among the barbaric nations of West Africa, there appear such beliefs as that in Nuffi, that criminals who escape their punishment here will receive it in the other world; the division of the Yoruba under-world into an upper and a lower region for the righteous and wicked; the Kru doctrine that only the good will rejoin their ancestors in heaven; the Oji doctrine that only the good will dwell after death in the heavenly house or city of the Deity whom they call the 'Highest.'[221] How far is all this to be taken as native conception, and how far as due to ages of Christian and Moslem intercourse, to which at any rate few will scruple to refer the last case?

In the lower ranges of civilization, some of the most remarkable doctrines of this class are recorded in North America. Thus they appear in connexion with the fancy of a river or gulf to be passed by the departing soul on its way to the land of the dead, one of the most remarkable traits of the mythology of the world. This seems in its origin a nature-myth, connected probably with the Sun's passage across the sea into Hades, and in many of its versions it appears as a mere episode of the soul's journey without any moral sense attached to it. Brebeuf, the same early Jesuit missionary who says explicitly of the Hurons that there is no difference in their future life between the fate of the virtuous and the vicious, mentions also among them the tree-trunk that bridges the river of death; here the dead must cross, the dog that guards it attacks some souls, and they fall. Yet in other versions this myth has a moral sense attached to it, and the passage of the heaven-gulf becomes an ordeal to separate good and wicked. To take but one instance, there is Catlin's account of the Choctaw souls journeying far westward, to whom the long slippery barkless pine-log, stretching from hill to hill, bridges over the deep and dreadful river; the good pass safely to a beauteous Indian paradise, the wicked fall into the abyss of waters, and go the dark hungry wretched land where they are henceforth to dwell.[222] This and many similar beliefs current in the religions of the world, which need not be particularised here, seem best explained as originally nature-myths, afterwards adapted to a religious purpose. A different conception was recorded so early as 1623, by Captain John Smith among the Massachusetts, whose name is still borne by the New England district they once inhabited: They say, at first there was no king but Kiehtan, that dwelleth far westerly above the heavens, whither all good men go when they die, and have plenty of all things. The bad men go thither also and knock at the door, but he bids them go wander in endless want and misery, for they shall not stay there.[223] Lastly, the Salish Indians of Oregon say that the good go to a happy hunting-ground of endless game, while the bad go to a place where there is eternal snow, hunger, and thirst, and are tantalised by the sight of game they cannot kill, and water they cannot drink.[224] If, now, in looking at these records, the doubts which beset them can be put aside, and the accounts of the different fates assigned to the good and wicked can be accepted as belonging to genuine native American religion and if, moreover, it be considered that the goodness and wickedness for which men are to be thus rewarded and punished are moral qualities, however undeveloped in definition, this will amount to an admission that the doctrine of moral retribution at any rate appears within the range of savage theology. Such a view, however, by no means invalidates the view here put forward as to the historical development of the doctrine, but only goes to prove at how early a stage it may have begun to take place. The general mass of evidence still remains to show the savage doctrine of the future state, as originally involving no moral retribution, or arriving at this through transitional and rudimentary stages.

In strong contrast with the schemes of savage future existence, I need but set before the reader's mind a salient point here and there in the doctrine of distinct and unquestionable moral retribution, as held in religions of the higher culture. The inner mystic doctrines of ancient Egypt may perhaps never be extracted now from the pictures and hieroglyphic formulas of the 'Book of the Dead.' But the ethnographer may satisfy himself of two important points as to the place which the Egyptian view of the future life occupies in the history of religion. On the one hand, the soul's quitting and revisiting the corpse, the placing of the image in the tomb, the offering of meat and drink, the fearful journey to the regions of the departed, the renewed life like that on earth, with its houses to dwell in and fields to cultivate—all these are conceptions which connect the Egyptian religion with the religions of the ruder races of mankind. But on the other hand, the mixed ethical and ceremonial standard by which the dead are to be judged adapts these primitive and even savage thoughts to a higher social development, such as may be shown by fragments from that remarkable 'negative confession' which the dead must make before Osiris and the forty-two judges in Amenti. 'O ye Lords of Truth! let me know you!... Rub ye away my faults. I have not privily done evil against mankind.... I have not told falsehoods in the tribunal

of Truth.... I have not done any wicked thing. I have not made the labouring man do more than his task daily.... I have not calumniated the slave to his master.... I have not murdered.... I have not done fraud to men. I have not changed measures of the country. I have not injured the images of the gods. I have not taken scraps of the bandages of the dead. I have not committed adultery. I have not withheld milk from the mouths of sucklings. I have not hunted wild animals in the pasturages. I have not netted sacred birds.... I am pure! I am pure! I am pure!'[225]

The Vedic hymns, again, tell of endless happiness for the good in heaven with the gods, and speak also of the deep pit where the liars, the lawless, they who give no sacrifice, will be cast.[226] The rival theories of continuance and retribution are seen in instructive coexistence in classic Greece and Rome. What seems the older belief holds its ground in the realm of Hades; that dim region of bodiless, smoke-like ghosts remains the home of the undistinguished crowd in the μ■σος β■ος, the 'middle life.' Yet at the same time the judgment-seat of Minos and Rhadamanthos, the joys of Elysium for the just and good, fiery Tartarus echoing with the wail of the wicked, represent the newer doctrine of a moral retribution. The idea of purgatorial suffering, which hardly seems to have entered the minds of the lower races, expands in immense vigour in the great Aryan religions of Asia. In Brahmanism and Buddhism, the working out of good and evil actions into their necessary consequence of happiness and misery is the very key to the philosophy of life, whether life's successive transmigrations be in animal, or human, or demon births on earth, or in luxurious heaven-palaces of gold and jewels, or in the agonizing hells where Oriental fancy riots in the hideous inventory of torture—caldrons of boiling oil and liquid fire; black dungeons and rivers of filth; vipers, and vultures, and cannibals; thorns, and spears, and red-hot pincers, and whips of flame. To the modern Hindu, it is true, ceremonial morality seems to take the upper hand, and the question of happiness or misery after death turns rather on ablutions and fasts, on sacrifices and gifts to brahmans, than on purity and beneficence of life. Buddhism in South East Asia, sadly degenerate from its once high estate, is apt to work out the doctrine of merit and demerit into debtor and creditor accounts kept in good and bad marks from day to day; to serve out so much tea in hot weather counts 1 to the merit-side, and putting a stop to one's women scolding for a month counts 1 likewise, but this may be balanced by the offence of letting them keep the bowls and plates dirty for a day, which counts 1 the wrong way; and it appears that giving wood for two coffins, which count 30 marks each, and burying four bones, at 10 marks a-piece, would just be balanced by murdering a child, which counts 100 to the bad.[227] It need hardly be said here that these two great religions of Asia must be judged rather in their records of long past ages, than in the lingering degeneration of their modern reality.

In the Khordah-Avesta, a document of the old Persian religion, the fate of good and wicked souls at death is pictured in a dialogue between Zarathustra (Zoroaster), and Ahura-Mazda and Anra-Mainyu (Ormuzd and Ahriman). Zarathustra asks,'Ahura-Mazda, Heavenly, Holiest, Creator of the corporeal world, Pure! When a pure man dies, where does his soul dwell during this night?' Then answers Ahura-Mazda: 'Near his head it sits down, reciting the Gâthâ Ustavaiti, praying happiness for itself; "Happiness be to the man who conduces to the happiness of each. May Ahura-Mazda create, ruling after his wish."' On this night the soul sees as much joyfulness as the whole living world possesses; and so the second and the third night. When the lapse of the third night turns itself to light, then the soul of the pure man goes forward, recollecting itself by the perfume of plants. A wind blows to meet it from the mid-day regions, a sweet-scented one, more sweet-scented than the other winds, and the soul of the pure man receives it—'Whence blows this wind, the sweetest-scented which I ever have smelt with the nose?' Then comes to meet him his own law (his rule of life) in the figure of a maiden beautiful, shining, with shining arms, powerful, well-grown, slender, large-bosomed, with praiseworthy body, noble, with brilliant face, one of fifteen years, as fair in her growth as the fairest creatures. Then to her speaks the soul of the pure man, asking, 'What maiden art thou whom I have seen here as the fairest of maidens in body?' She answers, 'I am, O youth, thy good thoughts, words, and works, thy good law, the own law of thine own body. Thou hast made the pleasant yet pleasanter to me, the fair yet fairer, the desirable yet more desirable, the sitting in a high place sitting in a yet higher place.' Then the soul of the pure man takes the first step and comes to the first paradise, the second and third step to the second and third paradise, the fourth step and arrives at the Eternal Lights. To the soul speaks a pure one deceased before, asking it, 'How art thou, O pure deceased, come away from the fleshly dwellings, from the corporeal world hither to the invisible, from the perishable world hither to the imperishable. Hail! has it happened to thee long?' 'Then speaks Ahura-Mazda: "Ask not him whom thou askest, for he is come on the fearful way of trembling, the separation of body and soul. Bring him hither of the food, of the full fatness, that is the food for a youth who thinks, speaks, and does good, who is devoted to the good law after death—that is the food for a woman who especially thinks good, speaks good, does good, the following, obedient, pure after death."' And now Zarathustra asks, when a wicked one dies, where his soul dwells? He is told how, running about near the head, it utters the prayer, Ke maúm:—'Which land shall I praise, whither shall I go praying, O Ahura-Mazda?' In this night it sees as much unjoyfulness as the whole living world; and so the second and the third night, and it goes at dawn to the impure place, recollecting itself by the stench. An evil-smelling wind comes towards the dead from the north, and with it the ugly hateful maiden who is his own wicked deeds, and the soul takes the

fourth step into the darkness without beginning, and a wicked soul asks how long—woe to thee!—art thou come? and the mocking Anra-Mainyu, answering in words like the words of Ahura-Mazda to the good, bids food to be brought—poison, and mixed with poison, for them who think and speak and do evil, and follow the wicked law. The Parsi of our own time, following in obscure tradition the ancient Zoroastrian faith, before he prays for forgiveness for all that he ought to have thought, and said, and done, and has not, for all that he ought not to have thought, and said, and done, and has, confesses thus his faith of the future life:—'I am wholly without doubt in the existence of the good Mazadayaçnian faith, in the coming of the resurrection and the later body, in the stepping over the bridge Chinvat, in an invariable recompense of good deeds and their reward, and of bad deeds and their punishment.'[228]

In Jewish theology, the doctrine of future retribution appears after the Babylonish captivity, not in ambiguous terms, but as the strongly-expressed and intensely-felt religious conviction it has since remained among the children of Israel. Not long afterward, it received the sanction of Christianity.

A broad survey of the doctrine of the Future Life among the various nations of the world shows at once how difficult and how important is a systematic theory of its development. Looked at ethnographically, the general relations of the lower to the higher culture as to the belief in future existence may be defined somewhat as follows:—If we draw a line dividing civilization at the junction of savagery and barbarism—about where the Carib and New Zealander ends and the Aztec or Tatar begins, we may see clearly the difference of prevalent doctrine on either side. On the savage side, the theory of hovering ghosts is strong, rebirth in human or animal bodies is often thought of, but above all there prevails the expectation of a new life, most often located in some distant earthly region, or less commonly in the under-world or on the sky. On the cultured side, the theory of hovering ghosts continues, but tends to subside from philosophy into folklore, the theory of re-birth is elaborated into great philosophic systems, but eventually dies out under the opposition of scientific biology, while the doctrine of a new life after death maintains its place with immense power in the human mind, although the dead have been ousted by geography from any earthly district, and the regions of heaven and hell are more and more spiritualized out of definite locality into vague expressions of future happiness and misery. Again, on the savage side we find the dominant idea to be a continuance of the soul in a new existence, like the present life, or idealized and exaggerated on its model; while on the cultured side the doctrine of judgment and moral retribution prevails with paramount, though not indeed absolute sway. What, then, has been the historical course of theological opinion, to have produced in different stages of culture these contrasted phases of doctrine?

In some respects, theories deriving savage from more civilized ideas are tenable. In certain cases, to consider a particular savage doctrine of the future state as a fragmentary, or changed, or corrupted outcome of the religion of higher races, seems as easy as to reverse this view by taking savagery as representing the starting-point. It is open to anyone to suppose that the doctrine of transmigration among American savages and African barbarians may have been degraded from elaborate systems of metempsychosis established among philosophic nations like the Hindus; that the North American and South African doctrine of continued existence in a subterranean world may be derived from similar beliefs held by races at the level of the ancient Greeks; that when rude tribes in the Old or New World assign among the dead a life of happiness to some, and of misery to others, this idea may have been inherited or adopted from cultured nations holding more strongly and systematically the doctrine of retribution. In such cases the argument is to a great extent the same, whether the lower race be considered degenerate descendants of a higher nation, or whether the simpler supposition be put forward that they have adopted the ideas of some more cultured people. These views ought to have full attention, for degenerate and borrowed beliefs form no small item in the opinions of uncivilized races. Yet this kind of explanation is more adapted to meet special cases than general conditions; it is rather suited to piecemeal treatment, than to comprehensive study, of the religions of mankind. Worked out on a large scale, it would endeavour to account for the doctrines of the savage world, as being a patchwork of fragments from various religions of high nations, transported by not easily-conceived means from their distant homes and set down in remote regions of the earth. It may be safely said that no hypothesis can account for the varied doctrines current among the lower tribes, without the admission that religious ideas have been in no small measure developed and modified in the districts where they are current.

Now this theory of development, in its fullest scope, combined with an accessory theory of degeneration and adoption, seems best to meet the general facts of the case. A hypothesis which finds the origin of the doctrine of the future life in the primitive animism of the lower races, and thence traces it along the course of religious thought, in varied developments fitted to exacter knowledge and forming part of loftier creeds, may well be maintained as in reasonable accordance with the evidence. Such a theory, as has been sufficiently shown in the foregoing chapters, affords a satisfactory explanation of the occurrence, in the midst of cultured religions, of intellectually low superstitions, such as that of offerings to the dead, and various others. These, which the development theory

treats naturally as survivals from a low stage of education lingering on in a higher, are by no means so readily accounted for by the degeneration theory. There are more special arguments which favour the priority of the savage to the civilized phases of the doctrine of a future life. If savages did in general receive their views of another existence from the religious systems of cultured nations, these systems can hardly have been such as recognize the dominant doctrines of heaven and hell. For, as to the locality of the future world, savage races especially favour a view little represented in civilized belief, namely, that the life to come is in some distant earthly country. Moreover, the belief in a fiery abyss or Gehenna, which excites so intensely and lays hold so firmly of the imagination of the most ignorant men, would have been especially adapted to the minds of savages, had it come down to them by tradition from an ancestral faith. Yet, in fact, the lower races so seldom recognize such an idea, that even the few cases in which it occurs lie open to suspicion of not being purely native. The proposition that the savage doctrines descend from the more civilized seems thus to involve the improbable supposition, that tribes capable of keeping up traditions of Paradise, Heaven, or Hades, should nevertheless have forgotten or discarded a tradition of Hell. Still more important is the contrast between the continuance-theory and the retribution-theory of the future existence, in the sections of culture where they respectively predominate. On the one hand, the continuance-theory, with its ideas of a ghostly life like this, is directly vouched for by the evidence of the senses in dreams and visions of the dead, and may be claimed as part of the ‘Natural Religion,’ properly so called, of the lower races. On the other hand, the retribution-theory is a dogma which this evidence of apparitions could hardly set on foot, though capable of afterwards supporting it. Throughout the present study of animistic religion, it constantly comes into view that doctrines which in the lower culture are philosophical, tend in the higher to become ethical; that what among savages is a science of nature, passes among civilized nations into a moral engine. Herein lies the distinction of deepest import between the two great theories of the soul’s existence after bodily death. According to a development theory of culture, the savage, unethical doctrine of continuance would be taken as the more primitive, succeeded in higher civilization by the ethical doctrine of retribution. Now this theory of the course of religion in the distant and obscure past is conformable with experience of its actual history, so far as this lies within our knowledge. Whether we compare the early Greek with the later Greek, the early Jew with the later Jew, the ruder races of the world in their older condition with the same races as affected by the three missionary religions of Buddhism, Mohammedanism, Christianity, the testimony of history vouches for the like transition towards ethical dogma.

In conclusion, though theological argument on the actual validity of doctrines relating to the future life can have no place here, it will be well not to pass by without further remark one great practical question which lies fairly within the province of Ethnography. How, in the various stages of culture, has the character and conduct of the living been affected by the thought of a life to come? If we take the savage beliefs as a starting-point, it will appear that these belong rather to speculative philosophy than to practical rule of life. The lower races hold opinions as to a future state because they think them true, but it is not surprising that men who take so little thought of a contingency three days off, should receive little practical impulse from vague anticipations of a life beyond the grave. Setting aside the consideration of possible races devoid of all thought of a future existence, there unquestionably has been and is a great mass of mankind whose lives are scarcely affected by such expectations of another life as they do hold. The doctrine of continuance, making death as it were a mere journey into a new country, can have little direct action on men’s conduct, though indirectly it has indeed an enormous and disastrous influence on society, leading as it does to the slaughter of wives and slaves, and the destruction of property, for the use of the dead in the next world. If this world to come be thought a happier region, the looking forward to it makes men more willing to risk their lives in battle, promotes the habit of despatching the sick and aged into a better life, and encourages suicide when life is very hateful here. When the half-way house between continuance and retribution is reached, and the idea prevails that the manly virtues which give rank and wealth and honour here will lead hereafter to yet brighter glory, then this belief must add new force to the earthly motives which make bold warriors and mighty chiefs. But among men who expect to become hovering ghosts at death, or to depart to some gloomy land of shades, such expectation strengthens the natural horror and hatred of dissolution. They tend toward the state of mind frequent among modern Africans, whose thought of death is that he shall drink no more rum, wear no more fine clothes, have no more wives. The negro of our own day would feel to the utmost the sense of those lines in the beginning of the Iliad, which describe the heroes’ ‘souls’ being cast down to Hades, but ‘themselves’ left a prey to dogs and carrion birds.

Rising to the level of the higher races, we mark the thought of future existence taking a larger and larger place in the convictions of religion, the expectation of a judgment after death gaining in intensity and becoming, what it scarcely seems to the savage, a real motive in life. Yet this change is not to be measured as proceeding throughout in any direct proportion with the development of culture. The doctrine of the future life has hardly taken deeper and stronger root in the higher than in the middle levels of civilization. In the language of ancient Egypt, it is the dead who are emphatically called the ‘living,’ for their life is everlasting, whether in the world of the departed, or nearer home in the tomb, the ‘eternal dwelling.’ The Moslem says that men sleep in life and wake in death;

the Hindu likens the body which a soul has quitted to the bed he rises from in the morning. The story of the ancient Getæ, who wept at births and laughed at funerals, embodies an idea of the relation of this life to the next which comes to the surface again and again in the history of religion, nowhere perhaps touched in with a lighter hand than in the Arabian Nights' tale where Abdallah of the Sea indignantly breaks off his friendship with Abdallah of the Land, when he hears that the dwellers on the land do not feast and sing when one of them dies, like the dwellers in the sea, but mourn and weep and tear their garments. Such thoughts lead on into the morbid asceticism that culminates in the life of the Buddhist saint, eating his food with loathing from the alms-bowl that he carries as though it held medicine, wrapping himself in grave-clothes from the cemetery, or putting on his disfigured robe as though it were a bandage to cover a sore, whose looking forward is to death for deliverance from the misery of life, whose dreamiest hope is that after an inconceivable series of successive existences he may find in utter dissolution and not-being a refuge even from heaven.

The belief in future retribution has been indeed a powerful engine in shaping the life of nations. Powerful both for good and evil, it has been made the servant-of-all-work of many faiths. Priesthoods have used it unscrupulously for their professional ends, to gain wealth and power for their own caste, to stop intellectual and social progress beyond the barriers of their consecrated systems. On the banks of the river of death, a band of priests has stood for ages to bar the passage against all poor souls who cannot satisfy their demands for ceremonies, and formulas, and fees. This is the dark side of the picture. On the bright side, as we study the moral standards of the higher nations, and see how the hopes and fears of the life to come have been brought to enforce their teachings, it is plain that through most widely differing religions the doctrine of future judgment has been made to further goodness and to check wickedness, according to the shifting rules by which men have divided right from wrong. The philosophic schools which from classic times onward have rejected the belief in a future existence, appear to have come back by a new road to the very starting-point which perhaps the rudest races of men never quitted. At least this seems true as regards the doctrine of future retribution, which is alike absent from the belief of classes of men at the two extremes of culture. How far the moral standard of life may have been adjusted throughout the higher races with reference to a life hereafter, is a problem difficult of solution, so largely do unbelievers in this second life share ethical principles which have been more or less shaped under its influence. Men who live for one world or for two, have high motives of virtue in common; the noble self-respect which impels them to the life they feel worthy of them; the love of goodness for its own sake and for its immediate results; and beyond this, the desire to do good that shall survive the doer, who will not indeed be in the land of the living to see his work, but who can yet discount his expectations into some measure of present satisfaction. Yet he who believes that his thread of life will be severed once and for ever by the fatal shears, well knows that he wants a purpose and a joy in life, which belong to him who looks for a life to come. Few men feel real contentment in the expectation of vanishing out of conscious existence, henceforth, like the great Buddha, to exist only in their works. To remain incarnate in the memory of friends is something. A few great spirits may enjoy in the reverence of future ages a thousand years or so of 'subjective immortality;' though as for mankind at large, the individual's personal interest hardly extends beyond those who have lived in his time, while his own memory scarce outlives the third and fourth generation. But over and above these secular motives, the belief in immortality extends its powerful influence through life, and culminates at the last hour, when, setting aside the very evidence of their senses, the mourners smile through their tears, and say it is not death but life.

Footnote 120:

Williams, 'Fiji,' vol. i. p. 239; Seemann, 'Viti,' p. 398.

Footnote 121:

Arbousset and Daumas, p. 347; Casalis, p. 247.

Footnote 122:

Brasseur, 'Mexique,' vol. iii. p. 20, &c.

Footnote 123:

See 'The Buke of John Mandeuill,' 31, edited by Geo. F. Warner, published by the Roxburghe Club, 1889; Yule, 'Cathay,' Hakluyt Soc. (Note to 3rd ed.)

Footnote 124:

Wuttke, 'Volksaberglaube,' p. 215. Other cases in Bastian, 'Mensch,' vol. ii. pp. 58, 369, &c.

Footnote 125:

Schoolcraft, ‘Algic Res.’ vol. ii. pp. 32, 64, and see ante, vol. i. p. 312.

Footnote 126:

Steller, ‘Kamtschatka,’ p. 271; Klemm, ‘C. G.’ vol. ii. p. 312.

Footnote 127:

Kalewala, Rune xvi.; see Schiefner’s German Translation, and Castrén, ‘Finn. Myth.’ pp. 128, 134. A Slavonic myth in Hanusch, p. 412.

Footnote 128:

Homer. Odyss. xi. On the vivification of ghosts by sacrifice of blood, and on libations of milk and blood, see Meiners, vol. i. p. 315, vol. ii. p. 89; J. G. Müller, p. 85; Rochholz, ‘Deutscher Glaube und Brauch,’ vol. i. p. 1, &c.

Footnote 129:

See for example, various details in Bastian, ‘Mensch,’ vol. ii. pp. 369-75, &c.

Footnote 130:

See vol. i. p. 481; also below, p. 52, note. Tanner’s ‘Narr.’ p. 290; Schoolcraft, ‘Indian Tribes,’ part iii. p. 233; Keating, vol. ii. p. 154; Loskiel, part i. p. 35; Smith, ‘Virginia,’ in Pinkerton, vol. xiii. p. 14. See Cranz, ‘Grönland,’ p. 269.

Footnote 131:

Callaway, ‘Zulu Tales,’ vol. i. pp. 316-20.

Footnote 132:

Shortland, ‘Traditions of New Zealand,’ p. 150; R. Taylor, ‘New Zealand,’ p. 423. The idea, of which the classic representative belongs to the myth of Persephone, that the living who tastes the food of the dead may not return, and which is so clearly stated in this Maori story, appears again among the Sioux of North America. Ahak-tah (‘Male Elk’) seems to die, but after two days comes down from the funeral-scaffold where his body had been laid, and tells his tale. His soul had travelled by the path of braves through the beautiful land of great trees and gay loud-singing birds, till he reached the river, and saw the homes of the spirits of his forefathers on the shore beyond. Swimming across, he entered the nearest house, where he found his uncle sitting in a corner. Very hungry, he noticed some wild rice in a bark dish. ‘I asked my uncle for some rice to eat, but he did not give it to me. Had I eaten of the food for spirits, I never should have returned to earth.’ Eastman, ‘Dacotah,’ p. 177.

Footnote 133:

Castrén, ‘Finn. Myth.’ p. 139, &c.

Footnote 134:

Bosman, ‘Guinea,’ Letter 19, in Pinkerton, vol. xvi. p. 501; Burton, ‘Dahome,’ vol. ii. p. 158. For modern visits to hell and heaven by Christianized negro visionaries in America, see Macrae, ‘Americans at Home,’ vol. ii. p. 91.

Footnote 135:

Lucian. Philopseudes, c. 17-28.

Footnote 136:

Plutarch. De Sera Numinis Vindicta, xxii.; and in Euseb. Præp. Evang. xi. 36.

Footnote 137:

Ward, ‘Hindoos,’ vol. ii. p. 63.

Footnote 138:

Gregor. Dial. iv. 36. See Calmet, vol. ii. ch. 49.

Footnote 139:

Augustin. Epist. clxiv. 2.

Footnote 140:

See Pearson, ‘Exposition of the Creed;’ Bingham, ‘Ant. Ch. Ch.’ book x. ch. iii. Art. iii. of the Church of England was reduced to its present state by Archbp. Parker’s revision.

Footnote 141:

Codex Apocr. N. T. Evang. Nicod. ed. Giles. ‘Apocryphal Gospels,’ &c. tr. by A. Walker; ‘Gospel of Nicodemus.’ The Greek and Latin texts differ much.

Footnote 142:

The following details mostly from T. Wright, ‘St. Patrick’s Purgatory’ (an elaborate critical dissertation on the mediæval legends of visits to the other world).

Footnote 143:

St. John, ‘Far East,’ vol. i. p. 278. Rigg. in ‘Journ. Ind. Archip.’ vol. iv. p. 119. See also Ellis, ‘Polyn. Res.’ vol. i. p. 397; Bastian, ‘Oestl. Asien,’ vol. i. p. 83; Irving, ‘Astoria,’ p. 142.

Footnote 144:

Molina, ‘Chili,’ vol. ii. p. 89.

Footnote 145:

Brasseur, ‘Mexique,’ vol. iii. p. 496; Sahagun, iii. App. c. 2, x. c. 29; Clavigero, vol. ii. p. 5.

Footnote 146:

See Wright, l.c. &c.; Alger, p. 391; &c.

Footnote 147:

‘History of Colon,’ ch. 61; Pet. Martyr. Dec. i. lib. ix.; Irving, ‘Life of Columbus,’ vol. ii. p. 121.

Footnote 148:

Stanbridge in ‘Tr. Eth. Soc.’ vol. i. p. 299; G. F. Moore, ‘Vocab. W. Austr.’ p. 83; Bonwick, ‘Tasmanians,’ p. 181.

Footnote 149:

Schoolcraft, ‘Indian Tribes,’ part i. p. 321; see part iii. p. 229.

Footnote 150:

Mariner, ‘Tonga Is.’ vol. ii. p. 107. See also Burton, ‘W. and W. fr. W. Africa,’ p. 154 (Gold Coast).

Footnote 151:

Hesiod. Opera et Dies, Pindar, Olymp. ii. antistr. 4. Callistrat. Hymn. in Ilgen, Scolia Græca, 10. Strabo, iii. 2, 13; Plin. iv. 36.

Footnote 152:

Loc. cit.

Footnote 153:

Procop. De Bello Goth. iv. 20; Plut. Fragm. Comm. in Hesiod. 2; Grimm, ‘D. M.’ p. 793; Hersart de Villemarqué, vol. i. p. 136; Souvestre, ‘Derniers Bretons,’ p. 37; Jas. Macpherson, ‘Introd. to Hist. of Great Britain and Ireland,’ 2nd ed. London, 1772, p. 180; Wright, ‘St. Patrick’s Purgatory,’ pp. 64, 129.

Footnote 154:

Steller, ‘Kamtschatka,’ p. 269.

Footnote 155:

Harmon, ‘Journal,’ p. 299; see Lewis and Clarke, p. 139 (Mandans).

Footnote 156:

J. G. Müller, ‘Amer. Urrelig.’ pp. 140, 287; see Humboldt and Bonpland, ‘Voy.’ vol. iii. p. 132; Falkner, ‘Patagonia,’ p. 114.

Footnote 157:

Taylor, ‘New Zealand,’ p. 232; Turner, ‘Polynesia,’ p. 235.

Footnote 158:

Callaway, ‘Zulu Tales,’ vol. i. p. 317, &c.; Arbousset and Daumas, p. 474. See also Burton, ‘Dahome,’ vol. ii. p. 157.

Footnote 159:

Mason, ‘Karens,’ l.c. p. 195; Cross, l.c. p. 313. Turanian examples in Castrén, ‘Finn. Myth.’ p. 119.

Footnote 160:

See below, pp. 79, 85.

Footnote 161:

Festus, s.v. ‘manalis,’ &c.

Footnote 162:

Sophocl. Œdip. Tyrann. 178; Lucian. De Luctu, 2. See classic details in Pauly, ‘Real-Encyclop.’ art. ‘inferi.’

Footnote 163:

Birch in Bunsen’s ‘Egypt,’ vol. v.; Wilkinson, ‘Ancient Eg.’ vol. ii. p. 368; Alger, p. 101.

Footnote 164:

Smith, ‘History of Virginia,’ in ‘Works’ ed. by Arber; Pinkerton, vol. xiii. pp. 14, 41; vol. xii. p. 604; see below, p. 95.

Footnote 165:

Thorpe, ‘Analecta Anglo-Saxonica,’ p. 115.

Footnote 166:

Schirren, p. 151. See Taylor, ‘N. Z.’ p. 525.

Footnote 167:

Meiners, vol. ii. p. 781; Maury, ‘Magie,’ &c. p. 170.

Footnote 168:

Oviedo, ‘Nicaragua,’ p. 160; Brinton, p. 288.

Footnote 169:

J. G. Müller, ‘Amer. Urrel.’ p. 138, see also 220 (Caribs), 402 (Peru), 505, 660 (Mexico); Brinton, ‘Myths of New World,’ p. 233; Taylor, ‘Physical Theory,’ ch. xvi.; Alger, ‘Future Life,’ p. 590; see also above, p. 16, note.

Footnote 170:

Humboldt and Bonpland, ‘Voy.’ vol. v. p. 90; Martius, ‘Ethnog. Amer.’ vol. i. p. 233; Turner, ‘Polynesia,’ p. 531; Plutarch. De Facie in Orbe Lunæ; Bastian, ‘Psychologie,’ pp. 80, 89 (souls in stars).

Footnote 171:

See Schoolcraft, ‘Indian Tribes,’ part i. pp. 269, 311; Smith, ‘Virginia,’ in Pinkerton, vol. xiii. p. 54; Waitz, vol. iii. p. 223; Squier, ‘Abor. Mon. of N. Y.’ p. 156; Catlin, ‘N. A. Ind.’ vol. i. p. 180.

Footnote 172:

Mariner, ‘Tonga Is.’ vol. ii. p. 134; Turner, ‘Polynesia,’ p. 103; Taylor, ‘New Zealand,’ pp. 101, 114, 256.

Footnote 173:

Callaway, ‘Rel. of Amazulu,’ p. 393; Burton, ‘W. and W. fr. W. Afr.’ p. 454; Castrén, ‘Finn. Myth.’ p. 295.

Footnote 174:

Herodot. iv. 158, see 185, and Rawlinson’s note. See Smith’s ‘Dic. of the Bible,’ s.v. ‘firmament.’ Eisenmenger, part i. p. 408.

Footnote 175:

Eyre, ‘Australia,’ vol. ii. p. 367.

Footnote 176:

Schoolcraft, ‘Indian Tribes,’ part iv. p. 240 (but compare part v. p. 403); Morgan, ‘Iroquois,’ p. 176; Sproat, ‘Savage Life,’ p. 209.

Footnote 177:

D’Orbigny, ‘L’Homme Américain,’ vol. ii. pp. 319, 328; see Martius, vol. i. p. 485 (Jumanas).

Footnote 178:

J. G. Müller, p. 403; Brasseur, ‘Mexique,’ vol. iii. p. 496; Kingsborough, ‘Mexico,’ Cod. Letellier, fol. 20.

Footnote 179:

Max Müller, ‘Chips,’ vol. i. p. 46; Roth in ‘Zeitschr. d. Deutsch. Morgenl. Ges.’ vol. iv. p. 427.

Footnote 180:

Cross, ‘Karens,’ l.c. pp. 309, 313; Le Jeune in ‘Rel. des Jés.’ 1634, p. 16; Steller, ‘Kamtschatka,’ p. 272; Callaway, ‘Zulu Tales,’ vol. i. p. 316; Klemm, ‘Cultur-Gesch.’ vol. ii. pp. 310, 315; J. G. Müller, ‘Amer. Urrel.’ pp. 139, 286.

Footnote 181:

Bastian, ‘Psychologie,’ p. 224; Schoolcraft, ‘Indian Tribes,’ part ii. p. 135.

Footnote 182:

D’Orbigny, ‘L’Homme Américain,’ vol. i. p. 364; Spix and Martius, ‘Brasilien,’ vol. i. p. 383; De Laet, Novus Orbis, xv. 2.

Footnote 183:

Cranz, ‘Grönland,’ p. 258.

Footnote 184:

Magyar, ‘Süd-Afrika,’ p. 336.

Footnote 185:

Edda: ‘Gylfaginning.’

Footnote 186:

‘Koran,’ ch. lv. lvi.

Footnote 187:

Eisenmenger, ‘Entdecktes Judenthum,’ part i. p. 7.

Footnote 188:

Hardy, ‘Manual of Budhism,’ pp. 5, 24; Köppen, ‘Rel. des Buddha,’ vol. i. p. 235, &c.

Footnote 189:

Brebeuf in ‘Rel. des Jés.’ 1636, p. 105.

Footnote 190:

Sahagun, ‘Hist. de Nueva España,’ book iii. appendix ch. i., in Kingsborough, vol. vii.; Brasseur, vol. iii. p. 571.

Footnote 191:

Casalis, ‘Basutos,’ pp. 247, 254.

Footnote 192:

Burton, ‘Dahome,’ vol. ii. p. 156; ‘Tr. Eth. Soc.’ vol. iii. p. 403; ‘Wit and Wisdom from W. Afr.’ pp. 280, 449; see J. G. Müller, p. 140.

Footnote 193:

Castrén, ‘Finn. Myth.’ p. 126, &c.; Kalewala, Rune xv. xvi. xlv. &c.; Meiners, vol. ii. p. 780.

Footnote 194:

Homer. Il. ix. 405; Odyss. xi. 218, 475; Virg. Æn. vi. 243, &c., &c.

Footnote 195:

Gen. xxxv. 29; xxv. 8; xxxvii. 35; Job xi. 8; Amos ix. 2; Psalm lxxxix. 48; Ezek. xxxi., xxxii.; Isaiah xiv. 9, xxxviii. 10-18; 1 Sam., xxviii. 15; Eccles. ix. 10. ‘Records of the Past,’ vol. i. pp. 141-9; Sayce ‘Lectures on Hist. of Rel.’ part ii.; Alger, ‘Critical History of the Doctrine of a Future Life,’ ch. viii.

Footnote 196:

The doctrine of reversal, as in Kamchatka, where rich and poor will change places in the other world (Steller, pp. 269-72), is too exceptional in the lower culture to be generalized. See Steinhauser, ‘Rel. des Negers,’ l. c., p. 135. A Wolof proverb is ‘The more powerful one is in this world, the more servile one will be in the next.’ (Burton, ‘Wit and Wisdom,’ p. 28.)

Footnote 197:

Ellis, ‘Polyn. Res.’ vol. i. pp. 245, 397; see also Turner, ‘Polynesia,’ p. 237 (Samoans); Mariner, ‘Tonga Is.’ vol. ii. p. 105.

Footnote 198:

Sproat, ‘Savage Life,’ p. 209.

Footnote 199:

‘Rec. des Voy. au Nord,’ vol. v. p. 23 (Natchez); Garcilaso de la Vega, ‘Commentarios Reales,’ lib. i. c. 23, tr. by C. R. Markham; Prescott, ‘Peru,’ vol. i. pp. 29, 83; J. G. Müller, p. 402, &c.

Footnote 200:

Cranz, ‘Grönland,’ p. 259.

Footnote 201:

Charlevoix, ‘Nouvelle France,’ vol. vi. p. 77; Lescarbot, ‘Hist. de la Nouvelle France,’ Paris, 1619, p. 679.

Footnote 202:

Lery, ‘Hist. d’un Voy. en Brésil,’ p. 234; Coreal, ‘Voi. aux Indes Occ.’ i. p. 224.

Footnote 203:

Rochefort, ‘Iles Antilles,’ p. 430.

Footnote 204:

‘Journ. Ind. Archip.’ vol. i. p. 325.

Footnote 205:

Brebeuf in ‘Rel. des Jés.’ 1636, p. 104; see also Meiners, vol. ii. p. 769; J. G. Müller, pp. 89, 139.

Footnote 206:

Chateaubriand, ‘Voy. en Amérique’ (Religion).

Footnote 207:

Oviedo, ‘Nicaragua,’ p. 22; Torquemada, ‘Monarquia Indiana,’ book xiii. c. 48; Sahagun, book iii. app. ch. i.-iii. in Kingsborough, vol. vii. Compare Anderson, ‘Exp. to W. Yunnan,’ p. 125. (Shans, good men and mothers dying in child-birth to heaven, bad men and those killed by the sword to hell.)

Footnote 208:

Alger, ‘Future Life,’ p. 93.

Footnote 209:

Brinton, ‘Myths of New World,’ p. 300.

Footnote 210:

Ellis, ‘Polyn. Res.’ vol. i. p. 397; see also Williams, ‘Fiji,’ vol. i. p. 243.

Footnote 211:

Brinton, p. 242, &c.

Footnote 212:

J. G. Müller, ‘Amer. Urrel.’ pp. 87, 224. See also the opinions of Meiners, ‘Gesch. der Religion,’ vol. ii. p. 768; Wuttke. ‘Gesch. des Heidenthums,’ vol. i. p. 115.

Footnote 213:

Ellis, l. c.; Moerenhout, ‘Voyage,’ vol. i. p. 433.

Footnote 214:

Rochefort, ‘Iles Antilles,’ p. 378.

Footnote 215:

Bosman, ‘Guinea,’ letter x.; in Pinkerton, vol. xvi. p. 401.

Footnote 216:

St. John, ‘Far East,’ vol. i. p. 181; see Mundy, ‘Narrative,’ vol. i. p. 332.

Footnote 217:

Macpherson, p. 92. Compare Moerenhout, l. c. (Tahiti).

Footnote 218:

Mason, l. c. p. 195. See also De Brosses, ‘Nav. aux Terres Australes,’ vol. ii. p. 482 (Caroline Is.).

Footnote 219:

Castrén, ‘Finn. Myth.’ pp. 136, 144. See Georgi, ‘Reise im Russ. Reich,’ vol. i. p. 278. Compare accounts of Purgatory among the North American Indians, apparently derived from missionaries, in Morgan, ‘Iroquois,’ p. 169; Waitz, vol. iii. p. 345.

Footnote 220:

See T. Wright, ‘St. Patrick’s Purgatory.’

Footnote 221:

Waitz, vol. ii. pp. 171, 191; Bowen, ‘Yoruba Lang.’ p. xvi. See J. L. Wilson, p. 210.

Footnote 222:

Brebeuf in ‘Rel. des Jés.’ 1635, p. 35; 1636, p. 105. Catlin, ‘N. A. Ind.’ vol. ii. p. 127; Long’s ‘Exp.’ vol. i. p. 180. See Brinton, p. 247; Waitz, vol. ii. p. 191, vol. iii. p. 197; and the collection of myths of the Heaven-Bridge and Heaven-Gulf in ‘Early History of Mankind,’ chap. xii.

Footnote 223:

Smith, ‘New England,’ in Pinkerton, vol. xiii. p. 244.

Footnote 224:

Wilson in ‘Tr. Eth. Soc.’ vol. iii. p. 303.

Footnote 225:

Birch, Introduction to and translation of the ‘Book of the Dead,’ in Bunsen, vol. v.; Wilkinson, ‘Ancient Eg.’ vol. v.

Footnote 226:

For references to Rig Veda see Muir, ‘Sanskrit Texts,’ sec. xviii.; Max Müller, Lecture on Vedas in ‘Essays,’ vol. ii.

Footnote 227:

‘Journ. Ind. Archip.’ new ser. vol. ii. p. 210. See Bastian, ‘Oestl. Asien,’ vol. iii. p. 387.

Footnote 228:

Spiegel, ‘Avesta,’ ed. Bleek, vol. iii. pp. 136, 163; see vol. i. pp. xviii. 90, 141; vol. ii. p. 68.

CHAPTER XIV. ANIMISM (_continued_).

Animism, expanding from the Doctrine of Souls to the wider Doctrine of Spirits, becomes a complete Philosophy of Natural Religion—Definition of Spirits similar to and apparently modelled on that of Souls—Transition stage: classes of Souls passing into good and evil Demons—Manes-Worship—Doctrine of Embodiment of Spirits in human, animal, vegetable, and inert bodies—Demoniacal Possession and Obsession as causes of Disease and Oracle-inspiration—Fetishism—Disease-spirits embodied—Ghost attached to remains of Corpse—Fetish produced by a Spirit embodied in, attached to, or operating through, an Object—Analogues of Fetish-doctrine in Modern Science—Stock-and-Stone Worship—Idolatry—Survival of Animistic Phraseology

in modern Language—Decline of Animistic theory of Nature.

The general scheme of Animism, of which the doctrine of souls hitherto discussed forms part, thence expands to complete the full general philosophy of Natural Religion among mankind. Conformably with that early childlike philosophy in which human life seems the direct key to the understanding of nature at large, the savage theory of the universe refers its phenomena in general to the wilful action of pervading personal spirits. It was no spontaneous fancy, but the reasonable inference that effects are due to causes, which led the rude men of old days to people with such ethereal phantoms their own homes and haunts, and the vast earth and sky beyond. Spirits are simply personified causes. As men's ordinary life and actions were held to be caused by souls, so the happy or disastrous events which affect mankind, as well as the manifold physical operations of the outer-world, were accounted for as caused by soul-like beings, spirits whose essential similarity of origin is evident through all their wondrous variety of power and function. Much that the primitive animistic view thus explains, has been indeed given over by more advanced education to the 'metaphysical' and 'positive' stages of thought. Yet animism is still plainly to be traced onward from the intellectual state of the lower races, along the course of the higher culture, whether its doctrines have been continued and modified into the accepted philosophy of religion, or whether they have dwindled into mere survivals in popular superstition. Though all I here undertake is to sketch in outline such features of this spiritualistic philosophy as I can see plainly enough to draw at all, scarcely attempting to clear away the haze that covers great parts of the subject, yet even so much as I venture on is a hard task, made yet harder by the responsibility attaching to it. For it appears that to follow the course of animism on from its more primitive stages, is to account for much of mediæval and modern opinion whose meaning and reason could hardly be comprehended without the aid of a development-theory of culture, taking in the various processes of new formation, abolition, survival, and revival. Thus even the despised ideas of savage races become a practically important topic to the modern world, for here, as usual, whatever bears on the origin of philosophic opinion, bears also on its validity.

At this point of the investigation, we come fully into sight of the principle which has been all along implied in the use of the word Animism, in a sense beyond its narrower meaning of the doctrine of souls. By using it to express the doctrine of spirits generally, it is practically asserted that the idea of souls, demons, deities, and any other classes of spiritual beings, are conceptions of similar nature throughout, the conceptions of souls being the original ones of the series. It was best, from this point of view, to begin with a careful study of souls, which are the spirits proper to men, animals, and things, before extending the survey of the spirit-world to its fullest range. If it be admitted that souls and other spiritual beings are conceived of as essentially similar in their nature, it may be reasonably argued that the class of conceptions based on evidence most direct and accessible to ancient men, is the earlier and fundamental class. To grant this, is in effect to agree that the doctrine of souls, founded on the natural perceptions of primitive man, gave rise to the doctrine of spirits, which extends and modifies its general theory for new purposes, but in developments less authenticated and consistent, more fanciful and far-fetched. It seems as though the conception of a human soul, when once attained to by man, served as a type or model on which he framed not only his ideas of other souls of lower grade, but also his ideas of spiritual beings in general, from the tiniest elf that sports in the long grass up to the heavenly Creator and Ruler of the world, the Great Spirit.

The doctrines of the lower races fully justify us in classing their spiritual beings in general as similar in nature to the souls of men. It will be incidentally shown here, again and again, that souls have the same qualities attributed to them as other spirits, are treated in like fashion, and pass without distinct breaks into every part of the general spiritual definition. The similar nature of soul and other spirit is, in fact, one of the commonplaces of animism, from its rudest to its most cultured stages. It ranges from the native New Zealanders' and West Indians' conceptions of the 'atua' and the 'cemi,' beings which require special definition to show whether they are human souls or demons or deities of some other class,[229] and so onward to the declaration of Philo Judæus, that souls, demons, and angels differ indeed in name, but are in reality one,[230] and to the state of mind of the modern Roman Catholic priest, who is cautioned in the rubric concerning the examination of a possessed patient, not to believe the demon if he pretends to be the soul of some saint or deceased person, or a good angel (neque ei credatur, si dæmon simularet se esse animam alicujus Sancti, vel defuncti, vel Angelum bonum).[231] Nothing can bring more broadly into view the similar nature of souls and other spiritual beings than the existence of a full transitional series of ideas. Souls of dead men are in fact considered as actually forming one of the most important classes of demons and deities.

It is quite usual for savage tribes to live in terror of the souls of the dead as harmful spirits. Thus Australians have been known to consider the ghosts of the unburied dead as becoming malignant demons.[232] New Zealanders have supposed the souls of their dead to become so changed in nature as to be malignant to their nearest and dearest friends in life;[233] the Caribs said that, of man's various souls, some go to the seashore and capsize boats, others to the forest to be evil spirits;[234] among the Sioux

Indians the fear of a ghost's vengeance has been found to act as a check on murder;[235] of some tribes in Central Africa it may be said that their main religious doctrine is the belief in ghosts, and that the main characteristic of these ghosts is to do harm to the living.[236] The Patagonians lived in terror of the souls of their wizards, which become evil demons after death;[237] Turanian tribes of North Asia fear their shamans even more when dead than when alive, for they become a special class of spirits who are the hurtfullest in all nature, and who among the Mongols plague the living on purpose to make them bring offerings.[238] In China it is held that the multitudes of wretched destitute spirits in the world below, such as souls of lepers and beggars, can sorely annoy the living; therefore at certain times they are to be appeased with offerings of food, scant and beggarly; and a man who feels unwell, or fears a mishap in business, will prudently have some mock-clothing and mock-money burnt for these 'gentlemen of the lower regions.'[239] Notions of this sort are widely prevalent in Indo-China and India; whole orders of demons there were formerly human souls, especially of people left unburied or slain by plague or violence, of bachelors or of women who died in childbirth, and who henceforth wreak their vengeance on the living. They may, however, be propitiated by temples and offerings, and thus have become in fact a regular class of local deities.[240] Among them may be counted the diabolic soul of a certain wicked British officer, whom native worshippers in the Tinnevelly district still propitiate by offering at his grave the brandy and cheroots he loved in life.[241] India even carried theory into practice by an actual manufacture of demons, as witness the two following accounts. A certain brahman, on whose lands a kshatriya raja had built a house, ripped himself up in revenge, and became a demon of the kind called brahmadasyu, who has been ever since the terror of the whole country, and is the most common village deity in Kharakpur.[242] Toward the close of the last century there were two brahmans, out of whose house a man had wrongfully, as they thought, taken forty rupees; whereupon one of the brahmans proceeded to cut off his own mother's head, with the professed view, entertained by both mother and son, that her spirit, excited by the beating of a large drum during forty days, might haunt, torment, and pursue to death the taker of their money and those concerned with him. Declaring with her last words that she would blast the thief, the spiteful hag deliberately gave up her life to take ghostly vengeance for those forty rupees.[243] By instances like these it appears that we may trace up from the psychology of the lower races the familiar ancient and modern European tales of baleful ghost-demons. The old fear even now continues to vouch for the old belief.

Happily for man's anticipation of death, and for the treatment of the sick and aged, thoughts of horror and hatred do not preponderate in ideas of deified ancestors, who are regarded on the whole as kindly patron spirits, at least to their own kinsfolk and worshippers. Manes-worship is one of the great branches of the religion of mankind. Its principles are not difficult to understand, for they plainly keep up the social relations of the living world. The dead ancestor, now passed into a deity, simply goes on protecting his own family and receiving suit and service from them as of old; the dead chief still watches over his own tribe, still holds his authority by helping friends and harming enemies, still rewards the right and sharply punishes the wrong. It will be enough to show by a few characteristic examples the general position of manes-worship among mankind, from the lower culture upward.[244] In the two Americas it appears not unfrequently, from the low savage level of the Brazilian Camacans, to the somewhat higher stage of northern Indian tribes whom we hear of as praying to the spirits of their forefathers for good weather or luck in hunting, and fancying when an Indian falls into the fire that the ancestral spirits pushed him in to punish neglect of the customary gifts, while the Natchez of Louisiana are said to have even gone so far as to build temples for dead men.[245] Turning to the dark races of the Pacific, we find the Tasmanians laying their sick round a corpse on the funeral pile, that the dead might come in the night and take out the devils that caused the diseases; it is asserted in a general way of the natives, that they believed most implicitly in the return of the spirits of their departed friends or relations to bless or injure them as the case might be.[246] In Tanna, the gods are spirits of departed ancestors, aged chiefs becoming deities after death, presiding over the growth of yams and fruit trees, and receiving from the islanders prayer and offerings of first fruits.[247] Nor are the fairer Polynesians behind in this respect. Below the great mythological gods of Tonga and New Zealand, the souls of chiefs and warriors form a lower but active and powerful order of deities, who in the Tongan paradise intercede for man's benefit with the higher deities, who direct the Maori war parties on the march, hover over them and give them courage in the fight, and, watching jealously their own tribes and families, punish any violation of the sacred laws of tapu.[248] Thence we trace the doctrine into the Malay islands, where the souls of deceased ancestors are looked to for prosperity in life and help in distress.[249] In Madagascar, the worship of the spirits of the dead is remarkably associated with the Vazimbas, the aborigines of the island, who are said still to survive as a distinct race in the interior, and whose peculiar graves testify to their former occupancy of other districts. These graves, small in size, and distinguished by a cairn and an upright stone slab or altar, are places which the Malagasy regard with equal fear and veneration, and their faces become sad and serious when they even pass near. To take a stone or pluck a twig from one of these graves, to stumble against one in the dark, would be resented by the angry Vazimba inflicting disease, or coming in the night to carry off the offender to the region of ghosts. The Malagasy is thus enabled to account for every otherwise unaccountable ailment by his having knowingly or unknowingly given offence to some Vazimba. They are not indeed always malevolent, they may be placable or implacable, or

partake of both characters. Thus it comes to pass, that at the altar-slab which long ago some rude native family set up for commemoration or dutiful offering of food to a dead kinsman, a barbaric supplanting race now comes to smear the burnt fat of sacrifice, and set up the heads of poultry and sheep and the horns of bullocks, that the mysterious tenant may be kind, not cruel, with his superhuman powers.[250]

On the continent of Africa, manes-worship appears with extremest definiteness and strength. Thus Zulu warriors, aided by the 'amatongo,' the spirits of their ancestors, conquer in the battle; but if the dead turn their backs on the living, the living fall in the fight, to become ancestral spirits in their turn. In anger the 'itongo' seizes a living man's body and inflicts disease and death; in beneficence he gives health, and cattle, and corn, and all men wish. Even the little children and old women, of small account in life, become at death spirits having much power, the infants for kindness, the crones for malice. But it is especially the head of each family who receives the worship of his kin. Why it is naturally and reasonably so, a Zulu thus explains. 'Although they worship the many Amatongo of their tribe, making a great fence around them for their protection; yet their father is far before all others when they worship the Amatongo. Their father is a great treasure to them even when he is dead. And those of his children who are already grown up know him thoroughly, his gentleness, and his bravery.' 'Black people do not worship all Amatongo indifferently, that is, all the dead of their tribe. Speaking generally, the head of each house is worshipped by the children of that house; for they do not know the ancients who are dead, nor their laud-giving names, nor their names. But their father whom they knew is the head by whom they begin and end in their prayer, for they know him best, and his love for his children; they remember his kindness to them whilst he was living; they compare his treatment of them whilst he was living, support themselves by it, and say, "He will still treat us in the same way now he is dead. We do not know why he should regard others besides us; he will regard us only."'[251] It will be seen in another place how the Zulu follows up the doctrine of divine ancestors till he reaches a first ancestor of man and creator of the world, the primæval Unkulunkulu. In West Africa, manes-worship displays in contrast its two special types. On the one hand, we see the North Guinea negroes transferring the souls of the dead, according to their lives, to the rank of good and evil spirits, and if evil worshipping them the more zealously, as fear is to their minds a stronger impulse than love. On the other hand, in Southern Guinea, we see the deep respect paid to the aged during life, passing into worship when death has raised them to yet higher influence. There the living bring to the images of the dead food and drink, and even a small portion of their profits gained in trade; they look especially to dead relatives for help in the trials of life, and 'it is no uncommon thing to see large groups of men and women, in times of peril or distress, assembled along the brow of some commanding eminence, or along the skirts of some dense forest, calling in the most piteous and touching tones upon the spirits of their ancestors.'[252]

In Asia, manes-worship comes to the surface in all directions. The rude Veddas of Ceylon believe in the guardianship of the spirits of the dead; these, they say, are 'ever watchful, coming to them in sickness, visiting them in dreams, giving them flesh when hunting;' and in every calamity and want they call for aid on the 'kindred spirits,' and especially the shades of departed children, the 'infant spirits.'[253] Among non-Hindu tribes of India, whose religions more or less represent præ-Brahmanic and præ-Buddhistic conditions, wide and deep traces appear of an ancient and surviving cultus of ancestors.[254] Among Turanian tribes spread over the northern regions of the Old World, a similar state of things may be instanced from the Mongols, worshipping as good deities the princely souls of Genghis Khan's family, at whose head stands the divine Genghis himself.[255] Nor have nations of the higher Asiatic culture generally rejected the time-honoured rite. In Japan the 'Way of the Kami,' better known to foreigners as the Sin-tu religion, is one of the officially recognized faiths, and in it there is still kept up in hut and palace the religion of the rude old mountain-tribes of the land, who worshipped their divine ancestors, the Kami, and prayed to them for help and blessing. To the time of these ancient Kami, say the modern Japanese, the rude stone implements belong which are found in the ground in Japan as elsewhere: to modern ethnologists, however, these bear witness not of divine but savage parentage.[256] In Siam the lower orders scruple to worship the great gods, lest through ignorance they should blunder in the complex ritual; they prefer to pray to the 'theparak,' a lower class of deities among whom the souls of great men take their places at death.[257] In China, as every one knows, ancestor-worship is the dominant religion of the land, and interesting problems are opened out to the Western mind by the spectacle of a great people who for thousands of years have been thus seeking the living among the dead. Nowhere is the connexion between parental authority and conservatism more graphically shown. The worship of ancestors, begun during their life, is not interrupted but intensified when death makes them deities. The Chinese, prostrate bodily and mentally before the memorial tablets that contain the souls of his ancestors, little thinks that he is all the while proving to mankind how vast a power unlimited filial obedience, prohibiting change from ancestral institutions, may exert in stopping the advance of civilization. The thought of the souls of the dead as sharing the happiness and glory of their descendants is one which widely pervades the world, but most such ideas would seem vague and weak to the Chinese, who will try hard for honour in his competitive examination with the special motive of glorifying his dead ancestors, and whose titles of rank will raise his deceased father and grandfather a grade above himself, as

though, with us, Zachary Macaulay and Copley the painter should now have viscounts' coronets officially placed on their tombstones. As so often happens, what is jest to one people is sober sense to another. There are 300 millions of Chinese who would hardly see a joke in Charles Lamb reviling the stupid age that would not read him, and declaring that he would write for antiquity. Had he been a Chinese himself, he might have written his book in all seriousness for the benefit of his great-great-grandfather. Among the Chinese, manes-worship is no rite of mere affection. The living want the help of the ancestral spirits, who reward virtue and punish vice: 'The exalted ancestor will bring thee, O Prince, much good!'—'Ancestors and fathers will abandon you and give you up, and come not to help, and ye will die.' If no help comes in time of need, the Chinese will reproach his ancestor, or even come to doubt his existence. Thus in a Chinese ode the sufferers in a dreadful drought cry, 'Heu-tsi cannot or will not help.... Our ancestors have surely perished.... Father, mother, ancestors, how could you calmly bear this?' Nor does manes-worship stop short with direct family ties; it is naturally developed to produce, by deification of the heroic dead, a series of superior gods to whom worship is given by the public at large. Thus, according to legend, the War-god or Military Sage was once in human life a distinguished soldier, the Mechanics' god was a skilful workman and inventor of tools, the Swine-god was a hog-breeder who lost his pigs and died of sorrow, and the Gamblers' god, a desperate gamester who lost his all and died of want, is represented by a hideous image called a 'devil gambling for cash,' and in this shape receives the prayers and offerings of confirmed gamblers, his votaries. The spirits of San-kea Ta-te, and Chang-yuen-sze go to partake of the offerings set out in their temples, returning flushed and florid from their meal; and the spirit of Confucius is present in the temple, where twice a year the Emperor does sacrifice to him.[258]

The Hindu unites in some degree with the Chinese as to ancestor-worship, and especially as to the necessity of having a son by blood or adoption, who shall offer the proper sacrifices to him after death. 'May there be born in our lineage,' the manes are supposed to say, 'a man to offer to us, on the thirteenth day of the moon, rice boiled in milk, honey and ghee.' Offerings made to the divine manes, the 'pitaras' (patres, fathers) as they are called, preceded and followed by offerings to the greater deities, give to the worshipper merit and happiness.[259] In classic Europe, apotheosis lies part within the limits of myth, where it was applied to fabled ancestors, and part within the limits of actual history, as where Julius and Augustus shared its honours with the vile Domitian and Commodus. The most special representatives of ancestor-worship in Europe were perhaps the ancient Romans, whose word 'manes' has become the recognized name for ancestral deities in modern civilized language; they embodied them as images, set them up as household patrons, gratified them with offerings and solemn homage, and counting them as or among the infernal gods, inscribed on tombs D. M., 'Diis Manibus.'[260] The occurrence of this D. M. in Christian epitaphs is an often-noticed case of religious survival.

Although full ancestor-worship is not practised in modern Christendom, there remains even now within its limits a well-marked worship of the dead. A crowd of saints, who were once men and women, now form an order of inferior deities, active in the affairs of men and receiving from them reverence and prayer, thus coming strictly under the definition of manes. This Christian cultus of the dead, belonging in principle to the older manes-worship, was adapted to answer another purpose in the course of religious transition in Europe. The local gods, the patron gods of particular ranks and crafts, the gods from whom men sought special help in special needs, were too near and dear to the inmost heart of præ-Christian Europe to be done away with without substitutes. It proved easier to replace them by saints who could undertake their particular professions, and even succeed them in their sacred dwellings. The system of spiritual division of labour was in time worked out with wonderful minuteness in the vast array of professional saints, among whom the most familiar to modern English ears are St. Cecilia, patroness of musicians; St. Luke, patron of painters; St. Peter, of fishmongers; St. Valentine, of lovers; St. Sebastian, of archers; St. Crispin, of cobblers; St. Hubert, who cures the bite of mad dogs; St. Vitus, who delivers madmen and sufferers from the disease which bears his name; St. Fiacre, whose name is now less known by his shrine than by the hackney-coaches called after him in the seventeenth century. Not to dwell here minutely on an often-treated topic, it will be enough to touch on two particular points. First, as to the direct historical succession of the Christian saint to the heathen deity, the following are two very perfect illustrations. It is well known that Romulus, mindful of his own adventurous infancy, became after death a Roman deity propitious to the health and safety of young children, so that nurses and mothers would carry sickly infants to present them in his little round temple at the foot of the Palatine. In after ages the temple was replaced by the church of St. Theodorus, and there Dr. Conyers Middleton, who drew public attention to its curious history, used to look in and see ten or a dozen women, each with a sick child in her lap, sitting in silent reverence before the altar of the saint. The ceremony of blessing children, especially after vaccination, may still be seen there on Thursday mornings.[261] Again, Sts. Cosmas and Damianus, according to Maury, owe their recognized office to a similar curious train of events. They were martyrs who suffered under Diocletian, at Ægææ in Cilicia. Now this place was celebrated for the worship of Æsculapius, in whose temple incubation, i.e. sleeping for oracular dreams, was practised. It seems as though the idea was transferred on the spot to the

two local saints, for we next hear of them as appearing in a dream to the Emperor Justinian, when he was ill at Byzantium. They cured him, he built them a temple, their cultus spread far and wide, and they frequently appeared to the sick to show them what they should do. Legend settled that Cosmas and Damianus were physicians while they lived on earth, and at any rate they are patron-saints of the profession of medicine to this day.[262] Second, as to the actual state of hagiolatry in modern Europe, it is obvious on a broad view that it is declining among the educated classes. Yet modern examples may be brought forward to show ideas as extreme as those which prevailed more widely a thousand years ago. In the Church of the Jesuit College at Rome lies buried St. Aloysius Gonzaga, on whose festival it is customary especially for the college students to write letters to him, which are placed on his gaily decorated and illuminated altar, and afterwards burnt unopened. The miraculous answering of these letters is vouched for in an English book of 1870. To the same year belongs an English tract commemorating a late miraculous cure. An Italian lady afflicted with a tumour and incipient cancer of the breast was exhorted by a Jesuit priest to recommend herself to the Blessed John Berchmans, a pious Jesuit novice from Belgium, who died in 1621, and was beatified in 1865. Her adviser procured for her 'three small packets of dust gathered from the coffin of this saintly innocent, a little cross made of the boards of the room the blessed youth occupied, as well as some portion of the wadding in which his venerable head was wrapped.' During nine days' devotion the patient accordingly invoked the Blessed John, swallowed small portions of his dust in water, and at last pressed the cross to her breast so vehemently that she was seized with sickness, went to sleep, and awoke without a symptom of the complaint. And when Dr. Panegrossi the physician beheld the incredible cure, and heard that the patient had addressed herself to the Blessed Berchmans, he bowed his head, saying, 'When such physicians interfere, we have nothing more to say!'[263] To sum up the whole history of manes-worship, it is plain that in our time the dead still receive worship from far the larger half of mankind, and it may have been much the same ever since the remote periods of primitive culture in which the religion of the manes probably took its rise.

It has now been seen that the theory of souls recognizes them as capable either of independent existence, or of inhabiting human, animal, or other bodies. On the principle here maintained, that the general theory of spirits is modelled on the theory of souls, we shall be able to account for several important branches of the lower philosophy of religion, which without such explanation may appear in great measure obscure or absurd. Like souls, other spirits are supposed able either to exist and act flitting free about the world, or to become incorporate for more or less time in solid bodies. It will be well at once to get a secure grasp of this theory of Embodiment, for without it we shall be stopped every moment by a difficulty in understanding the nature of spirits, as defined in the lower animism. The theory of embodiment serves several highly important purposes in savage and barbarian philosophy. On the one hand it provides an explanation of the phenomena of morbid exaltation and derangement, especially as connected with abnormal utterance, and this view is so far extended as to produce an almost general doctrine of disease. On the other hand, it enables the savage either to 'lay' a hurtful spirit in some foreign body, and so get rid of it, or to carry about a useful spirit for his service in a material object, to set it up as a deity for worship in the body of an animal, or in a block or stone or image or other thing, which contains the spirit as a vessel contains a fluid: this is the key to strict fetishism, and in no small measure to idolatry. In briefly considering these various branches of the Embodiment-theory, there may be conveniently included certain groups of cases often impossible to distinguish apart. These cases belong theoretically rather to obsession than possession, the spirits not actually inhabiting the bodies, but hanging or hovering about them and affecting them from the outside.

As in normal conditions the man's soul, inhabiting his body, is held to give it life, to think, speak, and act through it, so an adaptation of the self-same principle explains abnormal conditions of body or mind, by considering the new symptoms as due to the operation of a second soul-like being, a strange spirit. The possessed man, tossed and shaken in fever, pained and wrenched as though some live creature were tearing or twisting him within, pining as though it were devouring his vitals day by day, rationally finds a personal spiritual cause for his sufferings. In hideous dreams he may even sometimes see the very ghost or nightmare-fiend that plagues him. Especially when the mysterious unseen power throws him helpless on the ground, jerks and writhes him in convulsions, makes him leap upon the bystanders with a giant's strength and a wild beast's ferocity, impels him, with distorted face and frantic gesture, and voice not his own nor seemingly even human, to pour forth wild incoherent raving, or with thought and eloquence beyond his sober faculties to command, to counsel, to foretell—such a one seems to those who watch him, and even to himself, to have become the mere instrument of a spirit which has seized him or entered into him, a possessing demon in whose personality the patient believes so implicitly that he often imagines a personal name for it, which it can declare when it speaks in its own voice and character through his organs of speech; at last, quitting the medium's spent and jaded body, the intruding spirit departs as it came. This is the savage theory of dæmoniacal possession and obsession, which has been for ages, and still remains, the dominant theory of disease and inspiration among the lower races. It is obviously based on an animistic interpretation, most genuine and rational in its proper place in man's intellectual history, of the actual symptoms of the cases. The general doctrine of

disease-spirits and oracle-spirits appears to have its earliest, broadest, and most consistent position within the limits of savagery. When we have gained a clear idea of it in this its original home, we shall be able to trace it along from grade to grade of civilization, breaking away piecemeal under the influence of new medical theories, yet sometimes expanding in revival, and at least in lingering survival holding its place into the midst of our modern life. The possession-theory is not merely known to us by the statements of those who describe diseases in accordance with it. Disease being accounted for by attack of spirits, it naturally follows that to get rid of these spirits is the proper means of cure. Thus the practices of the exorcist appear side by side with the doctrine of possession, from its first appearance in savagery to its survival in modern civilization; and nothing could display more vividly the conception of a disease or a mental affection as caused by a personal spiritual being than the proceedings of the exorcist who talks to it, coaxes or threatens it, makes offerings to it, entices or drives it out of the patient's body, and induces it to take up its abode in some other. That the two great effects ascribed to such spiritual influence in obsession and possession, namely, the infliction of ailments and the inspiration of oracles, are not only mixed up together but often run into absolute coincidence, accords with the view that both results are referred to one common cause. Also that the intruding or invading spirit may be either a human soul or may belong to some other class in the spiritual hierarchy, countenances the opinion that the possession-theory is derived from, and indeed modelled on, the ordinary theory of the soul acting on the body. In illustrating the doctrine by typical examples from the enormous mass of available details, it will hardly be possible to discriminate among the operating spirits, between those which are souls and those which are demons, nor to draw an exact line between obsession by a demon outside and possession by a demon inside, nor between the condition of the demon-tormented patient and the demon-actuated doctor, seer, or priest. In a word, the confusion of these conceptions in the savage mind only fairly represents their intimate connexion in the Possession-theory itself.

In the Australian-Tasmanian district, disease and death are ascribed to more or less defined spiritual influences; descriptions of a demon working a sorcerer's wicked will by coming slyly behind his victim and hitting him with his club on the back of his neck, and of a dead man's ghost angered by having his name uttered, and creeping up into the utterer's body to consume his liver, are indeed peculiarly graphic details of savage animism.[264] The theory of disease-spirits is well stated in its extreme form among the Mintira, a low race of the Malay peninsula. Their 'hantu' or spirits have among their functions that of causing ailments; thus the 'hantu kalumbahan' causes small-pox; the 'hantu kamang' brings on inflammation and swellings in the hands and feet; when a person is wounded, the 'hantu pari' fastens on the wound and sucks, and this is the cause of the blood flowing. And thus, as the describer says, 'To enumerate the remainder of the hantus would be merely to convert the name of every species of disease known to the Mintira into a proper one. If any new disease appeared, it would be ascribed to a hantu bearing the same name.'[265] It will help us to an idea of the distinct personality which the disease-demon has in the minds of the lower races, to notice the Orang Laut of this district placing thorns and brush in the paths leading to a part where small-pox had broken out, to keep the demons off; just as the Khonds of Orissa try with thorns, and ditches, and stinking oil poured on the ground, to barricade the paths to their hamlets against the goddess of small-pox, Jugah Pennu.[266] Among the Dayaks of Borneo, 'to have been smitten by a spirit' is to be ill; sickness may be caused by invisible spirits inflicting invisible wounds with invisible spears, or entering men's bodies and driving out their souls, or lodging in their hearts and making them raving mad. In the Indian Archipelago, the personal semi-human nature of the disease-spirits is clearly acknowledged by appeasing them with feasts and dances and offerings of food set out for them away in the woods, to induce them to quit their victims, or by sending tiny proas to sea with offerings, that spirits which have taken up their abode in sick men's bowels may embark and not come back.[267] The animistic theory of disease is strongly marked in Polynesia, where every sickness is ascribed to spiritual action of deities, brought on by the offerings of enemies, or by the victim's violation of the laws of tapu. Thus in New Zealand each ailment is caused by a spirit, particularly an infant or undeveloped human spirit, which sent into the patient's body gnaws and feeds inside; and the exorcist, finding the path by which such a disease-spirit came from below to feed on the vitals of a sick relative, will persuade it by a charm to get upon a flax-stalk and set off home. We hear, too, of an idea of the parts of the body—forehead, breast, stomach, feet, &c.—being apportioned each to a deity who inflicts aches and pains and ailments there.[268] So in the Samoan group, when a man was near death, people were anxious to part on good terms with him, feeling assured that if he died with angry feelings towards any one, he would certainly return and bring calamity on that person or some one closely allied to him. This was considered a frequent source of disease and death, the spirit of a departed member of the family returning and taking up his abode in the head, chest, or stomach of a living man, and so causing sickness and death. If a man died suddenly, it was thought that he was eaten by the spirit that took him; and though the soul of one thus devoured would go to the common spirit-land of the departed, yet it would have no power of speech there, and if questioned could but beat its breast. It completes this account to notice that the disease-inflicting souls of the departed were the same which possessed the living under more favourable circumstances, coming to talk through a certain member of the family, prophesying future events, and giving directions as to family affairs.[269] Farther east, in the Georgian and Society Islands, evil demons are sent to scratch and tear people into convulsions and hysterics, to torment poor wretches as with barbed hooks, or to twist and knot

inside them till they die writhing in agony. But madmen are to be treated with great respect, as entered by a god, and idiots owe the kindness with which they are appeased and coaxed to the belief in their superhuman inspiration.[270] Here, and elsewhere in the lower culture, the old real belief has survived which has passed into a jest of civilized men in the famous phrase of the 'inspired idiot.'

American ethnography carries on the record of rude races ascribing disease to the action of evil spirits. Thus the Dacotas believe that the spirits punish them for misconduct, especially for neglecting to make feasts for the dead; these spirits have the power to send the spirit of something, as of a bear, deer, turtle, fish, tree, stone, worm, or deceased person, which entering the patient causes disease; the medicine-man's cure consists in reciting charms over him, singing 'He-le-li-lah, &c.,' to the accompaniment of a gourd-rattle with beads inside, ceremonially shooting a symbolic bark representation of the intruding creature, sucking over the seat of pain to get the spirit out, and firing guns at it as it is supposed to be escaping.[271] Such processes were in full vogue in the West Indies in the time of Columbus, when Friar Roman Pane put on record his quaint account of the native sorcerer pulling the disease off the patient's legs (as one pulls off a pair of trousers), going out of doors to blow it away, and bidding it begone to the mountain or the sea; the performance concluding with the regular sucking-cure and the pretended extraction of some stone or bit of flesh, or such thing, which the patient is assured that his patron-spirit or deity (cemi) put into him to cause the disease, in punishment for neglect to build him a temple or honour him with prayer or offerings of goods.[272] Patagonians considered sickness as caused by a spirit entering the patient's body; 'they believe every sick person to be possessed of an evil demon; hence their physicians always carry a drum with figures of devils painted on it, which they strike at the beds of sick persons to drive out from the body the evil demon which causes the disorder.'[273] In Africa, according to the philosophy of the Basutos and the Zulus, the causes of disease are the ghosts of the dead, come to draw the living to themselves, or to compel them to sacrifice meat-offerings. They are recognized by the diviners, or by the patient himself, who sees in dreams the departed spirit come to torment him. Congo tribes in like manner consider the souls of the dead, passed into the ranks of powerful spirits, to cause disease and death among mankind. Thus, in both these districts, medicine becomes an almost entirely religious matter of propitiatory sacrifice and prayer addressed to the disease-inflicting manes. The Barolong give a kind of worship to deranged persons, as being under the direct influence of a deity; while in East Africa the explanation of madness and idiocy is simple and typical—'he has fiends.'[274] Negroes of West Africa, on the supposition that an attack of illness has been caused by some spiritual being, can ascertain to their satisfaction what manner of spirit has done it, and why. The patient may have neglected his 'wong' or fetish-spirit, who has therefore made him ill; or it may be his own 'kla' or personal guardian-spirit, who on being summoned explains that he has not been treated respectfully enough, &c.; or it may be a 'sisa' or ghost of some dead man, who has taken this means of making known that he wants perhaps a gold ornament that was left behind when he died.[275] Of course, the means of cure will then be to satisfy the demands of the spirit. Another aspect of the negro doctrine of disease-spirits is displayed in the following description from Guinea, by the Rev. J. L. Wilson, the missionary:—'Demoniacal possessions are common, and the feats performed by those who are supposed to be under such influence are certainly not unlike those described in the New Testament. Frantic gestures, convulsions, foaming at the mouth, feats of supernatural strength, furious ravings, bodily lacerations, gnashing of teeth, and other things of a similar character, may be witnessed in most of the cases which are supposed to be under diabolical influence.'[276] The remark several times made by travellers is no doubt true, that the spiritualistic theory of disease has tended strongly to prevent progress in the medical art among the lower races. Thus among the Bodo and Dhimal of North-East India, who ascribe all diseases to a deity tormenting the patient for some impiety or neglect, the exorcists divine the offended god and appease him with the promised sacrifice of a hog; these exorcists are a class of priests, and the people have no other doctors.[277] Where the world-wide doctrine of disease-demons has held sway, men's minds, full of spells and ceremonies, have scarce had room for thought of drugs and regimen.

The cases in which disease-possession passes into oracle-possession are especially connected with hysterical, convulsive, and epileptic affections. Mr. Backhouse describes a Tasmanian native sorcerer, 'affected with fits of spasmodic contraction of the muscles of one breast, which he attributes, as they do all other diseases, to the devil'; this malady served to prove his inspiration to his people.[278] When Dr. Mason was preaching near a village of heathen Pwo, a man fell down in an epileptic fit, his familiar spirit having come over him to forbid the people to listen to the missionary, and he sang out his denunciations like one frantic. This man was afterwards converted, and told the missionary that 'he could not account for his former exercises, but that it certainly appeared to him as though a spirit spoke, and he must tell what was communicated.' In this Karen district flourishes the native 'wee' or prophet, whose business is to work himself into the state in which he can see departed spirits, visit their distant home, and even recall them to the body, thus raising the dead; these wees are nervous excitable men, such as would become mediums, and in giving oracles they go into actual convulsions.[279] Dr. Callaway's details of the state of the Zulu diviners are singularly instructive. Their symptoms are ascribed to possession by 'amatongo' or ancestral spirits; the disease is common, from some it departs of its

own accord, others have the ghost laid which causes it, and others let the affection take its course and become professional diviners, whose powers of finding hidden things and giving apparently inaccessible information are vouched for by native witnesses, who at the same time are not blind to their tricks and their failures. The most perfect description is that of a hysterical visionary, who had ‘the disease which precedes the power to divine.’ This man describes that well-known symptom of hysteria, the heavy weight creeping up within him to his shoulders, his vivid dreams, his waking visions of objects that are not there when he approaches, the songs that come to him without learning, the sensation of flying in the air. This man was ‘of a family who are very sensitive, and become doctors.’[280] Persons whose constitutional unsoundness induces morbid manifestations are indeed marked out by nature to become seers and sorcerers. Among the Patagonians, patients seized with falling sickness or St. Vitus’s dance were at once selected for magicians, as chosen by the demons themselves who possessed, distorted, and convulsed them.[281] Among Siberian tribes, the shamans select children liable to convulsions as suitable to be brought up to the profession, which is apt to become hereditary with the epileptic tendencies it belongs to.[282] Thus, even in the lower culture, a class of sickly brooding enthusiasts begin to have that power over the minds of their lustier fellows, which they have kept in so remarkable a way through the course of history.

Morbid oracular manifestations are habitually excited on purpose, and moreover the professional sorcerer commonly exaggerates or wholly feigns them. In the more genuine manifestations the medium may be so intensely wrought upon by the idea that a possessing spirit is speaking from within him, that he may not only give this spirit’s name and speak in its character, but possibly may in good faith alter his voice to suit the spiritual utterance. This gift of spirit-utterance, which belongs to ‘ventriloquism’ in the ancient and proper sense of the term, of course lapses into sheer trickery. But that the phenomena should be thus artificially excited or dishonestly counterfeited, rather confirms than alters the present argument. Real or simulated, the details of oracle-possession alike illustrate popular belief. The Patagonian wizard begins his performance with drumming and rattling till the real or pretended epileptic fit comes on by the demon entering him, who then answers questions from within him with a faint and mournful voice.[283] In Southern India and Ceylon the so-called ‘devil-dancers’ have to work themselves into paroxysms, to gain the inspiration whereby they profess to cure their patients.[284] So, with furious dancing to the music and chanting of the attendants, the Bodo priest brings on the fit of maniacal inspiration in which the deity fills him and gives oracles through him.[285] In Kamchatka the female shamans, when Billukai came down into them in a thunderstorm, would prophesy; or, receiving spirits with a cry of ‘hush!’ their teeth chattered as in fever, and they were ready to divine.[286] Among the Singpho of South-East Asia, when the ‘natzo’ or conjurer is sent for to a sick patient, he calls on his ‘nat’ or demon, the soul of a deceased foreign prince, who descends into him and gives the required answers.[287] In the Pacific Islands, spirits of the dead would enter for a time the body of a living man, inspiring him to declare future events, or to execute some commission from the higher deities. The symptoms of oracular poss
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The Fundamental Principles

Of

Old and New World Civilizations

A Comparative Research Based on a Study of the Ancient Mexican Religious, Sociological, and Calendrical Systems.

By

Zelia Nuttall

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EDITORIAL NOTE.

The author of this volume explains in her preface how she came to be led beyond her special field of research into a comparative study of the early civilizations of the Old World; and how she traced the origin of the swastika, in Mexico, to an astronomical source and, in all countries alike, found its use as a sacred symbol accompanied by evidences of a certain phase of culture based on pole-star worship, and the recognition of the fixed laws of nature, which found expression in the ideal of celestial kingdoms or states organized on a set numerical plan and regulated by the apparent revolutions of circumpolar constellations.

The results of the author's researches seem to justify her summary of conclusions; but she distinctly states that she does not wish to propound any theory. She invites further study and discussion by Orientalists and Americanists before drawing final conclusions from the facts she has gathered. The publication of this paper will open anew the consideration of pre-Columbian visits to the New World, shown, as many have believed, by identities too many and too close to be considered as mere resemblances or as the natural results of independent intellectual development.

The illustrations are nearly all from drawings by the author. The analytical Index has been prepared by Miss Mead. It will be seen, by the numbering at the bottom of each page, that it was at first intended to include this paper in Volume I of the Archaeological and Ethnological Papers of the Museum; but the addition of the text relating to the Old World made too bulky a volume, and it is therefore issued as Volume II of the series.

To Mrs. Nuttall for the gift of her work, the results of years of research, and to the several generous friends who have provided the means for publishing this volume, the editor expresses his gratitude in behalf of the Museum.

F. W. PUTNAM, Curator of the Peabody Museum. Harvard University, March 1, 1901.

AUTHOR'S PREFACE.

In February, 1898, while engaged upon the translation and commentary of the anonymous Hispano Mexican MS. of the Biblioteca Nazionale Centrale Library, of Florence, my interest was suddenly and unexpectedly diverted from my self-imposed task by the circumstances described in the opening pages of the present publication.

Laying my work aside, as I then supposed, for a few days only, I seized the new thread of investigation with a keen and enthusiastic interest, little knowing that it, in turn, was not only to hold me fast for nearly three years, but was to lead me out of my original field of research, into distant, and to me, hitherto untrodden realms, in close pursuit of facts relating to the oldest forms of religion, social organization, and symbolism.

The first portion of the present publication was planned as a short monograph of forty-one pages, treating of the origin of the native swastika or cross symbols, and was written in July, 1898, its outcome being the unforeseen conclusion that the cosmical conceptions of the ancient Mexicans were identical with those of the Zuñis. I next traced the same fundamental set of ideas in Yucatan, Central America and Peru and formed the wish to add this investigation to the preceding. The result has been the portion of the work extending from page 41, paragraph 2, to page 284, which was printed in 1899.

Having once launched into a course of comparative research, the deep interest I have always taken in the question of Asiatic contact led me to carry my investigation of the same subject into China. It then seemed impossible not to extend researches from Eastern to Western Asia, and from Asia Minor to Egypt, Greece, Rome and Western Europe. It is in this unpremeditated way that the scope of the present investigation enlarged itself of its own accord, for the simple reason that the most interesting and precious facts fell into my way as I advanced and all I had to do was to pick them up and add them to my collection of evidence.

One serious disadvantage, arising from the circumstance that the present investigation has been in press for nearly three years, is my inability to make any alteration, amendment, or addition, in the earlier portions, which stand as written at different times. It is a matter of regret to me that I was not acquainted with O'Neil's "Night of the Gods" and Hewitt's "Ruling Races of Prehistoric Times," at an earlier stage of my investigation, as through them my publication would have been enriched by many valuable additions which I could have incorporated in the body of my work without unduly sacrificing its unity of form.

In the line of Maya investigation notable advances have been made since I wrote (on page 221), about the "septenary set of signs" described by Mr. A. P. Maudslay in 1886, and about the inscription on the tablet of the Temple of the Cross at Palenque (pp. 237-39). Since that time an important publication on the Tablet of the Cross, to which I should have liked to refer, has been issued by the much esteemed Nestor of Maya investigations, Herr Geheimrath Dr. Förstemann. My attention has also been drawn by the best versed of American students of the Maya Codices, Mr. Charles P. Bowditch, to the fact that Mr. Maudslay now recognizes the general recurrence of an eighth sign in combination with the septenary group, causing this to consist of an initial glyph, followed by seven instead of six signs. Referring the reader to pp. 221 and 222, I point out that the employment of an initial glyph, representing the synopsis of a whole, followed by seven signs, appears even more strongly to corroborate my view that the inhabitants of Copan were acquainted with the septenary, cosmical division I have traced.

My fellow archaeologists will understand the disadvantage of issuing an investigation partly written a few years previously, and will realize that, had I, at the outset, been in possession of all the facts I have since learned, the present work would have been very differently planned and executed. On the other hand, as it partakes somewhat of the nature of a log-book, the reader is able to follow closely my blundering course, and will recognize and appreciate some of its perils and difficulties. It being, unfortunately, impossible to re-write the book. I shall have to be resigned to incur some criticism and blame for omissions, which could have been averted. I shall, however, be content if my prolonged study of ancient Mexican archaeology and the present research open out new lines of investigation, and conclusively prove that primitive cross-symbols and the swastika are universally accompanied by vestiges of a certain set of cosmical conceptions and schemes of organization, which can be traced back to an original pole-star worship. I can but think that the material I have collected will also lead to a recognition that the rôle of the Phœnicians, as intermediaries of ancient civilization, was greater than has been supposed, and that it is imperative that future research be devoted to a fresh study and examination of those indications which appear to show that America must have been intermittently colonized by the intermediation of Mediterranean seafarers.

To me the most interesting result of the present investigation is the fact that, having once started on an unpremeditated course of study, I found an unsuspected wealth of material and finally attained one main, totally undreamed-of conclusion, concerning the law

governing the evolution of religion and civilization. This leads me to think that, as I groped in darkness, searching for light, I unwittingly struck the true key-note of that great universal theme which humanity, with a growing perception of existing, universal harmony, has ever been striving to seize and incorporate into their lives. The fact that many of the transcriptions of the original harmony have been and are discordant, and that they temporarily obscure, instead of rendering, its sublime grandeur, unity and noble simplicity, appears as the inevitable result of the mental activity, ingenuity and creative imagination to which mankind also owes its intellectual and spiritual progress.

In conclusion I regret my inability to express adequately my grateful appreciation of the unfailing loyalty of those true friends, in particular Prof. F. W. Putnam, who, trusting in the earnestness of my purpose and endeavor, have constantly encouraged and cheered me as they patiently awaited the long-delayed completion of my work.

Z. N. CAMBRIDGE, MASS., DECEMBER 31, 1900.

THE FUNDAMENTAL PRINCIPLES OF OLD AND NEW WORLD CIVILIZATIONS.

One evening, in February, 1898, I left my desk and, stepping to the window, looked out at Polaris and the circumpolar region of the sky, with a newly awakened and eager interest.

For thirteen years I had been studying and collecting material with the hope of obtaining some understanding of the calendar, religion and cosmogony of the ancient Mexicans, but had hitherto purposely refrained from formulating or expressing any conclusions on the latter subjects having felt unable to extract a clear and satisfactory understanding of the native beliefs from the chaotic mass of accumulated data under which they lay like the ruin of an ancient temple. Though frequently discouraged, I had, however, never ceased to pursue my research and to note carefully the slightest indication or suggestion which might prove of ultimate value. Becoming utterly absorbed in the collection of such notes, I found no time to publish anything during the past four years, though realizing, with regret, that those interested in my work might be disappointed at my delay in issuing the papers announced, in 1894, as speedily forthcoming. Slowly but steadily, however, I was gaining ground. Various excursions along new lines of research increased my experience and, in crossing and re-crossing the field of ancient Mexico, I frequently had occasion to observe certain familiar landmarks, from a new point of view, and illuminated by rays of fresh light proceeding from recently acquired sources. It was remarkable how often facts, which had seemed so hopelessly complicated, finally appeared to be quite simple and comprehensible. This was noticeably the case with the Aztec deities which, for years, had seemed to me as numberless. After closely studying their respective symbols, attributes and names, during several consecutive months, and subjecting them to a final minute analysis, I found that their number dwindled in a remarkable way and also verified the truth of the statement made by the anonymous author of the Biblioteca Nazionale manuscript which I was editing, that the Mexicans painted one and the same god under a different aspect “with different colours,” according to the various names they gave him in each instance.

It was particularly interesting to find that, in assuming that certain names designated different native deities, the early Spanish writers had committed a mistake as great as though someone, reading the litany of the Virgin in a Catholic prayer-book, for the first time, inferred that it was a series of invocations addressed to distinct divinities, amongst whom figured the “morning star,” a “mirror of justice,” and a “mystical rose,” etc. An examination of the texts of several native prayers preserved, established that the Mexicans addressed their prayers to a supreme Creator and ruler, whom they termed “invisible, incomprehensible and impalpable,” and revered as “the father and mother of all.” Some of their so-called idols were, after all, either attempts to represent in objective form, the attributes of the divine power, the forces of nature, the elements, etc., or rebus figures. As these “gods” or “idols” are enumerated farther on and are exhaustively treated in my commentary of the Biblioteca Nazionale manuscript, now in press, it suffices for my present purpose merely to mention here that the most mysterious figure of Mexican cosmogony, Tezcatlipoca, whose symbolical name literally means “shining mirror,” proved to be identical with Mictlantecuhtli, the lord of the underworld, whose title may also be interpreted as “the ruler or regent of the North,” since Mictlampa is the name of this cardinal point.

The Codex Fuenleal (Anales del Museo Nacional, Mexico, tomo II, p. 88) preserves an important myth relating how Tezcatlipoca, after having been the sun, was cast down from this supreme position by Huitzilopochtli, “descended to the water,” but had arisen again in the shape of an ocelot, and transformed himself into the constellation of Ursa Major.

According to Sahagun the native name of this star-group was Citlal-Colotl or “star scorpion.” Reference to Nahuatl dictionaries revealed that this insect had doubtlessly been named colotl on account of its habit of recurving its tail when enraged.

The Nahuatl verb coloa means, to bend over or twist something, the adjective coltic is applied to something bent over or recurved. The noun colotli, which is almost identical with colotl, means “the cross-beams, the mounting, branch or handle of a cross” (“armadura de manga de cruz.” See Molina’s dictionary).

The above facts show that the idea underlying the name for Ursa Major is primarily that of “something bent over or recurved.” It is obvious that the form of the constellation answers to this description. It is, moreover, extremely significant to find, in the Maya language also, a certain resemblance between the words for scorpion and for a cross. This, in Maya, is zin-che and that for a scorpion is zin-au. The above data justify the induction that the native conception of a cross was connected with the idea of its arms being bent over or recurved, as in the Mexican calendar-swastika.

It is important to find the scorpion figured as one of several symbols of Mictlantecuhtli, the lord of the North, in his sculptured effigy preserved at the National Museum of Mexico (fig. 19).

It is more significant that the verb coloa, besides meaning “to bend over or twist something,” also expressed the action “of describing or performing a circle by walking around something.” Now this is precisely what Tezcatlipoca (the Ursa Major) is represented as doing on page 77 of the B.N. manuscript, since he figures there, surrounded by a circle of footsteps. I could but note that this fact showed that the name of Colotl, applied to the constellation, was not incompatible with its identification with Tezcatlipoca. Once my attention had been drawn to the action of walking, performed by this god, I naturally considered, with fresh interest, the peculiar fact that he is usually represented with one foot only. The circumstances under which he had been deprived of this member are set forth in several of the Codices wherein we see that, after he “descended to the water,” he had an encounter with an alligator, who had viciously bitten off his foot and carried it away. (See Féjérvary Codex, pp. 3 and 74. Vatican, II, p. 74.) Pictures representing Tezcatlipoca, after this event, display the broken end of the tibia exposed and the transverse section of the bone forming a ring, usually painted either white or red. Special pains seem to have been taken to accentuate the hollowness of the bone ring, since its centre is usually painted blue, the symbolical color of air, and conventionalized puffs of breath or air are shown as issuing from it (fig. 1). In some cases, as on the sculptured monolith called “the Stone of Tizoc,” these symbols of breath, issuing from the broken tibia, are figured in such a way that modern writers, ignoring what they were meant to represent, were led to identify them as some animal’s tail attached to the foot of the deity. The hollow circle and puffs of air, constantly associated with the god, frequently figure as his ear ornament when his broken tibia is concealed (fig. 2, no. 3). Besides certain fanciful interpretations which have been given to this symbol, it has been explained as being a hieroglyph conveying the name Tezcatlipoca, and consisting of an obsidian mirror=tezcatl, and smoke=poctli. A possible objection to this assertion might be that in Mexican pictography, the mirror is invariably represented as jet-black, in a white or red frame. In the Codex Telleriano Remensis, a combination of symbols (of water, fire and a serpent) are figured as issuing from the base of the bone (fig. 1, nos. 5, 6). Having taken particular pains to collect all representations of the footless god, I was specially interested in one (Féjérvary, p. 1) in which he is figured as standing on the cross-shaped symbol ollin, the accepted meaning of which is Four Movements. The most remarkable and puzzling picture I found, however, is that (fig. 1, no. 2) in which the jaws of a tecpatl, the symbol of the North, are represented as holding one of Tezcatlipoca’s ankles in a tight grip and practically fastening him thus to the centre of a diagonal cross. In this and other pictures (Codex Féjérvary, 41, 43 and 96) it is obvious that the artists had endeavored to convey the idea of a person permanently attached to one spot by one foot. The only form of locomotion possible to him would be to describe a circle by hobbling on one foot around the other, which would serve as an axis or pivot. The association of this peculiarity with the symbols of the North impressed me deeply and involuntarily caused me to think of a title bestowed in the Codex Fuenleal upon the supreme divinity, namely, “The Wheel of the Winds;” as well as of an expression employed by Tezozomoc (Cronica, p. 574). Referring to the constellations revered by the natives, he mentions “the North and its wheel.”

[Illustration.]

Figure 1

Realizing that some definite and important meaning must underlie the remarkable representations of Tezcatlipoca, I resorted to all possible means to gain an understanding of them. Referring to Nahuatl dictionaries, I found a variety of synonymous names for a person who limped or was lame or maimed. Amongst them was Popoztequi from poztequi, the verb, “to break a leg.” Other names were xopuztequi, xotemol and Icxipuztequi (icxitl=foot). The latter name happened to be familiar to me, for the commentator of the Vatican Codex, Padre Rios, gives it as the name of a god and translates it as “the lame devil.” He records it immediately after Mictlantecuhtli, the lord of the North, and designates it as the name of one of the four principal and primitive gods of the Mexicans.

The commentator of the Telleriano-Remensis Codex, moreover, records that these four gods were “said to have been stars and had fallen from the heavens. At the present time there are stars in the firmament named after them” (Kingsborough, vol. v, pp. 132 and 162).

Other synonymous terms for lame persons were icxinecuiltic and xonecuiltic. Tzimpuztequi, on the other hand, besides meaning lame, also signified something crooked, bent or incurvated. The second name furnished me with an important clue, for Sahagun distinctly records that the native name for the constellation Ursa Minor was Xonecuilli and that it was figured as an S (Historia, l. VII, cap. 3). Besides, the Academia MS. of his monumental work contains the native drawing of this star-group reproduced as fig. 16, no. 1. He also states that S-shaped loaves of bread named xonecuilli were made at a certain festival in honor of this constellation, while the B.N. MS. records that a peculiar recurved weapon, figured in the hands of deities, was named xonequitl (fig. 16, nos. 2 and 3).

The above data furnished me with indisputable evidence of the existence, in ancient Mexico, of a species of star cult connected with the circumpolar constellations and with Tezcatlipoca, the lord of the North, the central figure of the native cosmogony. It was puzzling to find this god connected not only with the Ursa Major but also with Ursa Minor, but an indication suggesting a possible explanation or reconciliation of these apparent inconsistencies is furnished by the descriptions of the strange ritual performance, which was annually repeated at the festival Tlacaxipehualiztli and was evidently the dramatization of a sacred myth.

As an illustration and a description of this rite are contained in the B.N. MS. and the subject is fully treated in my commentary, I shall but allude here to its salient features. It represented a mortal combat between a prisoner, attached by a short piece of cord to the centre of a large circular stone, and five warriors, who fought him singly. The fifth, who was masked as an ocelot and always obtained victory in the unequal contest, fought with his left hand, being “left-handed,” a peculiarity ascribed to Huitzilopochtli. It was he who subsequently wore the skin of the flayed victim, an action which obviously symbolized a metamorphosis. One point is obvious: this drama exhibits the victor as a warrior who was able to circumscribe the stone freely and was masked as an ocelot—Tezcatlipoca—the Ursa Major, but was endowed, at the same time, with the left-handedness identified with Huitzilopochtli. This mythical personage vanquishes and actually wears the skin of the man attached to the stone; becomes his embodiment, in point of fact, and obtains the supremacy for which he had fought so desperately. In the light shed by the Codex Fuenleal, before cited, it was easy to see that the entire performance dramatized the mythical combat between Tezcatlipoca and Huitzilopochtli for the position of the ruling power, in the heavens—the sun. At the same time it was decidedly puzzling to find celestial supremacy personified by a man, firmly fastened to one spot, the centre of a stone circle. It was impossible not to perceive the identity of thought underlying the representation of this prisoner and the pictures of Tezcatlipoca, the one-footed or lame god—Xonecuilli the Ursa Minor. It was moreover of extreme interest to note the existence of traditional records, preserved in the native myths, of changes in the relative positions of celestial bodies and of the Ursa Major in particular.

Whilst dwelling upon the striking analogy existing between the representations of Tezcatlipoca held fast by the symbol of the North and the prisoner attached to what is described either as “a temalacatl, stone whorl” or “an image of the sun,” my gaze fell on a small model of the calendar-stone of Mexico, hanging above my desk, and rested on the symbol Ollin in its centre. The learned director of the National Museum of Mexico, Señor Troncoso (Anales del Museo Nacional, vol. II), had expressed his view that this symbol was an actual figurative representation of the annual apparent movements of the sun, and recorded its positions at the solstitial and equinoctial periods. I had, moreover, submitted a drawing of this same figure to the eminent English astronomer, Prof. Norman Lockyer, and he had corroborated this view and established its correctness. On the other hand, I had long noted that the _Ollin_ was usually figured with an eye, the symbol for star, in its centre (fig. 2, nos. 1, 3), and had also paid particular attention to the fact that the Mexicans had conceived the ideas of two suns, a young day sun and an ancient night or black sun. In the B. N. MS., on the mantas worn at their respective festivals, the day sun is depicted in a somewhat fanciful manner, in blue and red on a white field. The black sun is, however, represented in classical style, so to speak, as on the sculptured calendar-stone, with four larger and four smaller V-shaped rays issuing from it. In this connection it is well to recall here that the Mexicans had no specific name for the sun, beyond _Tonatiuh_, which merely means “that which sheds light” and could equally apply to the stars. In the picture-writings the image of the sun was employed to convey the word _Teotl_. But we find that this word, assumed to be equivalent to their “Dios” by the Spaniards, was also a reverential title bestowed upon chieftains and superiors and was constantly employed in the composition of words to signify something divine, supremely beautiful, etc. Whilst I was pondering on the possibility that the symbol _Ollin_ might have represented the movements of the luminaries of night as well as the orb of day, my attention became fixed upon the four numerals in each of the ends of the symbol and I was struck by a certain resemblance between their positions and those of the four stars which form the body of the bear in the constellation of Ursa Major. It was then that it occurred to me, as mentioned in the

opening sentence of this introduction, to look at the familiar constellations, with a view to verifying the resemblance noted above. As my gaze sought “the pointers” in Ursa Major, and then mechanically turned to Polaris, I thought of some passages I had recently re-read, in Professor Lockyer’s Dawn of Astronomy, realizing that his observations, dealing with the latitude 26° (taking Thebes as representing Egypt), could equally apply to Mexico as this country stretches from latitude 15° to 31°.

[Illustration.]

Figure 2

“The moment primitive man began to observe anything, he must have taken note of the stars, and as soon as he began to talk about them he must have started by defining, in some way or other, the particular star he meant.... Observers would first consider the brightest stars and separate them from the dimmer ones; they would then discuss the stars which never set (the circumpolar constellations) and separate them from those which did rise and set. Then they would naturally, in a northern clime, choose out the constellation of the Great Bear or Orion, and for small groups, the Pleiades (_op. cit._ p. 132).... A few years’ observation would have appeared to demonstrate the absolute changelessness of the places of the rising and setting of the same stars. It is true that this result would have been found to be erroneous when a long period of time had elapsed and when observation became more accurate, but for hundreds of years the stars would certainly appear to represent fixity, while the movements of the sun, moon and planets would seem to be bound by no law ... would appear erratic, so long as the order of their movements was not known.”

The reflection that Ursa Major was probably the first constellation which made any deep impression upon the mind of prehistoric man in America, as elsewhere, lent an additional interest to the star-group, as I concentrated my mind upon its form and endeavored to imagine it in four equidistant positions, corresponding to the numerals in the symbol _Ollin_ of the calendar-stone of Mexico (fig. 2, no. 2).

I succeeded in obtaining, in succession, mental images of the constellation in four opposite positions. This effort led to an unforeseen result which surprised me. In a flash of mental vision I perceived a quadrupled image of the entire constellation, standing out in scintillating brilliancy from the intense darkness of the wintry sky (fig. 3, no. 3). At the same moment I saw that it bore the semblance of a symmetrical swastika of giant proportions. This fact, so unexpectedly realized, gave rise to such an absorbing train of new ideas and interpretations of the data I had accumulated, that I left my window, on that memorable night, with a growing perception of the deep and powerful influence the prolonged observation of Polaris and the circumpolar constellations would naturally have exerted upon the mind of primitive man. Deeply impressed with the striking resemblance between the composite image of Polaris, Ursa Major, and certain forms of the swastika, I started on a fresh line of investigation, and devoted myself to the study of primitive astronomy and its influence upon the intellectual development of mankind in general and the American races in particular. After having worked, during thirteen years, without any preconceived ideas about the ancient Mexican civilization and without formulating any general conclusion concerning it, I saw all the knowledge I had slowly acquired fall into rank and file and organize itself into a simple and harmonious whole.

[Illustration.]

Figure 3

Realizing this I perceived how, with the origin of the swastika, I had found the origin of the set of primeval ideas which had governed the human race from its infancy and which, in Mexican and Central American civilizations, ultimately developed into their ingenious system of government and social organization.

[Illustration.]

Plate I. Chart of the Polar Constellations. I: Just After Sunset. II: Midnight. III: Just Before Sunrise.

[Illustration.]

Plate II. Various Forms of the Swastika.

[Illustration.]

Figure 4

The sequel to the above episode was that, with the aid of my movable star-chart, I made the following notes of the apparent positions of the circumpolar constellations at the times of sunrise, midnight and sunset, choosing the periods of the solstices and equinoxes in order to obtain an exact division of the year (pl. I). Whilst studying these I realized that the midnight position was the only stable one, since the actual visibility of the constellations before dawn and after dusk would be subject to considerable variation, according to seasons, latitudes and atmospherical conditions. Having noted these positions, I next combined them separately, obtaining the remarkable results given in fig. 4. The combined midnight positions of the Ursa Major or Minor, at the four divisions of the year, yielded symmetrical swastikas, the forms of which were identical with the different types of swastika or cross-symbols (the normal, ogee and volute, etc.), which have come down to us from remote antiquity and are reproduced here for comparison (pl. II, _a-f_). Reflection showed me that such composite pictures of the Ursa constellations constituted an exact record of their annual rotation, and afforded a perfect sign for the period of a year. I moreover perceived how the association of rotatory motion with the advance of time, and its division into fixed periods or cycles, would be the natural outcome of the recognition of the annual rotation of the star-groups.

The Calendar-Swastika, or cross of ancient Mexico (pl. II, _g_) constitutes an absolute proof of the native association of the cross-symbol with the ideas of rotatory motion and the progress of time, and furnishes an indication that, in an analogous manner, the swastika may have been primarily and generally employed by primitive races, as a sign for a year or cycle. A close scrutiny of the respective forms of the crosses yielded by Ursæ Major and Minor shows that the normal swastika and suavastika may be explained as the separate representations of the two constellations—the angular break in the outline of Ursa Major suggesting the direction of the bend to the right of the arms of the normal swastika, whilst the form of Ursa Minor obviously suggests the bend to the left which is characteristic of the suavastika.

[Illustration.]

Figure 5

My growing conviction that the Bear constellations had furnished the archetype of the different forms of swastika and cross-symbols, found subsequent support when I referred to the map showing the geographical distribution of the ancient symbol published by Prof. Thomas Wilson in his valuable and comprehensive monograph on the subject,(1) to which I am indebted for much information and several illustrations (pl. II, _a-f_, etc.). The map, reproduced here (fig. 5), proves that, with two exceptions, which can be attributed to a migration southward, the employment of the swastika has been confined to the northern hemisphere, _i. e._, precisely to that portion of our globe from which the circumpolar constellations are visible.

[Illustration.]

Figure 6. Star-Map, Representing The Precessional Movement Of The Celestial Pole From The Year 4000 B.C. To The Year 2000 A.D. (_From Piazzi Smyth_.)

The interesting possibility of being able to determine, approximately, the date in the world’s history when the swastika began to be employed as a symbol, next occurred to me. Piazzi Smyth’s star-map, discussed and reproduced in Professor Lockyer’s work already cited (fig. 6), illustrates the changes of direction of the earth’s axis in space, which gives rise to what is called the precession of the equinoxes and has a cycle of something like 25,000 or 26,000 years. Reference to this star-map (fig. 6) proved that the observations, leading to the adoption of the swastika as a symbol, could not possibly have been made until after Ursa Major had become circumpolar, about 4,000 B.C. At that period, when Draconis was the pole-star, the circle described about it by Ursa Major was considerably closer than it is at present. The accompanying illustrations (fig. 7), subject to correction, demonstrate the relative distance of the constellation about 2,770 B.C., 1,800 B.C., and 2,000 A.D., and show how much more strikingly impressive the polar region of the heavens was in remote antiquity.

[Illustration.]

Figure 7.

Let us now briefly review some of the ideas which would naturally suggest themselves to the mind of the primitive observer, after he had recognized the apparent immovability of the polar-star, concentrated his attention upon this feature, and contrasted it with the varying motions of all other celestial bodies in general and with the rotation of the circumpolar star-groups in particular.

This recognition would lead to his gradually learning to utilize Polaris as a means of ascertaining direction. His appreciation of valuable guidance rendered in perilous wanderings would develop feelings of trust, dependence and gratitude towards the one changeless star which permanently rendered valuable services and under whose guidance difficult and essential nocturnal expeditions could be safely undertaken. Superiority and, eventually, extensive supernatural power would more and more be attributed to it, as knowledge was gained of the laws of motion from which it alone seemed to be exempt. This exemption would cause it to be viewed as superior to all other heavenly bodies and even to the sun, and it is easy to see how this idea, becoming predominant, might cause the cult of the pole-star to disestablish an organized sun-cult amongst some tribes. Historical evidence, to which I shall revert more fully proves, indeed, that a native American ruler and reformer actually employed the following reasoning in order to convert his council and people from the worship of the sun to that of a superior divinity which could have been no other but Polaris: “It is not possible that the sun should be the God who created all things, for if so he would sometimes rest and light up the whole world from one spot. Thus it cannot be otherwise but that there is someone who directs him and this truly is the true Creator.”

These words shed a whole flood of light upon primitive religious ideas at an early stage of development. They prove that the association of repose and immovability with the supreme power signified a radical change of thought, based upon prolonged astronomical observation, and indicated intellectual advancement. Attempts to render the new idea objective, to express it and impress it upon the multitude, would naturally end in the production of images of the supernatural power, representing or typifying immovability, changelessness, strength combined with absolute repose.

It is thus rendered evident what a deep significance may be embodied in the rudest images of supernatural beings in attitudes of repose, since a prolonged course of astronomical observation and reasoning may have preceded their production.

Simultaneously with the recognition of Polaris as an immutable centre of axial energy, the rotatory movement of Ursa Major must have excited interest and observation. It was inevitable that star-gazers should gradually recognize a constant agreement between certain positions of Ursa Major and Cassiopeia after dusk for instance, and the annual recurrence of rain, verdure and bountiful food-supplies.

The members of a tribe who, more observant than others, had learned to associate certain positions of these constellations with the seasons and, as a consequence, were able to decide when expeditions to distant localities, in quest of game or fruit, might be successfully undertaken, would naturally assume leadership and command obedience and respect.

The sense of responsibility, superiority and, possibly, rivalry would act upon such individuals as a powerful incentive to further observation and thought and it is evident that, as their mental faculties expanded and one generation transmitted its store of accumulated knowledge to the next, a regular caste of astronomer-leaders would develop, with a tendency to conceal the secrets of their power from the ignorant majority. A broken line, carved on a rock by one of these primitive observers, would have constituted a valuable secret note of the position of Ursa Major on a memorable occasion and would be looked upon as a mystic or magical sign by the uninitiated. A series of such inscriptions might represent the store of astronomical knowledge accumulated by several generations of observers, and it is interesting to recognize that such astronomical records as these were probably the first which men were impelled to perpetuate in a lasting form; since it was absolutely necessary that they should be permanently available for reference at prolonged intervals of time. What is more, the mere fact of being obliged to refer to these inscriptions would cause the astronomers to reside permanently in one locality. The habit of consulting the prophet or oracle before undertaking important steps, involving the welfare of the tribe, would gradually cause the rocks or cavern in which he resided to be invested with a certain sacredness.

It is thus evident that the first men, who rudely scratched the outline of Ursa Major or Minor on a rock, took what was probably one of the most momentous steps in the history of the human race, and it is easy to see how a variety of combinations of circumstances would have led many men, in widely-separated localities and at different periods of the world’s history, to perform precisely the same action. In some cases, under favorable surroundings, the rudimentary attempt would mark the starting point for a long line of patient observation and study, which would inevitably lead to the creation of centres of intellectual growth, to the association of the different positions of the constellation with the seasons and culminate in the habitual employment of a swastika as the sign for a year, or cycle of time.(2)

The idea of rotation, associated with calendar signs and periods, finds its most striking and convincing exemplification in the following description of the ancient Mexican game “of those who fly,” translated from Clavigero (op. et ed. cit. p. 236). This

performance, which furnished a diversion to the Spaniards after the Conquest, had evidently been, originally, connected with religious ideas. “The Indians selected a tall, stout and straight tree, and, lopping off its branches, planted it firmly in the centre of the great square” (which was always situated in the centre of the city and had four roads leading to it from the four quarters). “On the summit they placed a large cylinder of wood, the shape of which was compared by the Spaniards to that of a mortar. Four strong ropes hung from this and supported a square frame composed of four wooden beams. Four other ropes were fastened by one end to the pole itself and wound around it thirteen times. Their loose ends were passed through holes in the middle of each beam and hung from these. Four Indians, masked as eagles or other birds, ascended the pole singly, by means of certain loops of cord, and mounting on the cylinder they performed in this perilous position a few dance-like movements. Each man then attached himself to the loose end of one of the hanging ropes, and then, with a violent jerk and at the same moment, the four men cast themselves into space from their positions on the beams. This simultaneous movement caused the frame and cylinder to revolve and uncoil the ropes to which the men were fastened and these descended to the ground after performing a series of widening circles in the air. Meanwhile a fifth individual, who had mounted the wooden cylinder after the others, stood on this as it revolved, beating a small drum with one hand, whilst he held a banner aloft with the other.” Whilst it is obvious that this peculiar and dangerous performance clearly symbolized axial rotation, typified by the revolving pivot and the four men in aërial motion, its full meaning and intention are only made clear by the following explanation recorded by Clavigero. “The essential point in this game was to calculate so exactly the height of the pole and the length of the ropes, that the men should describe precisely thirteen circles each before reaching the ground, so as to represent the cycle (of 4×13=)52 years.”

This passage constitutes absolute proof that the Mexican Calendar system was intimately associated with axial rotation and ideas such as could only have been derived from observation of Polaris and of the circumpolar constellations. The game itself was a beautiful and well-conceived illustration of the flight of time, typified by the aërial circles performed by the men masked as birds, and of its methodical division into fixed periods.

Leaving the subject of the calendar for the present we must revert to my tables recording the apparent annual and nocturnal axial rotation of the circumpolar constellations.

Whilst studying these the reflection naturally arose, that the people who observed Ursa Major must have paid equal attention to Cassiopeia and noticed that these constellations ever occupied opposite positions to each other as they circled around the pole. Dwelling on the fact that in ancient Mexico Ursa Major was associated with an ocelot, I remembered the many representations in which an ocelot is represented as confronting an eagle, usually in mortal combat. Mexican war-chiefs were classed into two equally honorable grades, designated as the “ocelots and the quauhtlis, _i. e._, eagles.” The constellation of Cassiopeia presents to me, a marked resemblance to the image of a bird with outspread wings, whose head is turned toward Polaris. The fact that when this star-group seems to be above, Ursa Major seems to be below, and _vice versa_, would obviously suggest the idea of an eternal combat between two adversaries who alternately succumbed and resuscitated. It was interesting on reasoning further, to note that once the above idea had taken root it must have been impossible not to associate in course of time, the quadruped and the bird with the elements to which they seemed to pertain, and gradually to conceive the idea of an everlasting antagonism between the powers of the sky and of the earth, or light and darkness, and other opposites which suggested themselves naturally, or were artificially created, by the fertile mind of man. In this connection it should be observed that the mythical adversary of Tezcatlipoca, the ocelot, designated as Ursa Major, is Huitzilopochtli, whose idol, in the Great Temple of Mexico, represented him masked as a hummingbird (see Atlas Duran). The special reason why this bird became associated with the god is explained by the following passage in Gomara (Histoire générale des Indes. Paris, 1584, chap. 96, p. 190): “This bird died, or rather fell asleep in the month of October and remained attached by its feet to a twig. It awakened again in April when the flowers blossomed. For this reason, in the language of the country it is named Huitzitzilin, the resuscitated.” We therefore see that whilst it is stated in the myth that the ocelot arose again after having been cast down from the sky by Huitzilopochtli, the very name of the latter betokened that the bird-god had also only just “resuscitated” from a presumably similar defeat.

[Illustration.]

Figure 8.

As one and the same object may suggest several resemblances at the same time or consecutively, and thus give rise to a group of associations around a single figure, I venture to point out that the zigzag form of Cassiopeia may well have been compared to forked lightning and caused the idea of lightning and thunder to become indissolubly connected with the conception of a great celestial bird. Again there is the possibility that the same star-group may have more strikingly suggested, to other people, the idea

of the winding body of a serpent describing a perpetual circle around a central star. In Mexico, as elsewhere, we find the serpent closely associated with the idea of time. It is represented as encircling the calendar wheel published by Clavigero (fig. 8). Four loops, formed of its body, mark the four divisions of the year. Twin serpents, whose heads and tails almost meet, are sculptured around the famous calendar-stone of Mexico. Four serpents whose bent bodies form a large swastika and whose heads are directed towards a central figure, are represented in the Codex Borgia in association with calendar-signs (fig. 9, _cf._ Féjérvary, p. 24). I shall have occasion to refer in detail to Mexican serpent-symbolism further on.

Meanwhile I would submit the interesting results obtained on combining the positions apparently assumed by the circumpolar constellations during a single night. The tables exhibit four composite groups representing the positions at the solstitial and equinoctial periods (fig. 10).

[Illustration.]

Figure 9.

[Illustration.]

Figure 10.

The night of the winter solstice, the longest of the year, yielded alone a symmetrical figure. It resembled the well-known triskelion, the companion-symbol of the swastika (figs. 10 and 11). Just as this had proved to be the most natural of year symbols, so the triskelion revealed itself as a natural sign of the winter solstice, the period recognized and celebrated by most inhabitants of the northern hemisphere as the turning-point of the year. In a climate like that of Mexico and Central America, however, where the year divided itself naturally into a dry and a rainy season, it is evident that the winter solstice would be less observed and that the ardently-desired recurrence of the rainy season, after a long and trying period of drought, should be regarded as the annual event of utmost importance. Indeed, if carefully looked into, the entire religious cult of these people seems to express but one great struggling cry to the God of Nature for life-giving rain, and a hymn of thanksgiving for the annual, precious, but uncertain gift of water.

[Illustration.]

Figure 11.

To these supplicants the winter solstice betokened little or nothing and it is not surprising to find no proofs of the employment of the triskelion as a sacred symbol in ancient Mexico. On the other hand, it has been traced by Mr. Willoughby on pottery from Arkansas, and in Scandinavia, where the circumpolar constellations have doubtlessly been observed from remote times, and the winter solstice has ever been hailed as the herald of coming spring, the triskelion is often found associated with the swastika.

[Illustration.]

Figure 12.

I am indebted to Prof. Thomas Wilson’s work already cited for the two following illustrations of objects exhibiting this association. The first is a spearhead found in Brandenburg, Germany (fig. 12). The second is a bronze brooch from Scandinavia, to which I shall presently revert (fig. 13). It exhibits, besides the triskelion, swastika and circle, the S-shaped figure which was, as I shall show further on, the sign actually employed by the ancient Mexicans and Mayas as the image of the constellation Ursa Minor, whose outline it indeed effectually reproduces.

Before referring to the Mexican and Maya representations of the star-group, I would next demonstrate that the sacred numbers of Mexico, and of other countries situated in the northern hemisphere, coincide exactly with the number of stars in the circumpolar constellations themselves and in simple combinations of the same.

Ursa Major and Ursa Minor each contains seven stars, and the number seven is the most widely-spread sacred number. Ancient traditions record that the race inhabiting Mexico consisted of seven tribes who traced their separate origins to seven caves, situated in the north. In memory of these, at the time of the Conquest, there were seven places of sacrifice in the city of Mexico. I shall recur to the number seven further on, in discussing the native social organization, and now direct attention to the five stars of Cassiopeia and to the fact that the combination of the stars in this constellation with Polaris and Ursa Major yields the number thirteen. This

result is specially interesting since the entire Calendar-system of Mexico and Yucatan is based on the combination of the numerals 13+7=20, the latter again being 4×5.

[Illustration.]

Figure 13.

On the other hand the same number, 13, is also obtained by the combination of the Ursæ star-groups with Polaris. The number 5 is constantly yielded by Cassiopeia and the four-fold repetitions of the groups supply the suggestion of the number 4. The combination of Ursa Minor and Cassiopeia yields 12. The accompanying figure exhibits swastikas composed of Ursa Minor accompanied by Ursa Major and Cassiopeia separated and combined (fig. 14). I next direct attention to the peculiar difference in the numerical values of the Ursæ swastikas.

In the first, the central star, surrounded by four repetitions of the seven-star constellation, yielded a total of twenty-nine stars—4x5+9. Further combinations will be seen by a glance at the Ursa Major swastika (fig. 4). The analysis of the Ursa Minor swastika is not so simple and occasions a certain perplexity.

When I had first combined the four positions of this constellation, I had, naturally, and without further thought, figured Polaris but once, as the fixed centre, whereas I had repeated the other stars of the compact group four times. It was not until I began to count the stars in the swastika that I realized how I had, unconsciously, made one central star stand for four, and thus deprived the composite group of the numerical value of three stars. On the other hand, if I repeated the entire constellation four times, I obtained a swastika with four repetitions of Polaris in the middle. In this way, however, Polaris became displaced, and the idea of a fixed centre was entirely lost. A third possible method of composing the swastika was to allow one central star for each cross-arm. But this gave two central stars, each of which would represent two stars. Unless enclosed in a circle and considered as a central group by themselves, the four and the two repetitions of Polaris could not convey the idea of a pivot or fixed centre. The three respective numerical values obtained from these experimental combinations were 4×6+1=25, 4×7=28, and finally 2×13 or 4×6+2=26. In each swastika the central star forcibly stood for and represented two or four (fig. 15).

[Illustration.]

Figure 14.

In the triskelions the same perplexity arose: if Polaris was repeated, the idea of a fixed centre was lost (fig. 15); if figured singly, it nevertheless necessarily and inevitably stood as an embodiment of three stars. Reasoning from my own experience, I could but perceive, in the foregoing facts, a fruitful and constant source of mental suggestions, the natural outcome of which would be the association of the central star with an enhanced numerical value, and a familiarity with the idea of one star being an embodiment of two, three or four.

[Illustration.]

Figure 15.

As the evolution of religious thought and symbolism progressed, this idea would obviously lead to the conception of a single being uniting several natures in his person. In this connection it is certainly extremely interesting to find the serpent associated with the Calendar in Mexico and Yucatan, its Nahuatl name being homonymous for twin, _i. e._ two, and the Maya for serpent, _can_ or _cam_, being homonymous for the number four. The serpent was, therefore, in both countries the most suggestive and appropriate symbol which could possibly have been employed in pictography, to convey the idea of dual or quadruple natures embodied in a single figure.(3) Added to this the circumstance that, to the native mind, the serpent, upon merely shedding its skin, lived again, we can understand why the ancient Mexicans not only employed it as a symbol of an eternal renewal or continuation of time and of life, but also combined it with the idea of fecundity and reproductiveness. In Yucatan where the Maya for serpent, _can_, is almost homonymous with _caan_=sky or heaven and the adjective _caanlil_=celestial, divine, the idea of a divine or celestial serpent would naturally suggest itself. It is therefore not surprising to find, in both countries, the name of _serpent_ bestowed as a title upon a supreme, celestial embodiment of the forces of nature and its image employed to express this association in objective form. In Yucatan one of the surnames of Itzamná, the supreme divinity, was Canil, a name clearly related to _caanlil_=divine and _can_=serpent.

In Mexico the duality and generative force implied by the word “coatl” are clearly recognizable in the native invocations addressed to “Our lord Quetzalcoatl the Creator and Maker or Former, who dwells in heaven and is the lord of the earth [Tlaltecuhtli]; who is our celestial father and mother, great lord and great lady, whose title is Ome-Tecuhtli [literally, two-lord=twin lord] and Ome-Cihuatl [literally, two-lady=twin lady”] (Sahagun, book VI, chaps. 25, 32 and 34).

The following data will suffice to render it quite clear that the Mexicans and Mayas employed the serpent as an expressive symbol merely, signifying the generative force of the Creator to whom alone they rendered homage. It is no less an authority than Friar Bartholomew de las Casas who maintained that “in many parts of the [American] Continent, the natives had a particular knowledge of the true God; they believed that He created the Universe and was its Lord and governed it. And it was to Him they addressed their sacrifices, their cult and homage, in their necessities...” (Historia Apologetica, chap. 121).

Friar Bartholomew specially adds that this was the case in Mexico according to the authority of Spanish missionaries and no one can doubt that this was the case when they read that in the native invocations, preserved by Sahagun, the supreme divinity is described as “invisible and intangible, like the air, like the darkness of night,” or as the “lord who is always present in all places, who is [as impenetrable as] an abyss, who is named the wind [air or breath] and the night.” “All things obey him, the order of the universe depends upon his will—he is the creator, sustainer, the omnipotent and omniscient.” He is termed “the father and mother of all,” “the great god and the great goddess,” “our lord and protector who is most powerful and most humane,”—“our lord in whose power it is to bestow all contentment, sweetness, happiness, wealth and prosperity, because thou alone art the lord of all things.” One prayer concludes thus: “Live and reign forever in all peace and repose thou who art our lord, our shelter, our comfort, who art most kind, most bountiful, invisible and impalpable!” (Sahagun, book VI, on the rhetoric, moral philosophy and theology of the Mexicans, chaps. 1-40). It is related that, in gratitude for the birth of a son, the ruler of Texcoco, Nezahual-coyotl erected a temple to the Unknown God.... It consisted of nine stories, to symbolize the nine heavens. The exterior of the tenth, which formed the top of the nine other stories, was painted black with stars. Its interior was encrusted with gold, precious stones and feathers and held “the said god, who was unknown, unseen, shapeless and formless” (Ixtlilxochitl, Historia Chichimeca ed. Chavero, p. 227; see also p. 244). A passage in Sahagun (book VI, chap. VII) states that “the invisible and imageless god of the Chichimecs was named Yoalli-ehecatl [literally, night-air or wind], which means the invisible and impalpable god ... by whose virtue all live, who directs by merely exerting his wisdom and will.” In the Codex Fuenleal (chap. 1) the remarkable title of “wheel of the winds=Yahualliehecatl,” is recorded as “another name for Quetzalcoatl.” This undeniably proves that the Mexicans not only figured the Deity by the image of a serpent but also thought of him as a wheel which obviously symbolized centrical force, rotation, lordship over the four quarters, _i. e._, universal rulership.

[Illustration.]

Figure 16.

Returning from these ideas of later development to the primitive source of their suggestion, let us now examine the native picture of Xonecuilli, Ursa Minor, preserved in the unpublished Academia MS. of Sahagun’s Historia, in Madrid (fig. 16, no. 1). It is an exact representation of the star-group. The fact that the seven stars are figured of the same size in accurate relation to each other, either proves that the eyesight of the native astronomers was extremely keen and their atmosphere remarkably clear, or that possibly, the minor stars of the group were more brilliant in ancient times, than they are now. Astronomers tell us, for instance, that as late as the seventeenth century the star in the body of Ursa Major nearest to the tail, was as bright as the others, while it is now of the fourth magnitude only.

It must be admitted that the shape of the constellation resembles an S. An SS sign is mentioned by Sahagun (Historia, book VIII, chap. 8) as occurring frequently, as a symbolical design on native textile fabrics. It figures as such, in the black garments of the female consort of Mictlantecuhtli in the Vienna Codex, pp. 23 and 33. He denounces it as suspect and hints that it was intimately connected with the ancient religion.

S-shaped sacred cakes, called Xonecuilli, were made during the feast of Macuilxochitl=five flowers, and are figured (fig. 16, no. 2) in the B. N. MS. (p. 69) with a four-cornered cross-shaped cake of a peculiar form (fig. 20, III), which is found associated with five dots or circles in the Codices and also with the Tecpatl-symbol of the North (fig. 20, I and II).

A recurved staff, which is held in the hand of a deity in the B. N. MS. is designated in the text as a _xonoquitl_ (fig. 16, no. 3). Amongst the insignia of the “gods,” sent as presents by Montezuma to Cortés upon his landing at Vera Cruz, were three such recurved “sceptres,” the descriptions of which I have collated and translated in my paper on the Atlatl or Spear-thrower of the

Ancient Mexicans (Peabody Museum Papers, vol. 1, no. 3, Cambridge, 1891, p. 22). In this work I presented my reasons for concluding that these recurved sceptres were ceremonial forms of the atlatl. I now perceive that they were endowed with deeper significance and meaning. The Nahuatl text of Sahagun's Laurentian MS. of the Historia de la Conquista (lib. XII, chap. IV) records the name of one of these staffs as "hecaxonecuilli," literally "the curved or bent over, air or wind," and describes it as made of "bent or curved wood, inlaid with stars formed of white jade=chalchihuite." This passage authorizes the conclusion that four representations in the B. N. MS. of black recurved sceptres, exhibiting a series of white dots, are also heca-xonoquitl, inlaid with stars, and that all of these are none other but conventional representations of the constellation Xonecuilli, the Ursa Minor. In each case the deity, carrying the star-image, also displays the ecacozcatl the "jewel of the wind," the well-known symbol of the wind-god. In one of these pictures (p. 50) he not only bears in his hand the star-image, but also exhibits a star-group on his head-dress, consisting of a central-star, on a dark ground, surrounded by a blue ring. Attached to this against a dark ground, six other stars are depicted, making seven in all. In connection with this star-group it is interesting to note that the hieroglyph, designated by Fra Diego de Landa as "the character with which the Mayas began their count of days or calendar and named Hun-Imix," furnishes a case of an identical though inverted group (Relacion de las Cosas de Yucatan, ed. B. de Bourbourg, p. 237). Enclosed in a black ring, the glyph displays, above, a large black dot with six smaller ones grouped in a semicircle about it, and below, four perpendicular bars.

Subject to correction, I am inclined to interpret this glyph as a hieratic sign for the constellation Ursa Minor and its four movements, and to consider it as furnishing a valuable proof of the origin of the Maya Calendar.

The seemingly inappropriate procedure of figuring shining stars by black dots actually furnishes the strongest proof that a star group is thus represented; for, in the Maya language, "ek" is a homonym for star and black, and a black spot was, in consequence, the most expressive sign for a star. This fact affords a valuable explanation of the reason why the ocelot, whose skin is spotted with black, was employed as the figure of the nocturnal sky, and clearly proves that the Mexicans adopted this symbol and its meaning from the Mayas.

[Illustration.]

Figure 17.

We will now revert to the S-shaped sign. Its association with images of star is further exemplified in Mexican Codices. It occurs on the wall of a temple, in combination with symbols for stars and the North-Mictlan, which consist in this case, of skulls and cross-bones (fig. 17, II).

In the Dresden Codex, of Maya origin, there is an extremely important page on which the S-sign occurs in connection with twin deities, besides rain and cross symbols (fig. 17, I). A careful examination of the group shows that one of the seated figures is accompanied by a downpour of water (painted blue in the original), besides the S-symbol which is also repeated above the head of his companion. Higher up, on the same page, the S occurs again in a group of glyphs alongside of twin-seated figures. These, as well as the single-seated form beneath them, have an eye or a large black spot surmounted by dots instead of a head (Vocabulaire de l'écriture hiératique de Yucatan, p. 38). Monsieur Léon de Rosny has identified this figure, which also occurs in the Codex Troano, as the image of the supreme divinity of the Mayas, of whom more anon, one of whose titles was Kin-ich-ahau, literally Sun-eye lord.

A similar sign consisting of the lower half of a human body seated, with a large eye on its knees is repeated several times in the Borgian Codex. This form is also figured as seated in a temple, without the eye-star, but three stars are on the roof and the S-sign is on the lower wall of the building (Borgian Codex, p. 16).

The above facts demonstrate that, in both MSS. derived from different sources, the same association of ideas is expressed.(4) The S sign appears in connection with twin- or single-seated forms, surmounted by a symbol for star. It is unnecessary for me to lay further stress upon the obvious facts: that the only celestial body which could possibly have been associated with a seated form, suggesting repose, was Polaris. It is, moreover, only by assuming that the sign of the seated star represents the stationary pole-star that its combination in the Codices with the S-sign—Xonecuilli—Ursa Minor, can be understood. I likewise draw attention to the possibility that the S, or single representation of the constellation, may well have been employed as a sign for the summer solstice, since, in some localities, during the shortest night of the year, Ursa Minor may have been visible in one position only. Assuming that the triskelion was the sign for the winter solstice we should thus have natural signs for the two nights marking the turning-points of light and darkness in the year.

Reverting to fig. 17, I, from the Codex Dresdenis, I draw attention that it furnishes definite proof that the Mayas associated the idea of the immovable seated star with twin deities and that they connected the S-symbol with cross and rain symbols. A striking combination of the latter symbols is represented under the principal seated figures. It consists of a diagonal cross traversed perpendicularly by a band of blue water.

[Illustration.]

Figure 18.

Further Maya cross-symbols should be cursorily examined here, viz: fig. 18, I, II, III, VI, VII and VIII. They will be found to consist of variations of two fundamental types, often figured alongside of each other and enclosed in a square, or circle. One type consists of two diagonally crossed bars, plain or representing cross bones (I). A rectilinear cross with interlaced circle (II) is also found. The other type exhibits a small cross, square, circle or dot in the centre of the square with a circle in each corner. In some cases these are united by a series of dots to the central circle and thus form a diagonal cross (VI and VIII) which is sometimes figured as contained in a flower with four petals, such as is also found in Mexican symbolism. The diagonal, dotted cross is frequently combined with four pairs of black bars, placed in the middle of each side of the square, pointing towards the centre. Similar pairs of black bars are figured in the B. N. MS. (p. 3) on the manta of Mictlantecuhtli, with stars, around one of his symbols, a spider. They likewise recur on two of several sacrificial papers on p. 69, amongst which one exhibits a diagonal cross, another the S-sign, while others display realistic drawings of stars with six or eight points.

The pairs of bars figure in the hieroglyph designated by Maya scholars as the sign for _Kin_, the sun, which may be seen in the centre of large diagonal cross-symbols in fig. 18, VII, VIII, from the Dresden Codex: The cross, of fig. 18, VII, is composed of two bones and two arrowpoints, a particularly interesting combination considering that in the Maya a bone is _bak_, an arrow is _kab-cheil_ and the name given to the gods of the four quarters “the sustainers of the world,” is _Bakab_. It cannot be denied that the phonetic elements of this name occur in the words for bones and arrows which form the cross, symbolic of the four quarters. In fig. 18, VIII, the cross may be composed of four bones, but of this I am not certain. In both cases, however, the crosses rest on a curious double and parti-colored symbol and are associated with serpent signs, in which the open jaws and teeth are prominent features. It is noteworthy that while “can” or “cam” is the Maya for serpent, the word “camach” means jaw. The figure consisting of the upper jaw only of a serpent, in the left hand corner of the band above, fig. 18, VIII, proves, therefore, to be a cursive phonetic sign for serpent.

The parti-colored symbol combined with the cross obviously signifies a duality, such as light and darkness, the Above and the Below and a series of dualities—possibly the two divisions of the year, the dry and rainy seasons. In Mexico we are authorized by documentary evidence, to give a wider and deeper interpretation to the symbol of duality, for it can be absolutely proven that the Mexican philosophers divided the heavens into two imaginary portions, and respectively identified these with the male and female principles.

In Nahuatl the West was designated as Cihuatlampa, “the place or part of the women.” The souls of the women who had earned immortality were supposed to dwell there, whilst the souls of the men resided in the East. In the appendix to book III of Sahagun’s Historia, it is described how, according to the native belief, the souls of the male warriors hailed the daily appearance of the sun above the eastern horizon, and escorted it to Nepantla, the zenith. Here the souls of the women awaited it and assumed the duty of escorting the sun to the western horizon, the symbol for which was calli=the house. The above passage indicates that the native philosophers imagined across the middle of the sky a line of demarcation, separating the portions of the heaven respectively allotted to the male and female souls. For four years after death these souls retained their human form, and then, after passing through nine successive heavens, entered into the celestial paradise where they assumed the forms of different kinds of butterflies and humming-birds. The names of these are enumerated in the Nahuatl text of Sahagun’s Laurentian MS. (book III).(5) The symbolism of the humming-bird has already been explained by a passage cited from Gomara’s Historia. In this connection it is extremely interesting to find the humming-bird represented in the B. N. MS., as sucking honey from a flower, which is attached by a cord, covered with bird’s down, to a bone, the symbol of death.

This peculiar but expressive group of symbols figures only on the head-dresses of deities wearing certain other symbols, amongst which we find the Eca-cozcatl and Eca-xonequilli the image of Ursa Minor, already described.

The merest indication of the association of a circumpolar constellation with the idea of death (disappearance) and resurrection (re-appearance) is of special interest, since the ancient Mexicans located the Underworld, the “place of the dead,” in the North.

Reflection showed, however, that such an association could only have suggested itself to the minds of star-observers living in southern latitudes, approximate to the equator, or in localities where the northern horizon was more or less shut off from view by intervening mountains. In such places Polaris would appear comparatively close to the boundary-line of the northern sky so that the Ursa constellations and Cassiopeia would be invisible to the local astronomers at midnight during that period of the year when one or the other of the star-groups seemingly stretched between Polaris and the northern horizon. A glance at plate I shows that, at the present time, it is about the period of the autumnal equinox that Ursa Minor would be invisible at midnight, in such localities, while Ursa Major would gradually disappear from view towards midnight, during a certain number of nights, according to latitude and locality, between the autumnal equinox and the winter solstice whilst Cassiopeia would seem to hover above the horizon. The total or partial alternate periodical disappearance of the two most familiar star-groups in the extreme North and their re-appearance after sometimes regular intervals of time could but have made a profound impression upon primitive astronomers and thinkers. Whilst the mere periodical reversal of the positions of Cassiopeia and Ursa Major suggested alternate victory and defeat, the actual though brief and partial disappearance of either star-group must have appeared to be a descent into an under-ground space, associated with darkness and death, followed by a resurrection. In his Cronica, Tezozomoc records, besides Mictlan (the land of the dead), another name for the underworld, Opochcal-ocan, literally, the place of the house to the left. This appellation can only be understood when it is realized that, in a sufficiently southern latitude, an observer, watching the setting of a circumpolar constellation below the horizon, would always see it disappear to his left and subsequently rise to his right. It is evident that in time this fact would give rise to the association of the left with the underworld, the lower region, and the right with the region above. The native idea of a dwelling in the underworld is further demonstrated by the bestowal of the symbol _calli_=house, upon the western horizon below which all heavenly bodies were seen to disappear. A definite connection between the West and one half of the North being thus established, it would naturally result that a corresponding union of the South and East would be thought of in time, and that these quarters would become associated with the rising of celestial bodies, _i. e._, with light, the Above, while the opposite quarters became identified with their setting, _i. e._, with darkness, the Below.

Pausing to review the foregoing conclusions, which I have shown to be the natural and inevitable result of simple but prolonged astronomical studies, observation and plain reasoning, we see that they led to a conception of the Cosmos as divided into seven parts, _i. e._, the fixed Centre, the pivot, primarily suggested by Polaris who was regarded as the creative, generative and ruling power of the universe; the Four Quarters, seemingly ruled by the central force and associated with the elements; the Above and the Below, suggested by the rising and setting of celestial bodies and associated with light and darkness, sky and earth, etc., etc.

Many of my readers will doubtless recognize at once that the above organization of the Cosmos into the Centre or Middle, the Above and the Below, and the Four Quarters, is precisely that which the Zuñi priests taught Mr. Frank Cushing, when they initiated him into their secret beliefs. Other explorers have recorded the same conception amongst different native American tribes and with these proofs that this set of ideas is still held on our Continent at the present time, I point out the fact that the Maya figures (fig. 18, VII and VIII, from the Dresden Codex) become perfectly intelligible only when interpreted as representing the Centre, the Four Quarters, the Above and the Below, the latter figured by the dark and light halves of the dual sign. Furthermore, I can demonstrate that this fundamental set of elementary, abstract ideas, furnishing the first principles of organization, is plainly visible under the surface of the ancient Mexican civilization and can be traced not only in Yucatan and Central America, but also in Peru. In these countries, as I shall show, it assumed an absolute dominion over the minds of the native sages, directly suggesting the forms of government and social organization existing at the time of the Conquest and faintly surviving to the present day. It entirely controlled the development of aboriginal religious cult and philosophical speculations and pervaded not only the native architecture and decorative art, but also all superstitious rites and ceremonies, and entered into the very games and pastimes of the people.

The following table presents the bare outline of the scheme of organization exposed in the preceding text. In making it I have, after due consideration, definitely adopted the assignment of the Mexican symbols and colors to the cardinal points given by Friar Duran in the Calendar-swastika contained in his atlas and reproduced (pl. II, _g_).

Each of these is North; West; South; then East. Symbols: Tecpatl, Flint; Calli, House; Acatl, Cane; Tochtli, Rabbit. Colors: Red; Yellow; Blue; Green. Elements: Fire; Earth; Air; Water. Warmth; Darkness; Breath; Rain.

Together, North and West are The Below, the “female” region. TEZCATLIPOCA=MICTLANTECUHTLI.

South and East are The Above, the “male” region, HUITZILOPOCHTLI.

Combined, they are The Centre. The dual, generative, ruling and directive Force. QUETZALCOATL. The Divine Twin.

Before proceeding to examine more closely the great edifice of human thought which was reared, in the course of centuries, on the ground plan designated above, we must retrace our steps and consider what a deep impression the gradual realization of the changes in the relative positions of Polaris and certain familiar star-groups must have produced upon those who were the first to realize them. Transporting ourselves back to the gray dawn of civilization, let us endeavor to understand the position of the native priest astronomers who, having received and transmitted a set of religious and cosmical ideas, based on the assumption of the absolute and eternal immutability of the centre of the heaven, Polaris, gradually became aware that it also was subject to change, evidently obeyed an unseen higher power and that the ancient order of things, recorded by their predecessors, had actually passed away.

It is obvious that, in all centres of astronomical observation and intellectual culture, a complete revolution of fundamental doctrine or thought must have taken place. A period of painful misgivings and doubt must have been passed through, during which an earnest and anxious observation of all celestial bodies must have seemed imperative and obligatory. Under such circumstances astronomy must have made great strides and astronomical observation become the foremost and highest duty of the intellectual leaders of the native races. Pyramids and temples would be built for the purpose of verifying and recording the positions of sun, moon, planets and stars, and the orientation of these buildings would be carefully planned accordingly. Before obtaining glimpses of the great evolution of religious thought which progressed on our Continent in olden times, it is well to realize, by means of Piazzi Smyth's map (fig. 6) that the world ceased to possess a brilliantly conspicuous, absolutely immovable pole-star for a prolonged period of time, stretching somewhere between 500 B.C. and 1200 A.D.

The ancient native chronicles record that under "divine" leadership great migrations of tribes took place within this period, the purpose of which was to find a locality which fulfilled certain ardently-desired conditions connected with religious cult.

From various centres of civilization in Mexico and Central America we also hear different accounts of how, at different times, small bands of earnest men, under a leader of superior intelligence, bent on a peaceable but unexplained errand, arrived from distant regions and departed for an unknown goal, after delaying just long enough to teach social organization and impart a higher civilization to the tribes encountered on their passage.

These preserved the memory of the _title_ of the leader, in their different languages and he became the culture-hero of their tribe. The fact that, in each case, these sages taught the ignorant tribes the division of time and instituted the calendar, proves that they were skilled in astronomy.

From a sentence uttered by Montezuma to the native astronomers whom he termed "the Sons of the Night," we learn that it was their custom "to climb mountains" so as "to study the stars." When one considers the full import of the problems which had to be faced by these ancient sages, who earnestly endeavored to account for the great changes which had taken place in the heavens, within the memory of man, it seems natural to suppose that many an expedition was undertaken for the purpose of acquiring further astronomical knowledge, of finding, perhaps, the immovable star which had been revered in past ages by the ancestors of the native race.

The cult of Polaris may well have made such expeditions assume the aspect of an imperative religious duty and sacred pilgrimage. As all expeditions across Mexico and Central America would necessarily be limited by the oceans and be fruitless as far as Polaris was concerned, it is obvious that the line of exploration which would be ultimately adopted, would run from south to north and _vice versa_. A small band of enthusiasts, setting forth under the leadership of some of the most advanced thinkers of the time, would undoubtedly have been prepared to devote their entire lives to the object in view. As long as a single member of such an expedition existed, he would be a powerful and active agent in spreading the fundamental set of ideas derived from the observation of Polaris. In lapse of time, by transmission, its influence might travel to a region too remote perhaps for direct contact to have taken place.

If I have indulged in the foregoing line of conjecture and surmise, it is because it is my purpose also to demonstrate, by absolute proof, that the dominion of the above set of ideas extended over Yucatan, Honduras, Guatemala and even reached Peru, where its influence is distinctly visible.

It also extended far to the north in prehistoric times, for certain carved shell-gorgets which have been found in prehistoric graves in Illinois, Missouri and Tennessee exhibit emblems which have definite meanings in the Maya language, spoken in Yucatan.

In order to maintain this assertion I must make a slight digression from the main subject and revert to the myth already cited, recording the casting down from heaven of Tezcatlipoca who arose and ascended again in the form of an ocelot. There are

interesting native pictures of this combat and the fall of the ocelot in the Vatican Codex II, p. 34, the Féjérvary Codex, p. 56, and others equally important, representing the fall or descent of an eagle from the sky, to which I shall revert.

It is moreover recorded by Mendieta (p. 82) that Tezcatlipoca likewise descended or let himself down from the sky by a spider's thread, and in the Bodleian MS. (p. 12) there are two curious pictures one of an ocelot and a cobweb, the other of an ocelot, descending head foremost from stars. The same incident is also pictured in the Vienna Codex (p. 9) where the ocelot, attached by the tail, is connected by a cord with star-emblems.

There are two facts of special interest in regard to the above descent of Tezcatlipoca by a spider's thread. The first is that the title Tzontemoc="he who descends head foremost" is recorded in the Codex Fuenleal immediately after the name Mictlantecuhtli. The second is that the spider is figured on the manta of Mictlantecuhtli in the B. N. MS. and is sculptured in the centre, above his forehead, in his sculptured image, identified as such by Señor Sanchez (Anales del Museo Nacional III, p. 299) and reproduced here (fig. 19). It represents "the lord of the North or Underworld" descending, head foremost, with a tecpatl or flint knife issuing from his mouth and with outspread limbs, the outlines of which are almost lost under the multitude of symbols which are grouped around him. These symbols are carefully analyzed in my commentary on the B. N. MS. in which I also describe other known carved representations of the same conception and point out analogous pictures in the Maya Codices. The position of the limbs of the descending figure is best understood by a glance at fig. 20, II, from the Dresden Codex. It represents a bar with cross symbols from which a human body is descending. The feet rest on dual symbols, about which more could be written than the scope of the present paper allows. A tecpatl or flint knife, attached to the body by a double bow with ends, may be seen between the dual symbols, and its presence is of utmost importance since it proves that the Mayas also associated the flint with the same figure. Instead of a head the body exhibits a sort of equidistant cross with four circles. Strange to say, the only analogous cross-figures I have been able to find in all the Codices are those reproduced in fig. 20, I, III, and IV. The latter exhibits a curious, conventionalized flower growing on the top of a pyramid. Its stem and leaves are painted brown and are spotted, resembling the skin of an ocelot. As there is a Mexican flower, the Tigridia, of which the native name was ocelo-xochitl, it may be that it is this which is thus represented. Fig. 20, III, from the B. N. MS., figures as a sacred cake, alongside of the S-shaped xonecuilli breads which were made in honor of Ursa Minor at a certain feast. Finally, fig. 20, I, represents a certain kind of ceremonial staff which is inserted between the two peaks of a mountain—a favorite method employed by the native scribes, to convey the idea that the object figured was in the exact centre. This kind of staff occurs frequently in certain Codices, sometimes being carried by a high priest. It invariably exhibits a flower-like figure with five circles and is surmounted by a tecpatl or flint knife. Without pausing to discuss the subject fully I merely point out here that, collectively, these symbols explain each other and convey the idea of the Centre and the Four Quarters evidently associated with the tecpatl, the symbol of the north, and the ocelot and xonecuilli=Ursa Minor. It is particularly interesting to note that the outspread human body is made to serve as a sort of cross-symbol. A careful study of the conventional representation of the face of "the lord of the North," in fig. 19, gives the impression that it was also used to convey the idea of duality, or the union of two in one. The upper half of the face exhibits a numeral on either cheek under the eyes, seeming to convey the idea of dualities. The two circular ear ornaments, united by a band above the head, and the two nostrils united in one nose, seem to convey the idea of the union of the dualities, whilst the lower half of the face, which is rendered strikingly different to the upper, by being in higher relief and marked with perpendicular lines, exhibits a mouth from which a flint knife, with symbolical eye and fangs carved on it, is hanging like a tongue. I have already shown that the flint knife was regarded as the sacred producer of the "vital spark." I may add here that I have also found, in the Codices, tecpatl-symbols on which the curved symbol of air or breath was figured. To my idea the sculptured face is meant to symbolize the dual creator, the dispenser of the spark and breath of life, whilst the human skull on his back betokens that he is also the giver of death. Though unable to enter fully into the subject here, I would nevertheless state that I can produce further data to prove that the human face was frequently employed for a symbolical purpose by the native American races who were evidently entirely under the dominion of the idea of duality, of the Above and Below and the life-producing union of both.

[Illustration.]

Figure 19.

[Illustration.]

Figure 20.

The question why the spider, named “tocatl” in Nahuatl, should have been adopted as the chief symbol of Mictlantecuhtli, occupied me much until I found the clue to its significance in the Maya language. In this the word for North is _Aman_ and the name for “the spider whose bite is mortal,” is _Am_. This striking fact may be interpreted as a positive proof that the spider-symbol, employed by the Mexicans, must have originated in Yucatan, from the mere homonymy of two Maya words.

On the other hand shell-gorgets exhibiting the effigy of a spider, and obviously intended to be worn with its head turned downwards, have not only been found in Illinois but also in Tennessee and Missouri. On the gorgets from the latter States a cross is carved on the body of the spider (fig. 22, _a_). As certain spiders exhibit cross-markings, it is, of course, possible that it was chosen as a cross-symbol for this reason only, in some localities, just as the butterfly was evidently adopted in Mexico, as an apt image of the Centre and the Four Quarters on account of its shape and its possession of four wings. The conventionalized figure of a butterfly, with a star on its body and four balls, painted with the colors of the quarters, was a sacred symbol which is minutely described by Sahagun and is figured on a manta in the B. N. MS. A glance at its reproduction (fig. 21, no. 13) shows how the form of the insect has been conventionalized so as to resemble the ollin (no. 12) and other Mexican cross-symbols (nos. 2, 4, 11, 14 etc.). The eye or star in its centre, like that in the ollin, and circle (no. 4), signify Polaris; the conventionalized head and antennæ are obviously made to convey the idea of “two in one,” of the Above and Below united in the Centre.

[Illustration.]

Figure 21.

I venture to suggest that the dragon-fly was employed as a cross-symbol in an analogous manner, on the Algonquin garment preserved at the Riksmuseum, Stockholm, and described by Dr. Hjalmar Stolpe in his admirable study on American art (Amerikansk Ornamentik, Stockholm, 1896, p. 30). As I shall revert to it later on, I now draw special attention to the circumstance that instead of the cross, on a spider-gorget from Tennessee, there is a round hole which, when the shell-disc is held aloft, lets a ray of light shine through and furnishes an apt presentation of a star. This and the cross furnish analogies to the Mexican and Maya symbols of Polaris which are too obvious to need to be emphasized. Nor do these gorgets alone furnish an undeniable indication that an identical symbolism extended from Yucatan to Illinois. Other gorgets, also figured in Mr. Wm. H. Holmes’ monograph “Art in Shell,” several of which are in the Peabody Museum, from the stone graves in Tennessee, exhibit variously carved representations of a serpent. In all specimens the identical idea is carried out: the eye of the serpent forms the centre of the design on the disc and four circles on the body of the reptile, or four solid bars, interrupting a hollow line encircling the central motif, emphasized a division of the disc into four equal parts. The idea of the Serpent in repose, the Centre and the Four Quarters is thoroughly carried out and the true meaning of the design is only appreciated by the light of the Maya and Mexican symbolism which has already been so fully discussed.

[Illustration.]

Figure 22.

The third Tennessee gorget reproduced here (fig. 22, _c_), from Mr. Holmes’ work, exhibits a combination of numerals which is particularly interesting if confronted with the sacred numbers of the Mexicans and Mayas. From a central circle three curved lines issue in a fashion resembling those on fig. 21, no. 2, but the fact that the circular band exhibits seven double circles and the outer edge is divided into thirteen parts, is of special moment. Still another design, on a shell-gorget from Tennessee, not only exhibits the peculiarity, pointed out by Mr. Holmes, of a square with loops, resembling certain figures in Mexican Codices, but also other significant details which I shall point out (fig. 22, _b_). The cross in the centre occupies the centre of a star with eight rays and the four birds’ heads at the sides of the square illustrate rotation from right to left. I am inclined to view in this gorget an emblem of Polaris with Cassiopeia in rotation around it, figured as a bird, but whether this is the case or not it must be conceded that it is indeed remarkable to find a set of symbols, consisting of the spider, the cross, the serpent and the bird, carved on prehistoric gorgets found in the United States whilst the deep meaning of these identical symbols is furnished by Maya and Mexican records. I venture to remark here that no more expressive and appropriate ornament than these shell-gorgets could have been designed, or worn by the ancient Maya or Mexican priests, prophets and leaders who, in a remote past, had guided themselves by the light of Polaris and instituted its cult as the basis of their native religion.

On realizing the above-mentioned identity of symbolism, it is impossible not to conclude that the prehistoric race which inhabited certain parts of the United States was under the dominion of the same ideas as were the Mexicans and Mayas. The indications

point, in fact, to the probability that the origin of the employment of the spider-symbol originated in Yucatan, and if this be admitted then there is no reason to deny the possibility that the serpent-symbol came from there also, since the Maya language suggests an affinity between the serpent, _can_, and the sky=_caan_, and the numeral 4=_can_. I refrain, for the present, from expressing any final conclusion on this subject, which will doubtless afford ample food for reflection and argument to all interested in the important problem as to where the cradle of ancient American civilization was situated. But these symbolic gorgets go far towards substantiating Professor Putnam's oft-expressed conclusions that the ancient peoples of the central and southern portions of the United States were, to a certain extent, offshoots of the ancient Mexicans.

[Illustration.]

Figure 23.

Before abandoning the subject of native symbolism and star-emblems I should like to present, as a curiosity, with an appeal to specialists to enlighten me as to the astronomical knowledge of the Eskimos, an Eskimo drawing from Professor Wilson's instructive and useful monograph. It is said to represent a "flock of birds," but so closely resembles Cassiopeia and Polaris that I am tempted to view it as an indication that the Eskimos may also have associated the idea of a celestial bird, or birds, wheeling around a central point, with the constellation and the pole-star (fig. 23). Having once ventured so far afield, I cannot refrain from presenting here an interesting set of aboriginal star-symbols, reproduced from Professor Wilson's comprehensive work (fig. 24), each composed of a cross combined, with a single exception, with a circle. I draw attention to the striking resemblance of some of these signs to those painted on the finely decorated pottery found on the hacienda of Don José Luna, in Nicaragua, and described by J. F. Brandsford, M.D. (Archaeological Researches in Nicaragua, Smithsonian Inst., 1881, p. 30, B), and suggest that, in both localities, the symbol may be a rudimentary swastika, and represent Polaris and circumpolar rotation.

[Illustration.]

Plate III. 1. Shell gorget, Missouri. 2, 5-14. Pottery vessels, Arkansas. 3, 4, 15-17, 19-28. Pottery vessels, Missouri. 18. Pottery vessel, Kentucky. 6. National Museum. 3, 16, 17, 21, 24, 25. St. Louis Academy. All others Peabody Museum. Willoughby, "Pottery from the Mississippi Valley." Journal of American Folk-lore, January-March, 1897.

In conclusion I refer the reader to Mr. C. C. Willoughby's valuable and most interesting "Analysis of the decorations upon pottery from the Mississippi Valley" (Journal Amer. Folk-lore, vol. X, 1897), in which he figures the remarkable specimens preserved in the Peabody Museum, Cambridge, the designs on which, as he states, "are mostly of symbolic origin and have been in use among various tribes within the historic period from the Great Lakes to Mexico." With the kind permission of the editor of the Journal, I reproduce some of Mr. Willoughby's illustrations on Plate III.

[Illustration.]

Figure 24. Crosses And Circles Representing Star Symbols, Arizona.

Returning to consider the probable result of the gradual diffusion of star-cult owing to natural causes and of the consequent divergence from the idea of the Centre, which had so deeply influenced the minds of primitive men during many centuries, with earnest, and extended astronomical observation, keeping pace with the development of the idea of the Above and Below, it is obvious that the utmost attention would be next given to the conspicuous star groups and planets which are visible at certain times and then seem to have departed or descended into the under world. Any one who has read the interesting communications by Herr Richard Andree (Globus. bd. LXIV, nr. 22), On the relation of the Pleiades to the beginning of the year amongst primitive people, followed by a note by Herr Karl von den Steinen on the same subject, will realize that widely-separated tribes of men, by dint of simple observation, knew the exact length of the periodical appearance and disappearance of this star group and regulated their year accordingly. Herr Andree cites, for instance, that "in the Society islands, the year was divided into two portions, the first of which was named Matari-i-inia=the Pleiades above. It began and lasted during the time when these constellations were visible close to the horizon after sunset. The second period, named Matarii-i-raro=the Pleiades below, began and lasted for the time during which the star-group was invisible after sunset" (W. Ellis, Polynesian Researches, vol. II, p. 419, London 1829). That the ancient Mexicans had likewise observed the Pleiades and been deeply impressed by them is proven by the well-known fact that the ceremony of the kindling of the sacred fire, which betokened the commencement of a new cycle, was performed "when the Pleiades attained the zenith at midnight precisely." In my complete monograph in the ancient Mexican calendar-system it will be my endeavor to present all the data I have collected concerning the degree of elementary astronomical knowledge attained by the

native astronomers. I shall, therefore, content myself with pointing out here that besides the foregoing testimony about the Pleiades, the native name for which was the miec=the many, or the tianquiztli=the marketplace, there are records proving that the cult of the planet Venus was a firmly established feature of the native religion at the time of the Conquest. Sahagun records that the Nahuatl names for this planet were citlalpul or hueycitlallin both signifying “the great star.” “In the great temple of Mexico an edifice named ilhuicatitlan [literally, the land of the sky] consisted of a great, high column, on which the morning star was painted.... Captives were sacrificed in front of this column annually, at the period when the star re-appeared” (_op. cit._ appendix to book II).

With regard to the connection of the Pleiades with the beginning of the Mexican cycle, it is interesting to note Herr Andree’s statements that the most intimate connection of the star-group with the thoughts of primitive people, would naturally take place in such localities where its periodical movements coincided with the changes of season, wind and weather which affected agriculture. A survey of the data presented by Herr Andree shows that the cult of the Pleiades attained its greatest development amongst tribes inhabiting a southerly latitude. It was in South America, indeed, that the Peruvians, alongside of their highly developed sun-cult, rendered homage and offered sacrifices to the Pleiades. In Mexico, the cult of the Pleiades appears as intimately associated with that of the sun and to have assumed importance only in historical and comparatively recent times, probably when the periodicity of the sun’s movements had been taught or recognized and the sign _ollin_, which is an exact presentation of the annual course of the sun, had been invented and adopted as a symbol. I have already pointed out that this sign occurs on the calendar-stone, for instance, which has a human face in its centre, bearing two numerals on the forehead and obviously symbolizing the union of two in one. In other instances the centre displays the eye, or star symbol and conveys the suggestion that the “four movements” of the circumpolar constellations were thereby symbolized. It may be that, in ancient Mexico, the two symbols, respectively referring to the movements of the sun and of the circumpolar star-groups, were emblematic of the two different cults or religions which existed alongside of each other. The first, the cult of the Above, of the Blue Sky, was directed towards the sun and the planets and stars intimately associated with sunrise and sunset, amongst them the Pleiades. The cult of the Below, of the Nocturnal Heaven, was directed towards the moon, Polaris and the circumpolar constellations—also to the stars and planets during the period of their disappearance and possibly in the same way to the enigmatical “Black Sun,” figured in the B. N. MS. which may have been the sun during its nightly stay in the House of the Underworld, whose door was in the west. In order to obtain an idea of the immense proportions ultimately assumed by these two diverging cults and the enormous influence they exerted upon the entire native civilization, it will be necessary to examine the form of the social organization in Montezuma’s time.

In order to comprehend this, however, it is first necessary to study carefully the myths relating to its origin. Torquemada (lib. VI, chap. 41) cites the authority of Friar Andreas de Olmos for the following native account of the creation of man, which was differently recounted to him in each province. He states that the majority of the natives, however, agreed that “there was in heaven a god named ‘Shining Star’ (Citlal-Tonac) and a goddess named ‘She of the starry skirt’ (Citlal-Cue), who gave birth to a flint knife (Tecpatl). Their other children, startled at this, cast the flint down from the sky. It fell to earth at the place named ‘Seven caves’ and ‘produced 1,600 gods and goddesses,’ ” a figure of speech which evidently expressed the idea that, in coming in forcible contact with the soil the flint gave forth sparks innumerable which conveyed vitality to numberless beings. It is evidently the same idea of “life sparks” being called into existence by the union of heaven and earth which underlies the Texcocan version of the creation of man recorded as follows by Torquemada (_op. et loc. cit._). “The sun ... shot an arrow towards the land of Acolma near the boundary of Texcoco. This made a hole in the ground whence issued the first man....”

[Illustration.]

Figure 25.

The illustrated version of the above myths, given in the Vatican Codex I, designates the celestial progenitor of human life as Quetzalcoatl, also named Tonaca-Tecuhtli=the lord of our subsistence, Chicome-xochitl=“Seven roses or flowers” and Citlalla-Tonalla=“The Milky Way,” literally, The shining stars. The dual divinity is figured (fig. 25, no. 4) as two persons with the shaft of an arrow over each of their heads and with the symbol Tecpatl=flint, between them as the issue of their union. In the Borgian Codex (fig. 25, no. 1), a barbed arrowpoint, instead of the Tecpatl, figures between the celestial parents. Their union is symbolized by a covering, the shape of which, in further representations (fig. 25, nos. 3 and 5) in the same MS., offers resemblance to the tau-shaped windows which are such a common feature in Maya and also in Pueblo architecture (fig. 25, no. 2_b_). The preceding data, which could be amplified, seem to show that the natives associated the tau-shape not merely with the idea of the Male and Female principles, but also with the Above and the Below, or Heaven (air and water) and Earth (earth and fire). I shall have occasion, further on, to refer again to the symbolism of the native tau.

The above illustrations, however, definitely prove that the flint knife and the arrow (with a flint point, presumably), were indiscriminately designated as the medium by means of which the spark of life was created and imparted to earth-born beings.

It will be proved further that, at the period of the Conquest, the arrow was revered as an image of life-producing force in Yucatan and Mexico. The flint knife cased in wrappings was called “the son” of Cihuacoatl, the earth-mother, and was regarded as her special symbol. It is significant, therefore, to find that it was the emblem of office of one of the two high priests, who alone employed it, as a sacrificial knife, in performing his awful duty of immolating human victims.

The fact that the cane-shaft of an arrow figures above the head of the celestial couple in the Vatican Codex is particularly interesting because the name Ome-Acatl=Two-Cane, is given as the name of a divinity by Sahagun (book I, chap. 15) and that the ceremony of kindling the New Fire, at the commencement of a cycle of years was also associated with the calendar sign Ome-Acatl (Sahagun, book VII, chap. 10).

At a certain festival images of Omacatl were manufactured and carried by the devout to their houses in order to receive from them “blessings and multiplication of possessions” (Sahagun, book II, chap. 19).

I draw attention to the fact that life is supposed to have proceeded from the union of stellar divinities, that the Tecpatl and flint are the well-known symbols for the North and Fire and that the Vatican commentator identifies the celestial parent as “Seven-Flowers.” What is more, Duran (vol. I, pp. 8 and 9) relates that the native race was organized into seven separate tribes and that these “claimed to have come out of ‘seven caves’ (Chicom-oztoc) which were situated in Teo-Culhuacan or Aztlan ‘a land of which all men know that it is in the North.’ ” Now Teo-Culhuacan is composed of the word Teotl, which designated the stars, the sun, the gods and, by extension, something divine or celestial. Culhua (_cf._ Coloa) means something bent over or recurved, or the action of describing a circle by moving around something, and _can_ means “the place of” in Nahuatl. This locality is represented in the picture-writings by a strange and impossible mountain with a recurved summit (fig. 26, no. 1). Aztlan literally means “the land of whiteness, brightness, light.” In Duran’s Atlas the seven caves are represented as containing men and women—the progenitors of the seven tribes. The order in which these are described, in the Mexican myth, as having issued from the caves, is instructive and sheds light upon the provenance and purpose of the tradition. It represents the Mexicans as the superior predestined race who remained in their cave the “longest, by divine command,” their “god having promised them this land.” The tradition relates that six tribes reached and settled down in the central plateau of Mexico, 302 years before the Aztecs arrived, under the leadership of Huitzilopochtli an oracular divinity, whose commandments were transmitted to the people by four priests (Duran, chap. II).

In my opinion it is impossible to study the above and supplementary data without realizing that the native race assigned its origin to a dual star-divinity, associated with the Tecpatl, the symbol for the North and for Fire. The peculiarity that the divinity is designated as Seven-flowers, and that there were seven tribes, indicates that the native idea was that each tribe came from one of the seven stars in Ursa Major or Minor. The Aztecs seem to have claimed for themselves the descent from the superior star, the central one, and to have thus justified or supported their ultimate establishment of a central government which ruled over the other six tribes.

[Illustration.]

Figure 26.

The assumption that the native race claimed descent from the Ursa Major or Minor constellation is further supported by the fact that the shape of the mythical recurved mountain and the name Aztlan=land of light or brightness are simultaneously explained, as well as the number of caves and tribes. It does not seem to be a mere coincidence that in two totally different Codices (the Selden MS. p. 7, Kingsborough, vol. 1, and the B. N. MS., p. 70) a sacred dance is represented as executed by seven individuals who move around a central seated personage. In the latter MS. the seated figure wears a head-dress surmounted by flint knives and his face is painted _red_ the color assigned to the North. Moreover the dance is taking place before an image of Mictlan-Tecuhtli, the lord of the North, whose raiment is strewn with cross-symbols. Referring to other native dances we find that the most sacred of all dances was performed at the festival of the god of fire by priests only, who, smeared with black paint to typify darkness and night, carried two torches in each hand and first sat, then slowly moved, in a circle, around the “divine brazier,” and finally cast their torches into it (Duran II, p. 174). This, probably the most ancient of sacred dances, must have been extremely impressive and significative to those who witnessed it, at night-time, from the base of the pyramid and heard the distant solemn chant of the dancers. To watchers from afar, the fire and the lighted torches revolving around must have seemed like a great central star with other stars wheeling about it.

Further on, it will be shown that the earliest form under which the Deity was revered was that of fire and the foregoing description fully explains why it was first chosen as the most fitting image of the central immovable star. It has already been shown that, in the popular game of “the flyers,” a high pole surmounted by one man served as the pivot for the circumvolation of the four performers, who “acted” the “flight of time.” The idea of an extended rule, proceeding from a central dual force, was, however, carried out on a grand scale in the most solemn of all public dances named the Mitotiliztli. Duran (II, p. 85) states that as many as “8,600 persons danced in a wheel in the courtyard of the Great Temple, which had four doorways, facing the cardinal points and opening out on to the four principal high roads leading to the capital. The doorways were respectively named after the four principal gods and were spoken of as ‘the doorway of such and such a god.’ ”

Clavigero, to whose work (Historia, ed. Mora, Mexico, 1844, p. 234) I refer the reader for further details, describes the dances at the time of the Conquest as having been most beautiful, and relates that the natives were exercised in these, from their childhood, by the priests. This authority also relates that the Mitotiliztli was performed by hundreds of dancers at certain solemn festivals, in the great central square of the city or in the courtyard of the temple, and gives the following description:

The centre of the space was occupied by two individuals (designated elsewhere as high priests) who beat measure on sacred drums of two kinds. One, the large huehuetl, emitted an extremely loud, deep tone, which could be heard for miles and was usually employed in the temples as a means of summoning to worship, etc. The second, the teponaztle, was a small portable wooden drum which was usually worn suspended from the neck by the leader in warfare and emitted the shrill piercing note he employed as a signal. The chieftains (each of which personified a god) surrounded the two musicians, forming several concentric circles, close to each other. At a certain distance from the outer one of these, the persons of an inferior class were placed in circles and these were separated by another interval of space, from the outermost circles, composed of young men and boys. The illustration given by Clavigero records the order and disposition of this sacred dance, which represented a kind of wheel, the centre of which was occupied by the instruments and their players. The spokes of the wheel were as many as there were chieftains in the innermost circle. All moved in a circle while dancing and strictly adhered to their respective positions. Those who were nearest the centre, the chieftains and elders, moved slowly, with gravity, having a smaller circle to perform. The dancers forming the outer circles were, however, forced to move with extreme rapidity, so as to preserve the straight line radiating from the centre and headed by the chieftains. The measure of the dance and of the chorus chanted by the participants was beaten by the drums and the musicians asserted their absolute control of the great moving wheel of human beings, by alternately quickening or slackening the measure. The perfect harmony of the dance, which successive sets of dancers kept going for eight or more hours, was only disturbed occasionally by certain individuals who pushed their way through the lines of dancers and amused these by indulging in all sorts of buffoonery. No one, on reading the above description of the most ancient and sacred of native dances can fail to recognize that it was an actual representation of axial rotation and that no more effective method of rendering the apparent differences in the degrees of velocity in the movements of the circumpolar and equatorial stars, could possibly have been devised. The fact that this dance was a most solemn and sacred rite, whose performance was obligatory to the entire population, indicates that it constituted an act of general obedience and homage and a public acknowledgment of the absolute dominion of a central dual, ruling power.

It is particularly interesting that, in this dance, the latter is represented by two individuals who respectively employ the sacred drum of the priesthood, and that used by war chieftains only (the one instrument emitting a low and the other a high tone); for the culture hero of the Tzendals, Votan, who, with the aid of his followers, taught this tribe the civil laws of government and the religious ceremonials, was entitled “the Master of the sacred Drum.” (See Brinton, American Hero-Myths, p. 214.)

Reverting to the organization of the native race into seven tribes and the wandering of the seventh and principal division, under the leadership of Huitzilopochtli: according to Tezozomoc (Cronica, p. 23), Huitzilopochtli was accompanied by “a woman who was called his sister and was carried by four men. She was a powerful sorceress, possessed the power of assuming the shape of an eagle, had made herself greatly feared and caused herself to be adored as a goddess.” Indignant at her arrogance the priests counselled a course which was adopted by the Mexicans. The woman and her family were left behind at Malinalco where they settled and populated a town, whilst the other portion of the tribe, under strictly masculine rule, advanced towards Tula where they established themselves. “This was the second division which had taken place, amongst the Mexicans or Aztecs ... and when they reached Tula they found their number greatly diminished.” This same incident is related with greater detail by Torquemada (vol. I, chap. II) from which we learn what a great animosity was felt against the woman. On one occasion, which I shall not pause to describe, two war chiefs menaced her. The “talk” she gave them in return is so remarkable that it deserves to be quoted in full; for it affords a deep insight into the native mode of expression, teaches us the titles of the woman and shows that her position was undoubtedly one of powerful authority.

“I am Quilaztli, your sister and of your tribe ... you know this and yet you think that the dispute or difference you have with me is like an ordinary one, such as you might wage with any ordinary base woman, who possessed little spirit or courage. If you indulge in this thought you are deceiving yourselves, for I am valiant and manly and my titles will oblige you to acknowledge this. For besides the ordinary name of Quilaztli, by which you know me, I also possess four titles, by which I know myself: the first of these is Cihuacoatl=the Woman-serpent (or twin); the second is Quauh-Cihuatl=the Eagle-woman; the third is Yao-Cihuatl=the Woman-warrior and the fourth is Tzitzimi-Cihuatl, the Woman of the Underworld. From the properties or qualities conveyed by these titles you can appreciate who I am; what power I yield and what harm I can do you and if you want to test the truth of this, here is my challenge!”

“The two brave captains, undaunted by the arrogant words by which she attempted to terrify them, responded: ’If you are as valiant as you describe yourself to be, we are not less so; but you are a woman and it is not meet that it should be said of us that we took up arms against women;’ and without speaking further they left her, much affronted that a woman should challenge and defy them. And they kept silence about this occurrence so that their people should not know of it.” Señor Alfredo Chavero (appendix, p. 125, to Duran’s Historia, Mexico, 1880), commenting upon this passage, says: “It is impossible to doubt that this tradition refers to an important event in the history of the Aztec tribe.... I think it contains the record of a religious struggle.”

The full significance of the narrative will become clear, I think, when the following points are dwelt upon. One thing is certain: here is a historical personage, a woman, who was termed _the sister_ of Huitzilopochtli, who evidently exerted a high authority and whose titles were actually the names of the highest female divinity. Sahagun (book VI, chap. 37) states that Quilaztli, a goddess, the same as Cihuacoatl, was the mother of all and was also named Tonant-zin=“our mother.” What is more significant still is that, in all historical records antedating the Conquest, a man bearing the feminine title of Cihuacoatl=serpent woman, is distinctly and repeatedly mentioned as the coadjutor of the Mexican ruler. Mr. Ad. Bandelier, in his careful study “On the social organization and mode of government of the Ancient Mexicans” (Twelfth Annual Report of the Peabody Museum of Am. Arch, and Ethn., Cambridge, 1879) to which I refer the reader, discusses the relative positions of Montezuma and the Cihuacoatl and states: “there is no doubt about their _equality_ of rank though their duties were somewhat different” (p. 665). This equality is illustrated by the records that both rulers shared the same privileges regarding dress. Thus they alone wore sandals and the Cihuacoatl is termed “the second or double of the king, his coadjutor” (Duran, chap. XXXII, p. 255 and Tezozomoc, chap. XL, p. 66). The latter author, however, gives the full “sacred title” as Tlil-Potonqui Cihuacoatl, literally, “the black-powdered woman-serpent” and we thus learn that, whilst Montezuma’s garments were habitually blue like Huitzilopochtli, his coadjutor, like Tezcatlipoca, was associated with black. It is well known that some of the Mexican priests always smeared their bodies with black, which was therefore their special mark.

To my idea the foregoing data, with circumstantial evidence too diffuse to be conveniently produced, clearly indicate that at one time, in the early history of the Aztec race, it had been governed jointly by a male and a female ruler on a footing of perfect equality, the one being the living representative of the Above or masculine elements and the other personifying the Below or feminine elements. The fact that Cihuacoatl is named “the sister” of Huitzilopochtli shows that the female ruler was not necessarily his wife, although she was his coadjutor in her own right. Both rulers were respectively served by four persons presumably of their respective sex. Besides these Duran (chap. 3) records that “there were also other seven teotls=lords, who were much reverenced on account of the seven caves out of which the seven tribes had come.”

We thus perceive that at one time the chief authority was vested in a man and a woman, his sister, who enjoyed a perfect equality. Four persons administered the government of each ruler and each of the seven tribes had “its honoured representative.” For how long this organization had existed it is impossible to tell. Dissension arose and division supervened, but to the time of the Conquest the identical form of government was in force with the remarkable difference that the title and office of the Cihuacoatl, originally held by a woman, were held by a man, whom I do not hesitate to identify as one of the two “supreme pontiffs,” whose emblem of office was the flint knife, the offspring of Cihuacoatl, the earth-mother.

Historical evidence shows that this alteration had not been made without bloodshed and renewed difficulties. Thus it is related that, long after the Mexicans had separated from the sister of Huitzilopochtli and her adherents, they were induced to “ask the daughter of the ruler of Culhuacan to become the Queen of the Mexicans and mother of their god. She conformed with their request but was subsequently killed by her subjects, who flayed her body and dressed a youth in her skin [a figure of native speech which symbolized his assumption of her office]. Under this form she was revered as a goddess, was named our grandmother and ‘the mother of the god,’ etc.” These and the following details, taken from well-known authentic native sources, are attractively rendered in the “Newe Welt und Amerikanische Historien” (Johann Ludwig Gottfriedt. Frankfurt-a.-M., 1613, pp. 54 and 55).

Again, after the Mexicans had been settled at Tenochtitlan for some time, they desired to make an alliance with the King of Culhuacan and therefore “chose to nominate, as their ruler, Acamapichtli, who was the son of a Mexican chieftain by a daughter of the Culhuacan ruler” and evidently lived with the latter. For it is related that, on giving his consent, the king of Culhuacan stated that if only a _woman_ (of his family) had been nominated he would have refused (to trust her to the Mexicans). The farewell words he addressed to Acamapichtli are worthy of quotation: “Go my son, serve thy god, be his representative. Rule the creatures of the god by whom we live; the god of day, of the night and of the winds. Go and be the lord of the water and land owned by the Mexicans.”

As it is subsequently stated that Acamapichtli _and his queen_ were received at Tenochtitlan with great honors, it would seem as though the Mexicans who, from some deeply-rooted religious idea, considered it essential to have a female ruler of the line of the king of Culhuacan, obtained their desire only by accepting a male member of her family as a protection and safeguard for her sacred person. It may be that for the reasons of safety and preservation the female ruler, who was the living representative of the Cihuacoatl, gradually retired into absolute seclusion whilst a man of her kin assumed, in public, her title and prerogatives.

Unless it is assumed that this was the case, it seems impossible to explain why Acamapichtli is designated in the Codex Mendoza (Kingsborough, vol. I, pl. II) as having begun to rule in the year I Tecpatl or flint (approximately corresponding to A.D. 1364) with the title of “Woman-serpent”=Cihuacoatl. From this date the title seems always to have been borne by a man. When human sacrifices had become a prominent feature of the native cult and it became a duty of the Cihuacoatl to perform the bloody rite, it is obvious that it became impossible for a woman to fill the position.

We obtain, however, glimpses of the shadowy form of an invisible and venerable female ruler who is at the head of the “House of Women,” watches over the welfare of the women of the tribe and officiates as a priestess, with her assistants, at births, baptisms and marriages. In order to account for the obscurity which surrounds her, it should be noticed that the mere fact that the ideas of darkness and seclusion became indelibly associated with the female sex, would naturally and inevitably cause women to be housed up, veiled and condemned to comparative inaction and immobility. A primitive stage in the growth of the above idea is shown in the case of the Huaxtecas, the women of which tribe wore abundant covering whilst the men, on religious principle, wore none. A careful study of the conditions surrounding the Cihuacoatl or high priest shows that he also conformed to the exigencies of his position when he acted as the representative of the hidden forces of Nature, of the female principle. He and the entire priesthood smeared their bodies with black, cultivated long hair, and wore, during the performance of certain religious ceremonies, a wide and long garment reaching to the ground. It is noticeable that the designs on the garments of the priests, in the B. N. MS., are invariably executed in red and yellow, the symbolical colors of the north and west, combined with black the symbol of the union of both, the Below. In this connection it is noteworthy that in Mexican pictography the faces of women are usually painted yellow—the color of the West=the female region. The association of darkness, concealment and secrecy, with the female principle, is exemplified by the fact that a building in the enclosure of the Great Temple of Mexico, named the “house of darkness,” was dedicated to the earth-mother=Cihuacoatl (Sahagun, appendix to book II). Other temples of hers are described as being cave-like, underground, dark, with a single low entrance, the door of which was sometimes sculptured in the form of the great open jaws of a serpent. Only priests were allowed to penetrate into these mysterious chambers where sacred and secret rites were performed and a sacred fire was also kept burning in an adjoining chamber. Evidence, which I shall produce further on, establishes that the high-priest Cihuacoatl dwelt, at times, in a house named “place of darkness” and annually sacrificed a human victim in honor of the lord of the underworld, in an edifice called “the navel of the earth.”

The religious cult of one-half of the Mexican hierarchy was distinctly nocturnal. The chief duties of certain priests were astronomical observation and the supervision of the sacred fire, which was kept perpetually burning on the summit of each temple-crowned pyramid, in what was termed “the sacred or divine brazier” of sculptured stone. Two priests jointly watched by night and day and received and transmitted to the flames the incense offerings of the devout. The temple fires were extinguished only at the expiration of a cycle of fifty-two years and were then rekindled by the high priest at midnight precisely, with impressive solemnity.

In ancient Mexico, it should however be observed, although the logical association of women with the hidden forces of nature, the underworld and the Below, had exerted a certain influence over her practical existence, it had not yet given rise to the idea of her inferiority as compared to man, the associate of the Heaven, the Above, the visible and active forces of nature. The native sages did not identify her so intimately with the earth as to deny her the possession of a soul—the celestial spark. On the other hand it is curious to note that the Nahuatl word for wife is Cihua-tlan-tli and for husband is Te-o-quichtli. Is it possible that the particle _tlan_ in the first and _Teo_ in the second may have contributed to strengthen the association of the woman with earth=tlalli (tlan=land of) and the man with Teotl, the sun, something divine and celestial? In course of time it doubtlessly would have transpired, in Mexico as elsewhere, that the set of primitive ideas which, during untold centuries, imposed upon women seclusion, obscurity and inactivity

and thus hindered her development of strength of body and mind, would have directly induced an inferiority. This has been subsequently proclaimed, as we know, in many countries, as a direct proof of her lower nature and of her affinity with the element earth. The assumed and actual inferiority of woman may therefore be regarded as the logical, inevitable but artificial result of primordial classification and association. Suggested by the same natural phenomena which were visible to all inhabitants of the same latitudes, these ideas occurred to all people at a certain stage of their development and exerted a dominating influence over the subsequent growth of their intelligence. It is but now, that, unconsciously, mankind is beginning to emerge from the leading strings of its infancy, which became an iron bondage to its prolonged childhood. In Mexico, at the period of the Conquest, the absolute equality of the male and female principles was theoretically maintained. At the same time it is possible to discern certain agencies at work which were tending to connect the Below, the female principle, with harm and evil. From time immemorial it had been the custom of the Chichimecs, who, according to Sahagun (book XII, chap. 12, par. 5), inhabited an extremely poor and barren region of Mexico, to sacrifice the first animal killed in a hunting expedition and to offer it to "the Sun whom they called father and to the earth their mother." They severed its head and raised this as though offering it to the sun. They _then tilled the earth where the blood had been spilt_ and left the animal which had been sacrificed, on the spot (Ixtlilxochitl, Historia Chichimeca chap. VI and Relaciones p. 335). This passage, establishing the cultivation of the soil where the blood had been spilt, sheds a flood of light on the origin of the offerings of human blood and the sacrifices of human life, which were such a prominent and hideous feature of the Aztec religion.

At the beginning of the sixteenth century, instead of the blood being spilt directly upon the earth, to insure and increase the fruitfulness of the soil, a human being was stretched across a conical stone which became thus the image of the earth-mother, his heart was extracted and offered to the sun, the Above, and his blood was then smeared on the mouth of certain idols representing the Below. In the B. N. MS. an interesting illustration and account are given of an idol of the earth-mother who is figured as standing on a pedestal adorned with skulls and cross-bones with outstretched tongue which signified, "that she always had great thirst for human blood" and "never refused sacrifices offered to her."

Two priests are likewise pictured in the act of offering bowls containing human blood to the idol and a third, mounted on a ladder, is pouring the contents of another bowl over its head. It is obvious how the constant associations of the earth-mother with sanguinary sacrifices and bloodthirstiness would, in time, give rise to the idea of a hostile, maleficent power, linked with darkness and devouring fire, who, under the aspect of the serpent-woman, waged an eternal warfare on the human race and clamored for victims and bloody sacrifices. The natural sequence to the above associations is that in ancient Mexico the powers exerting fatal influence upon the human race are all represented as female, viz.: the Cihuacoatl or woman-serpent, the Ciuapipiltin and the Tzit-zime, etc. These and various other personifications of the female principle are described in detail in my notes and commentary to the B. N. MS.

After considering the foregoing data it seems impossible not to conclude that it must have taken centuries of time for the idea of duality, or of the Above and Below to have taken such a deep hold upon the native mind and to have produced such a growth of symbolism and association in so many ramifications of thought. Let us endeavor to obtain a further insight into the native mode of thought by carefully studying some significant details concerning the social organization of the Mexicans from the time of Acamapichtli to that of Montezuma and the influences it had been subjected to gradually. This, the first ruler, unquestionably ruled as the Cihuacoatl, a name which means either Woman-serpent or Female-twin. This fact in itself testifies to an epoch-making change in the organization of the Mexican government, in the making of which a concession was made to a previously existing order of things, by the retention of the female title by a male ruler.

Having carefully studied the question for many years, I have long considered it proven that when the Mexicans settled in the valley of Mexico they came under a series of influences emanating from an ancient and highly cultured centre of civilization situated in the south, which had followed, during untold centuries, the same lines of primitive thought which have been stated. This question of contact and influence from an older civilization is so important and the material I have collected on the subject is so extensive and complex, that it cannot be adequately treated here. Further on I shall discuss at length certain historical data throwing light on ancient contact and influences. Meanwhile I may as well state here that, having carefully weighed all testimony, I accept as amply proven and well supported, the testimony of Las Casas, Torquemada, Mendieta and others, who record that the Mexican culture-hero Quetzalcoatl was an actual person who had come to Mexico from Yucatan twice and had finally returned thither, leaving a small colony of his vassals behind him whose influence upon the religious and social organization and symbolism of the tribes, inhabiting the central plateau, can be plainly discerned. Montezuma himself, in his famous speech to Cortés, which the latter carefully reported to the Emperor Charles V, states that: "we [the Mexican rulers] were brought here by a lord, whose vassals all of

our predecessors were, and who returned from here to his native land. He afterwards came here again, after a long time, during which many of his followers who had remained, had married native women of this land, raised large families and founded towns in which they dwelt. He wished to take them away from here with him, but they did not want to go, nor would they receive or adopt him as their ruler, and so he departed. Hut we have always thought that his descendants would surely come to subjugate this country and claim us as their vassals....” (Historia de Nueva España. Hernan Cortés, ed. Lorenzana, p. 81; see also p. 96). I do not see how it is possible to construe such plain, unadorned statements of simple, common-place facts into the assumption that Montezuma was recounting a mythical account of the disappearance of the Light-god from the sky, as upheld by some modern writers, who interpret the whole episode as a sun-myth or legend.

I have already shown that the meaning of the ocelot-skin and the spider, employed as symbols by the Mexicans, is apparent only when studied by means of the Maya language of Yucatan, the land whence the culture-hero is said to have come by the foregoing authorities. I will add here that in the Maya chronicles, it is stated that the culture-hero had ruled in Chichen-Itza, the first part of which name, _Chichen_, means _red_. In Mexican records it is described that he departed by water from the Mexican coast and travelled directly east, bound for Tlapallan—a name which means _red_-land. I draw attention to the fact that any one sailing from the mouth of the Panuco river, for instance, in a straight line towards the east, would inevitably land on the coast of Yucatan, not far from the modern Merida and the ancient ruins of Chichen-Itza.

I shall also produce evidence, further on, to show that the meaning of the much-discussed name of the culture-hero’s home, Tullan, is also furnished by the Maya language. From more than one source, we learn, moreover, that there were several Tullans on the American continent. The conception of _Twin-brothers_ as the personification of the Above and Below had been adopted in Yucatan and it is to the influence emanating from that source that I attribute the movement made in Mexico, to substitute male twin-rulers in the place of the man and woman, who had previously and jointly ruled the ancient Mexicans.

Let us now analyze the Maya title Kukulcan, of which Quetzalcoatl is the Mexican equivalent. As already stated, the word _can_ means serpent and the numeral 4 and is almost homonymous with the word for sky or heaven=_caan_. The image of a serpent, therefore, directly suggested and expressed the idea of something quadruple incorporated in one celestial being and appropriately symbolized the divine ruler of the four quarters. In the word Kukulcan the noun _can_ is qualified by the prefix _kukul_. In the compiled Maya dictionary published by Brasseur de Bourbourg (appendix to de Landa’s Relacion) the adjective _ku_ or _kul_ is given as “divine or holy.” Kukulcan may therefore be analyzed as “the divine serpent” or the “Divine Four.” When Maya sculptors or scribes began to represent this symbol of the divinity they must have searched for some object, easy to depict, the sound of whose name resembled that of ku or kul. The Maya adjective “feathered” being _kukum_, the artists evidently devised the plan of representing, as an effigy of the divinity, a serpent decorated with feathers and to this simple attempt at representing the “divine serpent” in sculpture or pictography is due, in my opinion, the origin of the “feathered serpent” effigies found in Yucatan and Mexico, which have so puzzled archaeologists.

Of Kukulcan, the culture-hero of the Mayas, it is recounted that he had been one of four brothers who originally ruled at Chichen-Itza, over four tribes. “These brothers chose no wives but lived chastely and ruled righteously, until, at a certain time, one died or departed and two began to act unjustly and were put to death. The one remaining was Kukulcan. He appeased the strife which his brothers’ acts had aroused, directed the minds of the people to the arts of peace and caused to be built various edifices. After he had completed his work at Chichen-Itza he founded the great city of Mayapan, destined to be the capital of the confederacy of the Mayas.” (See Brinton, Hero-myths, p. 162.) Friar Diego de Landa relates that the current opinion amongst the Indians of Yucatan was that this ruler had gone to Mexico where, after his return (departure?) he was named Cezalcouatl and revered as one of their gods (Relacion, ed. Brasseur de Bourbourg, p. 36). Before analyzing the Nahuatl rendering of Kukulcan’s name I would point out the noteworthy coincidence that, during his reign at Chichen-Itza and Mayapan, he practically united in his person and assumed the offices formerly fulfilled by four rulers, of which he had been only one.

I would, moreover, draw attention to the remarkable, sculptured columns which support the main portal of the main pyramid-temple called El Castillo at Chichen-Itza. These represent gigantic feathered serpents and are figured on pl. XIV of Mr. Wm. Holmes’ most instructive and useful “Archaeological Studies,” Part I, “Monuments of Yucatan.” The feathers carved on the massive columns are evidently the precious tail feathers of the quetzal, which have the peculiarity of exhibiting, according to the way the light falls upon them, blue, red, yellow and green colors—precisely those assigned to the four quarters by the Mexicans and for all we know to the contrary, by the Mayas. Whether this feather was chosen for this peculiarity or for its beauty only, as that with which to deck the effigy of the divinity, can, of course, only be conjectured. In Mexico numberless effigies of feathered serpents exist. The resemblance of the sound of the Nahuatl words: feather=ihuitl, and heaven or sky=ilhui-çatl, should be recorded here as a possible

reason for the association of feathers with the serpent and as a means of conveying the idea of its divinity. It should also be noted that quetzal, the name of the most precious feathers the natives possessed, resembles in sound, the second part of the Nahuatl words for flame=tle-cueçal-lotl, or for “tongue of fire”=tle-cueçal-nenepilli. That the feathered serpent was an image of the divinity is finally proven, I think, by the following passage from Sahagun which establishes that the earliest form, under which the divinity was revered by the Mexicans, was that of fire: “Of all the gods the [most] ancient one is the God of Fire, who dwells in the midst of flowers, in an abode surrounded by four walls and _is covered with shining feathers like wings_” (_op. cit._ book VI, chap. IV). It is thus shown that whilst the word ihuitl=feather suggested something divine, the word quetzal, besides being the name of a particular kind of feather, conveyed the idea of something resplendent or shining [like fire]. The name for serpent, coatl, signified twin; thus there is a profound analogy between the Maya and Mexican symbol, pointing, however, to the Yucatan form as the most ancient.

Let us see how the name Quetzal-coatl occurs in Mexico. It is given as the name of the “supreme god whose substance was as invisible and intangible as air,” but who was also revered as the god of fire. The constant reference to air in connection with the supreme divinity caused him to be also adored as the god of air and of the four winds. On the other hand, the divine title of Quetzal-coatl was carried by the culture-hero whose personality has been discussed and who was a Yucatec ruler and high priest. Sahagun (_op. cit._ book III, chap. IX) informs us that “Quequet-zalcoa,” the plural form of the word Quetzalcoatl, was employed to designate “_the high priests_ (elsewhere designated as the ‘supreme pontiffs’) _who were the successors of Quetzalcoatl_.” He also states that “the high priest of the temple was [the representative of] the god Quetzalcoatl” (book I, chap. 5). “The priest who was most perfect in his conduct and in wisdom was elected to be high priest and assumed the name of Quetzalcoatl.... There were two such high priests equal in rank and honours.... One of these, the Quetzalcoatl Totec Tlamacazqui, was in the service of Huitzilopochtli.” Without pausing here to analyze this title since it will be discussed in detail in another publication I will only repeat that, after years of careful research, I have obtained the certainty that the foregoing title and office were those held by Montezuma at the time of the Conquest. What is more, I can produce ample evidence to prove that he was the living personification of Huitzilopochtli one of the “divine twins” and of the Above. He was not the first Mexican ruler who had filled this exalted rôle, for it is recorded that Axayacatl, one of Acamapichtli’s successors, had represented, in life, “our god Huitzilopochtli.” After his death his effigy “was first covered with a fine robe representing Huitzilopochtli; over this was hung the dress of Tlaloc ... the next garment was that of Youalahua [=the lord of the wheel] and the fourth was that of Quetzalcoatl” (Duran, vol. I, chap. 39, pp. 304 and 306).

Let us now see how Montezuma’s personification of Huitzilopochtli was carried out by his life and his surroundings. According to Bernal Diaz, an eye-witness, when the great Montezuma came forth in state to meet Cortés, he was conveyed on a sumptuous litter, being thus raised above the earth.(6) When he descended from this and walked, the golden soles of his sandals prevented his feet from coming into direct contact with the ground; he was supported, _i. e._ partially held up, by his four principal lords, and a baldachin adorned with light greenish-blue feathers, gold, pearls and jade representing the xoxouhqui-ilhuicatl=“the verdant or blue sky” (which was, by the way, a title of Huitzilopochtli), was carried over his head. Other lords preceded him, “sweeping the ground and spreading blankets upon it so that he should not tread upon the earth. All of these lords did not dare to think of raising their eyes to look at his face—only the four lords, his cousins, who supported him, possessed this privilege” (Bernal Diaz, Historia Verdadera de la Conquista. Madrid, 1632, p. 65). A feature, the origin of which can be directly traced back to the association of the star-god, Polaris, with repose and immovability, was that Montezuma, like his predecessors, was the only person privileged to sit on state occasions, on a throne or raised seat with a high back and rest whilst all other individuals stood or moved about him.

From several sources we know that Montezuma habitually wore blue or white attire, which sometimes was of open network. He employed gold, precious blue and green feathers, turquoise, pearls and emeralds for his personal ornaments. His diadem with a high point in front, was incrusted with turquoise or was made of burnished gold. He sometimes wore a crown made of featherwork, with a bird’s head of gold above his forehead. His emblem was the sun, the orb of day, and he presided over its cult which had developed itself simultaneously with the cult of the Above, a feature of which was the offering of “birds, butterflies and flowers.” Sometimes he wore, “attached to his sandals, small wings, named tzi-coyolli, resembling the wing of a bird. These produced a sound like that of tiny gold bells when he walked” (Tezozomoc, Cronica, p. 594).

It must be admitted, on reading the foregoing descriptions gleaned from Sahagun’s Historia, that it would be impossible to carry out, more perfectly and completely, the idea that Montezuma was the earthly representative of the Upper regions, the blue heaven. By pushing symbolism so far that he actually wore wings on his feet and avoided contact with the ground, it is not surprising that Montezuma’s adversaries, amongst neighboring tribes, should accuse him of exacting divine honors for his own person. At the same time there is no doubt that his own subjects revered him merely as a temporary representative and mouth-piece of the impersonal dual divinity. This idea is clearly conveyed by some native harangues, to which I refer the reader, and from which I

extract the following passages:

After his election, the ruler is solemnly addressed by one of the chief lords who says to him: “Oh! our humane, pious and beloved lord, who deserves to be more highly esteemed than all precious stones and feathers, you are here present because our sovereign god has placed thee [above us] as our lord.... You possess the seat and throne which was given [to your predecessors] by our lord god” ... “you are the image of our lord god and represent his person. He reposes in you and he employs you like a flute through which he speaks and he hears with your ears.... Oh, lord king! God sees what the persons do who rule over his domains and when they err in their office he laughs at them, but in silence, for he is god, and is omnipotent and can mock at whom he will. For he holds all of us in the palm of his hand and rocks us about, and we are like balls or round globes in his hands and we go rolling from one side to the other and make him laugh, and he serves himself of us as we go moving about on the palm of his hand!”

“Although thou art our neighbour and friend and son and brother, we are no more thy equals, nor do we consider you as a man, for now you have the person, the image, the conversation and the communion of our lord god. He speaks inside of you and instructs you and lets himself be heard through your mouth—his tongue is your tongue, and your face is his face ... he has adorned you with his authority and has given you fangs and claws so that you should be feared and reverenced ...” (Sahagun, book VI, chap. 10).

The foregoing figure of speech in which fangs and claws are alluded to as symbols of fear-inspiring power affords as valuable an insight into the native modes of thought and expression as do the similes employed in the following address to the newly-elected ruler by the spokesman of his vassals.

“Oh lord! may you live many years to fill your office prosperously; submit your shoulders to the very heavy and troublesome load; extend your wings and breast as a shelter to your subjects whom you have to carry as a load. Oh, lord! let your town and vassals enter under your shadow, for you are [unto them] like the tree named puchotl or aueuetl, which casts a great circle or wheel of shade, under which many are gathered in shelter” (_op. cit._ book VI, chap. II).

The admonition also addressed to the ruler, “Never to laugh and joke again as he had done previously to his election, and to assume the heart of an old, grave and severe man,” explains the true significance of the name of Montezuma or Mo-tecuh-zoma; which was an honorific title literally meaning, “our angry or wrathy [looking] lord.”

Whilst the above data establish beyond a doubt that the Mexican Quetzalcoatl was regarded as the visible representative of the celestial ruler of the universe and that divine honors were voluntarily accorded to him, it is interesting to read Montezuma’s explanation to Cortés concerning this question. The latter writes: “seated on a raised seat Montezuma discoursed as follows: ... ‘I know that you have been told by my enemies that I am, or have made myself a god.’... Raising his robes he showed me his body saying: ‘Here you see that I am made of flesh and bone, like yourself or like any one, and that I am mortal and tangible.’ Grasping his arms and his body with his hands he continued: ‘see how they have like to you.’ ”... (Historia, Hernan Cortés, ed. Lorenzana, p. 82). Better than all dissertations, the above words convey an idea of the naïf simplicity of the man who uttered them.

Referring the reader to Mr. Ad. Bandelier’s study, “On the social organization and mode of government of the ancient Mexicans,” for further details concerning the duties respectively filled by Montezuma and his coadjutor, I shall only explain here the conclusion I have reached that the former was the high priest of the cult of the sun and heaven, the visible ruler, the war lord, and the administrator of justice. As stated in a native harangue: “the supreme lord is like unto the heart of the population ... he is aided by two senators in all concerning the administration of the government: one of these was a ‘pilli’ and was named tlaca-tecuhtli; the other was a warrior and was entitled tlacoch-tecuhtli. Two other chieftains aided the supreme lord in the militia: one, entitled tlaca-teccatl, was a ‘pilli’ and warrior; the other, named tlacoch-calcatl, was not a ‘pilli.’ Such is the government or administration of the republic ... and these four officers did not occupy these positions by inheritance but by election” (Sahagun, book VI, chap. 20).

The following account of the republic of Tlaxcalla throws further light upon the form of government which prevailed throughout Mexico and Central America at the period of the Conquest. “The Captains of Tlaxcalla, each of whom had his just portion or number of soldiers ... divided their soldiers into four Battails, the one to Tepeticpac, another to Oco-telulco, the third to Tizatlan and the fourth to Quiahuiztlan, that is to say, the men of the Mountains, the men of the Limepits, the men of the Pinetrees, and the Watermen; all these four sorts of men did make the body of the Commonwealth of Tlaxcallan, and commanded both in Peace and War ... The General of all the whole army was called Xico-tencatl, who was of the Limepits ... the Lieutenant General was Maxix-catzin....” (A new survey of the West-Indies ... Thomas Gage, London, 1655, p. 31). In Mexico we find that the four executive officers were the chiefs or representatives of the four quarters of the City of Mexico. In each of these quarters there was a place where periodical offerings were made in reverence of one of the signs: acatl, tecpatl, callii and tochtli, which were the symbols of

the cardinal-points, the elements, and served as day and year signs in the calendar (Sahagun, book II, chap. 26).

An interesting indication that the entire dominion of Mexico was also divided into four equal quarters, the rule administration of which was attended to by four lords, inhabiting towns situated within a comparatively short distance from the capital, is furnished by Bernal Diaz (_op. cit._ p. 65). He relates that the four lords who supported Montezuma when he walked in state to meet Cortés were the lords of Texcoco, Iztapalapa, Tacuba and Coyoacan. These towns, which were minor centres of government, were respectively situated at unequal distances to the northeast, southeast, northwest and southwest of the capital.

These facts and the knowledge that “all lords, in life, represented a god” justify the inference that, just as Montezuma represented the central power of the Above or Heaven, the four lords who accompanied him were the personified rulers of the four quarters, associated with the elements. In ancient Mexico and Maya records the gods of the four quarters, also named “the four principal and most ancient Gods” are designated as “the sustainers of the Heaven” and it cannot be denied that, on the solemn occasion described, the four lords actually fulfilled the symbolical office of supporting Montezuma, the personification of the Heaven. This striking illustration is but one of a number I could cite in proof of the deeply ingrained mental habit of the native sages to introduce, into every detail of their life, the symbolism of the Centre, the Above and Below and the Four Quarters. I shall but mention here that it can be proven how, in their respective cities the lords of the cardinal points were central rulers who, in turn, directed the administration of the government by means of four dignitaries. Each of these was also the embodiment of a divine attribute or principle, “All noblemen did represent idols and carried the name of one” (Acosta, Naturall and Morall Historie, lib. 5, p. 349).

Each wore a special kind of symbolical costume and was the ruler or “advocate,” as he is termed, of a distinct class of people. “For to each kind or class of persons they gave a Teotl [=God or Lord] as an advocate. When a person died and was about to be buried, they clothed him with the diverse Insignia of the god to whom he belonged” (Mendieta lib. II, chap. 40). It being established that each of the four year-symbols, acatl, tecpatl, calli and tochtli, ruled four minor symbols, it seems evident that, just as the four lords of the cardinal-points would correspond to the above symbols, each of the minor lords and the category of people they represented would also be associated with the minor symbols. The obvious result of this classification would be the division of the entire population of the commonwealth into 4×5=20 categories of people, grouped under twenty local and four central governments, whose representatives in turn were under the rule of the supreme central dual powers. Having thus sketched, in a brief and preliminary way, the expansion of the idea of dividing all things into four parts, the bud of which was the swastika, let us examine the Mexican application of the idea of duality, pausing first to review the data relating to the Cihuacoatl, the personification of the Earth, the Below and the coadjutor of Montezuma.

Nothing has been definitely recorded about his personality, for he seems to have lived in absolute seclusion during the first occupation of Mexico by the Spaniards. He is frequently alluded to, however, and Cortés, Herrera, Torquemada and others, inform us that he had acted as Montezuma’s substitute and led the native troops against the Spaniards. It is interesting to find that after the Conquest Cortés appointed him as governor of the City of Mexico. “I gave him the charge of re-peopling the capital and in order to invest him with greater authority, I reinstated him in the same position, that of Cihuacoatl, which he had held in the time of Montezuma” (Carta Cuarta, Veytia I, p. 110).

Quite indirectly, it is possible to learn what sort of military equipment had been adopted by the Cihuacoatl when he acted as war-chief. Amongst certain presents, which were sent by Cortés to Charles V and are minutely described in vol. XII of the “Documentas ineditas del Archivio de Indias,” p. 347, there are several suits of armor, which could only have been appropriately worn by the “woman serpent.” One suit consisted of a “corselet with plates of gold and with woman’s breasts” and a skirt with blue bands. Another suit, instead of the breasts, exhibited a great wound in the chest, like that of a person who had been sacrificed. In another list (by Diego de Soto, p. 349) a shield is described “which displayed a sacrificed man, in gold, with a gaping wound in his breast, from which blood was streaming....” It is obvious that the first of these suits of armor conveyed figuratively the name and the second the office of the Cihuacoatl of whom Duran speaks as follows:

“He whose office it was to perform the rite of killing [the victim] was revered as the supreme pontiff and his name or title and pontifical robes varied according to the different periods [of the year] and the ceremonies which he had to perform. On the present occasion his title was Topiltzin, one of the names of the great lord ... (Quetzalcoatl) and he appeared carrying a large flint knife in his hand ...” (_op. cit._, chap. LXXXI). The following passage shows definitely that Montezuma’s coadjutor, his Quetzalcoatl or divine twin, had an equal share of divine honors accorded to him. “The head priest of the temple, named Quetzalcoatl, never came out of the temple or entered into any house whatever, because he was very venerable and very grave and was esteemed as a god. He only went into the royal palace” (Sahagun, book VI, chap. 39). The same authority designates the second “divine twin” as the

Tlalocan-tlamacazqui or, Tlalocan-tlenamacac and states that he served the Tlalocan-tecuhtli.

Before proceeding further, let us pause and inquire into the reason why the name Tlaloc, which is formed of tlalli=earth and is defined by Duran, for instance, as meaning “an underground passage or a great cave” (_op. cit._, chap. 84), should be the well-known title of the “god of rain.” The explanation is to be found in the text of the Vatican Codex, A. Kingsborough, V, p. 190. This teaches us that the last syllable of the name Tlaloc does not represent oc=inside of, but stands for octli, the name of the native wine now known as pulque, which is obtained from the agave plant. Tlaloc thus meant “earth-wine” and “by this metaphor they wanted to express that just as the fumes of wine make mankind gay and happy, so the earth when saturated with water, is gay and fresh and produces its fruits and cereals.” By the light of this explanation we see that the titles conferred upon Montezuma’s coadjutor were literally “the priest or lord, or dealer-of-fire in the place of the earth-wine.” “The clouds, rain, thunder and lightning were attributed to the lord Tlaloc who had many tlalocs and priests under him, who cultivated all foods necessary for the body, such as maize, beans, etc., and sent the rains so that the earth should give birth to all of its products. During their festival in springtime the priests went through the streets dancing and singing and carrying a shoot of green maize in one hand and a pot with a handle in the other. In this way they went asking for the [ceremonial] boiled maize and all fanners gave them some” ... (Sahagun, book VI, chap. 5).

The above and many scattered allusions throw light upon the group of ideas associated with the Cihuacoatl and clearly indicate what were his duties. To him devolved the care of the earth and his one thought was to secure abundance of rain and of crops. In order to ensure the proper cultivation of the ground, he had, under him, innumerable agents, who strictly superintended the cultivation of all food-plants, the irrigation of barren lauds, etc. These agents, who also resorted to ceremonial usages in order to bring rain or avert hail-storms and other disasters, were collectively named “the 400 pulque or octli-gods”—an appellation which developed into tochtli-gods, when the rabbit (=tochtli) had become the pictograph habitually employed to convey the sound of the word octli, and had been adopted as the symbol of the earth and of prolific reproduction in connection with this. The latter idea is born out of the female title, that of the earth-mother, who “always brought forth twins.” The Cihuacoatl thus stands out as the representative of the bountiful mother-earth and as the lord of agriculture, one of whose duties was the careful collection, storage and distribution of all food products. He presided over the cult of the fertility of the earth, of the nocturnal heaven, of the stars and moon, which were associated with the female principle and with growth in general. The following record proves that amongst his other duties he offered sacrifices to the invisible hidden powers of darkness and earth. “During the night, in the feast Titítl, the high priest named Tlillan tlenamacac [=the dealer with fire in the land of darkness=tlilli=black, evidently a title analogous to that of Tlill-potonqui-cihuacoatl, given by Tezozomoc, in Cronica, chap. 33], sacrificed a victim in honour of the god of the Underworld” (Sahagun, book II, appendix). In this, as on similar occasions, he was assisted by four priests who succeeded him in rank.

Mr. Bandelier has already recognized that judicial sentences were ultimately referred to the “woman-serpent,” who pronounced the “final sentence, which admitted of no appeal.” There are more reasons than can conveniently be presented here, proving that in Mexico, as in Guatemala, the priest of the Below, the personification of Tezcatli-poca=Shining Mirror, employed an actual mirror made of polished obsidian, as an aid in pronouncing final judgment on criminals.

The Cakchiquel procedure is described by Fuentes of Guzman, who is quoted by Dr. Otto Stoll in his most instructive and valuable work on the Ethnology of the Indian Tribes of Guatemala (Internationales Archiv für Ethnographie, band I, supplement I, 1888): “A road leads [from the ancient city of Guatemala] to a hill [figured with a large tree growing from it]; on its top there is a flat circular cement floor, enclosed by a low wall. In the centre is a pedestal, polished and shining like glass. No one knows of what substance it is made. This was the tribunal or court of the Cakchiquel Indians, where public trials were held and where the sentences were executed. The judges sat in a circle on the low wall. After the sentence had been pronounced, it had to be confirmed or vetoed by another authority. Three messengers, acting as deputies of the council, went to a deep ravine situated to the north of the palace, where, in a sort of hermitage or prayer-house, there was the oracle of the devil, which was a black, transparent stone, like glass, but more costly than [ordinary] obsidian. In this stone the devil revealed to the messengers, the sentence to be executed. If it agreed with the judgment pronounced, this was immediately executed upon the central pedestal [of the hill of justice] on which the criminal was also tortured, at times.” If nothing was seen in the mirror, and it gave no sign, the prisoner was pronounced free.

This oracle was also consulted before wars were undertaken ... “During the first years of the Spanish occupation, when the bishop Marroquin heard about this stone, he had it cut out and consecrated it as an altar, which is still in use in the convent of San Francisco in the capital. It is a precious stone of great beauty and is half a vara long.”

A picture in the Vatican Codex B (p. 48) represents a temple, on the summit of which a large obsidian mirror is standing on its edge. Inside the doorway there are many small black spots, which obviously represent small mirrors and convey the idea that the interior walls were incrusted with such. These illustrations would prove that sacred edifices were associated with obsidian mirrors even if Sahagun did not mention, as he does (book II, appendix), no less than three sacred edifices in the great temple of Mexico, which were associated with obsidian mirrors. It is, moreover, stated by Duran that “in Mexico the image of the god Tezcatlipoca was a stone, which was very shining and black, like jet. It was of the same stone of which the natives make razors and knives,” _i. e._, obsidian (Duran II, p. 98).

What is more, Bernal Diaz relates that the image of Tezcatlipoca, which he saw beside the idol of Huitzilopochtli in the hall of the great temple of Mexico, had shining eyes which were made of the native mirrors=tezcatl. “In connection with the shining eyes” of the god it is interesting to note that when, as Duran states, he was represented under another form, his idol “carried in its hand a sort of fan made of precious feathers. These surmounted a circular gold disc which was very brilliant and polished like a mirror. This meant that, in this mirror, he saw all that went on in the world. In the native language they named it ‘itlachiayan,’ which means, that in which he looks or sees” (Duran, _op. cit._, vol. II, p. 99).

Sahagun mentions an analogous sceptre which consisted of “a gold disc pierced in the centre, and surmounted by two balls, the upper and smaller of which supported a pointed object. This sceptre was called tlachieloni, which means ‘that through which one looks or observes;’ because with it one covered or hid one’s face and looked through the hole in the middle of the gold plate.” This kind of sceptre is not exclusively associated with Tezcatlipoca in the native picture writings, for it figures in the hand of Chalchiuhtlycue “the sister” of Tlaloc and of Omacatl whose attributes, the reeds and chalchiuite or jade beads, prove him to be also associated with the water. On the other hand the same sceptre is also assigned by Sahagun to the god of fire.

A clue to the truth and significance of this emblematic sceptre is furnished by the fact that, in order to express the divine title Tlachiuale, meaning “the Maker or Lord of all creatures or of young life,” the native scribes were naturally obliged to employ the verb tlachia=to look or see, in order to convey its sound. It is obvious that they cleverly agreed to express this verb by picturing some object which could be or was looked through. They therefore adopted a sceptre with a hollow disc, as an emblem, which was carried by the living representative of certain divinities, whose entire costume was in reality a sort of rebus, and in the case of Tlaloc, the lord of earthwine and fertility and the Tlachiuale or “Creator of young life,” par excellence, they once and for all designated his title by surrounding his eyes with two blue rings, accentuating thereby the action of seeing or looking. But this probably conveyed even more than the above title, for there is a Nahuatl noun tlachiuhtli, which means, “something made or formed or engendered,” or “earth which is ploughed and sown.” Then there is the verb tlachipaua which means, “the smile of dawn, the break of day, the clearing up of the weather,” also the purification and cleansing, all of which were supposed to be under the dominion of the rain-god and of his living representatives on earth, the rain-priests. The seemingly conflicting fact that the tlachieloni sceptre was also assigned to the god of fire is explained by the existence of the verb tiachinoa=to burn up the fields or forests, and of the noun tlachi-noliztli=the act of burning up or scorching the fields or forests, and finally, metaphorically, tlachinoli-teuotl=war or battle=destruction. It is only when we thus realize all the natives could express by the image of an eye, looking through a circle, that we begin to grasp its full meaning when employed as a symbol in their picture writings.

As to the obsidian mirror, which undoubtedly was the symbol of Tezcatlipoca and, consequently, must have pertained to his representative, the priest of the Night, we find that it played a most prominent rôle in the cult he presided over. In the first case it appears as though it was resorted to in Mexico as in the conquered province of Guatemala, as the oracle which rendered final judgment. A series of illustrations, etc., to be published in my final work on the Calendar System, will prove satisfactorily that the Mexican astronomers extensively employed black obsidian mirrors as an aid to astronomical observations, by means of reflection. Besides mirrors on the summits of temples and mountains, certain square columns, placed on an elevation and faced with a broad band of polished obsidian, are pictured in some Codices. It is obvious that the latter in particular, if carefully oriented, would have served as an admirable means of registering the periodical return of planets, stars or constellations to certain positions; they would then be reflected on the polished surface, as in a frame. In certain Codices the double, tau-shaped courtyard or enclosure surrounded by a high wall with battlements, which was employed in the daytime for the national game of ball, figures in combination with obsidian mirrors. I draw attention to the fact that the name of these courtyards was tlach-tli, which literally means the looking place=the observatory and that, amongst the edifices of the great temple, a tezca-tlachtli=obsidian-mirror-observatory, is described. I shall demonstrate more fully, on another occasion, that the chief purpose of these enclosures was to serve as astronomical observatories. Dr. Brinton, Señor Troncoso and other authorities have already observed that the game of ball itself was intended to represent the idea of the perpetual motion of the heavenly bodies. (See American Hero-myths, p. 119.)

Returning to reëxamine the divine title Tezcatlipoca we see that, when interpreted as “the lord of the shining obsidian mirror,” it was the most appropriate title of the lord of the Nocturnal Heaven, which myriads of mirrors reflected each night, throughout the land. It is easy to see how the habit of referring to the Temple Minor, in order to ascertain the positions of the stars, would naturally lead to its being consulted more extensively as an oracle later on. We thus clearly perceive how the lord of the Night, whose priests called themselves “the sons of the Night,” became intimately associated with divination and how the idea of a definite connection between the movements of the stars or human destinies would, in the lapse of centuries, make a deep and indelible impression upon the minds of men.

If the obsidian mirror was the symbol, par excellence, of Mexican star cult, there are evidences that the small mirror of polished pyrites was that of the sun-cult. The latter seems to have been employed, in some way or other, for the concentration of the rays of the sun required for the lighting of the sacred fire, at noon, on the days of the vernal equinox and summer solstice. As in Peru, this duty devolved upon the high priest of the Above or the Son of the Sun, a title which undoubtedly pertained also to the Mexican ruler, though not employed so ostentatiously as in Peru. A keen emulation, which may almost be termed an intense rivalry, seems to have existed between the two cults, which Sahagun even goes so far as to designate as two religions. From a chapter of his Historia we even learn that the entire population of Mexico was divided into two halves who respectively belonged to one or the other religion, a fact which naturally affected the position of the two classes of people and had created the native ideas, of an upper and a lower class or caste which will be further discussed.

Sahagun’s informants explained to him that, when a child was born, its parents, according to their class, registered it at one of the two educational establishments for the young and took vows to have it educated there as soon as it attained a suitable age. The lower class took their offspring to the Telpuchcalli, where they were dedicated to the service of the community and to warfare, _i. e._, the ruling class. “The ‘Lords, chieftains or elders,’ offered their sons to the Calmecac to be educated for the priesthood.”

It being impossible to present here in full the data showing how certain primitive conceptions had developed further and how some human occupations had become associated with the Above and others with the Below, I will but point out the important fact that the city of Mexico, divided into four quarters, each of which had five subdivisions (calpullis), actually consisted of two distinct parts. One of these was Mexico proper, where the Great Temple stood and where Montezuma and the lords resided; the other was Tlatelolco, where the lower classes dwelt and the merchant class prevailed. After a certain revolt the inhabitants of this portion of the city were, we are told, “degraded to the rank of women” (see Bandelier, _op. et loc. cit._). From this it would seem evident that their affairs or lawsuits were settled in the official house named the Cihua-tecpaneca, whilst the affairs of the nobility, residing in Mexico proper, were disposed of in the Tlaca-tecpaneca (see Duran, chap. 3). Knowledge of the prevalence of the division of the population into two parts is gained through a passage of Ixtl-ilxo-chitl’s Historia (chap. XXXV, p. 241): “To Quetzalmemalitzin was given the lordship of Teotihuacan ... with the title of Captain-general of the dominion of the noblemen. All affairs or lawsuits of the lords and the nobility belonging to the towns of the provinces situated in the plain, were to be attended to and settled in his town. The same title was bestowed upon Quechaltecpantzin of Otompan, with the difference that he was the captain-general of the commoners and attended to the affairs and claims of the commoners and populace of the provinces in the plains.”

A further detail concerning the position of the ancient capital of Mexico should not be omitted, for it is described as follows by the English friar Thomas Gage, who visited it in 1625: “The situation of this city is much like that of Venice, but only differs in this, that Venice is built upon the sea-water, and Mexico upon a lake, which seeming one is indeed two; one part whereof is standing water, the other ebbeth and floweth according to the wind that bloweth. That part which standeth is wholesome, good and sweet, and yieldeth store of small fish. That part which ebbeth and floweth is a saltish bitter and pestiferous water, yielding no kind of fish, small or great” (p. 43). Added to other data, this detail seems to indicate that the geographical position of the capital had been chosen with utmost care and profound thought, so that, built on a dual island on a dual lake, it should be in itself an image or illustration of the ideas of organization which I have shown to have dominated the entire native civilization. If it be admitted, as I think is evident, that the site of the capital was chosen and mapped out in accordance with these ideas, then we undoubtedly have, in ancient Mexico, not only one of the most remarkable “Holy Cities” ever built by mankind, but also the most convincing proof of the great antiquity and high development of the civilization under whose influence one of the greatest capitals of ancient America was founded.

It is impossible to read the following descriptions without recognizing that the identical fundamental ideas had undoubtedly determined the native topography of capitals situated in other parts of the continent. Beginning with Guatemala, which formed a part of ancient Mexico, I refer to the plan of the ancient capital and its description by Fuentes of Guzman, published by Dr. Otto Stoll in his work already cited: “A deep ditch, running from north to south, divided the town into two portions. One of these, situated

to the east, was inhabited by the nobility; whilst the commoners (Macehuales) lived in the western division." I pause here to call attention to the intentional coincidence that the association of the east with the Above, and the west with the Below, is exemplified here, topographically. The plan shows that the eastern half contained, in its centre, a great, oblong enclosure, surrounded by a high wall. A wall, running from east to west, divided this enclosure into two distinct courtyards with wide separate entrances from the west. The northern courtyard, designated as the "Place of the Palace," contains several buildings. The southern one, named the "Place of the Temple," contains an edifice on a terraced mound and several others. It is noticeable that, in the exact middle of the central wall, there is a seemingly double, unfortunately indistinguishable object, or building, which marks the exact middle of the entire dual enclosure. It is particularly interesting that the East City is divided into two portions by a wall running from the southeast angle of the wall of the Temple courtyard to the outer wall of the city. The southern half, in which the "Tribunal or hill of justice is to be seen, is designated as containing the houses of the Ahauas or heads of the Calpuls." The northern half, containing many houses, lacks designation. The West city is likewise divided into two distinct portions by a broad street, enclosed by a hill wall and conducting from the western and only entrance to the city directly to the Place of the Temple. A deep trench or ditch encloses the entire city, whilst nine watch-towers, on small hills, are placed at equal distances around it.

If this precious document clearly reveals the ground plan on which the native capitals were built, in accordance with the dominant idea, the following native map shows that the ancient dominion of Yucatan, for instance, was figured as an integral whole with form of a flat disc divided into four quarters, Ho, the modern Merida, in its centre. This map, copied from the native Codex Chumazel, has been published by Señor Crescencio Carillo of Ancona in the Anales del Museo Nacional de Mexico, vol. II, p. 43, as showing the territorial division of Yucatan before the Conquest (fig. 27). According to Herrera and Diego de Landa, the unity of the dominion was destroyed about two centuries before the Conquest by the destruction of the capital, Mayapan. The land then remained divided amongst many independent chiefs or Bacabs. Señor Carillo renders the Maya descriptive text written under the map, as follows: "Here is Mani. The beginning of the land, or its entrance, is Campeche. The extremity of the wing of the land is Calkini; the (chun) place where the wing grows or begins, is Izamal. The half of the wing is Zaci; the tip of the wing is Cumkal. The head of the land is the city, the capital Ho."

[Illustration.]

Figure 27.

The foregoing text shows that, notwithstanding the circular shape in which it is figured, the dominion was evidently thought of as in the form of a bird, the head of which was the capital.

[Illustration.]

Figure 28.

This figure of speech seems to have been prevalent in Mexico also and to be conveyed by the representation, in the Vienna Codex, of a double tau-shape to which the head, wings and claw, and tail of a quetzal are attached (fig. 28, no. 8). As I shall have occasion to demonstrate further on, the double tau signifies the Above and the Below and their union forming an integral whole. The following Nahuatl terms explain by themselves the symbolism of the bird-figure: cuitlapilli=the tail of an animal or bird, atlapalli=the wings of a bird, or the leaves of a tree, cuitlapalli atlapalli=vassals, the populace or lower classes, the laborers.

These words furnish irrefutable evidence that the lower class was familiarly known in Mexico as "the wings and the tail" of the commonwealth or state, or the leaves "on the trees" of the tribe. Sahagun states, on the other hand, that the Mexicans employed the metaphor of "a bird with wings and a tail" to designate a lord, governor or ruler. He also records that the terms hair, nails, a thorn, a spine, beard and eyelashes, were used to signify "someone who was noble, generous or of the lineage of the lords." Such metaphors as these may well cause us to despair at arriving at a complete understanding of the native imagery and symbolism. The symbolism of the bird's claw yet remains to be looked into. The Nahuatl for the same is xo-maxaltic, xo-tzayanqui or cho-cholli.

In one of the ancient Mexican harangues, previously quoted, it is said of the supreme ruler that he had been given "fangs and nails" in order to inspire fear and reverence. Scattered evidence and the fact that in the Codex Mendoza the decorated claws of an eagle, for instance, appear as a military device on the shields of certain war chiefs, seem to indicate that the warriors were spoken of, metaphorically, as "the claws or nails" of the state. The following passage finally proves that the tlachtli or courtyard the shape of which was a double tau, as in fig. 28, no. 8, was regarded by the Mexicans as an image of the state itself. In another native harangue it was said of the newly-elected ruler: "He is now placed or put into the Tlachtli, he has been invested with the leathern

gloves, so that he can govern and throw back the ball to the one who throws it to him in the game. For the business of governing very much resembles this game and the game of dice" (Sahagun, book VI, chap. xiii). The latter game alluded to, the patolli, was played on a mat in the shape of a cross, marked off with divisions, with stone markers, the moves of which were decided by the numbers obtained on casting the dice, which consisted of beans with marks on them. It is interesting to find that the word pat-olli seems to be connected with the verb pat-cayotia=to be substituted in the place of another, or to succeed another in office or dignity. The above comparison of the game to the business of governing indicates that a feature of the government was a methodical succession or rotation in office or dignity, a point to which I draw special attention, as I shall refer to it later.

The evidence that the Mexicans regarded the form of the courtyard, named tlachtli, as that of the state itself is noteworthy. On the other hand, the native map contained in the Codex Mendoza, p. 1, shows us that they figured their territory as a square, surrounded by water and divided into four equal parts by diagonal cross-streams or canals. As in the Maya map the centre of this is occupied by the well-known hieroglyph or rebus of Te-noch-ti-tlan, the ancient capital, which consisted of Mexico and Tlatelolco. In three of the four triangular divisions, two chieftains are figured, whilst in one there are four, the complete number of chieftains thus being ten. The incontrovertible evidence that the dominion of the Mexicans, as well as that of the Mayas, was figured and regarded as an integral whole has seemed to me to be of extreme importance, because it points to a fresh interpretation of the much-discussed meaning of the name Tullan, "the glorious centre of culture where the high priest Quetzalcoatl, had dwelt and whence he had been driven by the wiles of his enemies. It is a place that we hear of in the oldest myths and legends of many and different races. Not only the Aztecs, but the Mayas of Yucatan and the Kiches and Cakchiquels of Guatemala, bewailed in woful songs, the loss of that beautiful land and counted its destruction as the common starting-point in their annals.... According to the ancient Cakchiquel legends, however, ... 'there were four Tullans, as the ancient men have told us.' The most venerable traditions of the Maya race claimed for them a migration from Tullan in Zuyva."... "When it happened to me," says Friar Duran, "to ask a [Mexican] Indian who cut this pass through the mountains or who opened that spring of water or who built that old ruin? the answer was: The Tultecs, the disciples of Papa," _i. e._, Quetzalcoatl. (See Brinton, American Hero-Myths, p. 88.) Considering that the identity of Tullan has not yet been satisfactorily established, that several Tullans are said to have existed and that a small town, about a dozen leagues to the northeast of Mexico, is named Tullan-tzinco=little Tullan, I should like to direct the attention of Americanists to the following Maya words: Tul-um=fortification, edifice, wall and enclosure. Tula-cal, Tuliz, adjectives=whole, entire, undivided, integral. Tul-ul, adjective=general, universal. Tul-tic, verb=to belong, to correspond to something. Tul=all around or full. Tul=in composition, to have abundance. Tulnah=to be too full, to overflow, to proceed, to issue, abound, high-tide. Tulaan=past participle of tul.

I am of opinion that, after carefully examining the foregoing words and their meanings, we must admit that an intelligible and satisfactory derivation and signification of the much-discussed Tula of the Mexicans, which has been vainly sought in the Nahuatl language, are obtained if we connect it with the Maya words for fortress, or stronghold, an enclosed place, an integral whole, an overflowing source of abundance and plenty. If we do this, then the problematic term Tolteca, given by Mexicans to the superior people from whom they had derived their culture and knowledge, means nothing more than such persons who had belonged (Maya verb tultic) or were members of a highly cultured commonwealth or ancient centre of civilization, such as had flourished during countless centuries, in Yucatan and the present Chiapas, Honduras and Guatemala.

Reserving this subject for future, more detailed, discussion, I point out that the name Ho, given to the capital, which is designated in the map as the "head of the land," is obviously derived from the Maya hol, hool, or hoot, which means not only head but also chieftain. The circumstance that a single word, Ho, conveyed the triple meaning of a capital, a chieftain and a head, is particularly noteworthy, as it affords not only important clues to native symbolism, which I shall trace later on, but also shows that the presence of the syllable Ho or O, in certain native names of localities, may possibly indicate that it was a capital, the residence of a chieftain. Further light is shed upon the following native association of ideas when the following words are studied. The ancient Maya name for a pyramid or artificial mound was ho-m and the pyramidal elevations on which temples or palaces were built were designated as ho-mul or o-mul (see Vocabulary, Brasseur de Bourbourg). The title Holpop was moreover that of the "chieftain of the mat," whose prerogative it was to sit on a mat and to beat the sacred drum during the public dances or ritual performances (Cogolludo). The ancient word for vase, vessel or cup in general was ho-och, whilst o-och meant food or maintenance (Arte de la lengua Maya, Fray Beltram de Santa Rosa, ed. Espinosa, Merida, 1859). If the foregoing data be summarized we find that the word ho, the ancient name of the head of the land, which is figured in its centre, is not only homonymous with capital and chieftain, but also with pyramid, vase or receptacle and maintenance, and finally with the numeral 5, also "ho." We shall see that the identical ideas were similarly associated in ancient Mexico.

Referring once more to the ancient map of Yucatan and to the peculiarity that the head of the figurative bird, the capital, Ho, is supposed to occupy the centre of the state, I point out nos. 1 and 5 (fig. 28) from the Bodleian and Selden MSS. as somewhat analogous representations of a central capital or chief, and nos. 3 and 6 as possibly being images of a territorial subdivision of the state, resembling a spider's web. In an unpublished Mexican MS., which has been recently brought to light, the middle of the concentric circles is painted blue and suggests the idea of a system of distribution or irrigation, proceeding from a central supply of water and radiating in all directions. An accentuation of centrality is brought into relief in fig. 28, no. 6, where the spider's web is placed in the middle, between the two peaks of a mountain. In no. 2 a small quadruple sign, which frequently occurs in the Vienna Codex, always painted in the colors of the four quarters and united by a cross-band across the centre (no. 4). also figures between two peaks, above two feet, the significance of which I do not venture to determine. A remarkable circular disc resembling the Maya map, and also divided into four parts by cross lines, but exhibiting footsteps denoting rotation, is represented in the entrance of a temple, in the Vienna Codex (fig. 28, no. 7). These figures will be referred to again further on.

Let us now bestow attention upon the names of the Mexican capital and first note that the edifice of the Great Temple, in which the Cihuacoatl performed an annual ceremony already mentioned, was called tlal-xic-co, literally "in the navel of the earth or land" (from tlalli=earth, land or country, xictli=navel and co=in) (Sahagun, book II, appendix). Besides this edifice there was, in the middle of the lagoon of Chalco, an island, which, to this day, bears the name of Xico=in the navel or centre. This indicates the curious circumstance that the edifice and island had apparently been regarded as forming "ideal centres," and shows that the name of Mexico itself may have been associated with the same conception being, as it was, the central seat of government. Gomara states that "the city was divided into two halves or parts, one named Tlal-telolco=small island (literally, 'in the earth-mound') and the other named Mexico, which means 'something which flows,' " (Histoire Généralle des Indes, Paris, 1634, chap. 38). The Nahuatl word alluded to can be no other than the verb memeya which, according to Molina, signifies "water, or something liquid which issues or flows in many directions." I have already pointed out that the Maya words to express water which rises and overflows, high tide and, by extension, abundance and plenty, are tul, tulnah and, finally, tulaan, past participle of tul. If the particle "me" conveyed the above idea, its combination with xico would cause the name Mexico to be replete with significance and to mean "the figurative centre whence all maintenance proceeded and flowed in all directions, throughout the land."

The Borgian Codex furnishes representations of identical meaning. On page 4 a human body, the centre of which forms a large red disc, is stretched across the double tau-shaped tlachtli which obviously represents the four quarters, being painted with their four symbolic colors. It is particularly noteworthy that the limbs of the central figure are represented as wearing the green skin of a lizard, while its face is enclosed in the open jaws of the reptile. It should also be noted here that whilst the Nahuatl names are cuetz-palin and topitzin, the Maya term for lizard is mech or ix-mech. On the same page a similar, but smaller, figure is depicted on a background representing the nocturnal heaven. On the following page the figure of a dead woman is stretched on a red disc whilst a priest is drilling the fire-stick into a circular symbol, with four balls, which is the well-known symbol for chalchiuitl=jade. As the name of the female water goddess is Chalchiutlycue, this detail is significant and will be referred to later on. It is noteworthy that on both pages 5 and 6 the performance of the above rite is accompanied by the image of the goddess of the earth and underworld, represented with a death's head, and with her hair strewn with stars. Her body is that of a green lizard, and she carries ears and blossoms of maize and holds a blue garment on which the chalchihuitl symbol figures.

In connection with representatives of the human form outstretched in sacrifice, on whose body the rite of kindling the sacred fire or of extracting the heart is being performed, it seems evident that, under the dominion of the fundamental ideas I have been discussing, the native sages regarded and utilized the human form as an image of the Middle and Four Quarters. It is well known that the number 20 was termed "one count" and connected with the number of fingers and toes, distributed equally on his four extremities. The human victim thus formed a living swastika or cross and became not only the consecrated image of the supreme, creative, central divinity who controlled the Four Quarters, but also an image of the central government with its supreme ruler; whilst the four chiefs of the Quarters were symbolized by the four limbs. Each of these terminated in a symbolized group consisting of a hand, maitl, with a thumb (=touey mapilli or vei mapilli, literally, the great finger, or our great finger) and four fingers (mapilli); or of a great toe, touei xopil or topec-xopil (literally, our great toe, or our lord toe) and of four toes=xopilli.

[Illustration.]

Figure 29.

The above association of ideas was doubtlessly accentuated by the fact that the word pilli means a nobleman, a chieftain; thence he terms pilconetl=the son of a nobleman and pilhua=he who has sons (pil in this case meaning son and hua=possessor of). This

latter fact could have been very aptly conveyed in the picture-writings by employing fingers to express the sound “pilli.” The number of sons a chieftain had could thus be easily expressed by his exhibiting a corresponding number of fingers. I shall revert to this possibility presently, and now referring to fig. 29, no. 2, direct attention to the obvious intention to express the idea that the fire produced was distributed to the four quarters by means of the figures, painted in symbolical colors, three of which are visible. Another picture in the same Codex represents four similar figures springing towards the cardinal points from a source or fountain of water, whilst a priest above a triangular cloak(7) holds a pair of weapons (?) in his hands (fig. 29, no. 1). If carefully studied, these groups seem to corroborate the derivation of the name Mexico, given above. What is more, the first group affords an explanation of the meaning and purpose of three strange recumbent stone figures bearing circular vessels, which have been respectively found in Mexico, Tlaxcala and Chichen-Itza and are now preserved at the National Museum in Mexico. They furnish the most convincing proof that an identical cult and symbolism had existed in these widely-separated localities. The conclusion I have previously expressed, that an actual connection had been established between Chichen-Itza and Mexico by the Maya high priest Kukulcan, or Quetzalcoatl, is thus corroborated by undeniable evidence, which will be supplemented later on.

The three monoliths have been described and illustrated in the Anales del Museo Nacional, Mexico, vol. 1, p. 270, by the late Señor Jesus Sanchez, and are here reproduced. The statue exhumed at Chichen-Itza by Dr. Le Plongeon (pl. IV, fig. 1) closely resembles that found at Tlaxcalla in Mexico (pl. III, fig. 2). Dr. Brinton, who erroneously describes the Chichen-Itza statue as representing “a sleeping god,” points out the extremely important fact that there was a divinity worshipped in Yucatan called Cum-ahau, “the lord of the vase,” who is designated in a MS. dictionary as “Lucifer (the lord of the underworld) the principal native divinity.” He adds there is good ground to suppose that this lord of the vase ... was the god of fertility common to the Maya and Mexican cult (Hero-Myths, p. 165). Considering that the great market-place in the capital was actually the centre to which the entire product of the land was periodically carried from its remotest confines, was there classified, exchanged or distributed far and wide, the comparison to a central flowing source of maintenance was most appropriate.

That some particular spot in or near the city should have gradually assumed importance and sanctity as marking the exact centre of the metropolis, _i. e._, of the integral whole of the Mexican “empire” is but natural and it is not surprising to find that solemn rites were performed on this spot. In one of the chronicles to which I shall revert, it is stated that the New Fire was at times kindled on the prostrate body of a slave, and this curious statement is corroborated by a picture in the Borgian Codex, showing a priest producing fire from a circular vessel placed on the body of a victim beneath whom a face enclosed in the open jaws of a reptile, is visible (fig. 29).

[Illustration.]

Plate IV.

Dr. Le Plongeon, to whom much credit is due for its discovery, identified the Chichen-Itza statue, for reasons not fully explained, as a portrait of Chac-Mool, or Lord Tiger, and relates that it was found at a depth of eight metres, not far from the base of the Great Pyramid Temple. A statue of a standing tiger, with a human head and a shallow depression in its back, was also found near the same spot. I have seen other sculptured figures of human beings holding a vase, as at the hacienda near Xochicalco, Mexico, and of tigers, with circular depressions on their backs, and hope to be able to reproduce their photographs on another occasion.

The most elaborately sculptured recumbent statue is undoubtedly that which was found in or near the city of Mexico (pl. IV, fig. 3). The under surface of its base (pl. IV, fig. 5) is entirely covered with zigzag water lines and representations of roots of plants, figured as in the Codices; shells, one kind of which is the well-known symbol of parturition, and frogs which are intimately associated with water symbolism. On the hair of the statue a flower-like ornament is carved (pl. IV, fig. 4) in connection with which it should be noted that the Nahuatl for flower is xochitl, pronounced hoochitl, resembling the Maya hooch=vase. The small groups of five dots forming a border around the circular vessel are noteworthy, as they are likewise sculptured on the calendar-stone. The characteristic scrolls about the eyes of the figure show that it personates tlaloc, or earth-wine. The fertility of the earth, caused by rain, is symbolized by the wreath of ears of corn and reeds (Nahuatl, _tollin_) which is sculptured around the base of this, one of the most remarkable of ancient American monuments.

Señor Sanchez cites Torquemada (Monarquia Indiana, vol. II, p. 52) as the only authority who mentions a recumbent image or idol and relates that, “in the city of Tula, there was preserved in the great temple, an image of Quetzalcoatl ... he was figured as lying down, as though going to sleep.... Out of reverence the image was covered with mantles or cloths.... They said that when sterile women made offerings or sacrifices to the god Quetzalcoatl, he immediately caused them to become pregnant....” He was the god

of the Winds which he sent to sweep or clear the way for the tlaloques="the earth-wine" gods.

Señor Sanchez also quotes Gama, who, basing himself upon Torquemada's authority, maintains that Tezcatzon-catl, the principal rain or octli-god, was figured as lying in an intoxicated condition, holding a vase of pulque in his hands. To the above data I add the description by Bernal Diaz, of a "figure in sculpture" he saw on the summit of the great temple of Mexico: "It was half man and half lizard (lagarto), was encrusted with precious stones and one-half of it was covered with cloths. They said that half of it was full of all the kinds of seeds that were produced in the entire land, and told [me] that it was the god of sown land, of seeds and fruits. I do not remember his name...." (Historia Verdadera, p. 71). It may be as well to note, that the Nahuatl names for lizard, cuetz-palin and topitzin, approximately convey the sound of the first syllables of the name of the culture-hero Quetzalcoatl, and of the title "topiltzin" bestowed upon him. It must, of course, remain a matter of conjecture whether the lizard was possibly employed in the above case as a pictograph, to express the sound of its name. One thing seems certain, that the Tula image of Quetzalcoatl, to which divinity barren women directed their invocations, and the statue described by Bernal Diaz as that "of the god of seeds, fruits and cultivated land," were undoubtedly analogous to the sculptured recumbent figure found in Mexico, and exhibiting the symbols of Tlaloc, or earth-wine, of maize, and of parturition. Bernal Diaz further relates that the said image was kept on the uppermost terrace of the Great Temple, in one of five "concavities surrounded by barbacans or low walls the wood-work of which was very richly carved" (_op. et loc. cit._).

The inference to be drawn from the foregoing data is that the Mexicans and the Mayas habitually kept, on the summit of their principal temple, in their centres of government, a statue holding a circular vessel and figuratively representing the "navel or centre of the land." The group of ideas already traced in the Maya ho=capital, hom=pyramid, ho-och=vessel, o-och=maintenance, ho=5, thus proves to be completely carried out, for, on this consecrated spot, which emblematized the source whence all life proceeded, sacred emblematic rites were performed, the purpose of which was to typify the union, in the centre, of the four elements requisite for the productiveness of the earth.

[Illustration.]

Figure 30.

The ground plan of the Caracol or Round Temple of Chichen-Itza, which was built, according to tradition, by the high priest Quetzalcoatl, carries out the idea of the middle and of the four quarters in so obvious a manner that it may safely be assumed that it represented the supposed centre of a dominion (fig. 30). Referring the reader to the interesting description of this remarkable edifice in Mr. William Holmes' valuable work already cited, I note that round temples, dedicated to Quetzalcoatl, are recorded to have also existed in Mexico. It seems probable that, at certain festivals, the living representatives of the Above and Below performed certain sacred rites on the summit of one of these circular edifices. It is obvious that such rites could only have been fitly performed by the coöperation of both twin rulers or Quequetzalcoas, each of whom personified two elements. The appropriate season for such rites would be that when the necessity of insuring a successful harvest would seem most urgent. It is a recorded fact that the most solemn festivals of the year were held between the vernal equinox, on which date the ritual year began, and the fall of the first rain which usually occurs about the middle of May. It is extremely significant that at this precise period the festival toxcatl took place (_cf._ Maya thoaxol or thoxol=distribution, giving each one a little, and o-och=food or maintenance) during which Tezcatlipoca and Huitzilopochtli were jointly honored. During this festival the "sacred dough," named tzoalli, was a prominent feature of the ritual and it was undoubtedly associated with the idea of the life-giving union of the four elements, the Above and Below, or the male and female principles.

It can, moreover, be directly connected with the recumbent statues representing the centre; for, whilst Bernal Diaz recorded that the statue on the summit of the Great Temple held a collection of all the seeds of the land, Cortés, in his descriptive letter, gives us an important detail which evidently applied to the identical statue. He relates that "the bodies of the idols are made of a dough consisting of all the kinds of seeds and vegetables that these people ate. These are ground, mixed with each other and then moistened with the blood of the hearts of human victims ..." (_op. cit._ p. 105). Sahagun relates that an image of the earth goddess, under the title of Seven-serpents or twins, was made of this sacred dough and that offerings of all kinds of maize, beans, etc., were made before it "because she is the author and giver of all these things which sustain the life of the people" (book II, 4). It is well known that the dough images were broken into small pieces and these were distributed to the priests and people, who partook of the substance after having prepared themselves by fasting, for the sacred rite. I draw attention to the fact that the above sacred substance is but the natural outcome of the primitive notion already mentioned, which led the hunters to spill blood upon the earth, to obtain its increased fruitfulness. An insight having been thus obtained of the origin of blood sacrifices in ancient America, it is

possible to understand the meaning of certain representations showing the performance of ritual blood-offerings.

On the well-known bas-relief preserved in the National Museum of Mexico, and illustrated in the Anales (vol. I, p. 63), the two historical rulers of ancient Mexico, who figure as Quequetzalcoas, or divine twins, in exactly the same costume, are sculptured with blood flowing from their shins and in the act of piercing their ears with a sharp bone instrument. Two streams of blood descend from these and meet before falling into the open jaws figured beneath an altar, on which two conventionalized flowers appear. The two rows of teeth=tlantli, convey the sound of the affix tlan=land of, or tlalli=earth. But the most remarkable and striking instance of the group of ideas we have been studying is found on p. 62 of the Borgian Codex. On a background formed by a pool of water, there is a group which represents the "earth-mother" lying on a band of lizard-skin, with two maize plants issuing from her body and growing into a large two-branched tree, in the centre of which is a flint-knife or tecpatl. A bird stands on its summit and its branches terminate in maize plants. Its growth is being furthered by the two streams of blood which proceed from two human figures, standing at each side of the tree. One is painted black and evidently represents the Lord of the Below; the other is painted blue-green and represents the Lord of the Above. The blood-sacrifice they are jointly offering is that mentioned in the "Lyfe of the Indians," as performed in order to obtain generation. Unquestionably this symbolical group would have been equally intelligible to Mayas or Mexicans, since the ideas it expressed were held in common by both people.

Before proceeding further it is necessary to state that after the native philosophers had, for an indefinite period of time, been satisfied with the artificial division of all things into four quarters, corresponding to the cardinal points and elements, the idea of the Above and Below gradually grew in importance, whilst prolonged thought and observation disclosed that the above classification demanded revision. On carefully investigating the attributes of the principal ancient Mexican deities or personifications of the elements we see that the native thinkers had found themselves obliged to make a distinction between the different forms of each element, having realized, for instance, that water not only fell to earth from the heaven, but also issued from the depths of the earth in the form of springs or fountains, and formed rivers and lakes. The final conclusions they reached in this instance are best explained by the fact that the name of the god Tlaloc means earth-wine or rain only, and that his sister "Chalchiuhtlycue" appears as the personification of wells, springs, rivers and lakes. It is evident that the classification of the ocean or sea must have given rise to much serious thought. We know how the problem was solved by the fact that the Nahuatl name for the ocean is "ilhuica-atl"=heaven-water. Accordingly, the rain and the ocean pertained to the heaven, the Above and male principle, whilst the wells, springs, rivers, etc., belonged to the earth, the Below, the female principle.

As in this case, so it was with the other elements, each of which was finally personified by a male deity and his female counterpart, which, in some cases, tended to represent its distinctive and beneficent properties. As these deities are separately treated in my commentary of the "Lyfe of the Indians" and lack of space forbids my discussing them here, I shall but mention that the ultimate native systematization of the elements, each of which was thought of as an attribute only of supreme and central divinity, corresponds exactly to that held by the Zuñis of to-day and set forth in the following account given by Mr. Frank H. Cushing and quoted in Dr. Brinton's "Native Calendar of Central America and Mexico" (p. 8). In quoting it I draw special attention to the numerical divisions given, as this is absolutely essential for the understanding of the statements I shall make, further on, concerning the origin of the native Calendar-systems.

[Illustration.]

Figure 31.

"In the ceremonies of the Zuñis the complete terrestrial sphere is symbolized by pointing or blowing the smoke to the four cardinal points, to the zenith and nadir, the individual himself making the seventh number. When the celestial is also symbolized, only the six directions are added to this seven, because the individual remains the same, so that the number typifying the universe, terrestrial and celestial, becomes 13. When, on the other hand, in their ceremonies, the rite requires the officiant to typify the supra- and intra-terrestrial spheres, that is, the upper and lower worlds [the Above and the Below], the same number 13 results, as it is held that in each the sun stands for the individual, being in turn the day sun and night sun, the light and dark sun, but ever the same and therefore counts but once."

After having gained this knowledge of native speculative philosophy, let us penetrate still further into their modes of thinking by studying, first of all, a series of symbols of the earth-mother taken from one of the most valuable of Mexican MSS., the Vienna Codex (fig. 31). In these the idea of the vase, bowl or receptacle and of the serpent predominates. It is instructive of native thought to find the vase represented as containing a child (no. 1), an agave plant (no. 7), a fire, denoting warmth (no. 3), a flower (no. 12),

and a bunch of hair, the numerical symbol for multiplicity=the number 400 (no. 5). In no. 2, the hollow between two recurved peaks conveys the idea of a central vase; a band with eyes rests upon the peaks and denotes the heaven. No. 4 shows a double vase, enclosed in a similar representation of the nocturnal heaven—the idea to be conveyed being evidently that of a receptacle hidden in darkness. No. 9 displays an open jaw, two claws, a human heart and a stream of blood issuing from it. Nos. 10 and 11 present different shapes of the serpent's jaw, the symbol of the earth.

The double-headed serpent forming a vase containing a flower (no. 12) is particularly interesting because the flower=xoch-itl in Nahuatl, seems to suggest an intentional likeness to the Maya word for "vase, vessel or cup in general," ho-och (Arte de la lengua Maya, Fray Pedro Beltran de Santa Rosa, ed. Espinosa, Mérida, 1859) as well as hoch or o-och="food and maintenance." The symbolical vase-like opening in the core of the agave plant, (no. 8) is such as is made to this day, in order to collect the juice, which, when fermented, constitutes the sacred wine of the ancient Mexicans, octli, now better known as pulque.(8) As will be shown the Mexicans considered this as "the drink of life." Its use was rigidly regulated and supervised by the "octli-lords" or "rain-priests" who distributed it at certain dances, in order to induce a state of mild intoxication amongst the participants.

As in the case of the Zuñis and Tarahumari Indians of the present day, referred to by W J McGee, in his valuable and instructive article on "The beginning of Marriage" (the American Anthropologist, vol. IX, no. 11, p. 371), "certain ceremonials typifying the fecundity of the earth and of the leading people thereof" were performed by the ancient Mexicans. These public ceremonials had also been "apparently developed to the end that the tribes and peoples might be encouraged to increase and multiply and possess the fecund earth." They took place at the period of the year when the heaven and earth were also supposed to unite, _i. e._, at the beginning of the rainy season. During this the ordinary out-door occupations of the agriculturist and hunter were forcibly interrupted and the regular and periodical transportations of produce and tribute to the capital became impossible, owing to torrential rain, swollen rivers and impassable roads. This period of enforced shelter and confinement indoors seems to have become the definite mating season of the aborigines. At the same time the union of the sexes had obviously assumed a sort of consecration since it was intimately associated with the cosmical, philosophical and religious ideas and coincided with what was regarded as the annual union of the elements or of the Above and Below, the heaven and earth.

At that period of its history, when the Aztec race was jointly governed by a priest, personifying the heaven and a priestess, "his wife and sister," who personified the earth, some form of sacred marriage rite must have been annually performed. The consecrated character of their union must have naturally caused their offspring to be regarded as of a holy and almost divine origin. It is easy to realize, therefore, how, in ancient Mexico, the artificial idea of "superior birth" came into existence, how a family or caste of rulers gradually developed, the members of which were entitled "teotl"=divine, whilst the men were regarded as "the sons of Heaven" and the women "the daughters of Earth." It is obvious from this that the periodical union of the sexes, accompanied as it was, by sacred dances and the distribution of sacred wine, must have gradually assumed a semi-religious character, whilst the ritual nuptials of the "divine" rulers, typifying, as it obviously did, the grand and impressive phenomenon of the rainy season, must have caused this marriage to assume the character of a hallowed rite and surrounded it with the most elevated and intense religious sentiments of which the native mind was capable.

After this recognition of the diverging influences which guided the development of primitive marriage institutions, we will return to the rain-priests or "octli-lords," of whom it is repeatedly stated that there were four hundred, a number corresponding to an assignment of 100 or 5×20 to each of the four provinces or divisions of the commonwealth. Their emblem was the sacred vase or receptacle and in the "Lyfe of the Indians" this will be seen figured on their mantas and shields (no. 6_a_). A small gold plate, of the same shape, is represented as worn by these "lords," attached to the nose (no. 6_b_); and, in the same MS., the symbolical ornament is also carried by the "sister of Tlaloc." It was evidently worn, like similar ornaments in other countries, hanging from the septum of the nose, and seems to have indicated a consecration of the breath as the substance of life. As an inference, merely based on an insight gained into the native modes of thought, I suggest that the explanation for the adoption of this ornament may have been the religious idea that the breath of life, dividing itself as it issues through the nostrils and uniting when inhaled, appeared to the native thinkers as a marvellous illustration of unity and duality, both ideas having constantly been present in their minds.

[Illustration.]

Figure 32.

In the Vienna Codex there is a remarkable picture of the earth-vase resting on a slab with five divisions. A profusion of puffs or breaths of air or vapor issue from it and, branching off in two directions, form what is like the conventional tree of life, also met with in Maya bas-reliefs and documents. At the extremities of the branches which turn downwards, a serpent's eye is visible and a forked-tongue issues above the middle (fig. 32, no. 1). The intention to express an exuberant vitality and growth issuing from the symbolical vase in the centre of the earth, seems obvious. This idea is still more clearly conveyed, however, in two symbolic pictures on pp. 21 and 29 of the Codex Borgia, which are reproduced as nos. 1 and 4 in fig. 1 of this publication. The first represents the vase overflowing with water and containing a flint-knife, the generator of the vital spark. The central group is surrounded by water and by sun-rays and obviously symbolizes the union of air, light and water, constituting the Above, with the flint the emblem of the earth-mother and of Tezcatlipoca, the lord of the Under-world. Fig. 1, no. 4, represents the vase overflowing with a liquid, which is designated as being the sacred octli or earth-wine by the presence of the rabbit, which expresses the sound of its name=tochtli. This rebus is surrounded by the nocturnal heaven strewn with stars and the reference to the union of rain or earth-wine with earth and darkness is evident. It has been generally assumed that these images of the vase, containing the rabbit or flint-knife, represented the moon. As the latter was intimately associated with the cult of night, of the earth-mother and ideas of growth, it is not impossible that by an extension of symbolism, this was the case, but only in the same way as the sun was the emblem of the cult of the Above. On the other hand the native drawings of the moon in Sahagun's Academia MS. represent it as a crescent with a human profile on the inner side, and in a specimen preserved at the Trocadéro Museum, Paris, it is similarly carved in rock crystal.

Before proceeding to investigate the symbol further, I would point out the general resemblance of the vase, especially as a conventionalized serpent's jaw, to the "horse-shoe" shape of the problematical stone "yokes" which have been so thoroughly studied by Dr. Hermann Strebel of Hamburg (Studien ueber Steinjoche aus Mexico and Mittel-Amerika. Internationales Archiv, bd. III, 1890). Mr. Francis Parry has advanced a view concerning the meaning of these curious "sacred stones."(9) This is somewhat corroborated, as will be shown, by my recent studies, which seem to indicate pretty clearly that these symbolical objects pertained to the cult of the earth-mother. A fact of unquestionable importance, cited by Mr. Parry, is the certified existence and use, amongst southern Californian Indians of the present day, of a rudely worked stone of the same shape, in a native religious rite. The owner of one of these stones, Mr. Horatio Rust, a pioneer resident of Pasadena, southern California, exhibited it in the Anthropological Section of the World's Columbian Exposition, at Chicago, 1893, and informed me how he had observed that, occasionally, a native assembly took place at a certain spot on a mountain side, during which invocations and offerings were made. He ascertained that the ceremony on one occasion was the equivalent of the puberty-dances of similar California tribes. Having visited and examined the spot after one of these celebrations, in which six young girls, decorated with garlands of flowers, were the chief participants, he found the "sacred stone," concealed and surrounded by offerings of corn, meal and pieces of money. The version published by Mr. Parry is slightly different to this account, which was given me by Mr. Rust himself.

In order fully to appreciate the close analogy between the Californian ceremonial offering of maize and meal to the emblematic stone and the ancient Mexican ritual offerings of seeds to an idol, holding a bowl or vase, it is necessary to read the following data. At the same time I would like to mention here that amongst the Hupa Indians of California, who have been termed "the Romans of Northern California by reason of their valour and far reaching dominions," we find that "flakes or knives of obsidian or jasper, sometimes measuring 15 inches or more in length, are employed for sacred purposes and are carried aloft in the hand in certain ceremonial dances, wrapped with skin or cloth. Such knives are esteemed so sacred that the Indians would on no account part with them, and Mr. Stephen Powers found that they could not be purchased at any price."(10)

It is scarcely necessary to recall here that the flint-knife was a well-known ancient Mexican emblem, nor to point out the importance of the conclusion that two well-defined symbols which played an important rôle in the Mexican and Mayan cult of the Below and of the Earth-mother, are actually found in use amongst Californian Indians at the present day.

A whole flood of light is thrown upon native symbolism, however, by the information obtained from the Zuñi Indians by Mr. F. H. Cushing. The following passage, from their Creation myth, affords the most positive confirmation of the foregoing conclusion, that the bowl or vase was the native emblem of the earth-mother. The Zuñi speaker said: "Is not the bowl the emblem of the Earth, our Mother? For from her we draw both food and drink, just as the babe draws nourishment from the breast of its mother. And round, as is the rim of the bowl, so is the horizon...."(11) Interesting as this explanation of the native symbolism undoubtedly is, it becomes most important when its full significance is realized and we recognize that originally earthenware bowls themselves were looked upon as sacred emblems formed indeed out of the material of the earth itself. This fact places the invention and manufacture of earthen vessels in an entirely new light and enables us to conjecture and understand why, quite apart from their utility, so much

care and decoration were lavished upon them and why, indeed, they were constantly buried with the dead. They obviously served as sacred emblems of the earth-mother, to whose care the dead body was confided, and originally the intention probably was to propitiate her by the beauty of the sacred vessels, which, to be symbolical of her bounty, necessarily contained food and drink.

Without pausing to discuss how easily this custom would have gradually given birth to the belief that the food and drink thus offered were intended for the use of the dead body itself, or its soul, I would point out that, in the absence of clay vessels, a stone, rough or worked, would have also served as an appropriate emblem of the earth-mother, being as it were, of her own substance. It is well known that in ancient Mexico this custom prevailed. There we also find that the bowl- or vase-shaped grave was employed, with a deeply religious and symbolical meaning. This is clearly revealed by a native drawing in the “Lyfe of the Indians,” representing a native burial. The deceased, represented by his skull only, has been placed in a deep hole, figured as a large inverted horse-shoe, painted brown and covered with small “horse-shoe” marks. The same religious symbolism which led to the adoption of a definite form of sepulchre, typifying the element earth, would evidently account for the adoption for burial purposes, of large clay vessels into which the remains of the dead were placed. In some localities these clay burial urns were, as we know, made large enough to contain the dead body itself. The difficulty of manufacturing these would naturally have led to the general adoption of cremation, simply as a means of reducing the remains so that they could repose in the sacred image of the earth. Cremation would, moreover, be a rite full of meaning since, to the native mind, earth was inseparable from its twin element fire, and both together constituted the “Below.”

It is significant to find, however, that the ashes of Montezuma’s predecessors had not been finally consigned to the earth. In strict accordance with their association with the Heaven and Above, their remains were never allowed to come in contact with the earth, but were usually preserved inside of a hollow wooden effigy of the deceased, which was dressed in his insignia and placed in a high tower, built for the express purpose. Cortés states that there were “forty very high towers” in the enclosure of the Great Temple of Mexico and that “all of these were sepulchres of the lords” (Historia de Nueva-España, ed. Lorenzana, pp. 105 and 106). Whilst it is evident that the remains of all lords and priests of heaven should thus be assigned a place of rest high above the earth, it is equally intelligible that the bodies of the lords and priests of the Below and all women should be consigned to the interior of the earth and by preference in caves. The Codex Féjérvary contains an interesting picture of the tied-up body of a woman, recognizable as such from the head-dress and her instrument of labor, the metlatl, on which the maize is ground. The mummy rests inside of a flat effigy of a serpent’s head, which seems to be carved in wood or stone and closely resembles fig. 31, no. 11. It is worth considering whether the carved stone-yokes may not have served in connection with the funeral rites of the consorts of rulers or high priestesses or priests of the Below.

If investigations of the vase or earth symbols are extended to countries lying south of Mexico, traces of the existence of an analogous cult are observable. There undoubtedly exists a striking resemblance between the form of the characteristic and peculiar stone “seats” which have been found in such numbers in Ecuador, to the vase, fig. 31, no. 3, for instance. The employment of these symbolical stones as a consecrated central altar or, possibly, as the throne of the living representative of the earth-mother, would have harmonized with the native ideas which have been traced on the preceding pages.

It was also extremely interesting to me to find the identical symbol in the Maya day-sign Caban, which has been identified by Dr. Schellhas and Geheimrath Förstemann as a symbol of the earth and is figured on p. 99 of Dr. Brinton’s Primer of Mayan Hieroglyphics. In the sign Caban, the horse-shoe mark is accompanied by a series of dots which seem to indicate liquid trickling from the receptacle and permeating the soil, an idea which is strictly analogous to the much more elaborate Mexican images of the vase full of rain or “earth-wine,” fig. 1, nos. 1 and 4, which, in cursive form, was employed as the emblem of the pulque, or octli lords, the priests of the earth. It is strikingly significant to find that in the Maya Codices the drops issuing from the horse-shoe are sometimes figured as trickling into the mouths of “divinities” whose faces also exhibit images of the sacred vase, analogous to that of the Mexican “octli-lords.”

These Maya divinities have been designated by Dr. Schellhas as god L, whose face is painted black and under whose eye a vase is painted, a peculiarity termed by Maya authorities “an ornamented eye” and which may be seen in fig. 33, iv; (2) as god M, “a second black god,” whose eye is likewise enclosed in a vase and whose hieroglyph is a vase on a black ground; and (3) as god C, of whom I shall subsequently speak in detail. (See Brinton’s Primer, pp. 122 and 124.) In the case of god L, the two horse-shoe marks from which drops are falling into the mouth of the god, are surmounted by the glyph imix, to which I shall revert.

[Illustration.]

Figure 33.

The horse-shoe mark with drops likewise occurs in the design resembling the akbal glyph, which has been interpreted as connected with akab=night. It also occurs, in Maya Codices, on bands exhibiting cross-symbols, sometimes in an inverted position and hanging from above and sometimes standing on two of the three mounds which are a feature of these interesting glyphs. Postponing a detailed discussion of these, I will but emphasize here that, in the Maya Codices the vase, cursively drawn as a "horse-shoe" mark, is proved to be intimately connected with the ideas of liquid falling from above, and constituting the drink of divinities and symbols associated with the sacred vase, night and darkness, all attributes of the Below. We shall next demonstrate that it was alternately placed, on the Maya Caban glyph, with a curious sign consisting of a pea-shaped black dot, to which a curved and wavy line is attached. This is always figured as issuing from above the dot, then extending downwards and half around it and terminating in a descending, undulating line.

I submit the following to the consideration of Maya specialists: It seems to me that this sign presents an extremely realistic drawing of the seed of a monocotyledonous plant, such as the maize or Indian corn, in its first stage of germination, when the radicle, having issued from the apex, turns downwards in characteristic fashion and penetrates into the earth. Besides the realism of the native drawing there can be no doubt that the image of a sprouting maize-seed is the most expressive and appropriate accompaniment to the symbol of fertilizing rain, on an earth-symbol, and I am unable to understand how Drs. Cyrus Thomas, Seler, Schellhas and Brinton could have overlooked the realism in this image of a sprouting seed, and concluded that it was a portrayal of "fermented liquor trickling downward," a "nose-ornament," or a "twisted lock of hair," "a cork-screw curl." The latter interpretation was made by Dr. Schellhas because he found the sign in connection with female figures in the Codices, which undoubtedly is a fact of extreme interest, as it furnishes a valuable proof that the Mayas associated the earth with the female principle.

Dr. Schellhas, however, records his observation that the sign caban occurs as a symbol of fruit-bearing earth, in the Codex Troano, as it is figured with leaves of maize (p. 33) or with climbing plants issuing from it and winding themselves around a pole (p. 32). Geheimrath Förstemann connects the day-name caban with "cab" to which Perez, in his dictionary, attaches the meaning of "earth, world and soil" (Die Tages götter der Mayas. Globus, vol. LXXIII, no. 9) and adds that the hieroglyph decidedly designates the earth. At the same time he interprets what I regard as the maize-grain and its radicle, as possibly representing a bird in its flight upwards, and he merely describes the accompanying inverted horse-shoe with dots, without attaching any positive meaning to it. It must be added that Dr. Förstemann himself states that he is not satisfied with his own interpretation of these two symbols, the first of which, the seed and radicle, likewise occurs in the day-sign cib, to which I shall recur.

If any doubt remains as to the signification of the day-sign cab, I think it will be dispelled when it is shown that the name cab, or caban is obviously related to the adjective, adverb and preposition cabal or cablil, which signifies low, below, on the earth, in, beneath and under. The frequent association of the cab glyph with the image of a bee, as in the Codex Troano, is partially explained by the fact that the Maya word for honey is cab, for honey-bee is yikil-cab. It affords at all events, an instance, in Maya hieroglyphic writing, of a method of duplicating the sound of a word analogous to that which I detected in Mexican pictography, and named complementary signs in my communication on the subject, published as an appendix to my essay on Ancient Mexican Shields (Internationales Archiv für Ethnographie, Leyden, 1892). On the other hand the day name and sign cib, on which the sprouting grain is also figured, seems to be related to the verb cibah=to will, to occur, to happen, to take place. The allusion contained in both glyphs is obviously the same and signifies, in the first place, the h

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It was a particularly good asteroid, a great jagged rock roughly four miles square on one side and two miles at its thickest. Within five minutes of sighting it they knew that its flatter side turned away from the sun more than seven times an Earth day. That meant they should be able to land for mineral specimens and still be off in time to avoid the heating phase for which they were not equipped.

"I'll go out," said Warrant Officer Cramer, a tan-skinned young man who was peering ahead even more earnestly than usual.

"I'm Captain of this tin crate so it's up to me," said Hartley. "Right?"

"Right in a wrong sort of way, _sir_. Just two men on board and you're pulling rank!"

For a moment Hartley looked irritated, then his blue eyes twinkled with laughter. "Give me one reason why I shouldn't."

"I've never been on an asteroid and I've been a little nervous about it. I don't want to keep barrelling around space with that kind of a faze-factor bugging the back of my mind."

The great flat side had just turned into shadow and Hartley started to ease the ship down. He said, suddenly bitter, "With all my experience the only thing the political brass lets me captain is a two-man scouter. Consider my rank unpulled--it's all yours Will."

Cramer gave him an appreciative glance and put on his outside gear.

"Let the Boy Scout have the dirty jobs," Hartley muttered, a nervous sneer twisting one side of his mouth. He idly adjusted for the descent onto the sheared stone face and, once Cramer was in the exit chamber, exchanged a parting wave with him through the quartz window.

Queer duck, saying a thing like that, Cramer thought as he opened the outer hatch. _A little too bitter about things for his own good sometimes._

But then his foot touched solid rock and he was too busy chipping specimens to worry about poor Nick. After each tiny chisel stroke his body bounced slightly away and, gripping the lead rope, he had to retrojet himself back into the circular light patch thrown by Scout III. The stuff was hard composition but, fortunately, with many straight stress lines so pieces slowly did come loose. One carefully placed blow, then a whirl of stars streaming across jet blackness, then a swing back into the light and another blow and another outward swing.

Suddenly a voice crackled in his ear. "You've been out fifty minutes, Will."

"It can't be!"

"Asteroid time's tricky when you're busy. How many chips you have?"

"About a dozen."

"How many do you want? Don't be such a glory boy, get in right now!"

* * * * *

As he pulled himself along the line and up through the hatch he realized that not only had he been undisturbed while on the rock but he hadn't even considered the possibility of becoming frightened! Pleased with himself, he closed the hatch door, raising the current in each magnetic lock to sealing maximum. As soon as the last bolt was sucked into place, his suit started decompressing while chamber pressure mounted in precise compensation. For a second he thought he saw a white speck eddy out of the specimen box attached to his belt but another did not follow. Anyway, suit vizors had a way of clouding up on the inside during chamber compression and that could play funny tricks.

Five minutes later, though, when he pulled off his helmet a little swarm of white specks welled up toward the ceiling. Then they were gone. _Funny_, he laughed to himself. "Funny, funny," he suddenly laughed aloud, "Talcum powder from the void!"

There was Hartley's face at the window, peering anxiously at him, and, for some inexplicable reason, that sight was even funnier. Shaking helplessly, Cramer slapped his knee and kept pointing at the face. _Life is so wonderfully wonderful!_ he said to himself, unable to utter anything aloud now. _Wonderful wonderfully!_

After a while Hartley opened the door to the front cabin and helped him to his cockpit seat. "Sorry, old man," Cramer gasped happily. "Don't know why I did that."

It was surprising how undisturbed by the private joke Hartley looked. He seemed to be too abstracted for that. "Feeling all right?" he finally asked.

"Perfect!" Cramer grinned, greeting the galactic reaches with a wave of his hand. "Isn't it a beautiful universe? I think I could count all the visible light sources out there in ten minutes if I wanted to. No, I don't want to count anything but my blessings, I just want to look."

"Not from here, though. This rock makes its crazy wobble into sunlight soon and I'd rather be off it when the surface starts heating up."

Hartley eased the craft upwards, pulling her back a few dozen miles. Then he balanced the power exhausts into hover and took the specimen box from Cramer's belt. "You've got ecstasy of the space deeps, never can tell when that'll strike a man out there." He studied the little slate-blue chips inside. "You notice that white stuff, Will?"

"First thought it was just vizor clouding." He was thinking with extraordinary clarity even though he still felt wildly elated. "Seemed to happen after the temperature moved above water-freezing."

"Yeah. You did everything by the book, son, except the thing that justified your excursion in the first place. When you came in you merely forgot to seal the specimen box and set its cryogenic cell for deep freeze. Bringing the chips into human temperature range may have destroyed some of the specimen's value. Usually doesn't matter but in this case I wonder--"

"Gosh, that's awful! I'd be glad to go out again."

"No, you may have stupidly done a smart thing. But you'll really boggle it this time with the ecstasy clouding your mind."

"I'm thinking clearly, really I am."

"Can't be."

"Okay," he said, "test me. Give me some digits to multiply while you punch them on the computer."

"All right," Hartley muttered impatiently. "38,373 times 14,621 times 322. Satisfied?"

After a few seconds, "1-8-0-6-5-8-6-2-5-8-2-6."

Hartley pulled a strand of tape from the computer. "Repeat it slowly." Eyes widening, he followed the response on the tape. "You've got it right!"

"Satisfied? Seriously, though, it's nothing when you know the tricks. Old-time non-machine calculating was one of my hobbies when I was a kid."

"It isn't 'nothing.' Space ecstasy ruins a man's ability to think straight for hours. Plenty of bodies are still drifting around space because in the early days they neglected the proper safety checks." He stared through the magnifier at the asteroid, its flat face now glittering in sunlight. "Starting to feel the hangover headache?"

"No, just fine. Nick, I've never felt this good in my life!"

"We'll wait here an hour."

* * * * *

But after the hour was up Cramer was still grinning. "I'm ready to go out again," he said.

Hartley stared at him. "Then it _was_ that white stuff. Man, you've hit on something. There have been a few reports about this kind of untroubled ecstasy reaction but nobody ever spotted that powder. We're going back!"

When the asteroid was back in position again they dropped to the surface. Cramer started up but Hartley held him back in his seat. "This time I do pull rank. I'm going out myself."

Cramer shrugged. "I'm in too good a mood to offer the slightest protest."

"Your mood's why I'm going." He put on his suit and went into the rear chamber. A few minutes later he disappeared outside.

"Everything okay?" Cramer radioed.

"Sure thing. I'll be right back. This stuff flakes off like mica, easy to handle when you know the angles of the fault lines."

A few minutes later he was on board again. "You sure were fast!" Cramer exclaimed.

"Get the comp-decomp going and don't chew so much fat."

"Okay." He activated the self-compensating cycle and watched his superior through the glass. There it was again, a few specks from the specimen box. He, too, had forgotten the standard operating procedure! Then later, as Hartley took off his helmet, a swarm of them ascended like angry midges to the ceiling. In a few seconds the Captain was laughing more relaxedly than Cramer had ever seen him laugh before.

When Hartley came into the cockpit he exclaimed, "Wonderful! There's something like mica in these rocks and the powder's all over in the schists." He went to a corner and pulled some things out of an equipment cabinet but his back blocked Cramer's view. Still facing away, he headed back into the exit chamber. "Go out again," he said.

"But, Captain, you won't know what you're doing!"

Hartley gave an airy wave. "You did, didn't you?"

"Yes but--"

"No buts, my young friend. I'll be on the line. Anything goes wrong, you turn on the winch and I'll be wrenched right back in."

"We'll be orbiting into sunlight and--"

"Forget it, I'll be back on time. There are only two universal laws, son--get happy and stay happy." He shut the door, put on his suit and ordered a compression recycling. As soon as it was completed, he jetted himself through the escape hatch.

* * * * *

Again he was back very quickly but this time, as soon as the helmet came off, he whipped out a specimen slide from an inner pocket, waved it gaily through the talc cloud (_again_, he had left the box unadjusted!) and slipped the slide into a portable pocket microscope. He gripped the scope in his eye like a monocle and stood spellbound for five minutes until with a shout of joy he let the little electronic cylinder drop into his hand. "I'm going back out," he said.

"But, Captain Hartley, you'll get caught on the heating surface."

"Open the cockpit door!" As soon as he came in, he sat down at the controls and lifted the craft off. "See, Cramer, I can think straight, too, under the influence. You were right this time and I've listened."

Then he switched to hover.

"We're not going back _again_, sir, are we?"

"Of course," Hartley grinned. "After all, I made the same mistake you did. Twice I've let the temperature of the specimen box dekelvinise!"

Despite his continuing sense of well-being, Cramer felt uneasy, but there was nothing he could put his finger on so he didn't protest. Anyway, he could see Hartley would not be swayed now from whatever was his strange purpose.

A few hours later they settled back on the asteroid and the Captain went out once more. Cramer tried to watch what he was doing but Hartley was too huddled over the fault he was working for much to be seen. An hour later he came back in, and made some fix notations in his log book as soon as his suit decompressed.

They took off immediately. "This time the box stays locked," he said, pointing at the lid dial which showed the tiny atomic power unit inside was keeping the core's contents at Kelvin 90. Then he radioed the mother ship for a directional beam and locked the craft on automatic pilot. He glanced thoughtfully at his assistant. "When we come in _I'll_ make the report."

"But I know that's standard, Captain, I learned it the first month at the academy."

"Just wanted to make sure you remembered. How do you feel, Will?"

"Perfect."

"No after effects! Same with me!" He thumped Cramer's back in a hail-fellow-well-met spirit and Cramer thought, _Not such a bad guy sometimes_.

* * * * *

But, of course, that little outburst of camaraderie had to stop short as soon as they debarked inside the mother ship. The _Solar Pioneer_ was strictly spit-and-polish, all twelve hundred feet of it, and as they came out of the scout craft hangar, there were brisk salutes to be exchanged and data registration books to countersign. General Chisholm, a natty man with brightly burnished swagger stick to match, was personally on hand to greet them.

"Anything of interest to report, Captain?" he snapped.

"Fairly routine, sir." He gave Cramer a silencing glance.

"That's the trouble, Captain, the whole voyage has been. You're the last craft in so we're heading back to Earth now."

Hartley held out the specimen box. "We spotted a good landing asteroid--one side flat as a mesa. Composition fairly similar to granite and mica."

"Nothing else?"

Cramer started to open his mouth but Hartley broke in; "Nothing, sir," he answered.

"The white stuff, sir," said Cramer, holding chin and stomach in.

The General glared directly at him. "You're out of order, Mister."

"Yessi--"

"Then don't say another word." He pulled out a little black book, made a notation and looked at Hartley as if no one else were there. "What's this about?"

"Nothing important, sir. We didn't have the specimen box set cryogenically a few times and when the temperature went up to human normal in the compression cycle chamber little water crystals flew out."

"Well, nothing unusual about that."

"But, sir," Cramer protested, "they couldn't have been just water."

"Silence!" Chisholm roared and two of his staff officers at the bend of a corridor turned to watch the fun. "Consider yourself under Probationary discipline, Mister Cramer. Informality's natural and permissible on a front-line craft like a scouter but chain of command has to be _absolute_ on a dreadnought, you know that."

"I'm very sorry this happened, sir," Hartley apologized.

"When we land he's under your probationary control for the first five days of Earth leave. It's up to you to teach him how to stay in line." He rubbed his brush mustache thoughtfully. "To begin with, though, it might be good to take him along to Analysis Lab just to show him how wrong he probably is even about the specimens. Any objections to that, Mister?"

"No sir!" he said, more hopeful now of exposing Hartley.

"A very good idea, sir," Hartley nodded unexpectedly.

They proceeded two hundred yards toward the stern where the Specimen Analysis Laboratory was located. In one long room there was a row of totally automatic equipment for both deepfreeze and normal temperature breakdowns. Sommers, the chief chemist, set the specimen box in a large, sealed chamber with one transparent side. When the inside temperature matched that within the box itself fine robot fingers unlocked it, withdrew samples and shifted them toward various test compartments. Meanwhile, Chisholm explained about the crystal cloud to the chemist.

"That must have been an exceptional batch," Sommers said, as he studied the response dial. "_Very_ little moisture here. Nothing important to that one way or the other, though. Matter of fact, nothing important to these specimens in general--usual asteroid run."

Hartley impassively considered the shocked expression on Cramer's face.

"Confined to quarters for the rest of the voyage," snapped the General, turning his back on the miscreant.

* * * * *

As Hartley led his ward to scout quarters, he kept shaking his head. "Shouldn't make trouble like that, Cramer. See where it gets you? I can't get ahead in this man's service so how far do you think _you_ can go?"

"But you didn't tell him the most important thing. And the material in the lab didn't give off _any_ whiteness even when its temperature was raised. I don't think you put in any new chips the third time you went out--I think you're trying to hide something!"

"Sure, right here." He pulled a pocket inside out. A few tobacco shreds were clinging to the lining. "Go ahead, tell them more and you'll keep getting into deeper trouble. Nobody will believe you anyway."

They stopped by the Recreation Room entrance to watch a foursome at ping pong. It was a good game, requiring special skill since the artificial gravity of the dreadnought-class craft varied slightly from that of Earth, "Come along," Hartley said finally, "no human company for you until touchdown. When we're on _terra firma_ I'll show you how silly you've been and you can get in on the ground floor for something really big."

Saying nothing, Cramer stepped into his little windowless cabin and listened as his door was locked from the outside. He broke open an emergency ration bar, munching sullenly until the idea came to him that the asteroid experience had to involve some new kind of drug Hartley wanted to keep to himself. He would have to convince the authorities that the matter warranted further investigation, chain of command rules or no rules.

Meanwhile, there was a week of isolation to be filled. There were thirty courses on his shelf to choose from, various things he had planned to learn when the occasion arose. Now there'd be enough time to absorb two of them. He set up the audio-visuals and started on the intensive twenty-four hour regimen that permitted even sleeping hours to be pedagogically fruitful.

A week later, as the _Solar Pioneer_ settled in its magnetic cradle near Paris, he found himself master of _Old Sanskrit_ (his eighth language) and _Luna: History of the First Settlements_. He also found himself once more face to face with the problem of Hartley's devious scheming. A Probationer's badge was given him to wear before the Captain took him off the ship. Hartley accompanied him in a RobotCab toward the tower city twenty miles down the Seine from the ancient arrondissements.

"That powder was a drug," Cramer said as soon as they were alone in the cab. "You think you can turn it to private advantage but the idea's insane--everybody knows the dangers of drugs."

"That's the beauty of it--it isn't a drug." Hartley leaned back and crossed his legs. "There wasn't any after-effect, was there?"

"Doesn't mean a thing--drugs only do their real damage after repeated dosages. Joy can't be this free--you have to pay for it at horribly compounded interest when it comes this easily."

"I'm willing to wager we're going to find this stuff perfect, no side effects at all and--"

"The cry down through the ages, Captain, all drugs have been evil but this newest one is the exception. Until it turns out to be the same narcotic chimera, pure hell."

[Illustration: "... all drugs have been evil but this newest one is the exception."]

"--and, Mr. Cramer, it isn't a drug."

He threw up his hands. "A chemical working like that one did isn't a drug!"

"Did you ever hear of a narcotic drug that was alive?"

"Alive? Did you say _alive_?"

"That's what I said," he smirked.

"But then--. You mean it's a germ?"

"Ah, getting smart at last!"

"Then we're infected and you want to corrupt other people the same way."

"Nobody can be infected." Eyes glittering, he watched the first vast metropolitan tower grow ahead of them. "The germs die after a few minutes of body warmth--die and _completely_ disintegrate. I saw it through the eye-socket microscope!"

* * * * *

Cramer felt the first cold horror brush his brow like the substanceless touch of the wings of the angel of death, but he managed to stifle his incipient protest. It was more important than ever now that he find out what was being planned. "That _is_ peculiar. I don't know whether it could be called a drug or not."

"It isn't one. But a name's not important one way or the other except sometimes for legal purposes. The important point's that here's something without any bad side effects because the body utterly destroys it." He pulled a cylinder from his pocket. It was the smallest deepfreeze unit generally available. "At least 100 cc in dormant _pure_ form inside this cryogenic package."

"That's what you were doing on the asteroid, gathering your own private stock!"

"Naturally. I saw that the powder lay in the schists and just scraped the stuff in and sealed it up." He patted the insulating ceramic. "Now we're going to see a friend of mine and, if I'm right, we have five millon dollars in the palm of my hand."

"Why are you telling me this?" Cramer demanded.

"Because it's simpler to have you in on it than on the outside. Not that you'll be able to do anything even if you remain so naively Boy Scoutish about it. Who's going to believe your story at this stage of the game? There's an even better reason why you'll keep quiet, though, but I won't tell you that until later."

Cramer was still considering how he might snatch the capsule away when the Captain dropped it back into a self-locking pocket of his suit. The cab had stopped before the sleekest tower on Boulevard Radial. Hartley jumped out, waving for Cramer to follow.

The elevator had several other people in it, all of whom eyed the Probationary badge with distaste. Any attempt to subdue Hartley would receive no support from these super-respectables.

The two of them got off at the eighty-seventh floor and were ushered into a vast, luxuriously-decorated chamber. About a dozen men and women were scattered about the room, boredly watching a color symphony unfold on one wall. They were all dressed in the sort of highest fashion glitter which evoked as much disgust as amusement among most space workers. But Hartley was obviously not typical of his breed; he enjoyed coming among these people, livening up as soon as he saw them.

A tall, blonde man came slowly toward them, wearily rejoicing. "So glad to see you, Hartley. Ah, a Probationary in tow--well, any Probationary is a fellow friend in the kingdom of chaos."

Hartley perfunctorily introduced them, then glanced around. "Drinking nectar?"

"It kills time, can't do any damage and--I know what you're going to say," he grinned, "it's a bore!"

"Well, it is, you should be on to something stronger."

"You gone space gaga?"

"Not at all, Neilson."

"Who would bother with what isn't safe? Everyone knows down to the last nerve tremor the consequences of really good stimulants. We've seen it, smella- and feela-visioned it through social indoctrination procedures to the point where no one would dare. All we can do is stick to the legally permissible alkaloid-heightened caffein derivatives."

"Suppose I told you there is something new, something perfect _and_ safe?"

"I'd say gaga again, sheer lunacy!"

"All right, just listen." He recounted their experiences on the asteroid and, despite himself, Neilson began to show real interest.

"And you have a capsule?"

"Yes, want to try a fleck? That's all you need, I think."

"Oh no!" Neilson exclaimed. "Not until I've run the tests."

"Well, that's what I'm here for. You're a biochemist, you have all the equipment."

* * * * *

Cramer looked disdainfully at the man. The type was common enough--probably knew next to nothing about his specialty. But--and this was what made it doubly revolting--he didn't have to know in order to be an expert. Good equipment could do _all_ the work in most cases.

Neilson waved languidly toward his other guests, mumbling, "See you shortly," and let the pair through a series of golden rooms to his Analyzer Laboratory. There he took the capsule from Hartley and placed it in a cryogenic tester similar to the one aboard the _Solar Pioneer_. After temperature adjustments were made, tiny filament hands began lifting out specimen flecks and shifting them to various test sections.

"Odd stuff," murmured Neilson as he surveyed the preliminary sheet punched out by the reporting machine. "It's a living organism and--and it's _silicon_-based! That's a real weird one. Its biological action in the human body wouldn't be like any narcotic, completely new. Can't read the next stuff--ah, here's the translation--heightened hormone discharges, not one of which is detrimental. Metabolic cycle of bacteria somewhere between three and four hours."

"The spin period for the asteroid! This stuff's likely to be available hundreds of places in the asteroid belt, wherever the spin period's in that range. Might have an endless supply because in its native habitat it reappears after the heating phase even though something in the human body destroys it permanently."

Now summaries were being pumped out more rapidly and Neilson was scanning them with unwonted speed. "Fleck dose too small for _any_ endocrine upset. None for musculature either. Gastro-intestinal negative. Bone Marrow negative. Ten minutes after entering the body this stuff dissolves completely into _lower_ elements! Physiologically non-habit-forming. Hartley, if this gives all the pleasure you claim it's the answer to our wildest prayers. I will try a fleck."

As soon as he inhaled the infinitesimal dosage he began grinning at the pair in speechless wonder. Hartley joined him and offered to set a bit up for Cramer.

"No," Cramer said, "I don't care what the analyzers say. You can't get something for nothing."

"This is beyond price," Neilson sighed contentedly. He moved to a wall mirror. "Not even a little retinal contraction. The dosage is so small the silicon base couldn't hurt you even if you took one an hour for the rest of your life. And there can't be any hangover."

"No law on the books against it and I don't think the public would tolerate a prohibition. This stuff is actually _good_ for you!" Hartley exulted.

"And we are the only ones on Earth who have it for at least the next few weeks!" He jotted down some calculations. "Figure a hundred thousand doses in the capsule and at least fifty dollars a microscopic flake slice, seventy-five dollars, more probably. Anybody can lay his hands on cryogenic capsules--they're all over the place. We'd only need a few dozen runners and I can get them easily enough. Are we in business, Hartley?"

"Let's give a free sample to your friends first."

"Fair enough, they're going to be among our best customers."

Cramer watched in horrified disgust as the others were summoned and willingly passed over into the fully-conscious ecstasy. But why the horror? Why the disgust? he demanded of himself. Why condemn something that even the Specimen Analyzer showed to be wholly beneficial? He couldn't find the tangible reason but that didn't matter; there had to be something wrong somewhere.

"Still not with it?" Hartley asked after a while.

"I'd just as soon not bother quite yet."

"Well, you do know what you're missing," shrugged the Captain. "My Probationary rights don't give the privilege to insist on this. As I told you, complaining to authority wouldn't change anything but now I'll give you the biggest reason why. Even in the highly unlikely case of their believing your story, they couldn't move against me because they'd know it wouldn't matter. First I'd see to it that word got out about germ-joy. There are hundreds of craft on the Mars run that can detour into the asteroid belt and pick up a supply once they know what to look for. Look at all the freighters that do a little bootlegging on the side now--there'd be no way to seal off that supply."

"I can see that," Cramer agreed. "I'm not interested in reforming anything. I just don't want to be personally involved."

"Perfectly all right," Hartley said thoughtfully. "Each man to his own tastes." Then he moved away to discuss business arrangements with his host.

How do I get out of here? Cramer wondered. _And how do I get anybody to listen, to believe such a wild story from a Probationary? Or would it be best to string along with them and see what happens?_

* * * * *

Trying all the while to hide his anxiety, he struggled with a dozen problems that seemed to have no solution, that might not even deserve a solution if the stuff were as harmless as it had shown itself to be so far. For the present, he had to appear to be one of them; just before going in to dinner, he asked for a fleck and there was a patter of applause from everyone with jovial cries of "For he's a jolly good fellow!" and "Now you're talking!"

There was no denying the renewed sense of youthful cleanliness it gave him, as if every nerve of his body had been gently washed down to dawn of life freshness.

The main course consisted of yeast snow nectar laced with rare confectionery spices that broke evanescently on the palate and then subtly vanished to make way for the next clearly distinct sensation. Behind his own mask of laughter Cramer drowsily watched all the other chattering faces. After a while there only seemed to be the glitter of eyeballs and silver and perfectly-spaced teeth sinking into nectar, and he got up with the assistance of Hartley and Neilson to accompany them sleepily, oh so yawn-sleepily! away to another room....

He saw himself floating from afar toward the asteroid, its rougher side glowing in the sun, the flatter one a sable blank. He moved slowly through a viscous atmosphere, one joint stickily shifting after the other. An enormous flake of whiteness settled on his face and he inhaled. To be _this_ happy, _this_ content! And again the movement around the surface as gradual as the turning of the asteroid itself. Over and over again, never an end to it, while another flake drifted inexorably toward his upturned face. And again that final happiness.

He swung imperceptibly, across the surface of his new home as it streamed in an arcing line along the invisible orbit of the asteroid belt. And always at the right interval another floating flake.

When the voices came to him they were hardly wanted and totally unneeded but, although he did not listen, he heard them and even identified their owners.

"He's hooked now," Hartley was saying.

"I guess so," Neilson answered. "But it's not physiological."

"Who cares about that? _Psychologically_ he's going to want the stuff from now on--any sensible person would. You know, we're actually doing him a favor, destroying his inhibitions against something so harmless."

"Which doesn't concern me one way or the other."

"Well, maybe it would have been neater just to get rid of him but Probationers have to report to HQ at the end of their punishment periods. If he doesn't go in today there'll be an investigation and, believe me, Neilson, they'd trace down my every movement and get an electronic hold on me that I couldn't shake. The whole thing would come out."

"A lot of good spilling our beans would do the government. Someone else would just bring in the happy germs."

"Yeah, but this next month's the time when _we_ make our killing. Hey, I think he's starting to wake up."

"No, prob--"

Neilson's answer mumbled itself away and he found himself floating across the flat face of the asteroid, waiting for the next huge flake to descend.

... And then he was really awake. He discovered that he was leaning against the back of a heavily-padded chair, alone in a guest bedroom. Approaching footsteps told him the pair was returning and he hastily shut his eyes. This had to be carefully managed.

"Ought to be waking up about now," said Neilson.

Cramer started stretching, then rubbed his lids and blinked at the light. "Give me a fleck," he pleaded. "Just a little bit."

The two of them nodded to one another and Hartley leaned forward. "Takes a little while to get it out of the freezer, Will."

"I want it now," he said petulantly.

Hartley gave his shoulder a comradely squeeze. "One of the gang now, eh? Come along and you'll get it. You have to report to HQ."

"I have five days Probationary." He got up and followed them a little unsteadily to the cryogenic freezer in another room.

"Five days are up," Hartley explained. "You've been doing a lot of sleeping, even were sleepy when you got up to eat."

"Don't understand."

"I'll tell you after you get our sniff."

"Yes, that's what I want now."

* * * * *

One tiny fleck came out on a holder the size of a fingernail paring. It was frightening how quickly they had developed techniques for handling the stuff.

"Take it fast!" Neilson shouted. "That germ colony's worth eighty dollars and it's breaking down fast. You won't get another."

Cramer leaned forward to quickly breath it in. By the time he exhaled it was already working its magic. He straightened up and smiled with hangdog gratitude. "Oh, that's good!"

"Had to get you used to it," Hartley said. "Only reason why we kept you sleepy--you'll thank us some day."

"Some day? I thank you _now_!"

Neilson gave him a friendly handshake but his eyes were coolly observant. "Okay," he nodded for Hartley's benefit.

Hartley glanced at his watch. "The stuff's all gone by now. They can't find a thing even if they do give you a checkup."

"But the silicon--"

"Not a trace," Neilson said. "This thing even breaks up on the atomic level, takes a little longer than the germ death but inside an hour no silicon."

"But the fission breakdown--"

"Don't ask me," Neilson shrugged, "it doesn't work that way. Must have something to do with the beautiful energy charge you get from germ-joy."

"Feeling clear-headed?" Hartley asked.

"Sure, I'll be right back for some more after I report."

He went out, grinning inwardly. They were right about one thing--it wasn't physiologically habit-forming. And he just did not have the kind of psychological defect for it to be habit-forming any other way.

When he reached Space Pioneer HQ he handed in his card at the Probationary desk. The Major in charge looked him up and down in stony silence, then suddenly barked, "Anything to say, Mister?"

"Yes sir. I want to register a complaint with General Chisholm personally."

"What!" His face turned beet red. "Look, soldier, we're not strictly GI in this outfit out of love of red tape. This is a dangerous service. You have to follow the chain of command every time." He entered a black mark on the card. "Tell your immediate superior."

"He's the one I'm complaining against, sir."

"Then go see the Inspector General!"

"The time lag, sir, it would take too long to reach General Chisholm."

The Major violently punched another mark on the card. "Wipe the grin off your face, Mister. What's so funny?"

"That's part of my complaint, sir. I've been drugged to joy."

"I really ought to call the General. You'd make a perfect punishment example."

"Just as long as I get to talk to the General, sir," he said, confidence in his success gone even if the evil stuff kept him feeling so good.

"Wait in the outside room." He reached for a phone. "Who's your immediate superior?"

"Scout Captain Hartley, sir." He went out and sat down on the edge of a chair. No, it wasn't going to work, he could just see it wasn't.

Then the Major was striding out and shouting, "Follow me, the General actually wants to break you in person!"

Cramer sighed and followed him up an escalator, then past two receptionists and two private secretaries. The Major pointed at a small door. "You go in on your own, soldier."

* * * * *

He turned the knob and stepped nervously into a room which was bare except for a glass-topped desk behind which General Chisholm was seated and a few wrought-iron chairs facing the desk. The General stared at him as if he weren't there but would materialize under prolonged scrutiny. "Sit down and tell me what this is all about," Chisholm said, raising one index finger from the desk.

Cramer sucked in his breath and the story came pouring out, faster and faster all the time as if he were racing against the moment when Chisholm would bark for silence and bring him crashing down. But the General said nothing, studying first one cuticle, then the speaker's face, then back to the next cuticle.

Suddenly he slammed on an intercom and said, "Get Dr. Jonas and tell him to bring a portable blood test rig."

"Then you _believe_ me, sir?" Cramer was too stunned to remain safely silent.

"Of course I don't, Mister, but there's too much smoke for no fire."

"The silicon trace may not show up now--"

A smile flashed up Chisholm's face, then disappeared. "Those are the chances you take when you tell sensational stories."

Cramer's heart sank once more. "Yes, sir."

The specialist arrived with his test machine rolling behind him like an obedient, lumbering mastiff. When he reached the center of the room he turned a dial on his signet ring and the machine stopped.

"This young warrant officer has given me an interesting account of his recent experiences which, he would have us believe, included being drugged into sleep and semi-sleep," said Chisholm. "I want you to test blood samples for silicon traces, in fact the whole gamut of tests."

Dr. Jonas' pointed chin sank toward his chest, then rose. "Yes, General Chisholm." He pulled up Cramer's left sleeve and applied a blood-sucker tube which clicked off drops until it reached fifty and stopped. The doctor set the fractionating apparatus on automatic and approached his superior's chair to say, "I hardly think a person could be sedated with a silicon compound, sir."

Chisholm gestured for Cramer to remain silent. "All right, while we're waiting for your machine to complete its run, here's a purely hypothetical problem. Imagine a silicon-based _bacteria_--"

"_What?_" Dr. Jonas exclaimed.

"I said a silicon-based bacteria. It raises human metabolism when absorbed into the blood stream in the form of a tiny frost flake, a flake whose very _atomic_ structure breaks down the elements scale without the explosive force of nuclear fission or any other kind of serious disruption."

"I'd say the whole thing's impossible, sir!"

"But let's just suppose it is not."

"Then I'd have to proceed on the assumption that the life cycle of the hypothetical form permits it to reach a high threshold of energy storage, part of which energy is smoothly released while the rest achieves a new balance as the silicon transmutes into elements of lesser weight."

"Sounds like a reasonable explanation for something unreasonable, doctor," he stiffly observed. "Your tests should be ready now."

* * * * *

Dr. Jonas looked satisfied as he pulled the tape from the machine. "No silicon." He stopped, frowning. "But there is indication of massive barbiturate dosages. This man _has_ been drugged! There shouldn't be any lasting damage--he's a healthy specimen all right--but whoever did this wasn't worrying about his welfare, General."

"Thank you, Dr. Jonas, you may go now." He casually leaned back in his chair. "This is Top Secret for the present. I will be consulting you later on this matter."

"Yes, sir."

But as soon as Jonas and his equipment were gone the General sprang into frantic action. "You're under arrest, Mister."

"Sir!"

"_Protective_ arrest--although it won't be announced that way. No time for explanations right now. Give me the precise reading and time for that asteroid."

When he had the information he activated a keyboard at one side of his desk which fed the orrery computer several miles away. A few seconds after he punched in the data, the reply came back with the exact present location of the asteroid. He immediately threw a switch which lowered the lights and simultaneously splashed a map of the solar system on all of one blank wall. The map carried the caption _Pioneer Logistic_ and showed a dozen labelled points scattered throughout the system's inner and median reaches. A few were moving very slowly while others appeared to be at rest.

After a minute's careful scrutiny the General leaped to his feet, muttering, "Good, good, Hazelton can get there in four hours." Starting his sender, he brought on Message Center and commanded: "Get me Admiral Hazelton on the _Star-Seeker_. Top Priority Instant Action Field Officer Line."

Cramer, accustomed to slower transmission channels, was startled by the speed with which Hazelton's voice came into the room. "Standing by, General."

"Admiral, have your daily code book handy?"

"Right here."

"Put her on today's complete garble in precisely ten seconds." He set his own coder and waited. "Okay. Hazelton, are you receiving me clearly?"

"Perfectly, Chisholm."

"All right, now nobody else can follow what I'm going to tell you. Immediately shift course for 325.83.21 in asteroid quadrant, subsection 38." A protesting squawk came hurtling across space. "First give your people my orders, then I'm going to tell you why."

Cramer gaped as he heard his superior start to repeat his story. The General _must_ have believed it!

Ten minutes later Hazelton broke in with a final "Oh, my God!" For a while only his heavy breathing could be heard, then he said, "Chisholm, if there's anything to this it's the worst social catastrophe of the century!"

"I know it. Contact me as soon as you have a sample analyzed. You should be able to manage in six hours or so--this line'll be open at all times from now on. Off."

Chisholm came back to the desk and looked steadily at Cramer. "You sure have me going far out on a prestige limb."

"I never expected anybody to believe me, sir," he replied, all gratitude.

"I still don't but we can't take any chances. I know something has to be going on. You see, Captain Hartley resigned from the service yesterday."

"But he's still under your command for three months, isn't he?"

"No, he's a free agent. He entered a Categorical Resignation. That means he's giving up all benefits accruing to a man of 25 years standing but his resignation is immediately effective."

"You could still arrange for his arrest through the civil channels."

"I doubt whether any continental president would care for that idea, I know I don't. Your former Captain's a very shrewd man, he knew we'd see how helpless we are--I only hope that you're lying through your teeth!"

"If I don't return soon, General Chisholm, he'll suspect something."

"Again, it doesn't matter very much." He sat down and rubbed his chin. "If we let you go back, do you think he'd let you see how they're organizing their operation? True, it would be more convenient for him if, for a few more days, we wouldn't be investigating

him--that's why he took the chance of letting you report back here and avoided the Probationary hunt. To his way of thinking, chances are that you'll want further dosages and keep quiet. But why should we expose you further to that stuff when the possible sacrifice involved won't give us any more information?"

"Then you're just going to surrender the point, let him realize you know and won't do anything about it?"

"Not exactly. The best we can do is keep him uncertain about you. Officially, you've been arrested for insubordinate behavior by a martinet General who's decided to make a horrible example of you. Someone looking like you is going to be seen entering a punishment craft heading for a monotony run to check the automatic satellites around Uranus. That's the stupid best we can do--we're over a barrel." His sharp eyes suddenly dug into Cramer's. "You'll be in isolation quarters for the next few hours. I only hope that you'll deserve to stay there, that your story is all malicious nonsense!"

* * * * *

Cramer was escorted to a small cell where there were no audio-visuals, only old-fashioned printed books. He picked up a few of them, stared at the title pages without knowing what he was reading, then began to pace his cell.

What if they didn't find a germ sample? After all, nobody had ever spotted the stuff before.

No, they knew what to look for now and that made a difference.

But maybe it didn't in this case.

And what made them feel so helpless? What gave Hartley that much of an advantage over a General of the Space Deeps?

Nothing added up and it seemed he had been shuffling the crazy pieces for a week when they came to take him back to Chisholm's office. The clock, though, told him only eight hours had passed.

Another man was in Chisholm's office now and he recognized him as soon as he came in--Shelby Johnson, President of North America. The newcomer nodded grimly as they were introduced to each other.

"President Johnson is here incognito, came by a private entrance," Chisholm explained. "You're not to mention this anywhere."

"A real mess!" Johnson exclaimed. "But at least there was someone decent enough to give us forewarning. This stuff's supposed to be so effective, no hangover, no known damage to the system--why didn't you go along with Hartley's reasoning?"

"There has to be some bad long-range effect, nothing comes that cheap."

"I only hope you're right." Johnson's grey eyes seemed to be focussed far off. "Otherwise the social damage will be terrible."

"_Everything_ you told me has been confirmed," said Chisholm. "Scouts had no trouble finding a batch and the tests confirm that it's seemingly harmless, breaks down completely."

"Then why don't you arrest Hartley?"

"That would just spread knowledge of this even faster. He's probably seen to it that will happen and can hold it over our heads."

"Counter the thing with a propaganda offensive, highlighting the evils."

"What evils? Young man," the President broke in, "Who's going to be scared off from something that sounds so harmless? Two things are working against us--the supply's easily replenishable _and_ testing equipment's much too common for us to put over any white lies."

"Still hard for you to understand, isn't it?" Chisholm sighed. "Cramer, a terribly big percentage of the population has become passive and bored, just looking for some easy diversion. We have all we can do just to keep this social cancer from spreading without germ-joy. _With_ it, matters can get out of hand. And I don't care how automated and wealthy a society is it can't get by if we develop _that_ big a burden of non-thinking freeloaders."

"General Chisholm isn't wholeheartedly with the plan I've adopted but--"

"But I haven't a thing better to suggest, Mr. President," the General conceded.

"Who does? Well, the plan for the next few weeks is this, to keep very close surveillance of Hartley's activities without openly conceding we know what he's up to. We have to hope that some defect will show up in a user even though the first report says no one sees how it can happen."

Cramer protested. "You're going to let him get away with it!"

"For the present," President Johnson nodded. "We're not interested in punishing a particular man. We have to give him all the joy-rope he needs and hope that he, as the longest-run user, suffers the consequences."

"I could keep taking it myself if you need a guinea pig."

"The rasher section of the public will supply enough guinea pigs," said the General. "You'll stay here at HQ, looking over all the reports that come in, Mr. Cramer, maybe your experience will help somewhere along the line. If, after a few weeks, nothing shows up, we will crack down on Hartley anyway."

"Not that it will do much good," said the President. "But we, too, need our moments of purely personal satisfaction."

* * * * *

The following day Cramer was given a robot-run suite high in HQ Tower. His human contacts were restricted to a few total security clears who occasionally brought him messages too delicate for transmission on the building's internal net. Inured to the isolation-training of the spacenaut, he was not disturbed by the lack of company.

But within two days a message arrived that did disturb him. The _Star-Seeker_, returning with its precious capsules of asteroid bacteria, was still a week from Earth base and already one scout who had somehow sampled germ-joy was under forcible restraint for trying to get additional dosages. Medical analysis showed no physiological addiction but it did indicate some purely psychological craving triggered by merely one dose. The scout was not moved by the warnings of the frost flake's possible danger since there was no binding proof of it.

Chisholm had scribbled across the bottom of the document: 'This is likely to become the classic form of our difficulty, the refusal to see horror unless it can be shown. And here again it's happening to a Space Service man!'

Cramer shuddered at that. The Service contained the cream of Earth's manpower. If germ-joy could bring out their psychological weaknesses, how much worse the effect was bound to be among the listless, bored masses!

As the days went by there were occasional reports on Hartley's activities. With Neilson's help his agents had smoothly eased into many sectors of the scientific underground and huge quantities of money were moving up through the distribution hierarchy. There were even spy reels for him to run off on his projector, reels which showed the ex-Captain looking fantastically youthful and self-satisfied.

Once in a while the bitterly ironic thought came to Cramer that maybe Hartley was inadvertently on the right side. Suppose, just suppose that germ-joy was actually _good_ for humanity! More than ever he longed for some evil effect to become manifest even if it meant he, himself, should be stricken by it.

Eventually he was summoned to Chisholm's office where several scientists were gathered. The feed lines for a Medical Computer had been set up there and he was put through another rigorous checkup. At the end of a half-hour Dr. Jonas threw up his hands and said, "You're in perfect health. Still no after effects--I don't think there'll ever be any. How could there be?"

Chisholm considered Cramer almost resentfully. "You're too damned healthy for our own good! Dr. Phillips here has equally bad news--he's a biophysicist."

Phillips, a skinny, dark-haired man, tried to smile through his look of bewilderment. "We've absolutely run through the testing gamut on the stuff _Star-Seeker_ brought back. Ultra-high microscopy shows no RNA or DNA in our frozen samples, in fact nothing to carry the genetic pattern--yet we know it's alive! We've no way of coping with something so radically different, something that breaks all the way down the atomic scale so peacefully. It can only be controlled by some _sub_-atomic patterns unknown to us."

"There's no way to probe it sub-atomically?" asked Cramer.

"Not at this fine a level. What methods we have show nothing exceptional there after the silicon breaks down." He frowned in a dreamy sort of way. "A lot of the tiniest subatomic bits are still a total mystery, too small for our analytic tools to grapple with. If this stuff would reappear in some analyzable form now we could learn an awful lot about those unknown interactions. Fat chance of that, though!"

"We'll wait another week," said Chisholm, "then, if nothing's happened, we'll pull Hartley and his crew in and hope the public won't end up in his corner. There are probably several thousand regular users already. We already have a few _scientists_ saying the stuff's all right, that we should _encourage_ its use!"

"Idiocy," observed Phillips sadly, "is no respecter of high IQ's."

* * * * *

The week went by more and more slowly in Cramer's tower suite and all the reports only confirmed the General's forebodings about the spread of germ-joy's appeal. Someone else had somehow brought in a batch and was distributing it through a new, completely independent set-up. And everywhere there were vague rumors of a beneficial substance that 'they', the eternally conspiratorial 'they' of undefinable higher authority, were keeping from popular use.

Then, on the seventh day, Cramer had the rash.

It encircled only the wrist of his left hand but the red splotches itched so violently that he immediately called in the medical team. By the time the doctors arrived it was already subsiding. A sample from the splotch area, though, showed a significant trace of silicon but none of the bacteria.

"Somehow the element reformed!" Phillips exclaimed. "We're approaching the breakthrough!"

Cramer watched the splotches shrink into themselves, fearfully wondering what the next phase would be. But, an hour later, this turned out to be bitterly anti-climactic for the assembled group. A urinalysis showed that his body had thrown off an amount of silicon roughly equivalent to the amount he must have taken in through the flakes.

"Looks like you've passed through your crisis," Jonas said. "You're in perfect shape again."

The scientists all looked crushed but their mood changed to annoyance when they saw Cramer's enthusiastic grin. "Don't you see?" he said. "If this happened to me, it should be happening to Hartley too. He got his first sniff only a little while after I did, so the incubation period's the same for him!"

"Unless the large amount he's taken in since then actually confers immunity," Phillips muttered.

Cramer's face fell but he persisted. "We have to find out one way or the other, don't we?"

"No doubt about that!" Phillips called Chisholm's office and explained what had happened.

"Then the operation's on," the General told him, happy to be acting at last. "Hartley's at Neilson's place and we have to get him. Bring along all the test equipment you'll need."

* * * * *

When they broke into the vast penthouse apartment they found nobody around. As they went through one empty chamber after another, they became increasingly nervous. "The building's been thoroughly staked out," Chisholm fumed. "We know he hasn't left this floor."

Then, in the last chamber, they found him. He was lying on a silken couch, breathing heavily, and when they came closer they saw that all visible parts of his body were covered with angry splotches.

"Get the cameras going," barked the General.

"No, do something for me," Hartley gasped, staring in horror at his hands as if waiting for something to appear there. "All ran away, all of them."

As they watched, the splotches on the back of each hand exploded into running sores. While an assistant took a sample from one of the evil, flowering things, Jonas held an anaesthetic bottle to the sinking man's nostrils. But it had no effect and he only groaned the louder, demanding surcease.

More sores opened up on the neck while most of the team frenziedly attended to the Analyzer. One of them came up to the foot of the couch where Cramer was standing with Chisholm and Jonas and whispered to them: "Now it's a silicon _virus_ and it's inducing massive flash-cancers!"

Phillips was too absorbed in some abstruse calculation to look toward the couch any more. "What a breakthrough!" he suddenly exclaimed. "We'll be able to extrapolate the interactions now!"

"Any danger of catching anything from him?" Chisholm asked, looking at the pullulating mass.

Jonas glanced at a report tape that had been handed to him. "No, you don't pick up carcinomas that way. And we know from Cramer's experience today that the victim only erupts into this when a certain critical intake has been exceeded."

There was one final gasp and Hartley lie dead, his mouth the only remaining recognizable feature. Chisholm steeled himself to look at the human wreckage with the objectivity of the nearby camera. "Horrible, but it would have been worse if it hadn't happened, if we didn't have this proof. A different kind of horror, social and slow, but even worse. This way only a few die, not the race."

Cramer heard the General pick up a phone and ask for President Johnson, and all about him there was the clamor of excited researchers getting on with their jobs. But he could not turn away from the ugly spectacle of this death quite yet, nor could he feel any exultation before it even though he knew this outcome was the most desirable of all available possibilities. When you had sailed across the farther deeps with one comrade you had to remember him for whatever had been best in him, not worst.

THE END

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Untitled

Eliza Acton

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MODERN COOKERY

FOR PRIVATE FAMILIES

BY ELIZA ACTON

NEW EDITION

LONDON LONGMANS, GREEN, READER, AND DYER 1882.

PREFACE.

It cannot be denied that an improved system of practical domestic cookery, and a better knowledge of its first principles, are still much needed in this country; where, from ignorance, or from mismanagement in their preparation, the daily waste of excellent provisions almost exceeds belief. This waste is in itself a very serious evil where so large a portion of the community often procure—as they do in England—with painful difficulty, and with the heaviest labour, even sufficient bread to sustain existence; but the amount of _positive disease_ which is caused amongst us by improper food, or by food rendered unwholesome by a bad mode of cooking it, seems a greater evil still. The influence of diet upon health is indeed a subject of far deeper importance than it would usually appear to be considered, if we may judge by the profound indifference with which it is commonly treated. It has occupied, it is true, the earnest attention of many eminent men of science, several of whom have recently investigated it with the most patient and laborious research, the results of which they have made known to the world in their writings, accompanied, in some instances, by information of the highest value as to the most profitable and nutritious modes of preparing various kinds of viands. In arranging the present enlarged edition of this volume for publication, I have gladly taken advantage of such of their instructions (those of Baron Liebig especially) as have seemed to me adapted to its character, and likely to increase its real utility. These, I feel assured, if carefully followed out, will much assist our progress in culinary art, and diminish the unnecessary degree of expenditure which has hitherto attended its operations; for it may safely be averred that good cookery is the best and truest economy, turning to full account every wholesome article of food, and converting into palatable meals, what the ignorant either render uneatable, or throw away in disdain. It is a popular error to imagine that what is called good cookery is adapted only to the establishments of the wealthy, and that it is beyond the reach of those who are not affluent. On the contrary, it matters comparatively little whether some few dishes, amidst an abundant variety, be prepared in their perfection or not; but it is of the utmost consequence that the food which is served at the more simply supplied tables of the middle classes should all be well and skilfully prepared, particularly as it is from these classes that the men principally emanate to whose indefatigable industry, high intelligence, and active genius, we are mainly indebted for our advancement in science, in art, in literature, and in general civilisation.

When both the mind and body are exhausted by the toils of the day, heavy or unsuitable food, so far from recruiting their enfeebled powers, prostrates their energies more completely, and acts in every way injuriously upon the system; and it is no exaggeration to add, that many a valuable life has been shortened by disregard of this fact, or by the impossibility of obtaining such diet as nature imperatively required. It may be urged, that I speak of rare and extreme cases; but indeed it is not so; and the impression produced on me by the discomfort and the suffering which have fallen under my own observation, has rendered me extremely anxious to aid in discovering an efficient remedy for them. With this object always in view, I have zealously endeavoured to ascertain, and to place clearly before my readers, the most rational and healthful methods of preparing those simple and essential kinds of nourishment

which form the staple of our common daily fare; and have occupied myself but little with the elegant superfluities or luxurious novelties with which I might perhaps more attractively, though not more usefully, have filled my pages. Should some persons feel disappointed at the plan I have pursued, and regret the omissions which they may discover, I would remind them, that the fashionable dishes of the day may at all times be procured from an able confectioner; and that part of the space which I might have allotted to them is, I hope and believe, better occupied by the subjects, homely as they are, to which I have devoted it—that is to say, to ample directions for dressing vegetables, and for making what cannot be purchased in this country—unadulterated bread of the most undeniably wholesome quality; and those refreshing and finely-flavoured varieties of preserved fruit which are so conducive to health when judiciously taken, and for which in illness there is often such a vain and feverish craving when no household stores of them can be commanded.[1]

Footnote 1:

Many of those made up for sale are absolutely dangerous eating; those which are not adulterated are generally so oversweetened as to be distasteful to invalids.

Merely to please the eye by such fanciful and elaborate decorations as distinguish many modern dinners, or to flatter the palate by the production of new and enticing dainties, ought not to be the _principal_ aim, at least, of any work on cookery. “Eat,—_to live_” should be the motto, by the spirit of which all writers upon it should be guided. I must here obtrude a few words of personal interest to myself. At the risk of appearing extremely egotistic, I have appended “_Author’s Receipt_” and “_Author’s Original Receipt_” to many of the contents of the following pages; but I have done it solely in self-defence, in consequence of the unscrupulous manner in which large portions of my volume have been appropriated by contemporary authors, without the slightest acknowledgment of the source from which they have been derived. I have allowed this unfairness, and much beside, to pass entirely unnoticed until now; but I am suffering at present too severe a penalty for the over-exertion entailed on me by the plan which I adopted for the work, longer to see with perfect composure strangers coolly taking the credit and the profits of my toil. The subjoined passage from the preface of my first edition will explain in what this toil—so completely at variance with all the previous habits of my life, and, therefore, so injurious in its effects—consisted; and prevent the necessity of recapitulating here, in another form, what I have already stated in it. “Amongst the large number of works on cookery which we have carefully perused, we have never yet met with one which appeared to us either quite intended for, or entirely suited to the need of the totally inexperienced! none, in fact, which contained the first rudiments of the art, with directions so practical, clear, and simple, as to be at once understood, and easily followed, by those who had no previous knowledge of the subject. This deficiency, we have endeavoured in the present volume to supply, by such thoroughly explicit and minute instructions as may, we trust, be readily comprehended and carried out by any class of learners; our receipts, moreover, with a few trifling exceptions which are scrupulously specified, are confined to such as may be _perfectly depended on_, from having been proved beneath our own roof and under our own personal inspection. We have trusted nothing to others; but having desired sincerely to render the work one of general usefulness, we have spared neither cost nor labour to make it so, as the very plan on which it has been written must of itself, we think, evidently prove. It contains some novel features, calculated, we hope, not only to facilitate the labours of the kitchen, but to be of service likewise to those by whom they are directed. The principal of these is the summary appended to the receipts, of the different ingredients which they contain, with the exact proportion of each, and the precise time required to dress the whole. This shows at a glance what articles have to be prepared beforehand, and the hour at which they must be ready; while it affords great facility as well, for an estimate of the expense attending them. The additional space occupied by this closeness of detail has necessarily prevented the admission of so great a variety of receipts as the book might otherwise have comprised; but a limited number, thus completely explained, may perhaps be more acceptable to the reader than a larger mass of materials vaguely given.

“Our directions for boning poultry, game, &c., are also, we venture to say, entirely new, no author that is known to us having hitherto afforded the slightest information on the subject; but while we have done our utmost to simplify and to render intelligible this, and several other processes not generally well understood by ordinary cooks, our first and best attention has been bestowed on those articles of food of which the consumption is the most general, and which are therefore of the greatest consequence; and on what are usually termed plain English dishes. With these we have intermingled many others which we know to be excellent of their kind, and which now so far belong to our national cookery, as to be met with commonly at all refined modern tables.”

Since this extract was written, a rather formidable array of works on the same subject has issued from the press, part of them from the pens of celebrated professional gastronomers; others are constantly appearing; yet we make, nevertheless, but slight perceptible progress in this branch of our domestic economy. Still, in our cottages, as well as in homes of a better order, goes on the “waste” of which I have already spoken. It is not, in fact, cookery-books that we need half so much as cooks really trained to a

knowledge of their duties, and suited, by their acquirements, to families of different grades. At present, those who thoroughly understand their business are so few in number, that they can always command wages which place their services beyond the reach of persons of moderate fortune. Why should not _all_ classes participate in the benefit to be derived from nourishment calculated to sustain healthfully the powers of life? And why should the English, as a people, remain more ignorant than their continental neighbours of so simple a matter as that of preparing it for themselves? Without adopting blindly foreign modes in anything merely because they _are_ foreign, surely we should be wise to learn from other nations, who excel us in aught good or useful, all that we can which may tend to remedy our own defects; and the great frugality, combined with almost universal culinary skill, or culinary knowledge, at the least—which prevails amongst many of them—is well worthy of our imitation. Suggestions of this nature are not, however, sufficient for our purpose. Something definite, practical, and easy of application, must open the way to our general improvement. Efforts in the right direction are already being made, I am told, by the establishment of well-conducted schools for the early and efficient training of our female domestic servants. These will materially assist our progress; and if experienced cooks will put aside the jealous spirit of exclusiveness by which they are too often actuated, and will impart freely the knowledge they have acquired, they also may be infinitely helpful to us, and have a claim upon our gratitude which ought to afford them purer satisfaction than the sole possession of any secrets—genuine or imaginary—connected with their craft.

The limits of a slight preface do not permit me to pursue this or any other topic at much length, and I must in consequence leave my deficiencies to be supplied by some of the thoughtful, and, in every way, more competent writers, who, happily for us, abound at the present day; and make here my adieu to the reader.

ELIZA ACTON

London, May, 1855.

VOCABULARY OF TERMS,

PRINCIPALLY FRENCH, USED IN MODERN COOKERY.

Aspic—fine transparent savoury jelly, in which cold game, poultry, fish, &c., are moulded; and which serves also to decorate or garnish them.

Assiette Volante—a dish which is handed round the table without ever being placed upon it. Small _fondus_ in paper cases are often served thus; and various other preparations, which require to be eaten very hot.

Blanquette—a kind of fricassee.

Boudin—a somewhat expensive dish, formed of the French forcemeat called _quenelles_, composed either of game, poultry, butcher's meat, or fish, moulded frequently into the form of a _rouleau_, and gently poached until it is firm; then sometimes broiled or fried, but as frequently served plain.

Bouilli—boiled beef, or other meat, beef being more generally understood by the term.

Bouillie—a sort of hasty pudding.

Bouillon—broth.

Casserole—a stewpan; and the name also given to a rice-crust, when moulded in the form of a pie, then baked and filled with a mince or _purée_ of game, or with a _blanquette_ of white meat.

Court Bouillon—a preparation of vegetables and wine, in which (in expensive cookery) fish is boiled.

Consommé—very strong rich stock or gravy.

Croustade—a case or crust formed of bread, in which minces, _purées_ of game, and other preparations are served.

Crouton—a sippet of bread.

Entrée—a first-course side or corner dish.[2]

Footnote 2:

Neither the roasts nor the removes come under the denomination of _entrées_; and the same remark applies equally to the _entremets_ in the second course. Large standing dishes at the sides, such as raised pies, _timbales_, &c., served usually in grand repasts, are called _flanks_; but in an ordinary service all the intermediate dishes between the joints and roasts are distinguished by the name of _entrées_, or _entremets_.

Entremets—a second-course side or corner dish.

Espagnole, or Spanish sauce—a brown gravy of high savour.

Farce—forcemeat.

Fondu—a cheese _soufflé_.

Gâteau—a cake, also a pudding, as _Gâteau de Riz_; sometimes also a kind of tart, as _Gâteau de Pithiviers_.

Hors d'œuvres—small dishes of anchovies, sardines, and other relishes of the kind, served in the first course.

Macaroncini—a small kind of maccaroni.

Maigre—made without meat.

Matelote—a rich and expensive stew of fish with wine, generally of carp, eels, or trout.

Meringue—a cake, or icing, made of sugar and whites of egg beaten to snow.

Meringué—covered or iced with a meringue-mixture.

Nouilles—a paste made of yolks of egg and flour, then cut small like vermicelli.

Purée—meat, or vegetables, reduced to a smooth pulp, and then mixed with sufficient liquid to form a thick sauce or soup.

Quenelles—French forcemeat, for which see page 163.

Rissoles—small fried pastry, either sweet or savoury.

Sparghetti—Naples vermicelli.

Stock—the unthickened broth or gravy which forms the basis of soups and sauces.

Tammy—a strainer of fine thin woollen canvas.

Timbale—a sort of pie made in a mould.

Tourte—a delicate kind of tart, baked generally in a shallow tin pan, or without any: see page 574.

Vol-au-vent—for this, see page 357.

Zita—Naples maccaroni.

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INTRODUCTORY CHAPTERS.

TRUSSING.

[Illustration:

Trussing Needles.]

COMMON and untrained cooks are often deplorably ignorant of this branch of their business, a knowledge of which is, nevertheless, quite as essential to them as is that of boiling or roasting; for without it they cannot, by any possibility, serve up dinners of decently creditable appearance. We give such brief general directions for it as our space will permit, and as our own observations enable us to supply; but it has been truly said, by a great authority in these matters, that trussing cannot be "_taught by words_;" we would, therefore, recommend, that instead of relying on any written instructions, persons who really desire thoroughly to understand the subject, and to make themselves acquainted with the mode of entirely preparing all varieties of game and poultry more especially for table, in the very best manner, should apply for some _practical_ lessons to a first-rate poulterer; or, if this cannot be done, that they should endeavour to obtain from some well experienced and skilful cook the instruction which they need.

GENERAL DIRECTIONS FOR TRUSSING.

Before a bird is trussed, the skin must be entirely freed from any down which may be on it, and from all the stubble-ends of the feathers;[3] the hair also must be singed from it with lighted writing paper, care being taken not to smoke nor blacken it in the operation. Directions for cleansing the insides of birds after they are drawn, are given in the receipts for dressing them, Chapters XIV. and XV. Turkeys, geese, ducks, wild or tame, fowls, and pigeons, should all have the necks taken off close to the bodies, but not the skin of the necks, which should be left sufficiently long to turn down upon the backs for a couple of inches or more, where it must be secured, either with a needle and coarse soft cotton, or by the pinions of the birds when trussed.

Footnote 3:

This should be _particularly_ attended to.

[Illustration]

For boiling, all poultry or other birds must have the feet drawn off at the first joint of the leg, or as shown in the engraving. (In the latter case, the sinews of the joint must be slightly cut, when the bone may be easily turned back as here.) The skin must then be loosened with the finger entirely from the legs, which must be pushed back into the body, and the small ends tucked quite under the apron, so as to be entirely out of sight.

[Illustration]

The wings of chickens, fowls, turkeys, and pigeons, are left on entire, whether for roasting or boiling. From geese, ducks, pheasants, partridges, black game, moor-fowl, woodcocks, snipes, wild-fowl of all kinds, and all small birds, the first two joints are taken off, leaving but one joint on, thus:—

The feet are left on ducks, and those of tame ones are trussed as will be seen at page 278, and upon roast fowls, pheasants, black and moor-game, pigeons, woodcocks, and snipes. The thick coarse skin of the legs of these must be stripped, or rubbed off with a hard cloth after they have been held in boiling water, or over a clear fire for a few minutes. The sharp talons must be pulled out, and the nails clipped. The toes of the pigeons for roasting should be cut off.

Geese, sucking-pigs, hares, and rabbits have the feet taken off at the first joint.

The livers and gizzards are served in the wings of roast turkeys and fowls only.

The heads are still commonly left on pheasants, partridges, and black game and moor-game; but the fashion is declining. Of this we shall speak more particularly in the ensuing chapter.

Poultry and birds in general, except perhaps quite the larger kinds, are more easily trussed into plump handsome form with twine and needles proper to the purpose (for which see page 1), than with skewers. The manner in which the legs and wings are confined is much the same for all; the principal difference being in the arrangement of the former for boiling, which has already been explained.

There is a present mode of trussing very large fowls for boiling or stewing which to our taste is more novel than attractive. The feet are left on, and after the skin has been loosened from them in every part, the legs are thrust entirely into the body by means of a slight incision made in the skin just above the first joint on the underside, the feet then appear almost as if growing out of the sides of the breast: the effect of this is not pleasing.

TO TRUSS A TURKEY, FOWL, PHEASANT OR PARTRIDGE, FOR ROASTING.

First draw the skin of the neck down over the back, and secure it from slipping up; then thread a trussing needle of convenient size,[4] for the occasion, with packthread or small twine (the former, from being the most flexible, is best); pass it through the pinion of the bird, then through the thick part of the thigh, which must be brought up close _under the wing_, and in a straight line quite through the body, and through the leg and pinion on the other side; draw them close, and bring the needle back, passing it through the thick part of the leg, and through the second joint of the pinion, should it be left on the bird; tie it quite tight; and then to secure the legs, pierce the sidebone and carry the twine over the legs, then pass the needle through the other sidebone, and tie them close down. If skewers be used they should be driven through the pinions and the legs, and a twine passed across the back of the bird, and caught over the points of it, and then tied in the centre of the back: this is only needful when the trussing is not firm.

Footnote 4:

These may be had, of various sizes, at any good ironmongers.

[Illustration]

When the head is left on a bird, it may still be trussed in the same way, and the head brought round, as shown here, and kept in place by a skewer passed through it, and run through the body. When the bird is trussed entirely with skewers, the point of one is brought from the other side, through the pinions and the thighs, and the head is fixed upon it. The legs are then pressed as much as possible under the breast, between it and the side-bones, where they are lettered _a b_. The partridge in the engraving is shown with the skewers just withdrawn after being roasted.

Hares, after being filled with forcemeat, and sewn or securely fastened up with skewers, are brought into proper roasting form by having the head fixed between the shoulders, and either fastened to the back by means of a long skewer, run through the head quite into it, or by passing one through the upper part of the shoulders and the neck together, which will keep it equally well in place, though less thrown back. The fore-legs are then laid straight along the sides of the hare, and a skewer is thrust through them both and the body at the same time; the sinews are just cut through under the hind-legs, and they are brought forward as much as possible, and skewered in the same manner as the others. A string is then thrown across, under the hare and over the points of both skewers, being crossed before it is passed over the second, and then tied above the back. The ears of a hare are left on; those of a rabbit, which is trussed in the same way, are taken off.

[Illustration:

Paste Brush.]

Joints of meat require but little arrangement, either for the spit or for boiling. A fillet of veal must have the flap, or part to which the fat adheres, drawn closely round the outside, and be skewered or bound firmly into good shape: this will apply equally to a round of beef. The skin or flank of loins of meat must be wrapped over the ends of the bones, and skewered on the underside. _The cook should_ _be particularly careful to separate the joints when it has not been done by the butcher_, and necks of veal or mutton also, or much trouble will often arise to the carver.

[Illustration:

Cutlet Bat.]

To flatten and bring cutlets into uniform shape, a bat of this form is used: and to egg or to cover them with clarified butter when they are to be crumbed, a paste-brush should be at hand. Indeed, these and many other small means and appliances, ought to be provided for every cook who is expected to perform her duty in a regular and proper manner, for they save much time and trouble, and their first expense is very slight; yet many kitchens are almost entirely without them.

TO TRUSS FISH.

Salmon, salmon-peel, pike, and some few other large fish, are occasionally trussed in the form of an S by passing a string through the head, and tying it securely, then through the centre of the body, and next round the tail, which should be turned the reverse way of the head, and the whole should then be drawn closely together and well fastened. Whitings and other fish of small size are trussed with the tails merely skewered into their mouths. _Obs._—It is indispensable for cooks to know how to carve neatly for pies, puddings, fricassees, and curries, at the least, hares, rabbits, fowls, and other birds. For those who are quite without experience in this branch of their business, the directions and the illustrations in the next chapter for carving a fowl into joints, will be found useful; and probably many of the other instructions also.

CARVING.

[Illustration:

Fish Carvers.]

Whether the passing fashion of the day exact it of her or not, a gentlewoman should always, for her own sake, be able to carve well and easily, the dishes which are placed before her, that she may be _competent_ to do the honours of a table at any time with propriety and self-possession.[5] To gentlemen, and especially to those who mix much in society, some knowledge of this art, and a

certain degree of skill in the exercise of it, are indispensable, if they would avoid the chance of appearing often to great disadvantage themselves, and of causing dissatisfaction and annoyance to others; for the uncouth operations of bad carvers occasion almost as much discomfort to those who witness, as they do generally of awkwardness and embarrassment to those who exhibit them.

Footnote 5:

As this can only be accomplished by practice, young persons should be early accustomed to carve at home, where the failure of their first attempts will cause them much less embarrassment than they would in another sphere, and at a later period of life.

The precise mode of carving various dishes must of course depend on many contingencies. For a plain family-dinner, or where strict economy is an imperative consideration, it must sometimes, of necessity, differ from that which is laid down here. We have confined our instructions to the fashion usually adopted in the world.

Carving knives and forks are to be had of many forms and sizes, and adapted to different purposes: the former should always have a very keen edge, and the latter two prongs only.

No. 1. COD'S HEAD AND SHOULDERS (AND COD FISH GENERALLY.)

The thick part of the back of this, as of all large fish—salmon excepted—is the firmest and finest eating. It should be carved across, rather thick, and, as much as possible, in unbroken slices, from _a_ to _b_. The sound, which is considered a delicacy, lies underneath, and lines the back-bone: it must be reached with a spoon in the direction _c_. The middle of the fish, when served to a family party, may be carved in the same manner, or in any other which convenience and economy may dictate.

No. 2. A TURBOT.

In carving this most excellent fish, the rich gelatinous skin attached to it, and a portion of the thick part of the fins, should be served with every slice. If the point of the fish-knife be drawn down the centre of the back through to the bone, in the lines _a b c_, and from thence to _d d d_, the flesh may easily be raised upon the blade in handsome portions,. The thickest parts of all flat fish are the best. A brill and a John Dory are served exactly like a turbot.

SOLES.

The more elegant mode of serving these, and the usual one at good tables, is to raise the flesh from the bones as from a turbot, which is easily done when the fish are large; but when they are too small well to admit of it, they must be divided across quite through the bone: the shoulders, and thick part of the body, are the superior portions.

No. 3. SALMON.

It is customary to serve a slice of the thick part of the back of this fish, which is marked from _a_ to _b_, with one of the thinner and richer portions of it, shown by the line from _c_ to _d_. It should be carved quite straight across, and the fine flakes of the flesh should be preserved as entire as possible. Salmon-peel, pike, haddocks, large whitings, and all fish which are served curled round, and with the backs uppermost, are carved in the same manner; the flesh is separated from the bone in the centre of the back, and taken off, on the outer side first, in convenient portions for serving. The flesh of mackerel is best raised from the bones by passing the fish-slice from the tail to the head: it may then be divided in two.

No. 4. SADDLE OF MUTTON.

The manner of trussing this joint varies almost from season to season, the mode which is considered in good taste one year being obsolete the next, in families where passing fashions are closely observed. It seems really immaterial whether it be served as shown in the engraving; or whether two or three joints of the tail be left on and surrounded with a paper frill. This joint is now trussed for roasting in the manner shown in the engraving; and when it is dished a silver skewer replaces the one marked _e_. It is likewise often still served in good families with only two or three joints of the tail left on. The most usual mode of carving it is in thin slices cut quite along the bone, on either side, in the line _a_ to _b_; but it is sometimes sliced obliquely from _c_ to _d_: this last fashion is rather gaining ground. The thick end of the joint must then, of course, be to the left of the carver. A saddle of pork or of lamb is carved exactly in the same manner.

No. 5. A HAUNCH OF VENISON (OR MUTTON.)

An incision must first be made entirely across the knuckle end of this joint, quite down to the bone, in the line _a b_, to let the gravy escape; it must then be carved in thin slices taken as deep as they can be, the whole length of the haunch, from _c_ to _d_. A portion of the fat should invariably be served with the venison.

No. 6. SIRLOIN OR RUMP OF BEEF.

As the very tender part of this favourite joint, which lies under the bone, and is called the _fillet_, is preferred by many eaters, the beef should be raised, and some slices be taken from it in the direction _a b_, before the carver proceeds further. The slices should be cut quite across the joint, from side to side, as indicated by the line from _c_ to _d_, in which direction the whole of the meat is occasionally carved, though it is much more usual to slice the upper part from _e_ to _f_. When the brown outside has been taken off this, it should be evenly carved in thin slices, and served with some of the gravy in the dish, and accompanied with horseradish very lightly and finely scraped, with tufts of which the beef is commonly garnished.

RIBS OF BEEF.

Are carved in the same manner as the sirloin; but there is no fillet attached to them.

A ROUND OF BEEF.

To carve this well, a very sharp-edged and thin-bladed knife is requisite. A thick slice should first be taken entirely off the top of the joint, leaving it very smooth; it should then be cut as thin and as evenly as possible, and delicate slices of the fat or udder should be served with the lean.

A BRISKET OF BEEF

Is carved in slices quite across the bones.

No. 7. LEG OF MUTTON.

This, whether roast or boiled, is dished as it lies in the engraving, unless when fanciful eaters prefer the underside of the joint laid uppermost, and carved quite across the middle, for the sake of the finely grained meat which lies beneath the part commonly called the Pope’s eye. In a general way, the mutton should be sliced, rather thick than thin as directed by the line between _a b_; the fat will be found in the direction _c d_.

No. 8. QUARTER OF LAMB.

The shoulder must be divided, and raised entirely from the breast in the direction of the letters _a b c d_. A slice of butter sprinkled with cayenne and salt is then usually laid between them, and a little lemon-juice is added, or a cold _Mâitre d’Hôtel_ sauce is substituted for these. The shoulder may then be removed into another dish or not, as is most convenient. The brisket is next separated from the long bones in the line _e f_, and carved in the direction g h; the rib-bones are divided from _i i_ to _j j_. The choice of the different parts is offered in serving them.

No. 9. SHOULDER OF MUTTON OR LAMB.

Commence by cutting from the outer edge direct to the bone of the shoulder in the line _a b_, and carve as many slices from that part of the joint as it will afford: then, if more be required, draw the knife on either side of the ridge of the blade-bone in the direction _c c d d_. The fat must be carved in the line _e f_. Some eaters have a preference for the juicy, but not very finely-grained flesh on the underside of the shoulder, which must be turned, for it to be carved. For the mode of boning a shoulder of mutton or veal, and giving it a more agreeable appearance, see 219.

No. 10. A SUCKING PIG.

Every part of a sucking pig is good, but some persons consider the flesh of the neck which lies between the shoulders, and the ribs as the most delicate portion of it. The shoulders themselves are preferred by others. They should be taken off, and the legs also, by passing the knife under them at the letters _a b c_. The ribs may then be easily divided from _e_ to _d_. The flesh only of the larger

joints should be served to ladies; but gentlemen often prefer it sent to them on the bones.

A FILLET OF VEAL.

There is no difference between the mode of carving this and a round of beef; but the brown outside slice of the veal is much liked by many eaters, and a portion of it should be served to them when it is known to be so. The forcemeat must be reached by cutting deeply into the flap, and a slice of it served always with the veal.

A LOIN OF VEAL.

This may be carved at choice quite across through the thick part of the flesh, or in slices taken in the direction of the bones. A slice of the kidney, and of the fat which surrounds it, should accompany the veal.

No. 11. A BREAST OF VEAL.

The brisket or gristles[6] of this joint must first be entirely separated from the rib-bones by pressing the knife quite through it in the line between _a_ and _b_; this part may then be divided as shown by the letters _c c d d d_, and the long bones or ribs may easily be separated in the direction _e f_. The taste of those who are served should be consulted as to the part of the joint which is preferred. The sweetbread is commonly sent to table with a roast breast of veal, and laid upon it: a portion of it should be served with every plate of the breast.

Footnote 6:

The _tendons_ are literally the small white gristles themselves, which are found under the flesh in this part of the joint. When freed from the bone attached to them, they may be dressed in a variety of ways, and are extremely good: but they require from four to six hours' stewing to render them perfectly tender, even when each tendon is divided into three or four slices. The upper flesh must be laid back from the tendons before they are taken from the breast, not left adhering to them. They are very good simply stewed in white gravy, and served with green peas, _à la Française_, in the centre. The breast entirely boned, forced, and rolled, makes a handsome dish, either roasted or stewed.

No. 12. A TONGUE.

This is sliced, not very thin, through the thickest and best part, shown by the letters _a b_. The fat of the root, when it is liked, must be carved by turning the tongue, and cutting in the direction _c d_.

No. 13. A CALF'S HEAD.

[Illustration]

An entire calf's head, served in its natural form, recalls too forcibly the appearance of the living animal to which it has belonged not to be very uninviting. Even when the half of one only is sent to table, something of the same aspect remains, and as it is in every way improved, and rendered most easy to carve when boned[7] and rolled, we would recommend its being so prepared whenever it can be done without difficulty. Our engraving does not give a very flattering representation of it in that form, but having been dressed with the skin on, it was not quite so easily brought into handsome shape as if it had been freed from it; yet we would nevertheless advise its being generally retained. When the head is served without being boned, it is carved across the cheek, in the line from _a_ to _b_; the part which in flavour and appearance resembles a sweetbread, and which is regarded as a delicacy, lies in the direction indicated by the letters _c d_. The flesh of the eye is another favourite morsel, which must be detached from the head by passing the point of the carving knife deeply round the eye-hole, in the circle marked _e e_.

Footnote 7:

This will be more easily accomplished by an experienced cook after the head has been boiled for half an hour and then allowed to cool; but it should not be left until cold before it is altogether prepared for dressing. After the bones are removed, it should be laid on a clean cloth, and the inside sprinkled over or rubbed with a little salt, mace, and cayenne, well mixed together; the tongue may be laid upon, and rolled up in it. It must be secured, first with a skewer, and then bound tightly round with tape. It should be boiled or stewed extremely tender; and is excellent when just covered with good stock, and simmered for two hours, or when strong broth is substituted for this, and the bones are added to it. The head may be glazed, and served with rich brown gravy, or with the ordinary

sauces if preferred; and it may be eaten cold, with Oxford brawn sauce, which is compounded of brown sugar, vinegar, mustard, and salt, mixed to the taste, with the addition of oil when it is liked.

No. 14. A HAM.

Strict economists sometimes commence the carving of a ham at the knuckle, and so gradually reach the choicer portion of it; but this method is not at all to be recommended. It should be cut at once through the thick part of the flesh, quite down to the bone, in the line _a b_, and sliced very thin and evenly, without separating the fat from the lean. The decoration of the ham No. 14, is formed by leaving on it a portion of the rind at the knuckle in a semi-circle, and then trimming it into scollops or points at pleasure; and the ornamental part of the top is formed from the fat which is pared away from the thick end and the edges. A paper ruffle, as will be seen, is wrapped round the bone of the knuckle.

No. 15. A PHEASANT.

This bird was formerly always sent to table with the head on, but it was a barbarous custom, which has been partially abandoned of late in the best houses, and which it is hoped may soon be altogether superseded by one of better taste. The breast is by far the finest part of a pheasant, and it is carved in slices from pinion to pinion, in the lines _a a b b_; the legs may then be taken off, in the direction _c d_. The bird, when it is preferred so, may be entirely dismembered by the directions for a fowl, No. 16. Black and moor-game are trussed and served like pheasants. The breasts of both are very fine eating, and the thigh of the black-cock is highly esteemed.

No. 16. A BOILED FOWL.

The boiled fowl of plate 6 is represented as garnished with branches of parsley, which is an error, as they would be appropriate to it only if it were cold, and it is seldom served so, being considered insipid. Small tufts of cauliflower would have been in better keeping with it, as the bird is supposed to be dished for the dinner-table. Unless it be for large family parties, fowls are seldom carved there entirely into joints; but when it is wished to divide them so, the fork should be fixed firmly in the centre of the breast, and the leg, being first disengaged from the skin, may be taken off with the wing in the line _a b_; or, the wing being previously removed, by carving it down the line to _b_, and there separating it from the neck-bone, the leg may be released from the skin, and easily taken off, by cutting round it from _a_ to _c_, and then turning it with the fork, back from the body, when the joint will readily be perceived.

[Illustration]

After the leg and wing on the other side have been taken off in the same manner, the merrythought must follow. To remove this, the knife must be drawn through the flesh in the line _d e_, and then turned towards the neck quite under the merrythought, which it will so lift from the breast, in this form:—The neck-bones—which lie close under the upper part of the wings, and are shaped thus—must next be disengaged from the fowl, by putting the knife in at the top of the joint, dividing the long part of the bone from the flesh, and breaking the short one off by raising it up, and turning it from the body; the breast, which is shown here, may then be divided from it by merely cutting through the tender ribs on either side.

[Illustration]

It is seldom that further disjointing than this is required at table; but when it is necessary to cut up the entire fowl, the remainder of it must be laid with the back uppermost, and to take off the side-bones, which are of this shape—the point of the knife must be pressed through the back-bone, near the top, about half an inch from the centre, and brought down towards the end of the back, quite through the bone, then turned in the opposite direction, when the joints will separate without difficulty. All which then remains to be done is, to lay the edge of the knife across the middle of the only two undivided bones, and then with the fork to raise the small end of the fowl, which will part them immediately: to carve a boiled fowl or chicken in a more modern manner, see the directions which follow. The breast, wings, and merrythought, are the most delicate parts of a fowl. On the upper part of the sidebone is the small round portion of flesh called the _oyster_, by many persons considered as a great delicacy.

No. 17. A ROAST FOWL.

It is not usual to carve fowls entirely at table in the manner described above. The wings, and any other joints are taken off only as they are required. The breast of a very large fowl may be carved in slices like that of a turkey; or the whole of that of a small one may be taken off with the wings, as shown by the line _a b_. As the liver is a delicacy, the handsomer mode of serving these last is

to remove the gizzard, which is seldom eaten, then to divide the liver, and to send an equal portion of it with each wing. The whole of a roast fowl may be carved by the directions we have already given for No. 16.

No. 18. A PARTRIDGE.

[Illustration]

When partridges are served to ladies only, or in parties where they are present, it is now customary to take off the heads, to truss the legs short, and to make them appear (in poulterer's phrase) _all breast_. For gentlemen's dinners, the heads may be left on or not at choice. The most ready mode of carving a partridge is to press back the legs, then to fix the fork firmly in the inside of the back, and by passing the blade of the knife flat under the lower part of the breast, to raise it, with the wings, entire from the body, from which it easily separates. The breast may then be divided in the middle, as shown by the line from _a_ to _b_ in the engraving here. This is by far the best and handsomest manner of carving a partridge, but when the supply of game at table is small, and it is necessary to serve three persons from the choicer parts of one bird, a not very large wing should be taken off with the leg on either side, in the line from _a_ to _b_ in No. 13, and sufficient of the breast will still remain to send to a third eater. The high game-flavour of the back of a partridge, as well as that of various other birds,[8] is greatly relished by many persons.

Footnote 8:

A great man o the north eloquently describes that of a grouse as "the most pungent, palate-piercing, wild bitter-sweet."

No. 19. A WOODCOCK.

[Illustration]

The thigh and back are the most esteemed parts of a woodcock which, being a small bird, may be carved entirely through the centre of the breast and back, or distributed in the same manner as the partridge for three, which we have described; or even carved down like a fowl, if needful. In whatever way it is divided, however, a portion of the toast which has received the trail, and on which it should always be sent to table, must invariably be served to all who partake of it. The very old fashion of trussing the bird with its own bill, by running it through the thighs and body, is again adopted by very good cooks of the present day; but the common method of preparing either woodcocks or snipes for table is this: the trussing of the legs is, however, better shown at Nos. 19 and 21 of Plate 6.

No. 20. A PIGEON.

The breast and wings of a pigeon may be raised in the same way as those of a partridge (see No. 18); or the bird may be carved entirely through in the line _a b_. For the second course, pigeons should be dished upon young delicate water-cresses.

No. 21. A SNIPE.

This bird is trussed, roasted, and served exactly like a woodcock. It is not of a size to require any carving, beyond dividing in two, if at all.

No. 22. A GOOSE.

The skin below the breast, called the apron, must first be cut off in a circular direction as indicated by the letters _a a a_, when a glass of port-wine or of claret, ready mixed with a teaspoonful of mustard, may be poured into the body or not, at choice. Some of the stuffing should then be drawn out with a spoon, and the neck of the goose, which ought to be to the right and not to the left hand, as here, being turned a little towards the carver, the flesh of the breast should be sliced in the lines from _b b b_ to _c c c_, on either side of the bone. The wings may then be taken off like those of any other bird, and then the legs, which, in the engraving No. 22, are trussed so completely under the apron as to render their outline scarcely distinguishable. Graceful and well-skilled carvers never turn birds on their sides to remove any of the joints, but those of a goose, unless it be very young, are sometimes severed from it with difficulty; and the common directions for assisting the process in that case are, to turn it on its side, and with the fork to press down the small end of the leg; then to pass the knife quite under it from the top down to the joint, when the leg should be turned back from the bird with the fork, while the thigh-bone is loosened from its socket with the knife. The end of the pinion marked _d_ is then held down in the same manner, to facilitate the separation of the bones at _e_, from which point the knife is drawn under the wing, which it takes off. The merrythought of a goose is small, and, to remove it the knife must first be turned a

little _from_ the neck, after the flesh has been cut through, and then passed under it, back towards the neck. For the remainder of the carving, the directions for that of a fowl will suffice.

DUCKS.

Tame ducks are served with the feet (which are liked by many people) left upon them and trussed up over the backs. If large they may be carved like a goose, but when very young may be disjointed like chickens; the only material difference between them being the position of the thigh-joints, which lie much further towards the back-bone than those of a fowl.

No. 23. A WILD DUCK.

The breasts of wild-fowl are the only parts of them held in much estimation, and these are carved in slices from the legs to the neck The legs and pinions may, if required, be taken off exactly like those of a pheasant.

No. 24. A TURKEY.

The carving of a turkey commences by taking slices off the breast, from the letters _b b_ quite through the forcemeat, which lies under the letter _a_, to _c c_: the greater part of the flesh of the wings is thus taken off likewise. When the bird is boned and filled with sausage or other forcemeat, the breast is carved entirely across in the direction _d e_, nearly, or quite down to the back, which it is better not altogether to divide at first, as the appearance of the turkey is not then so good. When it has been prepared in the ordinary manner, after the breast has been disposed of, the pinions and the legs may be taken off, the first in the line from _f_ to _g_, and the latter by passing the knife under it at _h_, and bringing it down to the joint at _i j_, where it must be taken off in the line shown. The whole of the joints being in form exactly like those of a fowl, may be separated in the same manner. The gizzard is more commonly eaten broiled after having been scored, and very _highly_ seasoned with cayenne and with a sufficiency of salt, than in any other way. A slice or portion of the liver should be served with the white flesh of the turkey as far as possible.

No. 25. A HARE.

A hare should be placed with its head to the left of the carver, therefore the engraving No. 25 shows it turned in the wrong direction. It is so very great an improvement to take out the back-bone before a hare is roasted, that we would recommend it to be done wherever it can be so without difficulty: it may then be carved in the line _a b_ quite through, or only partially so at choice. When the bone remains in, slices may be taken down the whole length of the back from _c c_ to _d d_; the legs, which, next to the back, are considered the best eating, may then be taken off in the direction _e f_ and the flesh divided from or served upon them, after the small bones have been parted from the thighs. The shoulders, which are not generally much esteemed, though sometimes liked by sportsmen, may next be taken off by passing the knife at the letters _g h_ between the joint and the body. When a hare is young, the back is sometimes divided at the joints into three or four parts, after being freed from the ribs and under-skin.

No. 26. A FRICANDEAU OF VEAL.

This is usually stewed, or rather braised sufficiently tender to be divided with a spoon, and requires no carving; but the fat (or underpart of the fillet) attached to it, marked _a a a_, which is sometimes, but not invariably served with it now, may be carved in even slices. The larding differs somewhat from that which we have described, but the mode shown here allows the _fricandeau_ to be glazed with more facility.

The engraving of the _entrée_ No. 26 is intended merely to show the manner of dishing the cutlets. They may be of mutton, lamb, veal, or pork; and the centre may be filled with the sauce or stewed, vegetable appropriate to either; as _soubise_, _purée_ of asparagus, of mushrooms, or of tomatas; or _green peas à la Française_, stewed cucumbers, or aught else that is suited to the kind of meat which is served.

Plate 1.

[Illustration:

1 COD'S HEAD.]

[Illustration:

2 TURBOT.]

[Illustration:

3 MIDDLE OF SALMON.]

H. Adlard, sc.

Plate 2.

[Illustration:

4 SADDLE OF MUTTON.]

[Illustration:

5 HAUNCH OF VENISON.]

[Illustration:

6 SIRLOIN OF BEEF.]

H. Adlard, sc.

Plate 3.

[Illustration:

7 LEG OF MUTTON.]

[Illustration:

8 QUARTER OF LAMB.]

[Illustration:

9 SHOULDER OF MUTTON.]

H. Adlard sc.

Plate 4.

[Illustration:

10 SUCKING PIG.]

[Illustration:

11 BREAST OF VEAL.]

H. Adlard, sc.

Plate 5.

[Illustration:

12 OX-TONGUE.]

[Illustration:

13 CALF'S HEAD.]

[Illustration:

14 HAM.]

H. Adlard, sc.

Plate 6.

[Illustration:

15 PHEASANT.]

[Illustration:

18 PARTRIDGE.]

[Illustration:

19 WOODCOCK.]

[Illustration:

16 BOILED FOWL.]

[Illustration:

20 PIGEON.]

[Illustration:

21 SNIPE.]

[Illustration:

17 ROAST FOWL.]

H. Adlard, sc.

Plate 7.

[Illustration:

22 GOOSE.]

[Illustration:

23 WILD DUCK.]

[Illustration:

24 TURKEY.]

H. Adlard, sc.

Plate 8.

[Illustration:

26 ENTRÉE OF CUTLETS.]

[Illustration:

25 HARE.]

[Illustration:

27 FRICANDEAU OF VEAL.]

H. Adlard, sc.

MODERN COOKERY.

[Illustration]

CHAPTER I.

=Soups.=

INGREDIENTS WHICH MAY ALL BE USED FOR MAKING SOUP OF VARIOUS KINDS:—Beef—Mutton—Veal—Hams—Salted Pork—Fat Bacon—Pigs' Ears and Feet—Venison—Black and Moor Game—Partridges—Pheasants—Wild Pigeons—Hares—Rabbits—Turkeys—Fowls—Tame Pigeons—Sturgeon—Conger Eel, with all sorts of Fish usually eaten—All Shell-Fish—Every kind of Vegetable and Herb fit for food—Butter—Milk—Eggs—Rice—Sago—Arrow-Root—Indian Corn—Hominy—Soujee—Tapioca—Pearl Barley—Oatmeal—Polenta[9]—Macaroni—Vermicelli—Semoulina, and other Italian Pastes.

Footnote 9:

The name given in English commerce to the maize flour or meal of Italy.

THE art of preparing good, wholesome, palatable soups, _without great expense_, which is so well understood in France, and in other countries where they form part of the daily food of all classes of the people, has hitherto been very much neglected in England;[10] yet it really presents no difficulties which a little practice, and the most common degree of care, will not readily overcome; and we strongly recommend increased attention to it, not only on account of the loss and inconvenience which ignorance of it occasions in many households, but because a better knowledge of it will lead naturally to improvement in other branches of cookery connected with it in which our want of skill is now equally apparent.

Footnote 10:

The inability of servants to prepare delicately and well even a little broth suited to an invalid, is often painfully evident in cases of illness, not only in common English life, but where the cookery is supposed to be of a superior order.

We have endeavoured to show by the list at the beginning of this chapter the immense number of different articles of which soup may be in turn compounded. It is almost superfluous to add, that it may be rendered at pleasure exceedingly rich, or simple in the extreme; composed, in fact, of all that is most choice in diet, or of little beyond herbs and vegetables. From the varied produce of a

well-stored kitchen garden, it may be made excellent at a very trifling cost; and where fish is fresh and abundant it may be cheaply supplied nearly equal in quality to that for which a full proportion of meat is commonly used. It is best suited to the colder seasons of the year when thickened well with rice, semoulina, pearl barley, or other ingredients of the same nature; and adapted to the summer months when lighter and more refreshing. Families who have resided much abroad, and those accustomed to continental modes of service, prefer it usually _in any form_ to the more solid and heavy dishes which still often supersede it altogether at our tables[11] (except at those of the more affluent classes of society, where it appears, as a matter of course, in the daily bills of fare), and which are so _oppressive_, not only to foreigners, but to all persons generally to whom circumstances have rendered them unaccustomed diet; and many a housekeeper who is compelled by a narrow income to adopt a system of rigid domestic economy, would find it assist greatly in furnishing comfortable meals in a very frugal manner, if the proper modes of making it were fully comprehended as they ought to be.[12]

Footnote 11:

The popular taste in England, even at the present day, is far more in favour of what is termed “_substantial_” food, than of any kind of pottage.

Footnote 12:

We are unable to give further space to this subject here, but may probably resume it at another part of the book, if practical.

The reader who desires to understand the _principles_ of soup-making is advised to study with attention the directions for “Baron Liebeg’s Extract of Beef,” in the present chapter, and the receipt for _bouillon_ which follows it.

A FEW DIRECTIONS TO THE COOK.

In whatever vessel soup is boiled, see that it be perfectly clean, and let the inside of the cover and the rim be equally so. Wash the meat, and prepare the vegetables with great nicety before they are laid into it; and be careful to keep it always closely shut when it is on the fire. Never, on any account, set the soup by in it, but strain it off at once into a clean pan, and fill the stock-pot immediately with water; pursue the same plan with all stewpans and saucepans directly they are emptied.

Skim the soup thoroughly when it _first_ begins to boil, or it will not be easy afterwards to render it clear; throw in some salt, which will assist to bring the scum to the surface, and when it has all been taken off, add the herbs and vegetables; for if not long stewed in the soup, their flavour will prevail too strongly. Remember that the trimmings, and the _bones_ of fresh meat, the necks of poultry, the liquor in which a joint has been boiled, and the shank-bones of mutton, are all excellent additions to the stock-pot, and should be carefully reserved for it. The remains of roast poultry and game also will improve both the colour and the flavour of broth or soup.

Let the soup be very slowly heated, and after it has been well skimmed, and has boiled for a few minutes, draw it to the side of the stove and keep it _simmering softly_, but without ceasing, until it is done; for on this, as will hereafter be shown, its excellence principally depends. Every good cook understands perfectly the difference produced by the fast boiling, or the _gentle stewing_, of soups and gravies, and will adhere strictly to the latter method.[13]

Footnote 13:

It is most difficult to render rapidly-boiled soup or gravy clear for table; but that which is only simmered will clarify itself if allowed to remain undisturbed for some little time (half an hour or so) after it is withdrawn from the fire; it should then be poured very gently from the sediment. Calf’s feet stock likewise may be converted into transparent jelly with far greater facility when it has not been thickened by too quick boiling, by which so many preparations in our English kitchens are injured.

Pour boiling water, in small quantities at first, to the meat and vegetables of which the soup is to be made when they have been fried or browned; but otherwise, always add _cold_ water to the meat. Unless precise orders to the contrary have been given, onions, eschalots, and garlic, should be used for seasoning with great moderation; for not only are they very offensive to many eaters, but to persons of delicate habit their effects are sometimes extremely prejudicial; and it is only in coarse cookery that their flavour is allowed ever strongly to prevail.

A small proportion of sugar, about an ounce to the gallon, will very much improve the flavour of gravy-stock, and of all rich brown soups; it may be added also to some others with advantage; and for this, directions will be given in the proper places.

Two ounces of salt may be allowed for each gallon of soup or broth, in which large quantities of vegetables are stewed; but an ounce and a half will be sufficient for such as contain few or none; it is always easy to add more if needful, but oversalting in the first instance is a fault for which there is no remedy but that of increasing the proportions of all the other ingredients, and stewing the whole afresh, which occasions needless trouble and expense, even when time will admit of its being done.

As no particle of fat should be seen floating on soup when sent to table, it is desirable that the stock should be made the day before it is wanted, that it may become quite cold; when the fat may be entirely cleared off without difficulty.

When cayenne pepper is not mixed with rice-flour, or with any other thickening, grind it down with the back of a spoon, and stir a little liquid to it before it is thrown into the stewpan, as it is apt to remain in lumps, and to occasion great irritation of the throat when swallowed so.

Serve, not only soups and sauces, but all other dishes, _as hot as possible_.

THE TIME REQUIRED FOR BOILING DOWN SOUP OR STOCK.

This must be regulated by several considerations; for though the mere juices of meat require but little boiling after they have been fully extracted by the slow heating recommended by Baron Liebeg, soup to which many vegetables are added (winter vegetables especially) requires long stewing to soften and to blend properly the flavour of _all_ the ingredients which it contains, as that of no one in particular ought to be allowed to predominate over the rest. We have in consequence retained the old directions as to time, in many of the following receipts; but an intelligent cook will soon ascertain from practice and observation how and when to vary it with advantage. _Over-boiling_ renders all preparations insipid, and causes undue reduction of them likewise: it is a fault, therefore, which should be carefully avoided.

TO THICKEN SOUPS.

Except for white soups, to which arrow-root is, we think, more appropriate, we prefer, to all other ingredients generally used for this purpose, the finest and freshest rice-flour, which, after being passed through a lawn sieve, should be thoroughly blended with the salt, pounded spices, catsup, or wine, required to finish the flavouring of the soup. Sufficient liquid should be added to it very gradually to render it of the consistence of batter, and it should also be perfectly smooth; to keep it so, it should be moistened sparingly at first, and beaten with the back of a spoon until every lump has disappeared. The soup should boil quickly when the thickening is stirred into it, and be simmered for ten minutes afterwards. From an ounce and a half to two ounces of rice-flour will thicken sufficiently a quart of soup.

Instead of this, arrow-root or the condiment known by the name of _tous les mois_, which greatly resembles it, or potato flour, or the French thickening called _roux_ (see Chapter V.), may be used in the following proportions:—Two and a half ounces of either of the first three, to four pints and a half of soup; to be mixed gradually with a little cold stock or water, stirred into the boiling soup, and simmered for a minute.

Six ounces of flour with seven of butter, made into a _roux_, or merely mixed together with a large knife, will be required to thicken a tureen of soup; as much as half a pound is sometimes used; these must be added by degrees, and carefully stirred round in the soup until smoothly blended with it, or they will remain in lumps. We would, however, recommend any other thickening rather than this unwholesome mixture.

All the ingredients used for soups should be fresh, and of good quality, particularly Italian pastes of every kind (macaroni, vermicelli, &c.), as they contract, by long keeping, a peculiarly unpleasant, musty flavour.

Onions, freed from the outer skin, dried gradually to a deep brown, in a slow oven, and flattened like Norfolk biffins, will keep for almost any length of time, and are extremely useful for heightening the colour and flavour of broths and gravies.[14]

Footnote 14:

The fourth part of one these dried onions (_des ognons brûlés_), of moderate size, is sufficient for a tureen of soup. They are sold very commonly in France, and may be procured in London at many good foreign warehouses.

TO FRY BREAD TO SERVE WITH SOUP.

Cut some slices a quarter of an inch thick from a stale loaf; pare off the crust and divide the bread into dice, or cut it with a small paste-cutter into any other form. For half a pound of bread put two ounces of the best butter into a frying-pan, and when it is quite melted, add the bread; keep it turned over a gentle fire until it is equally coloured to a very pale brown, then drain it from the butter, and dry it on a soft cloth, or on a sheet of paper placed before a clear fire upon a dish, or upon a sieve reversed.

SIPPETS À LA REINE.

Having cut the bread as for common sippets, spread it on a dish, and pour over it a few spoonsful of thin cream, or of good milk: let it soak for an hour, then fry it in fresh butter of a delicate brown, drain and serve the sippets very hot.

TO MAKE NOUILLES.

(_An elegant substitute for Vermicelli._)

Wet with the yolks of four eggs, as much fine dry sifted flour as will make them into a firm but very smooth paste. Roll it out as thin as possible, and cut it into bands of about an inch and a quarter in width. Dust them lightly with flour, and place four of them one upon the other. Cut them obliquely into the finest possible strips; separate them with the point of a knife, and spread them upon writing paper, so that they may dry a little before they are used. Drop them gradually into the boiling soup, and in ten minutes they will be done.

Various other forms may be given to this paste at will. It may be divided into a sort of ribbon macaroni; or stamped with small confectionary cutters into different shapes. It is much used in the more delicate departments of cookery, and when cut as for soup, and prepared as for the _Genoises à la Reine_ of Chapter XVIII. makes very superior puddings, pastry, fritters, and other sweet dishes.

VEGETABLE VERMICELLI.

(_Vegetables cut very fine for soups._)

Cut the carrots into inch lengths, then pare them round and round in ribands of equal thickness, till the inside is reached; next cut these ribands into straws, or very small strips; celery is prepared in the same way, and turnips also are first pared into ribands, then sliced into strips; these last require less boiling than the carrots, and attention must be paid to this, for if broken, the whole would have a bad appearance in soup. The safer plan is to boil each vegetable separately, till tolerably tender, in a little pale broth (in water if this be not at hand), to drain them well, and put them into the soup, which should be clear, only a few minutes before it is dished. For cutting them small, in other forms, the proper instruments will be found at the ironmonger’s.

EXTRACT OF BEEF; OR, VERY STRONG PLAIN BEEF GRAVY SOUP.

(_Baron Liebeg’s Receipt._)

OBSERVATION.—This admirable preparation is not only most valuable as a restorative of the best kind for invalids who require light but highly nutritious diet, it is also of the utmost utility for the general purposes of the kitchen, and will enable a cook who can take skilful advantage of it, to convert the _cold meat_ which often abounds so inconveniently in an English larder, from our habit of having joints of large size so much served, into good nourishing dishes, which the hashes and minces of our common cookery _are not_, though they may answer well enough as mere varieties of diet. We shall indicate in the proper chapters the many other uses to which this _beef juice_—for such indeed it is—will be found eminently adapted. Of its value in illness it is impossible to speak too highly; and in every family, therefore, the _exact_ mode of making it ought to be thoroughly understood. The economist who may consider it expensive, must remember that drugs and medical advice are usually far more so; and in cases of extreme debility the benefit derived from it, when it is well prepared and judiciously administered, is often remarkable. It should be given in small quantities at first, and in its pure state. It may afterwards be varied by the addition of vermicelli, semoulina, or other preparations of the kind; and also by using for it a portion of mutton, calf’s head, poultry, or game, when these suit a patient as well as the beef.

RECEIPT.—Take a pound of good, juicy beef (rump-steak is best for the purpose), from which all the skin and fat that can possibly be separated from it, has been cut away. Chop it up small like sausage-meat; then mix it thoroughly with an exact pint of cold water, and place it on the side of the stove to heat _very slowly indeed_; and give it an occasional stir. It may stand two or three hours before it is allowed to simmer, and will then require at the utmost but fifteen minutes of gentle boiling. Professor Liebeg directs even

less time than this, but the soup then occasionally retains a raw flavour which is distasteful. Salt should be added when the boiling first commences, and for invalids, this, in general, is the only seasoning required. When the extract is thus far prepared, it may be poured from the meat into a basin, and allowed to stand until any particles of fat it may exhibit on the surface can be skimmed off entirely, and the sediment has subsided and left the soup quite clear (which it speedily becomes), when it may be poured gently off, heated in a clean saucepan, and served at once. It will contain all the nutriment which the meat will yield. The scum should always be well cleared from the surface of the soup as it accumulates.

To make light beef tea or broth, merely increase the proportion of water to a pint and a half or a quart; but in all else proceed as above.

Meat (without fat or skin), 1 lb.; cold water, exact pint: heating 2 hours or more; to boil 15 minutes at the utmost. Beef tea or broth.—Beef, 1 lb.; water, 1-1/2 pint or 1 quart.

Obs.—To mingle vegetable diet in its best form with this extract, it will be sufficient, as we have explained in “Cookery for Invalids,” to boil down the kind of vegetable desired, sliced or cut up small, in a very moderate quantity of water, until its juices are well drawn out; then to strain off the liquid from it with slight pressure, and, when it has become cold, to pour it to the chopped meat instead of water. Several different sorts can be mixed together, and cooked in this way: the water must boil before they are added to it.

They should be much more tender than when merely boiled for table, but not reduced to pulp. The juice should remain clear; no salt should be added; and it should be quite cold before it is stirred to the meat.

When the extract is wanted for gravy, a small portion of onion, and of herbs, carrots, celery, and the other usual vegetables, may be stewed together, to give it the requisite flavour.

About an inch square of the Jewish beef (see Chapter of FOREIGN COOKERY), whether cooked or uncooked, will impart a fine savour to it; the smoked surface of this should be pared off before it is used, and it may be added in thin slices.

BOUILLON.

(_The Common Soup or Beef-Broth of France; cheap, and very wholesome._)

[Illustration]

This soup, or _broth_ as we should perhaps designate it in England, is made once or twice in the week, in every family of respectability in France; and by the poorer classes as often as their means will enable them to substitute it for the vegetable or _maigre_ soups, on which they are more commonly obliged to subsist. It is served usually on the first day with slices of untoasted bread soaked in it; on the second, it is generally varied with vermicelli, rice, or semoulina. The ingredients are, of course, often otherwise proportioned than as we have given them, and more or less meat is allowed according to the taste or circumstances of the persons for whom the _bouillon_ is prepared; but the process of making it is always the same, and is thus described (rather learnedly) by one of the most skilful cooks in Europe: “The stock-pot of the French artisan,” says Monsieur Carême, “supplies his principal nourishment; and it is thus managed by his wife, who, without the slightest knowledge of chemistry, conducts the process in a truly scientific manner. She first lays the meat into an earthen stock-pot, and pours cold water to it in the proportion of about two quarts to three pounds of the beef;[15] she then places it by the side of the fire, where it slowly becomes hot; and as it does so, the heat enlarges the fibre of the meat, dissolves the gelatinous substances which it contains, allows the albumen (or the muscular part which produces the scum) to disengage itself, and rise to the surface, and the OZMAZOME (_which is the most savoury part of the meat_) to be diffused through the broth. Thus, from the simple circumstance of boiling it in the gentlest manner, a relishing and nutritious soup will be obtained, and a dish of tender and palatable meat; but if the pot be placed and kept over a quick fire, the _albumen_ will coagulate, harden the meat, prevent the water from penetrating it, and the _ozmazome_ from disengaging itself; the result will be a broth without flavour or goodness, and a tough, dry bit of meat.”

Footnote 15:

This is a large proportion of meat for the family of a French artisan, a pound to the quart would be nearer the reality; but it is not the refuse-meat which would be purchased by persons of the same rank in England for making broth.

It must be observed in addition, that as the meat of which the _bouillon_ is made, is almost invariably sent to table, a part of the rump, the mouse-buttock, or the leg-of-mutton piece of beef, should be selected for it; and the simmering should be continued only until this is perfectly tender. When the object is simply to make good, pure-flavoured, beef broth, part of the shin or leg, with a pound or two of the neck, will best answer the purpose. When the _bouilli_ (that is to say, the beef which is boiled in the soup), is to be served, bind it into a good shape, add to it a calf's foot if easily procurable, as this much improves the quality of the _bouillon_; pour cold water to it in the proportion mentioned above, and proceed, as Monsieur Carême directs, to heat the soup _slowly_ by the side of the fire; remove carefully the head of scum which will gather on the surface before the boiling commences, and continue the skimming at intervals for about twenty minutes longer, pouring in once or twice a little cold water. Next, add salt in the proportion of two ounces to the gallon; this will cause a little more scum to rise; clear it quite off and throw in three or four turnips, as many carrots, half ahead of celery, four or five young leeks, an onion stuck with six or eight cloves, a large half teaspoonful of peppercorns, and a bunch of savoury herbs. Let the whole stew VERY softly without ceasing, from four hours and a half to six hours, according to the quantity: the beef in that time will be extremely tender but not overdone. It will be excellent eating if properly managed, and might often, we think, be substituted with great advantage for the hard, half-boiled, salted beef so often seen at an English table. It should be served with a couple of cabbages, which have been first boiled in the usual way, then pressed very dry, and stewed for ten minutes in a little of the broth, and seasoned with pepper and salt. The other vegetables from the _bouillon_ may be laid round it or not at choice. The soup if served on the same day must be strained, well cleared from fat, and sent to table with fried or toasted bread, unless the continental mode of putting slices or crusts of _untoasted_ bread into the tureen, and soaking them for ten minutes in a ladleful or two of the _bouillon_, be, from custom, preferred.

Beef, 8 to 9 lbs.; water, 6 quarts; salt, 3 oz. (more, if needed); carrots, 4 to 6; turnips, 4 or 5; celery, one small head; leeks, 4 to 6; one onion, stuck with 6 cloves; peppercorns, one small teaspoonful; large bunch of savoury herbs (calf's foot if convenient); to _simmer_ 5 to 6 hours.

Obs. 1.—This broth forms in France the foundation of all richer soups and gravies. Poured on fresh meat (a portion of which should be veal) instead of water, it makes at once an excellent _consommé_ or strong jellied stock. If properly managed, it is very clear and pale; and with an additional weight of beef and some spoonsful of glaze, may easily be converted into an amber-coloured gravy-soup, suited to modern taste.

Obs. 2.—It is a common practice abroad to boil poultry, pigeons, and even game, in the _=pot-au-feu=_ or soup-pot.[16] They should be properly trussed, stewed in the broth just long enough to render them tender, and served, when ready, with a _=good=_ sauce. A small ham, if well soaked, washed exceedingly clean, and freed entirely from any rusty or blackened parts, laid with the beef when the water is first added to it, and boiled from three hours and a half to four hours in the _bouillon_, is very superior in flavour to those cooked in water only, and infinitely improves the soup, which cannot however so well be eaten until the following day, when all the fat can easily be taken from it: it would, of course, require no salt.

Footnote 16:

In wealthy families the soup is boiled in a metal soup-pot, called a _=marmite=_.

CLEAR, PALE GRAVY SOUP OR CONSOMMÉ.

Rub a deep stewpan or soup-pot with butter, and lay into it three quarters of a pound of ham freed entirely from fat, skin, and rust, four pounds of leg or neck of veal, and the same weight of lean beef, all cut into thick slices; set it over a clear and rather brisk fire, until the meat is of a fine amber-colour; it must be often moved, and closely watched, that it may not stick to the pan, nor burn. When it is equally browned, lay the bones upon it, and pour in gradually four quarts of boiling water. Take off the scum carefully as it rises, and throw in a pint of cold water at intervals to bring it quickly to the surface. When no more appears, add two ounces of salt, two onions, two large carrots, two turnips, one head of celery, a faggot of savoury herbs, a dozen cloves, half a teaspoonful of whole white pepper, and two large blades of mace. Let the soup boil gently from five hours and a half to six hours and a half; then strain it through a very clean fine cloth, laid in a hair sieve. When it is perfectly cold, remove every particle of fat from the top; and, in taking out the soup, leave the sediment untouched; heat in a clean pan the quantity required for table, add salt to it if needed, and a few drops of chili or of cayenne vinegar. Harvey's sauce, or very fine mushroom catsup, may be substituted for these. When thus prepared the soup is ready to serve: it should be accompanied by pale sippets of fried bread, or sippets _à la reine_. (At tables where English modes of service entirely prevailed, clear gravy-soup, until very recently, was always accompanied by dice, or sippets as they are called, of delicately toasted bread. These are now seldom seen, but some Italian paste, or nicely prepared

vegetable, is served _in_ the soup instead). Rice, macaroni in lengths or in rings, vermicelli, or _nouilles_, may in turn be used to vary it; but they must always be boiled apart, till tender, in broth or water, and well drained before they are slipped into it. The addition of young vegetables, too, and especially of asparagus, will convert it into superior spring-soup; but they, likewise, must be separately cooked.

ANOTHER RECEIPT FOR GRAVY SOUP.

Instead of browning the meat in its own juices, put it with the onions and carrots, into a deep stewpan, with a quarter of a pint of _bouillon_, set it over a brisk fire at first, and when the broth is somewhat reduced, let it boil gently until it has taken a fine colour, and forms a glaze (or jelly) at the bottom of the stewpan; then pour to it the proper quantity of water, and finish the soup by the preceding receipt.[17]

Footnote 17:

The juices of meat, drawn out with a small portion of liquid, as directed here, may easily be reduced to the consistency in which they form what is called _glaze_; for particulars of this, see Chapter IV. The best method, though perhaps not the easiest, of making the clear, amber-coloured stock, is to pour a ladleful or two of pale but strong beef-broth to the veal, and to boil it briskly until well reduced, thrusting a knife when this is done into the meat, to let the juices escape; then to proceed more slowly and cautiously as the liquid approaches the state in which it would burn. It must be allowed to take a dark amber-colour only, and the meat must be turned, and often moved in it. When the desired point is reached, pour in more boiling broth, and let the pan remain off the fire for a few minutes, to detach and melt the glaze; then shake it _well_ round before the boiling is continued. A certain quantity of deeply coloured glaze, made apart, and stirred into strong, clear, pale stock, would produce the desired effect of this, with much less trouble.

Obs.—A rich, old-fashioned English brown gravy-soup may be made with beef only. It should be cut from the bones, dredged with flour, seasoned with pepper and salt, and fried a clear brown; then stewed for six hours, if the quantity be large, with a pint of water to each pound of meat, and vegetables as above, except onions, of which four moderate-sized ones, also fried, are to be added to every three quarts of the soup, which, after it has been strained and cleared from fat, may be thickened with six ounces of fresh butter, worked up very smoothly with five of flour. In twenty minutes afterwards, a tablespoonful of the best soy, half a pint of sherry, and a little cayenne, may be added to the soup, which will then be ready to serve.

CHEAP, CLEAR GRAVY SOUP.

The shin or leg of beef, if not large or coarse, will answer extremely well for this soup, and afford at the same time a highly economical dish of boiled meat, which will be found very tender, and very _palatable_ also, if it be served with a sauce of some piquancy. From about ten pounds of the meat let the butcher cut evenly off five or six from the thick fleshy part, and again divide the knuckle, that the whole may lie compactly in the vessel in which it is to be stewed. Pour in three quarts of cold water, and when it has been brought slowly to boil, and been well skimmed, as directed for _bouillon_ (Page 8), throw in an ounce and a half of salt, half a large teaspoonful of peppercorns, eight cloves, two blades of mace, a faggot of savoury herbs, a couple of small carrots, and the heart of a root of celery; to these add a mild onion or not, at choice. When the whole has stewed very softly for four hours, probe the larger bit of beef, and if quite tender, lift it out for table; let the soup be simmered from two to three hours longer, and then strain it through a fine sieve, into a clean pan. When it is perfectly cold, clear off every particle of fat; heat a couple of quarts, stir in, when it boils, half an ounce of sugar, a small tablespoonful of good soy, and twice as much of Harvey's sauce, or instead of this, of clear and fine mushroom catsup. If carefully made, the soup will be perfectly transparent and of good colour and flavour. A thick slice of lean ham will improve it, and a pound or so of the neck of beef with an additional pint of water, will likewise enrich its quality. A small quantity of good broth may be made of the fragments of the whole boiled down with a few fresh vegetables.

Brown caper, or hot horseradish sauce, or _sauce Robert_, or _sauce piquante_, made with the liquor in which it is boiled, may be served with the portion of the meat which is sent to table.

VERMICELLI SOUP.

(_Potage au Vermicelle._)

Drop very lightly, and by degrees, six ounces of vermicelli, broken rather small, into three quarts of boiling bouillon or clear gravy soup; let it simmer for half an hour[18] over a gentle fire, and stir it often. This is the common French mode of making vermicelli

soup, and we can recommend it as a particularly good one for family use. In England it is customary to soak, or to blanch the vermicelli, then to drain it well, and to stew it for a shorter time in the soup; the quantity also, must be reduced quite two ounces, to suit modern taste.

Footnote 18:

When of very fine quality, the vermicelli will usually require less boiling than this. We have named to the reader, in another part of the volume, Mr. Cobbett, 18, Pall Mall, as supplying all the Italian pastes extremely good. There are, of course, _many_ other houses in London where they may be procured equally so; but in naming Mr. Cobbett, who is personally unknown to us, we merely give the result of our own experience of many years. Some articles of _very_ superior quality purchased for us at his warehouse by a person merely commissioned to procure the best that could be had "_from Town_," first directed our attention to his house (a long established one, we believe), which is justly noted, especially amongst affluent country families, for the excellence of the goods which it sends out. We give this explanation, because it seems invidious to select, from the large number of deservedly celebrated establishments of the same class which are to be found here, any _one_ in particular for mention in a work of this nature.

Bouillon, or gravy soup, 3 quarts; vermicelli, 6 oz.; 30 minutes. Or, soup, 3 quarts; vermicelli, 4 oz.; blanched in boiling water 5 minutes; stewed in soup 10 to 15 minutes.

SEMOULINA SOUP.

(_Soupe à la Sémoule._)

Semoulina is used in the same way as the vermicelli. It should be dropped very lightly and by degrees into the boiling soup, which should be stirred all the time it is being added, and very frequently afterwards; indeed, it should scarcely be quitted until it is ready for table. Skim it carefully, and let it simmer from twenty to five-and-twenty minutes. This, when the semoulina is good and fresh, is, to our taste, an excellent soup.

Soup, 3 quarts; semoulina, 6 oz.; nearly, or quite 25 minutes.

MACARONI SOUP.

Throw four ounces of fine fresh[19] mellow Naples maccaroni into a pan of fast-boiling water, with about an ounce of fresh butter, and a small onion stuck with three or four cloves.[20] When it has swelled to its full size, and become tender, drain it well, cut it into half-inch lengths, and slip it into a couple of quarts of clear gravy-soup: let it simmer for a few minutes, when it will be ready for table. Observe, that the macaroni should be boiled quite tender; but it should by no means be allowed to burst, nor to become pulpy. Serve grated Parmesan cheese with it.

Footnote 19:

We must here repeat our warning against the use of long-kept macaroni, vermicelli, or semoulina; as when stale they will render any dish into which they are introduced quite unfit for table.

Footnote 20:

For white soups omit the onion.

Macaroni, 4 oz.; butter, 1 oz.; 1 small onion; 5 cloves; 3/4 hour, or more. In soup, 5 to 10 minutes.

Obs.—The macaroni for soups should always be either broken into short lengths before it is boiled, or cut as above, or sliced quickly into small rings not more than the sixth of an inch thick after it is boiled, unless the _cut_ or ring macaroni, which may be purchased at the Italian warehouses, be used; this requires but ten minutes' boiling, and should be dropped into the soup in the same way as vermicelli.[21] Four ounces of it will be sufficient for two quarts of stock. It may be added to white soup after having been previously boiled in water or veal-broth, and well drained from it: it has a rather elegant appearance in clear gravy-soup, but should have a boil in water before it is thrown into it.

Footnote 21:

For the different varieties of macaroni and vermicelli, and the time required to boil each of them, see Chapter XXI.

If served in very clear bright stock (_consommé_), it should be boiled apart until tender in a little good broth, which ought also to be clear and entirely free from fat; then well drained, and put into the soup for a minute, or into the tureen, the instant before the soup is dished.

SOUP OF SOUJEE.

The soujee is of Indian origin, but is now well manufactured in England,[22] and is, we think, somewhat more delicate than semoulina in flavour; and being made from wheat of the finest quality, is also quite as nutritious, or more so. For each quart of soup allow two ounces of soujee (the proportions can always be otherwise adapted to the taste after the first trial); drop it gradually into the boiling liquid, and simmer it for ten or twelve minutes. Bullock's semola is another preparation which may be used in exactly the same manner to thicken soup; but both this and soujee are more expensive at present than semoulina.

Footnote 22:

By Messrs. Stephens and Co., 2 White's Row, Bishopsgate.

POTAGE AUX NOUILLES, OR TAILLERINE SOUP

Make into _nouille_-paste, with very fine dry flour, the yolks of four fresh eggs, and when ready cut, drop it gradually into five pints of boiling soup; keep this gently stirred for ten minutes, skim it well, and serve it quickly. This is a less common, and a more delicately flavoured soup than the vermicelli, provided always that the _nouilles_ be made with really fresh eggs. The same paste may be cut into very small diamonds, squares, stars, or any other form, then left to dry a little, and boiled in the soup until swollen to its full size, and tender.

Nouille-paste of four eggs; soup, 5 pints: 10 minutes.

SAGO SOUP.

Wash in several waters, and float off the dirt from six ounces of fine pearl sago; put it into three quarts of good cold gravy-stock; let it stew gently from half to three quarters of an hour, and stir it occasionally, that it may not burn nor stick to the stewpan. A quarter of an ounce more of sago to each pint of liquid, will thicken it to the consistence of peas-soup. It may be flavoured with half a wineglassful of Harvey's sauce, as much cayenne as it may need, the juice of half a lemon, an ounce of sugar, and two glasses of sherry; or these may be omitted, and good beef-broth may be substituted for the gravy-soup, for a simple family dinner, or for an invalid; or, again, it may be converted into inexpensive white soup by the addition of some cream smoothly mixed with a dessertspoonful of arrow-root, or of thick cream and new milk in equal portions. Veal broth would be the most appropriate for this, or it might be made with half veal and half mutton.

Sago, 6 oz.; soup, 3 quarts: 30 to 45 minutes.

TAPIOCA SOUP.

This is made in the same manner, and with the same proportions as the preceding soup, but it must be simmered from fifty to sixty minutes.

RICE SOUP.

In France, this soup is served well thickened with the rice, which is stewed in it for upwards of an hour and a half, and makes thus, even with the common _bouillon_ of the country, an excellent winter _potage_. Wipe in a dry cloth, eight ounces of the best rice; add it, in small portions, to four quarts of hot soup, of which the boiling should not be checked as it is thrown in. When a clear soup is wanted wash the rice, give it five minutes' boil in water, drain it well, throw it into as much boiling stock or well-flavoured broth as will keep it covered till done, and simmer it very softly until the grains are tender but still separate; drain it, drop it into the soup, and let it remain in it a few minutes before it is served, but without simmering. When stewed in the stock it may be put at once, after being drained, into the tureen, and the clear _consommé_ may be poured to it.

An easy English mode of making rice-soup is this: put the rice into plenty of cold water; when it boils throw in a small quantity of salt, let it simmer for ten minutes, drain it well, throw it into the boiling soup, and simmer it gently from ten to fifteen minutes longer.[23] An extra quantity of stock must be allowed for the reduction of this soup which is always considerable.

Footnote 23:

The Patna requires much less boiling than the Carolina.

WHITE RICE SOUP.

Throw four ounces of well-washed rice into boiling water, and in five minutes after pour it into a sieve, drain it well, and put it into a couple of quarts of good white boiling stock; let it stew until tender; season the soup with salt, cayenne, and pounded mace; stir to it three quarters of a pint of very rich cream, give it one boil, and serve it quickly.

Rice, 4 oz.: boiled 5 minutes. Soup, 2 quarts: 3/4 hour or more. Seasoning of salt, mace, and cayenne; cream, 3/4 pint: 1 minute.

RICE-FLOUR SOUP.

Mix to a smooth batter, with a little cold broth, eight ounces of fine rice-flour, and pour it into a couple of quarts of fast-boiling broth or gravy soup. Add to it a seasoning of mace and cayenne, with a little salt if needful. It will require but ten minutes' boiling. Soup, 2 quarts; rice-flour, 8 oz.: 10 minutes.

Obs.—Two dessertspoonsful of currie-powder, and the strained juice of half a moderate-sized lemon will greatly improve this soup: it may also be converted into a good common white soup (if it be made of veal stock), by the addition of three quarters of a pint of thick cream to the rice.

STOCK FOR WHITE SOUP.

Though a knuckle of veal is usually preferred for this stock, part of the neck will answer for it very well. Whichever joint be chosen, let it be thoroughly washed, once or twice divided, and laid into a delicately clean soup-pot, or well-tinned large stout iron saucepan, upon a pound of lean ham, freed entirely from skin and fat, and cut into thick slices; or, instead of this, one half a pound of the Jewish smoked beef, of which we have already spoken, and from which the smoked surface, and _all_ fat, must be carefully carved away.

Dutch or hung beef also will answer the same purpose, but similar precautions must be observed with regard to the smoked portions of either; as they would impart a very unpleasant flavour to any preparation. Should _very_ rich soup be wished for, pour in a pint only of cold water for each pound of meat, but otherwise a pint and a half may be allowed. When the soup has been thoroughly cleared from scum, which should be carefully taken off from the time of its first beginning to boil, throw in an ounce of salt to the gallon (more can be added afterwards if needed), two mild onions, a moderate-sized head of celery, two carrots, a small teaspoonful of whole white pepper, and two blades of mace; and let the soup stew very softly from five to six hours, if the quantity be large: it should simmer until the meat falls from the bones. The skin of a calf's head, a calf's foot, or an old fowl may always be added to this stock with good effect. Strain it into a clean deep pan, and keep it in a cool place till wanted for use.

Lean ham, 1 lb.; veal, 7 lbs; water, 4 to 6 quarts; salt, 1-1/2 oz. (more if needed); onions, 2; celery, 1 head; carrots, 2; peppercorns, 1 teaspoonful; mace, 2 blades: 5 to 6 hours.

MUTTON-STOCK FOR SOUPS.

Equal parts of beef and mutton, with the addition of a small portion of ham, or dried beef, make excellent stock, especially for winter-soups. The necks of fowls, the bones of an undressed calf's head, or of any uncooked joint, may be added to it with advantage. According to the quality of soup desired, pour from a pint to a pint and a half of cold water to each pound of meat; and after the liquor has been well skimmed, on its beginning to boil, throw in an ounce and a half of salt to the gallon, two small heads of celery, three mild middling-sized onions, three well-flavoured turnips, as many carrots, a faggot of thyme and parsley, half a teaspoonful of white peppercorns, twelve cloves, and a large blade of mace. Draw the soup-pot to the side of the fire, and boil the stock as gently as possible for about six hours; then strain, and set it by for use. Be particularly careful to clear it _entirely_ from fat before it is prepared for table. One third of beef or _veal_, with two of mutton, will make very good soup; or mutton only will answer the purpose quite well upon occasion.

Beef, 4 lbs.; mutton, 4 lbs. (or, beef or veal from 2 to 3 lbs.; mutton from 5 to 6 lbs.); water, 1 to 1-1/2 gallon; salt, 1-1/2 oz.; mild turnips, 1 lb.; onions, 6 oz.; carrots, 3/4 lb.; celery, 6 to 8 oz.; 1 bunch of herbs; peppercorns, 1/2 teaspoonful; cloves, 12; mace, 1 large blade: 6 hours.

Obs.—Salt should be used sparingly at first for stock in which any portion of ham is boiled; allowance should also be made for its reduction, in case of its being required for gravy.

MADEMOISELLE JENNY LIND'S SOUP.

(_Authentic Receipt_)

This receipt does not merely bear the name of "Mademoiselle Lind," but is in reality that of the soup which was constantly served to her, as it was prepared by her own cook. We are indebted for it to the kindness of the very poplar Swedish authoress, Miss Bremer, who received it direct from her accomplished countrywoman.[24]

Footnote 24:

We were informed by Miss Bremer that Mademoiselle Lind was in the habit of taking this soup before she sang, as she found the sago and eggs soothing to the chest, and beneficial to the voice.

The following proportions are for a tureen of this excellent _potage_:—

Wash a quarter of a pound of the best pearl sago until the water poured from it is clear; then stew it quite tender and very thick in water or thick broth (it will require nearly or quite a quart of liquid, which should be poured to it cold, and heated slowly): then mix gradually with it a pint of good boiling cream, and the yolks of four fresh eggs, and mingle the whole carefully with two quarts of strong veal or beef stock, which should always be kept ready boiling. Send the soup immediately to table.

THE LORD MAYOR'S SOUP.

Wash thoroughly two sets of moderate sized pigs' ears and feet from which the hair has been carefully removed; add to them five quarts of cold water, and stew them very gently with a faggot of savoury herbs, and one large onion stuck with a dozen cloves, for nearly four hours, when the ears may be lifted out; stew the feet for another hour, then take them up, strain the soup, and set it in a cool place that it may become cold enough for the fat to be quite cleared from it. Next, bone the ears and feet, cut the flesh down into dice, throw a clean folded cloth over it, and leave it so until the soup requires to be prepared for table; then strew upon it two tablespoonsful of savoury herbs minced small, half a saltspoonful of cayenne, a little white pepper, and some salt. Put into a large saucepan half a pound of good butter, and when it begins to simmer thicken it gradually with as much flour as it will absorb; keep these stirred over a very gentle fire for ten minutes or more, but do not allow them to take the slightest colour; pour the soup to them by degrees, letting it boil up after each portion is added; put in the meat, and half a pint of sherry; simmer the whole from three to five minutes; dish the soup, and slip into it two or three dozens of delicately fried forcemeat-balls. (See Chapter VIII.)

Pigs' feet, 8; ears, 4; water, 5 quarts; bunch savoury herbs; 1 large onion; cloves, 12: 3-1/2 to 4 hours, feet, 1 hour more. Butter, 1/2 lb.; flour, 6 oz.[25]: 10 to 12 minutes. Minced herbs, 2 tablespoonsful; cayenne and common pepper, each 1/2 saltspoonful; salt, 1/2 teaspoonful or more; sherry, 1/2 pint: 3 to 5 minutes. Forcemeat-balls, 2 to 3 dozens.

Footnote 25:

The safer plan for an inexperienced cook is to weigh the flour, and then to sprinkle it from a dredging-box into the butter.

Obs.—We have given this receipt with the slightest possible variation from the original, which we derived from a neighbourhood where the soup made by it was extremely popular. We have better adapted it to our own taste by the following alterations.

THE LORD MAYOR'S SOUP.

(_Author's Receipt._)

We prefer to have this soup made, in part, the evening before it is wanted. Add the same proportion of water to the ears and feet as in the preceding directions; skim it thoroughly when it first boils, and throw in a tablespoonful of salt, two onions of moderate size, a small head of celery, a bunch of herbs, two whole carrots, a small teaspoonful of white peppercorns, and a blade of mace. Stew these softly until the ears and feet are perfectly tender, and, after they are lifted out, let the liquor be kept _just simmering_ only, while they are being boned, that it may not be too much reduced. Put the bones back into it, and stew them as gently as possible for an hour; then strain the soup into a clean pan, and set it by until the morrow in a cool place. The flesh should be cut into dice while it is still warm, and covered with the cloth before it becomes _quite_ cold. To prepare the soup for table clear the stock from

fat and sediment, put it into a very clean stewpan, or deep saucepan, and stir to it when it boils, six ounces of the finest rice-flour smoothly mixed with a quarter of a teaspoonful of cayenne, three times as much of mace and salt, the strained juice of a lemon, three tablespoonsful of Harvey's sauce, and half a pint of good sherry or Madeira. Simmer the whole for six or eight minutes, add more salt if needed, stir the soup often, and skim it thoroughly; put in the meat and herbs, and after they have boiled gently for five minutes, dish the soup, add forcemeat-balls or not, at pleasure, and send it to table quickly.

Moderate-sized pigs' feet, 8; ears, 4; water, 5 quarts; salt, 1 tablespoonful; onions, 2; celery, 1 head; carrots, 2; bunch of herbs; peppercorns, 1 small teaspoonful; mace, 1 blade: 3-1/2 to 4-1/2 hours. Stock, 5 pints; rice-flour, 6 oz.; cayenne, 1/4 teaspoonful; mace and salt, each 3/4 of a teaspoonful; juice of 1 lemon; Harvey's sauce, 3 tablespoonsful; sherry or Madeira, 1/2 pint: 6 to 8 minutes. Savoury herbs, 2 tablespoonsful: 5 minutes.

Obs. 1.—Should the quantity of stock exceed five pints, an additional ounce or more of rice must be used, and the flavouring be altogether increased in proportion. Of the minced herbs, two-thirds should be parsley, and the remainder equal parts of lemon thyme and winter savoury, unless sweet basil should be at hand, when a teaspoonful of it may be substituted for half of the parsley. To some tastes a seasoning of sage would be acceptable; and a slice or two of lean ham will much improve the flavour of the soup.

Obs. 2.—Both this soup, and the preceding one, may be rendered very rich by substituting strong _bouillon_ (see page 8) or good veal broth for water, in making them.

COCOA-NUT SOUP.

Pare the dark rind from a very fresh cocoa-nut, and grate it down small on an exceedingly clean, bright grater; weigh it, and allow two ounces for each quart of soup. Simmer it gently for one hour in the stock, which should then be strained closely from it, and thickened for table.

Veal stock, gravy-soup, or broth, 5 pints; grated cocoa-nut, 5 oz., 1 hour. Flour of rice, 5 oz.; mace, 1/2 teaspoonful; little cayenne and salt; mixed with 1/4 pint of cream: 10 minutes.

Or: gravy-soup, or good beef broth, 5 pints: 1 hour. Rice flour, 5 oz.; soy and lemon-juice, each 1 tablespoonful; finely pounded sugar, 1 oz.; cayenne, 1/4 teaspoonful; sherry, 2 glassesful.

Obs.—When either cream or wine is objected to for these soups, a half-pint of the stock should be reserved to mix the thickening with.

CHESTNUT SOUP.

Strip the outer rind from some fine, sound Spanish chestnuts, throw them into a large pan of warm water, and as soon as it becomes too hot for the fingers to remain in it, take it from the fire, lift out the chestnuts, peel them quickly, and throw them into cold water as they are done; wipe, and weigh them; take three quarters of a pound for each quart of soup, cover them with good stock, and stew them gently for upwards of three quarters of an hour, or until they break when touched with a fork; drain, and pound them smoothly, or bruise them to a mash with a strong spoon, and rub them through a fine sieve reversed; mix with them by slow degrees the proper quantity of stock; add sufficient mace, cayenne, and salt to season the soup, and stir it often until it boils. Three quarters of a pint of rich cream, or even less, will greatly improve it. The stock in which the chestnuts are boiled can be used for the soup when its sweetness is not objected to; or it may in part be added to it.

Chestnuts, 1-1/2 lb.: stewed from 2/3 to 1 hour. Soup, 2 quarts; seasoning of salt, mace, and cayenne: 1 to 3 minutes. Cream, 3/4 pint (when used).

JERUSALEM ARTICHOKE, OR PALESTINE SOUP.

Wash and pare quickly some freshly-dug artichokes, and to preserve their colour, throw them into spring water as they are done, but do not let them remain in it after all are ready. Boil three pounds of them in water for ten minutes; lift them out, and slice them into three pints of boiling stock; when they have stewed gently in this from fifteen to twenty minutes, press them with the soup, through a fine sieve, and put the whole into a clean saucepan with a pint and a half more of stock; add sufficient salt and cayenne to season it, skim it well, and after it has simmered for two or three minutes, stir it to a pint of rich boiling cream. Serve it immediately.

Artichokes, 3 lbs., boiled in water: 10 minutes. Veal stock, 3 pints 15 to 20 minutes. Additional stock, 1-1/2 pint; little cayenne and salt 2 to 3 minutes. Boiling cream, 1 pint.

Obs.—The palest veal stock, as for white soup, should be used for this; but for a family dinner, or where economy is a consideration excellent mutton-broth, made the day before and perfectly cleared from fat, will answer very well as a substitute; milk too may in part take the place of cream when this last is scarce: the proportion of artichokes should then be increased a little.

Vegetable-marrow, when young, makes a superior soup even to this, which is an excellent one. It should be well pared, trimmed, and sliced into a small quantity of boiling veal stock or broth, and when perfectly tender, pressed through a fine sieve, and mixed with more stock and some cream. In France the marrow is stewed, first in butter, with a large mild onion or two also sliced; and afterwards in a quart or more of water, which is poured gradually to it; it is next passed through a tammy,[26] seasoned with pepper and salt, and mixed with a pint or two of milk and a little cream.

Footnote 26:

Derived from the French _tamis_, which means a sieve or strainer.

COMMON CARROT SOUP.

The most easy method of making this favourite English soup is to boil some highly coloured carrots quite tender in water slightly salted, then to pound or mash them to a smooth paste, and to mix with them boiling gravy soup or strong beef broth (_see Bouillon_) in the proportion of two quarts to a pound and a half of the prepared carrots; then to pass the whole through a strainer, to season it with salt and cayenne, to heat it in a clean stewpan, and to serve it immediately. If only the red outsides of the carrots be used, the colour of the soup will be very bright; they should be weighed after they are mashed. Turnip soup may be prepared in the same manner.

Obs.—An experienced and observant cook will know the proportion of vegetables required to thicken this soup appropriately, without having recourse to weights and measures; but the learner had always better proceed by _rule_.

Soup, 2 quarts; pounded carrot, 1-1/2 lb.; salt, cayenne: 5 minutes.

A FINER CARROT SOUP.

Scrape very clean, and cut away all blemishes from some highly-flavoured red carrots; wash, and wipe them dry, and cut them into quarter-inch slices. Put into a large stewpan three ounces of the best butter, and when it is melted, add two pounds of the sliced carrots, and let them stew gently for an hour without browning; pour to them then four pints and a half of brown gravy soup, and when they have simmered from fifty minutes to an hour, they ought to be sufficiently tender. Press them through a sieve or strainer with the soup; add salt, and cayenne if required; boil the whole gently for five minutes, take off all the scum, and serve the soup as hot as possible.

Butter, 3 oz.; carrots, 2 lbs.: 1 hour. Soup, 4-1/2 pints: 50 to 60 minutes. Salt, cayenne: 5 minutes.

COMMON TURNIP SOUP.

Wash and wipe the turnips, pare and weigh them; allow a pound and a half for every quart of soup. Cut them in slices about a quarter of an inch thick. Melt four ounces of butter in a clean stewpan, and put in the turnips before it begins to boil; stew them gently for three quarters of an hour, taking care that they shall not brown, then have the proper quantity of soup ready boiling, pour it to them, and let them simmer in it for three quarters of an hour. Pulp the whole through a coarse sieve or soup strainer, put it again on the fire, keep it stirred until it has boiled three minutes or four, take off the scum, add salt and pepper if required, and serve it very hot. Turnips, 3 lbs.; butter, 4 oz.: 3/4 hour. Soup, 2 quarts: 3/4 hour. Last time: three minutes.

A QUICKLY MADE TURNIP SOUP.

Pare and slice into three pints of veal or mutton stock or of good broth, three pounds of young mild turnips; stew them gently from twenty-five to thirty minutes, or until they can be reduced quite to pulp; rub the whole through a sieve, and add to it another quart of stock, a seasoning of salt and white pepper, and one lump of sugar: give it two or three minutes' boil, skim and serve it. A large white onion when the flavour is liked may be sliced and stewed with the turnips. A little cream improves much the colour of this

soup.

Turnips, 3 lbs.; soup, 5 pints: 25 to 30 minutes.

POTATO SOUP.

Mash to a smooth paste three pounds of good mealy potatoes, which have been steamed, or boiled very dry; mix with them by degrees, two quarts of boiling broth, pass the soup through a strainer, set it again on the fire, add pepper and salt, and let it boil for five minutes. Take off entirely the black scum that will rise upon it, and serve it very hot with fried or toasted bread. Where the flavour is approved, two ounces of onions minced and fried a light brown, may be added to the soup, and stewed in it for ten minutes before it is sent to table.

Potatoes, 3 lbs.; broth, 2 quarts: 5 minutes. (With onions, 2 oz.) 10 minutes.

APPLE SOUP.

(_Soupe à la Bourguignon._)

Clear the fat from five pints of good mutton broth, _bouillon_, or shin of beef stock, and strain it through a fine sieve; add to it when it boils, a pound and a half of good cooking apples, and stew them down in it very softly to a smooth pulp; press the whole through a strainer, add a small teaspoonful of powdered ginger and plenty of pepper, simmer the soup for a couple of minutes, skim, and serve it very hot, accompanied by a dish of rice, boiled as for curries.

Broth, 5 pints; apples, 1-1/2 lb.: 25 to 40 minutes. Ginger, 1 teaspoonful; pepper, 1/2 teaspoonful: 2 minutes.

PARSNEP SOUP.

Dissolve, over a gentle fire, four ounces of good butter, in a wide stewpan or saucepan, and slice in directly two pounds of sweet tender parsneps; let them stew very gently until all are quite soft, then pour in gradually sufficient veal stock or good broth to cover them, and boil the whole slowly from twenty minutes to half an hour; work it with a wooden spoon through a fine sieve, add as much stock as will make two quarts in all, season the soup with salt and white pepper or cayenne, give it one boil, skim, and serve it very hot. Send pale fried sippets to table with it.

Butter, 4-1/2 oz.; parsneps, 2 lbs.: 3/4 hour, or more. Stock, 1 quart; 20 to 30 minutes; 1 full quart more of stock; pepper, salt: 1 minute.

Obs.—We can particularly recommend this soup to those who like the peculiar flavour of the vegetable.

ANOTHER PARSNEP SOUP.

Slice into five pints of boiling veal stock or strong colourless broth, a couple of pounds of parsneps, and stew them as gently as possible from thirty minutes to an hour; when they are perfectly tender, press them through a sieve, strain the soup to them, season, boil, and serve it very hot. With the addition of cream, parsnep soup made by this receipt resembles in appearance the Palestine soup.

Veal stock or broth, 5 pints; parsneps, 2 lbs.: 30 to 60 minutes. Salt and cayenne: 2 minutes.

WESTERFIELD WHITE SOUP.

Break the bone of a knuckle of veal in one or two places, and put it on to stew, with three quarts of cold water to the five pounds of meat; when it has been quite cleared from scum, add to it an ounce and a half of salt, and one mild onion, twenty corns of white pepper, and two or three blades of mace, with a _little_ cayenne pepper. When the soup is reduced one-third by slow simmering strain it off, and set it by till cold; then free it carefully from the fat and sediment, and heat it again in a very clean stewpan. Mix with it when it boils, a pint of thick cream smoothly blended with an ounce of good arrow-root, two ounces of very fresh vermicelli previously boiled tender in water slightly salted and _well drained_ from it, and an ounce and a half of almonds blanched and cut in strips: give it one minute’s simmer, and serve it immediately, with a French roll in the tureen.

Veal, 5 lbs.; water, 3 quarts; salt, 1-1/2 oz.; 1 mild onion; 20 corns white pepper; 2 large blades of mace: 5 hours or _more_. Cream, 1 pint; almonds, 1-1/2 oz.; vermicelli, 1 oz.: 1 minute. Little thickening if needed.

Obs.—We have given this receipt without any variation from the original, as the soup made by it—of which we have often partaken—seemed always much approved by the guests of the hospitable country gentleman from whose family it was derived, and at whose well-arranged table it was very commonly served; but we would suggest the suppression of the almond spikes, as they seem unsuited to the preparation, and also to the taste of the present day.

A RICHER WHITE SOUP.

Pound very fine indeed six ounces of sweet almonds, then add to them six ounces of the breasts of roasted chickens or partridges, and three ounces of the whitest bread which has been soaked in a little veal broth, and squeezed very dry in a cloth. Beat these altogether to an extremely smooth paste; then pour to them boiling and by degrees, two quarts of rich veal stock; strain the soup through a fine hair sieve, set it again over the fire, add to it a pint of thick cream, and serve it, as soon as it is at the point of boiling. When cream is very scarce, or not easily to be procured, this soup may be thickened sufficiently without it, by increasing the quantity of almonds to eight or ten ounces, and pouring to them, after they have been reduced to the finest paste, a pint of boiling stock, which must be again wrung from them through a coarse cloth with very strong pressure: the proportion of meat and bread also should then be nearly doubled. The stock should be well seasoned with mace and cayenne before it is added to the other ingredients.

Almonds, 6 oz.; breasts of chickens or partridges, 6 oz.; soaked bread, 3 oz.; veal stock, 2 quarts; cream, 1 pint.

Obs. 1.—Some persons pound the yolks of four or five hard-boiled eggs with the almonds, meat, and bread for this white soup; French cooks beat smoothly with them an ounce or two of whole rice, previously boiled from fifteen to twenty minutes.

Obs. 2.—A good plain white soup maybe made simply by adding to a couple of quarts of pale veal stock or strong well-flavoured veal broth, a thickening of arrow-root, and from half to three quarters of a pint of cream. Four ounces of macaroni boiled tender and well-drained may be dropped into it a minute or two before it is dished, but the thickening may then be diminished a little.

MOCK TURTLE SOUP.

To make a single tureen of this favourite English soup in the most economical manner when there is no stock at hand, stew gently down in a gallon of water four pounds of the fleshy part of the shin of beef, or of the neck, with two or three carrots, one onion, a small head of celery, a bunch of savoury herbs, a blade of mace, a half-teaspoonful of peppercorns, and an ounce of salt. When the meat is quite in fragments, strain off the broth, and pour it when cold upon three pounds of the knuckle or of the neck of veal; simmer this until the flesh has quite fallen from the bones, but be careful to stew it as softly as possible, or the quantity of stock will be so much reduced as to be insufficient for the soup. Next, take the half of a fine calf's head _with the skin on_, remove the brains, and then bone it[27] entirely, or let the butcher do this, and return the bones with it; these, when there is time, may be stewed with the veal to enrich the stock, or boiled afterwards with the head and tongue. Strain the soup through a hair-sieve into a clean pan, and let it drain closely from the meat. When it is nearly or quite cold, clear off all the fat from it; roll the head lightly round, leaving the tongue inside, or taking it out, as is most convenient, secure it with tape or twine, pour the soup over, and bring it gently to boil upon a moderate fire; keep it well skimmed, and simmer it from an hour to an hour and a quarter; then lift the head into a deep pan or tureen, add the soup to it, and let it remain in until nearly cold, as this will prevent the edges from becoming dark. Cut into quarter-inch slices, and then divide into dice, from six to eight ounces of the lean of an undressed ham, and if possible, one of good flavour; free it perfectly from fat, rind, and the smoked edges; peel and slice four moderate-sized eschalots, or if these should not be at hand, one mild onion in lieu of them. Dissolve in a well-tinned stewpan or thick iron saucepan which holds a gallon or more, four ounces of butter; put in the ham and eschalots, or onion, with half a dozen cloves, two middling-sized blades of mace, a half-teaspoonful of peppercorns, three or four very small sprigs of thyme, three teaspoonsful of minced parsley, one of lemon thyme and winter savoury mixed, and when the flavour is thought appropriate, the very thin rind of half a small fresh lemon. Stew these as softly as possible for nearly or quite an hour, and keep the pan frequently shaken: then put into a dredging box two ounces of fine dry flour, and sprinkle it to them by degrees; mix the whole well together, and after a few minutes more of gentle simmering, add very gradually five full pints of the stock taken free of fat and sediment, and made boiling before it is poured in; shake the pan strongly round as the first portions of it are added, and continue to do so until it contains from two to three pints, when the remainder may be poured in at once, and the pan placed by the side of the fire that it may boil in the gentlest manner for an hour. At

the end of that time turn the whole into a hair-sieve placed over a large pan, and if the liquid should not run through freely, knock the sides of the sieve, but do not force it through with a spoon, as that would spoil the appearance of the stock. The head in the meanwhile should have been cut up, ready to add to it. For the finest kind of mock turtle, only the skin, with the fat that adheres to it, should be used; and this, with the tongue, should be cut down into one inch squares, or if preferred into strips of an inch wide. For ordinary occasions, the lean part of the flesh may be added also, but as it is always sooner done than the skin, it is better to add it to the soup a little later. When it is quite ready, put it with the strained stock into a clean pan, and simmer it from three quarters of an hour to a full hour: it should be perfectly tender, without being allowed to break. Cayenne, if needed, should be thrown into the stock before it is strained; salt should be used sparingly, on account of the ham, until the whole of the other ingredients have been mixed together, when a sufficient quantity must be stirred into the soup to season it properly. A couple of glasses of good sherry or Madeira, with a dessertspoonful of strained lemon-juice, are usually added two or three minutes only before the soup is dished, that the spirit and flavour of the wine may not have time to evaporate; but it is sometimes preferred mellowed down by longer boiling. The proportion of lemon-juice may be doubled at will, but much acid is not generally liked. We can assure the reader of the excellence of the soup made by this receipt; it is equally palatable and delicate, and not heavy or cloying to the stomach, like many of the elaborate compositions which bear its name. The fat, through the whole process, should be carefully skimmed off. The ham gives far more savour, when used as we have directed, than when, even in much larger proportion, it is boiled down in the stock. Two dozens of forcemeat-balls, prepared by the receipt No. 11, Chap. VIII., should be dropped into the soup when it is ready for table. It is no longer customary to serve egg-balls in it.

Footnote 27:

This is so simple and easy a process, that the cook may readily accomplish it with very little attention. Let her only work the knife close to the bone always, so as to take the flesh clean from it, instead of leaving large fragments on. The jaw-bone may first be removed, and the flesh turned back from the edge of the other.

First broth:—shin, or neck of beef, 4 lbs.; water, 4 quarts; carrots, 2 or 3; large mild onion, 1; celery, small head; bunch savoury herbs; mace, 1 large blade; peppercorns, 1/2 teaspoonful; cloves, 6; salt, 1 oz.: 5 hours or more, _very gently_. For stock: the broth and 3 lbs. neck or knuckle of veal (bones of head if ready): 4 to 5 hours. Boned half-head with skin on and tongue, 1 to 1-1/4 hour. Lean of undressed ham, 6 to 8 oz. (6 if _very_ salt); shalots, 4, or onion, 1; fresh butter, 4 oz.; cloves, 6; middling-sized blades of mace, 2; peppercorns, 1/2 teaspoonful; _small_ sprigs of thyme, 3 or 4; minced parsley, 3 large teaspoonsful; minced savoury and lemon-thyme mixed, 1 small teaspoonful (thin rind 1/2 small lemon, when liked): 1 hour. Flour, 2 oz.: 5 minutes. Stock, full five pints; flesh of head and tongue, 1-3/4 to 2 lbs.: 3/4 of an hour to 1 hour (salt, if needed, to be added in interim). Good sherry or Madeira, 2 wineglassesful; lemon-juice, 1 to 2 dessertspoonsful; forcemeat-balls, 24.

Obs. 1.—The beef, veal, bones of the head, and vegetables may be stewed down together when more convenient: it is only necessary that a really good, well flavoured, and rather deeply-coloured stock should be prepared. A calf’s foot is always an advantageous addition to it, and the skin of another calf’s head[28] a better one still.

Footnote 28:

Country butchers, in preparing a calf’s head for sale in the ordinary way, take off the skin (or scalp), considered so essential to the excellence of this soup, and frequently throw it away; it may, therefore, often be procured from them at very slight cost, and is the best possible addition to the mock turtle. It is cleared from the head in detached portions with the hair on, but this may easily be removed after a few minutes’ scalding as from the head itself, or the feet, by the direction given in Chapter of _Sweet Dishes_. In London it is sold entire, and very nicely prepared, and may be served in many forms, besides being _added_ to soup with great advantage.

Obs. 2.—A couple of dozens mushroom-buttons, cleaned with salt and flannel, then wiped very dry, and sliced, and added to the ham and herbs when they have been simmered together about half an hour, will be found an improvement to the soup.

Claret is sometimes added instead of sherry or Madeira, but we do not think it would in general suit English taste so well. From two to three tablespoonsful of Harvey’s sauce can be stirred in with the wine when it is liked, or when the colour requires deepening.

OLD-FASHIONED MOCK TURTLE.

After having taken out the brain and washed and soaked the head well, pour to it nine quarts of cold water, bring it gently to boil, skim it very clean, boil it if large an hour and a half, lift it out, and put into the liquor eight pounds of neck of beef lightly browned in a

little fresh butter, with three or four thick slices of lean ham, four large onions sliced, three heads of celery, three large carrots, a large bunch of savoury herbs, the rind of a lemon pared very thin, a dessertspoonful of peppercorns, two ounces of salt, and after the meat has been taken from the head, all the bones and fragments. Stew these gently from six to seven hours, then strain off the stock and set it into a very cool place, that the fat may become firm enough on the top to be cleared off easily. The skin and fat of the head should be taken off together and divided into strips of two or three inches in length, and one in width; the tongue may be carved in the same manner, or into dice. Put the stock, of which there ought to be between four and five quarts, into a large soup or stewpot; thicken it when it boils with four ounces of fresh butter[29] mixed with an equal weight of fine dry flour, a half-teaspoonful of pounded mace, and a third as much of cayenne (it is better to use these sparingly at first, and to add more should the soup require it, after it has boiled some little time); pour in half a pint of sherry, stir the whole together until it has simmered for a minute or two, then put in the head, and let it stew gently from an hour and a quarter to an hour and a half: stir it often, and clear it perfectly from scum. Put into it just before it is ready for table three dozens of small forcemeat-balls; the brain cut into dice (after having been well soaked, scalded,[30] and freed from the film), dipped into beaten yolk of egg, then into the finest crumbs mixed with salt, white pepper, a little grated nutmeg, fine lemon-rind, and chopped parsley fried a fine brown, well drained and dried; and as many egg-balls, the size of a small marble, as the yolks of four eggs will supply. (See Chapter VIII). This quantity will be sufficient for two large tureens of soup; when the whole is not wanted for table at the same time, it is better to add wine only to so much as will be required for immediate consumption, or if it cannot conveniently be divided, to heat the wine in a small saucepan with a little of the soup, to turn it into the tureen, and then to mix it with the remainder by stirring the whole gently after the tureen is filled. Some persons simply put in the cold wine just before the soup is dished, but this is not so well.

Footnote 29:

When the butter is considered objectionable, the flour, without it, may be mixed to the smoothest batter possible, with a little cold stock or water, and stirred briskly into the boiling soup: the spices should be blended with it.

Footnote 30:

The brain should be blanched, that is, thrown into boiling water with a little salt in it, and boiled from five to eight minutes, then lifted out and laid into cold water for a quarter of an hour: it must be wiped very dry before it is fried.

Whole calf’s head with skin on, boiled 1-1/2 hour. Stock: neck of beef, browned in butter, 8 lbs.; lean of ham, 1/2 to 3/4 lb.; onions, 4; large carrots, 3; heads of celery, 3; large bunch herbs; salt, 2 oz. (as much more to be added when the soup is made as will season it sufficiently); thin rind, 1 lemon; peppercorns, 1 dessertspoonful; bones and trimmings of head: 8 hours. Soup: stock, 4 to 5 quarts; flour and butter for thickening, of each 4 oz.; pounded mace, half-teaspoonful; cayenne, third as much (more of each as needed); sherry, half pint: 2 to 3 minutes. Flesh of head and tongue, nearly or quite 2 lbs.: 1-1/4 to 1-1/2 hour. Forcemeat-balls, 36; the brain cut and fried; egg-balls, 16 to 24.

Obs.—When the brain is not blanched it must be cut thinner in the form of small cakes, or it will not be done through by the time it has taken enough colour: it may be altogether omitted without much detriment to the soup, and will make an excellent corner dish if gently stewed in white gravy for half an hour, and served with it thickened with cream and arrow-root to the consistency of good white sauce, then rather highly seasoned, and mixed with plenty of minced parsley, and some lemon-juice.

GOOD CALF’S HEAD SOUP.

(_Not expensive._)

Stew down from six to seven pounds of the thick part of a shin of beef with a little lean ham, or a slice of hung beef, or of Jewish beef, trimmed free from the smoky edges, in five quarts of water until reduced nearly half, with the addition, when it first begins to boil, of an ounce of salt, a large bunch of savoury herbs, one large onion, a head of celery, three carrots, two or three turnips, two small blades of mace, eight or ten cloves, and a few white or black peppercorns. Let it boil _gently_ that it may not be too much reduced, for six or seven hours, then strain it into a clean pan and set it by for use. Take out the bone from half a calf’s head with the skin on (the butcher will do this if desired), wash, roll, and bind it with a bit of tape or twine, and lay it into a stewpan, with the bones and tongue; cover the whole with the beef stock, and stew it for an hour and a half; then lift it into a deep earthen pan and let it cool in the liquor, as this will prevent the edges from becoming dry or discoloured. Take it out before it is quite cold; strain, and skim all the fat carefully from the stock; and heat five pints in a large clean saucepan, with the head cut into small thick slices or into inch-squares. As quite the whole will not be needed, leave a portion of the fat, but add every morsel of the skin to the soup, and of

the tongue also. Should the first of these not be perfectly tender, it must be simmered gently till it is so; then stir into the soup from six to eight ounces of fine rice-flour mixed with a quarter-teaspoonful of cayenne, twice as much freshly pounded mace, half a wineglassful of mushroom catsup,[31] and sufficient cold broth or water to render it of the consistence of batter; boil the whole from eight to ten minutes; take off the scum, and throw in two glasses of sherry; dish the soup and put into the tureen some delicately and well fried forcemeat-balls made by the receipt No. 1, 2, or 3, of Chapter VIII. A small quantity of lemon-juice or other acid can be added at pleasure. The wine and forcemeat-balls may be omitted, and the other seasonings of the soup a little heightened. As much salt as may be required should be added to the stock when the head first begins to boil in it: the cook must regulate also by the taste the exact proportion of cayenne, mace, and catsup, which will flavour the soup agreeably. The fragments of the head, with the bones and the residue of the beef used for stock, if stewed down together with some water and a few fresh vegetables, will afford some excellent broth, such as would be highly acceptable, especially if well thickened with rice, to many a poor family during the winter months.

Footnote 31:

Unless _very good_ and pure in flavour, we cannot recommend the addition of this or of any other catsup to soup or gravy.

Stock: shin of beef, 6 to 7 lbs.; water, 5 quarts: stewed down (with vegetables, &c.) till reduced nearly half. Boned half-head with skin on stewed in stock: 1-1/2 hour. Soup: stock, 5 pints; tongue, skin of head, and part of flesh: 15 to 40 minutes, or more if not quite tender. Rice-flour, 6 to 8 oz.; cayenne, quarter-teaspoonful; mace, twice as much; mushroom catsup, 1/2 wineglassful: 10 minutes. Sherry, 2 wineglassesful, forcemeat-balls, 20 to 30.

SOUP DES GALLES.

Add to the liquor in which a knuckle of veal has been boiled the usual time for table as much water as will make altogether six quarts, and stew in it gently sixpennyworth of beef bones and sixpennyworth of pork-rinds. When the boiling is somewhat advanced, throw in the skin of a calf's head; and in an hour afterwards, or when it is quite tender, lift it out and set it aside till wanted. Slice and fry four large mild onions, stick into another eight or ten cloves, and put them into the soup after it has stewed from six to seven hours. Continue the boiling for two or three hours longer, then strain off the soup, and let it remain until perfectly cold. When wanted for table, take it quite clear from the fat and sediment, and heat it anew with the skin of the calf's head cut into dice, three ounces of loaf sugar, four tablespoonsful of strained lemon-juice, two of soy, and three wineglassesful of sherry; give it one boil, skim it well, and serve it as hot as possible. Salt must be added to it sparingly in the first instance on account of the soy: a proper seasoning of cayenne or pepper must not, of course, be omitted.

This receipt was given to the writer, some years since, as a perfectly successful imitation of a soup which was then, and is still, she believes, selling in London at six shillings the quart. Never having tasted the original _Soupe des Galles_ she cannot say how far it is a correct one; but she had it tested with great exactness when she received it first, and found the result a very good soup prepared at an extremely moderate cost. The pork-rinds, when long boiled, afford a strong and flavourless jelly, which might be advantageously used to give consistence to other soups. They may be procured during the winter, usually at the butcher's, but if not, at the porkshops: they should be carefully washed before they are put into the soup-pot. When a knuckle of veal cannot conveniently be had, a pound or two of the neck and a morsel of scrag of mutton may instead be boiled down with the beef-bones; or two or three pounds of neck or shin of beef: but these will, of course, augment the cost of the soup.

POTAGE À LA REINE.

(_A Delicate White Soup._)

Should there be no strong veal broth, nor any white stock in readiness, stew four pounds of the scrag or knuckle of veal, with a thick slice or two of lean ham, a faggot of sweet herbs, two moderate-sized carrots, and the same of onions, a large blade of mace, and a half-teaspoonful of white peppercorns, in four quarts of water until reduced to about five pints; then strain the liquor, and set it by until the fat can be taken entirely from it. Skin and wash thoroughly, a couple of fine fowls, or three young pullets, and take away the dark spongy substance which adheres to the insides; pour the veal broth to them, and boil them gently from three quarters of an hour to an hour; then lift them out, take off all the white flesh, mince it small, pound it to the finest paste, and cover it with a basin until wanted for use. In the mean time let the bodies of the fowls be put again into the stock, and stewed gently for an hour and a half; add as much salt and cayenne, as will season the soup properly, strain it off when sufficiently boiled, and let it cool; skim off every particle of fat; steep, in a small portion of it, which should be boiling, four ounces of the crumb of light stale bread sliced thin,

and when it has simmered a few minutes, drain or wring the moisture from it in a clean cloth, add it to the flesh of the chickens, and pound them together until they are perfectly blended; then pour the stock to them in very small quantities at first, and mix them smoothly with it; pass the whole through a sieve or tammy, heat it in a clean stewpan, stir to it from a pint to a pint and a half of boiling cream, and add, should it not be sufficiently thick, an ounce and a half of arrow-root, quite free from lumps, and moistened with a few spoonsful of cold milk or stock.

REMARK.—This soup, and the two which immediately follow it, if made with care and great nicety by the exact directions given here for them, will be found very refined and excellent. For stock: veal, 4 lbs.; ham, 6 oz.; water, 4 quarts; bunch of herbs; carrots, 2; onions, 2; mace, large blade; peppercorns, 1/2 teaspoonful; salt: 5 hours. Fowls, 2, or pullets, 3: 3/4 to 1 hour; stewed afterwards 1 to 1-1/2 hour. Crumb of bread, 4 oz.; cream, 1 to 1-1/2 pint; arrow-root (if needed), 1-1/2 oz.

Obs.—Some cooks pound with the bread and chickens the yolks of three or four hard-boiled eggs, but these improve neither the colour nor the flavour of the _potage_.

WHITE OYSTER SOUP.

(_or Oyster Soup à la Reine._)

When the oysters are small, from two to three dozens for each pint of soup should be prepared, but this number can of course be diminished or increased at pleasure. Let the fish (which should be finely conditioned natives) be opened carefully; pour the liquor from them, and strain it; rinse them in it well, and beard them; strain the liquor a second time through a lawn sieve or folded muslin, and pour it again over the oysters. Take a portion from two quarts of the palest veal stock, and simmer the beards in it from twenty to thirty minutes. Heat the soup, flavour it with mace and cayenne, and strain the stock from the oyster-beards into it. Plump the fish in their own liquor, but do not let them boil; pour the liquor to the soup, and add to it a pint of boiling cream; put the oysters into the tureen, dish the soup, and send it to table quickly. Should any thickening be required, stir briskly to the stock an ounce and a half of arrow-root entirely free from lumps, and carefully mixed with a little milk or cream; or, in lieu of this, when a _rich_ soup is liked, thicken it with four ounces of fresh butter well blended with three of flour.

Oysters, 8 to 12 dozens; pale veal stock, 2 quarts; cream, 1 pint; thickening, 1 oz. arrow-root, or butter, 4 oz., flour, 3 oz.

RABBIT SOUP À LA REINE.

Wash and soak thoroughly three young rabbits, put them whole into the soup-pot, and pour on them seven pints of cold water or of clear veal broth; when they have stewed gently about three quarters of an hour lift them out, and take off the flesh of the backs, with a little from the legs should there not be half a pound of the former; strip off the skin, mince the meat very small, and pound it to the smoothest paste; cover it from the air, and set it by. Put back into the soup the bodies of the rabbits, with two mild onions of moderate size, a head of celery, three carrots, a faggot of savoury herbs, two blades of mace, a half-teaspoonful of peppercorns, and an ounce of salt. Stew the whole softly three hours; strain it off, let it stand to settle, pour it gently from the sediment, put from four to five pints into a clean stewpan, and mix it very gradually while hot with the pounded rabbit-flesh; this must be done with care, for if the liquid be not added in very small portions at first, the meat will gather into lumps and will not easily be worked smooth afterwards. Add as much pounded mace and cayenne as will season the soup pleasantly, and pass it through a coarse but very clean sieve; wipe out the stewpan, put back the soup into it, and stir in when it boils, a pint and a quarter of good cream[32] mixed with a tablespoonful of the best arrow-root: salt, if needed, should be thrown in previously.

Footnote 32:

We give this receipt exactly as we had it first compounded, but less cream and rather more arrow-root might be used for it, and would adapt it better to the economist.

Young rabbits, 3; water, or clear veal broth, 7 pints: 3/4 of an hour. Remains of rabbits; onions, 2; celery, 1 head; carrots, 3; savoury herbs; mace, 2 blades; white peppercorns, a half-teaspoonful; salt, 1 oz.: 3 hours. Soup, 4 to 5 pints; pounded rabbit-flesh, 8 oz.; salt, mace, and cayenne, if needed; cream, 1-1/4 pint; arrow-root, 1 tablespoonful (or 1-1/2 ounce).

BROWN RABBIT SOUP.

Cut down into joints, flour, and fry lightly, two full grown, or three young rabbits; add to them three onions of moderate size, also fried to a clear brown; on these pour gradually seven pints of boiling water, throw in a large teaspoonful of salt, clear off all the scum

with care as it rises, and then put to the soup a faggot of parsley, four not very large carrots, and a small teaspoonful of peppercorns; boil the whole very softly from five hours to five and a half; add more salt if needed, strain off the soup, let it cool sufficiently for the fat to be skimmed clean from it, heat it afresh, and send it to table with sippets of fried bread. Spice, with a thickening of rice-flour, or of wheaten flour browned in the oven, and mixed with a spoonful or two of very good mushroom catsup, or of Harvey's sauce, can be added at pleasure to the above, with a few drops of eschalot-wine, or vinegar; but the simple receipt will be found extremely good without them.

Rabbits, 2 full grown, or 3 small; onions fried, 3 middling-sized; water, 7 pints; salt, 1 large teaspoonful or more; carrots, 4, a faggot of parsley; peppercorns, 1 small teaspoonful: 5 to 5-1/2 hours.

SUPERLATIVE HARE SOUP.

Cut down a hare into joints, and put into a soup-pot, or large stewpan, with about a pound of lean ham, in thick slices, three moderate-sized mild onions, three blades of mace, a faggot of thyme, sweet marjoram, and parsley, and about three quarts of good beef stock. Let it stew very gently for full two hours from the time of its first beginning to boil, and more, if the hare be old. Strain the soup and pound together very fine the slices of ham and all the flesh of the back, legs, and shoulders of the hare, and put this meat into a stewpan with the liquor in which it was boiled, the crumb of two French rolls, and half a pint of port wine. Set it on the stove to simmer twenty minutes; then rub it through a sieve, place it again on the stove till very hot, but do not let it boil: season it with salt and cayenne, and send it to table directly.

Hare, 1; ham, 12 to 16 oz.; onions, 3 to 6; mace, 3 blades; faggot of savoury herbs; beef stock, 3 quarts: 2 hours. Crumb of 2 rolls; port wine, 1/2 pint; little salt and cayenne: 20 minutes.

A LESS EXPENSIVE HARE SOUP.[33]

Footnote 33:

The remains of a roasted hare, with the forcemeat and gravy, are admirably calculated for making this soup.

Pour on two pounds of neck or shin of beef and a hare well washed and carved into joints, one gallon of cold water, and when it boils and has been thoroughly skimmed, add an ounce and a half of salt, two onions, one large head of celery, three moderate-sized carrots, a teaspoonful of black peppercorns, and six cloves.

Let these stew very gently for three hours, or longer, should the hare not be perfectly tender. Then take up the principal joints, cut the meat from them, mince, and pound it to a fine paste, with the crumb of two penny rolls (or two ounces of the crumb of household bread) which has been soaked in a little of the boiling soup, and then pressed very dry in a cloth; strain, and mix smoothly with it the stock from the remainder of the hare; pass the soup through a strainer, season it with cayenne, and serve it when at the point of boiling; if not sufficiently thick, add to it a tablespoonful of arrow-root moistened with a little cold broth, and let the soup simmer for an instant afterwards. Two or three glasses of port wine, and two dozens of small forcemeat-balls, may be added to this soup with good effect.

Beef, 2 lbs.; hare, 1; water, 1 gallon; salt, 1-1/2 oz.; onions, 2; celery, 1 head; carrots, 3; bunch of savoury herbs; peppercorns, 1 teaspoonful; cloves, 6: 3 hours, or more. Bread, 2 oz.; cayenne, arrow-root (if needed), 1 tablespoonful.

ECONOMICAL TURKEY SOUP.

The remains of a roast turkey, even after they have supplied the usual mince and broil, will furnish a tureen of cheap and excellent soup with the addition of a little fresh meat. Cut up rather small two pounds of the neck or other lean joint of beef, and pour to it five pints of cold water. Heat these very slowly; skim the liquor when it begins to boil, and add to it an ounce of salt, a small, mild onion (the proportion of all the vegetables may be much increased when they are liked), a little celery, and the flesh and bones of the turkey, with any gravy or forcemeat that may have been left with them. Let these boil gently for about three hours; then strain off the soup through a coarse sieve or cullender, and let it remain until the fat can be entirely removed from it. It may then be served merely well thickened with rice[34] which has previously been boiled very dry as for currie, and stewed in it for about ten minutes; and seasoned with one large heaped tablespoonful or more of minced parsley, and as much salt and pepper or cayenne as it may require. This, as the reader will perceive, is a somewhat frugal preparation, by which the residue of a roast turkey may be turned to economical account; but it is a favourite soup at some good English tables, where its very simplicity is a recommendation. It can

always be rendered _more expensive_, and of richer quality, by the addition of lean ham or smoked beef,[35] a larger weight of fresh meat, and catsup or other store-sauces.

Footnote 34:

It will be desirable to prepare six ounces of rice, and to use as much of it as may be required, the reduction of the stock not being always equal, and the same weight of rice therefore not being in all cases sufficient. Rice-flour can be substituted for the whole grain and used as directed for _Rice Flour Soup_, page 15.

Footnote 35:

As we have stated in our chapter of Foreign Cookery, the _Jewish_ smoked beef, of which we have given particulars there, imparts a superior flavour to soups and gravies; and it is an economical addition to them, as a small portion of it will much heighten their savour.

Turkey soup _à la reine_ is made precisely like the _Potage à la Reine_ of fowls or pullets, of which the receipt will be found in another part of this chapter.

PHEASANT SOUP.

Half roast a brace of well-kept pheasants, and flour them rather thickly when they are first laid to the fire. As soon as they are nearly cold take all the flesh from the breasts, put it aside, and keep it covered from the air; carve down the remainder of the birds into joints, bruise the bodies thoroughly, and stew the whole gently from two to three hours in five pints of strong beef broth; then strain off the soup, and press as much of it as possible from the pheasants. Let it cool; and in the mean time strip the skins from the breasts, mince them small, and pound them to the finest paste, with half as much fresh butter, and half of dry crumbs of bread; season these well with cayenne, sufficiently with salt, and moderately with pounded mace and grated nutmeg, and add, when their flavour is liked, three or four eschalots previously boiled tender in a little of the soup, left till cold, and minced before they are put into the mortar. Moisten the mixture with the yolks of two or three eggs, roll it into small balls of equal size, dust a little flour upon them, skim all the fat from the soup, heat it in a clean stewpan, and when it boils throw them in and poach them from ten to twelve minutes, but first ascertain that the soup is properly seasoned with salt and cayenne. We have recommended that the birds should be partially roasted before they are put into the soup-pot, because their flavour is much finer when this is done than when they are simply stewed; they should be placed rather near to a brisk fire that they may be quickly browned on the surface without losing any of their juices, and the basting should be constant. A slight thickening of rice-flour and arrow-root can be added to the soup at pleasure, and the forcemeat-balls may be fried and dropped into the tureen when they are preferred so. Half a dozen eschalots lightly browned in butter, and a small head of celery, may also be thrown in after the birds begin to stew, but nothing should be allowed to prevail ever the natural flavour of the game itself; and this should be observed equally with other kinds, as partridges, grouse, and venison.

Pheasants, 2. roasted 20 to 25 minutes. Strong beef broth, or stock, 5 pints: 2 to 3 hours. Forcemeat-balls: breasts of pheasants, half as much dry bread-crumbs and of butter, salt, mace, cayenne; yolks of 2 or 3 eggs (and at choice 3 or 4 boiled eschalots).

Obs.—The stock may be made of six pounds of shin of beef, and four quarts of water reduced to within a pint of half. An onion, a large carrot, a bunch of savoury herbs, and some salt and spice should be added to it: one pound of neck of veal or of beef will improve it.

ANOTHER PHEASANT SOUP.

Boil down the half-roasted birds as directed in the foregoing receipt, and add to the soup, after it is strained and re-heated, the breasts pounded to the finest paste with nearly as much bread soaked in a little of the stock and pressed very dry; for the proper manner of mixing them, see _Potage à la Reine_, page 29. Half a pint of small mushrooms cleaned as for pickling, then sliced rather thickly, and stewed from ten to fifteen minutes without browning, in an ounce or two of fresh butter, with a slight seasoning of mace, cayenne, and salt, then turned into the mortar and pounded with the other ingredients, will be found an excellent addition to the soup, which must be passed through a strainer after the breasts are added to it, brought to the point of boiling, and served with sippets _à la Reine_, or with others simply fried of a delicate brown and well dried. We have occasionally had a small quantity of delicious soup made with the remains of birds which have been served at table; and where game is frequently dressed, the cook, by reserving all the fragments for the purpose, and combining different kinds, may often send up a good tureen of such, made at a

very slight cost.

Pheasants, 2; stock, 5 pints; bread soaked in gravy (see Panada, Chapter VIII), nearly as much _in bulk_ as the flesh of the breasts of the birds; mushrooms, 1/2 pint, stewed in one or two oz. of butter 10 to 15 minutes, then pounded with flesh of pheasants. Salt, cayenne and mace, to season properly.

PARTRIDGE SOUP.

This is, we think, superior in flavour to the pheasant soup. It should be made in precisely the same manner, but three birds allowed for it instead of two. Grouse and partridges together will make a still finer one; the remains of roast grouse even, added to a brace of partridges, will produce a very good effect.

MULLAGATAWNY SOUP.

Slice, and fry gently in some good butter three or four large onions, and when they are of a fine equal amber-colour lift them out with a slice and put them into a deep stewpot, or large thick saucepan; throw a little more butter into the pan, and then brown lightly in it a young rabbit, or the prime joints of two, or a fowl cut down small, and floured. When the meat is sufficiently browned, lay it upon the onions, pour gradually to them a quart of good boiling stock, and stew it gently from three quarters of an hour to an hour; then take it out, and pass the stock and onions through a fine sieve or strainer. Add to them two pints and a half more of stock, pour the whole into a clean pan, and when it boils stir to it two tablespoonsful of currie-powder mixed with nearly as much of browned flour, and a little cold water or broth, put in the meat, and simmer it for twenty minutes or longer should it not be perfectly tender, add the juice of a small lemon just before it is dished, serve it very hot, and send boiled rice to table with it. Part of a pickled mango cut into strips about the size of large straws, is sometimes served in this soup, after being stewed in it for a few minutes; a little of the pickle itself should be added with it. We have given here the sort of receipt commonly used in England for mullagatawny, but a much finer soup may be made by departing from it in some respects. The onions, of which the proportion may be increased or diminished to the taste, after being fried slowly and with care, that no part should be overdone, may be stewed for an hour in the first quart of stock with three or four ounces of grated cocoa-nut,[36] which will impart a rich mellow flavour to the whole. After all of this that can be rubbed through the sieve has been added to as much more stock as will be required for the soup, and the currie-powder and thickening have been boiled in it for twenty minutes, the flesh of part of a calf's head,[37] previously stewed almost tender, and cut as for mock turtle, with a sweetbread also parboiled or stewed in broth, and divided into inch-squares, will make an admirable mullagatawny, if simmered in the stock until they have taken the flavour of the currie-seasoning. The flesh of a couple of calves' feet, with a sweetbread or two, may, when more convenient, be substituted for the head. A large cupful of thick cream, first mixed and boiled with a teaspoonful of flour or arrow-root to prevent its curdling, and stirred into the soup before the lemon-juice, will enrich and improve it much.

Footnote 36:

That our readers to whom this ingredient in soups is new, may not be misled, we must repeat here, that although the cocoa-nut when it is young and fresh imparts a _peculiarly_ rich flavour to any preparation, it is not liked by all eaters, and is better omitted when the taste of a party is not known, and only one soup is served.

Footnote 37:

The scalp or skin only of a calf's head will make excellent mullagatawny, with good broth for stock; and many kinds of shell-fish also.

Rabbit, 1, or the best joints of, 2, or fowl, 1; large onions, 4 to 6; stock, 1 quart: 3/4 to 1 hour. 2-1/2 pints more of stock; currie-powder, 2 heaped tablespoonsful, with 2 of browned flour; meat and all simmered together 20 minutes or more; juice of lemon, 1 small; or part of pickled mango stewed in the soup 3 to 4 minutes.

Or,—onions, 3 to 6; cocoa-nut, 3 to 4 oz.; stock, 1 quart; stewed 1 hour. Stock, 3 pints (in addition to the first quart); currie-powder and thickening each, 2 large tablespoonsful: 20 minutes. Flesh of part of calf s head and sweetbread, 15 minutes or more. Thick cream, 1 cupful; flour or arrow-root, 1 teaspoonful; boiled 2 minutes, and stirred to the soup. Chili vinegar, 1 tablespoonful, or lemon-juice, 2 tablespoonsful.

Obs. 1.—The brain of the calf's head stewed for twenty minutes in a little of the stock, then rubbed through a sieve, diluted gradually with more of the stock, and added as thickening to the soup, will be found an admirable substitute for part of the flour.

Obs. 2.—Three or four pounds of a breast of veal, or an equal weight of mutton, free from bone and fat, may take the place of rabbits or fowls in this soup, for a plain dinner. The veal should be cut into squares of an inch and a half, or into strips of an inch in width, and two in length; and the mutton should be trimmed down in the same way, or into very small cutlets.

Obs. 3.—For an elegant table, the joints of rabbit or of fowl should always be boned before they are added to the soup, for which, in this case, a couple of each will be needed for a single tureen, as all the inferior joints must be rejected.

TO BOIL RICE FOR MULLAGATAWNY SOUPS, OR FOR CURRIES.

The Patna, or small-grained rice, which is not so good as the Carolina, for the general purposes of cookery, ought to be served with currie. First take out the unhusked grains, then wash the rice in several waters, and put it into a large quantity of cold water; bring it gently to boil, keeping it uncovered, and boil it softly for fifteen minutes, when it will be perfectly tender, and every grain will remain distinct. Throw it into a _large_ cullender, and let it drain for ten minutes near the fire; should it not then appear _quite_ dry, turn it into a dish, and set it for a short time into a gentle oven, or let it steam in a clean saucepan near the fire. It should neither be stirred, except just at first, to prevent its lumping while it is still quite hard, nor touched with either fork or spoon; the stewpan may be shaken occasionally, should the rice seem to require it, and it should be thrown lightly from the cullender upon the dish. A couple of minutes before it is done, throw in some salt, and from the time of its beginning to boil remove the scum as it rises.

Patna rice, 1/2 lb.; cold water, 2 quarts: boiled slowly, 15 minutes. Salt, 1 large teaspoonful.

Obs.—This, of all the modes of boiling rice which we have tried, and they have been very numerous, is indisputably the best. The Carolina rice answers well dressed in the same manner, but requires four or five minutes longer boiling: it should never be served until it is quite tender. One or two minutes, more or less, will sometimes, from the varying quality of the grain, be requisite to render it tender.

GOOD VEGETABLE MULLAGATAWNY.

Dissolve in a large stewpan or thick iron saucepan, four ounces of butter, and when it is on the point of browning, throw in four large mild onions sliced, three pounds weight of young vegetable marrow cut in large dice and cleared from the skin and seeds, four large or six moderate-sized cucumbers, pared, split, and emptied likewise of their seeds, and from three to six large acid apples, according to the taste; shake the pan often, and stew these over a gentle fire until they are tolerably tender; then strew lightly over and mix well amongst them, three heaped tablespoonsful of mild currie powder, with nearly a third as much of salt, and let the vegetables stew from twenty to thirty minutes longer; then pour to them gradually sufficient boiling water (broth or stock if preferred) to just cover them, and when they are reduced almost to a pulp press the whole through a hair-sieve with a wooden spoon, and heat it in a clean stewpan, with as much additional liquid as will make two quarts with that which was first added. Give any flavouring that may be needed, whether of salt, cayenne, or acid, and serve the soup extremely hot. Should any butter appear on the surface, let it be carefully skimmed off, or stir in a small dessertspoonful of arrow-root (smoothly mixed with a little cold broth or water) to absorb it. Rice may be served with this soup at pleasure, but as it is of the consistence of winter peas soup, it scarcely requires any addition. The currie powder may be altogether omitted for variety, and the whole converted into a plain vegetable _potage_; or it may be rendered one of high savour, by browning all the vegetables lightly, and adding to them rich brown stock. Tomatas, when in season, may be substituted for the apples, after being divided, and freed from their seeds.

Butter, 4 oz.; vegetable marrow, pared and scooped, 3 lbs.; large mild onions, 4; large cucumbers, 4; or middling-sized, 6; apples, or large tomatas, 3 to 6; 30 to 40 minutes. Mild currie-powder, 3 heaped tablespoonsful; salt, one small tablespoonful 20 to 32 minutes. Water, broth, or good stock, 2 quarts.

CUCUMBER SOUP.

Pare, split, and empty from eight to twenty[38] fine, well grown, but not old cucumbers,—those which have the fewest seeds are best for the purpose; throw a little salt over them, and leave them for an hour to drain, then put them with the white part only of a couple of mild onions into a deep stewpan or delicately clean saucepan, cover them nearly half an inch with pale but good veal stock, and stew them gently until they are perfectly tender, which will be in from three quarters of an hour to an hour and a quarter; work the whole through a hair-sieve, and add to it as much more stock as may be needed to make the quantity of soup required for

table; and as the cucumbers, from their watery nature, will thicken it but little, stir to it when it boils, as much arrow-root, rice-flour, or _tous les mois_ (see page 1), as will bring it to a good consistence; add from half to a whole pint of boiling cream, and serve the soup immediately. Salt and cayenne sufficient to season it, should be thrown over the cucumbers while they are stewing. The yolks of six or eight eggs, mixed with a dessertspoonful of chili vinegar, may be used for this soup instead of cream; three dessertspoonsful of minced parsley may then be strewed into it a couple of minutes before they are added: it must not, of course, be allowed to boil after they are stirred in.

Footnote 38:

This is a great disparity of numbers; but some regard must be had to expense, where the vegetable cannot be obtained with facility.

SPRING SOUP AND SOUP À LA JULIENNE.

Throw into three quarts of strong clear broth, or shin of beef stock, or of _consommé_, half a pint each of turnips and carrots prepared by the directions of page 20, or turned into any other shape that may be preferred, with rather less of the solid part of some white celery stems, and of leeks or of very mild onions[39] mixed. The latter must, if used, be sliced, drawn into rings, and divided into slight shreds. When these have simmered from twenty to thirty minutes, add the leaves of one or two lettuces and a few of sorrel, trimmed or torn, about the size of half-a-crown. Continue the gentle boiling until these are tender, and add at the moment of serving half a pint of asparagus-points boiled very green, and as many French beans cut into small lozenges, and also boiled apart; or substitute green peas for these last.

Footnote 39:

Only a very _subdued_ flavour of these is, we think, admissible for a delicate vegetable soup of any kind.

For the _Julienne_ soup, first stew the carrots, &c. tolerably tender in a couple of ounces of butter; pour the stock boiling to them; skim off all the fat from the surface, and finish as above. Sprigs of chervil, spinach (boiled apart, and sparingly added), green onions, very small tufts of brocoli or cauliflower, may all be used in these soups at choice. Both the kind and the proportion of the vegetables can be regulated entirely by the taste. Bread stamped out with a _very small_ round cutter, and dried a pale brown in the oven, is added sometimes to this spring soup, but is, we should say, no improvement. Winter vegetables should have three or four minutes' previous boiling (or blanching) before they are put into the soup.

AN EXCELLENT GREEN PEAS SOUP.

Take at their fullest size, but before they are of bad colour or worm-eaten, three pints of fine large peas, and boil them as for table (see Chapter XVII.) with half a teaspoonful of carbonate of soda in the water, that they may be very green. When they are quite tender, drain them well, and put them into a couple of quarts of boiling, pale, but _good_ beef or veal stock, and stew them in it gently for half an hour; then work the whole through a fine hair-sieve, put it into a clean pan and bring it to the point of boiling; add salt, should it be needed, and a small teaspoonful of pounded sugar; clear off the scum entirely, and serve the soup as hot as possible. An elegant variety of it is made by adding a half pint more of stock to the peas, and about three quarters of a pint of asparagus points, boiled apart, and well drained before they are thrown into it, which should be done only the instant before it is sent to table.

Green peas, 3 pints: boiled 25 to 30 minutes, or more. Veal or beef stock, 2 quarts (with peas): 1/2 an hour. Sugar, one small teaspoonful; salt, if needed.

Obs.—When there is no stock at hand, four or five pounds of shin of beef boiled slowly down with three quarts of water to two, and well seasoned with savoury herbs, young carrots, and onions, will serve instead quite well. A thick slice of lean, undressed ham, or of Jewish beef, would improve it.

Should a common English peas soup be wished for, make it somewhat thinner than the one above, and add to it, just before it is dished, from half to three quarters of a pint of young peas boiled tender and well drained.

GREEN PEAS SOUP, WITHOUT MEAT.

Boil tender in three quarts of water, with the proportions of salt and soda directed for them in Chapter XVII., one quart of large, full grown peas; drain and pound them in a mortar, mix with them gradually five pints of the liquor in which they were cooked, put the

whole again over the fire, and stew it gently for a quarter of an hour; then press it through a hair-sieve. In the mean time, simmer in from three to four ounces of butter,[40] three large, or four small cucumbers pared and sliced, the hearts of three or four lettuces shred small, from one to four onions, according to the taste, cut thin, a few small sprigs of parsley, and, when the flavour is liked, a dozen leaves or more of mint roughly chopped: keep these stirred over a gentle fire for nearly or quite an hour, and strew over them a half-teaspoonful of salt, and a good seasoning of white pepper or cayenne. When they are partially done drain them from the butter, put them into the strained stock, and let the whole boil gently until all the butter has been thrown to the surface, and been entirely cleared from it; then throw in from half to three quarters of a pint of young peas boiled as for eating, and serve the soup immediately.

Footnote 40:

Some persons prefer the vegetables slowly fried to a fine brown, then drained on a sieve, and well dried before the fire; but though more savoury so, they do not improve the colour of the soup.

When more convenient, the peas, with a portion of the liquor, may be rubbed through a sieve, instead of being crushed in a mortar; and when the colour of the soup is not so much a consideration as the flavour, they may be slowly stewed until perfectly tender in four ounces of good butter, instead of being boiled: a few green onions, and some branches of parsley may then be added to them.

Green peas, 1 quart; water, 5 pints: cucumbers, 3 to 6; lettuces, 3 or 4; onions, 1 to 4; little parsley; mint (if liked), 12 to 20 leaves; butter, 3 to 4 oz.; salt, half-teaspoonful; seasoning of white pepper or cayenne: 50 to 60 minutes. Young peas, 1/2 to 3/4 of a pint.

Obs.—We must repeat that the peas for these soups must not be _old_, as when they are so, their fine sweet flavour is entirely lost, and the dried ones would have almost as good an effect; nor should they be of inferior kinds. Freshly gathered marrowfats, taken at nearly or quite their full growth, will give the best quality of soup. We are credibly informed, but cannot assert it on our own authority, that it is often made for expensive tables in early spring, with the young tender plants or halms of the peas, when they are about a foot in height. They are cut off close to the ground, like small salad, we are told, then boiled and pressed through a strainer, and mixed with the stock. The flavour is affirmed to be excellent.

A CHEAP GREEN PEAS SOUP.

Wash very clean and throw into an equal quantity of boiling water salted as for peas, three quarts of the shells, and in from twenty to thirty minutes, when they will be quite tender, turn the whole into a large strainer, and press the pods strongly with a wooden spoon. Measure the liquor, put two quarts of it into a clean deep saucepan, and when it boils add to it a quart of full grown peas, two or even three large cucumbers, as many moderate-sized lettuces freed from the coarser leaves and cut small, one large onion (or more if liked) sliced extremely thin and stewed for half an hour in a morsel of butter before it is added to the soup, or gently fried without being allowed to brown; a branch or two of parsley, and, when the flavour is liked, a dozen leaves of mint. Stew these softly for an hour, with the addition of a small teaspoonful, or a larger quantity if required of salt, and a good seasoning of fine white pepper or of cayenne; then work the whole of the vegetables with the soup through a hair-sieve, heat it afresh, and send it to table with a dish of small fried sippets. The colour will not be so bright as that of the more expensive soups which precede it, but it will be excellent in flavour.

Pea-shells, 3 quarts; water, 3 quarts: 20 to 30 minutes. Liquor from these, 2 quarts; full-sized green peas, 1 quart; large cucumbers, 2 or 3; lettuces, 3; onion, 1 (or more); little parsley; mint, 12 leaves; seasoning of salt and pepper or cayenne: stewed 1 hour.

Obs.—The cucumbers should be pared, quartered, and freed from the seeds before they are added to the soup. The peas, as we have said already more than once, should not be _old_, but taken at their full growth, before they lose their colour: the youngest of the shells ought to be selected for the liquor.

RICH PEAS SOUP.

Soak a quart of fine yellow split peas for a night, drain them well, and put them into a large soup-pot with five quarts of good brown gravy stock; and when they have boiled gently for half an hour, add to the soup three onions, as many carrots, and a turnip or two, all sliced and fried carefully in butter; stew the whole softly until the peas are reduced to pulp, then add as much salt and cayenne as may be needed to season it well, give it two or three minutes' boil, and pass it through a sieve, pressing the vegetables with it. Put into a clean saucepan as much as may be required for table, add a little fresh stock to it should it be too thick, and reduce it by quick boiling if too thin; throw in the white part of some fresh celery sliced a quarter of an inch thick, and when this is tender send

the soup quickly to table with a dish of small fried or toasted sippets. A dessertspoonful or more of currie-powder greatly improves peas soup: it should be smoothly mixed with a few spoonsful of it, and poured to the remainder when this first begins to boil after having been strained.

Split peas, 1 quart: soaked one night. Good brown gravy soup, 5 quarts: 30 minutes. Onions and carrots browned in butter, 3 of each; turnips, 2: 2-1/2 to 3-1/2 hours. Cayenne and salt as needed. Soup, 5 pints; celery, sliced, 1 large or 2 small heads: 20 minutes.

Obs.—When more convenient, six pounds of neck of beef well scored and equally and carefully browned, may be boiled gently with the peas and fried vegetables in a gallon of water (which should be poured to them boiling) for four or five hours.

COMMON PEAS SOUP.

Wash well a quart of good split peas, and float off such as remain on the surface of the water; soak them for one night, and boil them with a bit of soda the size of a filbert in just sufficient water to allow them to break to a mash. Put them into from three to four quarts of good beef broth, and stew them in it gently for an hour; then work the whole through a sieve, heat afresh as much as may be required for table, season it with salt and cayenne or common pepper, clear it perfectly from scum, and send it to table with fried or toasted bread. Celery sliced and stewed in it as directed for the rich peas soup, will be found a great improvement to this.

Peas, 1 quart: soaked 1 night; boiled in 2 quarts or rather more of water, 2 to 2-1/2 hours. Beef broth, 3 to 4 quarts: 1 hour. Salt and cayenne or pepper as needed: 3 minutes.

PEAS SOUP WITHOUT MEAT.

To a pint of peas, freed from all that are worm-eaten, and well washed, put five pints of cold water, and boil them tolerably tender; then add a couple of onions (more or less according to the taste), a couple of fine carrots grated, one large or two moderate-sized turnips sliced, all gently fried brown in butter; half a teaspoonful of black pepper, and three times as much of salt. Stew these softly, keeping them often stirred, until the vegetables are sufficiently tender to pass through a sieve; then rub the whole through one, put it into a clean pan, and when it boils throw in a sliced head of celery, heighten the seasoning if needful, and in twenty minutes serve the soup as hot as possible, with a dish of fried or toasted bread cut into dice. A little chili vinegar can be added when liked: a larger proportion of vegetables also may be boiled down with the peas at pleasure. Weak broth, or the liquor in which a joint has been boiled, can be substituted for the water; but the soup is very palatable as we have given the receipt for it. Some persons like it flavoured with a little mushroom catsup. All peas soup is rendered more wholesome by the addition of a small quantity of currie-paste or powder.

Split peas, 1 pint; water, 5 pints: 2 hours or more. Onions, 2; carrots, 2; large turnip, 1; pepper, 1/2 teaspoonful; salt, 1-1/2 teaspoonful: 1 to 1-1/2 hour. Celery, 1 head: 20 minutes.

OX-TAIL SOUP.

An inexpensive and very nutritious soup may be made of ox-tails, but it will be insipid in flavour without the addition of a little ham, knuckle of bacon, or a pound or two of other meat. Wash and soak three tails, pour on them a gallon of cold water, let them be brought gradually to boil, throw in an ounce and a half of salt, and clear off the scum carefully as soon as it forms upon the surface; when it ceases to rise, add four moderate-sized carrots, from two to four onions, according to the taste, a large faggot of savoury herbs, a head of celery, a couple of turnips, six or eight cloves, and a half-teaspoonful of peppercorns. Stew these gently from three hours to three and a half, if the tails be very large; lift them out, strain the liquor, and skim off all the fat; divide the tails into joints, and put them into a couple of quarts or rather more of the stock; stir in, when these begin to boil, a thickening of arrow-root or of rice flour (see page 4), mixed with as much cayenne and salt as may be required to flavour the soup well, and serve it very hot. If stewed down until the flesh falls away from the bones, the ox-tails will make stock which will be quite a firm jelly when cold; and this, strained, thickened, and well flavoured with spices, catsup, or a little wine, would, to many tastes, be a superior soup to the above. A richer one still may be made by pouring good beef broth instead of water to the meat in the first instance.

Ox-tails, 3; water, 1 gallon; salt, 1-1/2 oz.; carrots, 4; onions, 2 to 4; turnips, 2; celery, 1 head; cloves, 8; peppercorns, 1/2 teaspoonful; faggot of savoury herbs: 3 hours to 3-1/2. For a richer soup, 5 to 6 hours. (Ham or gammon of bacon at pleasure, with other flavourings.)

Obs.—To increase the savour of this soup when the meat is not served in it, the onions, turnips, and carrots may be gently fried until of a fine light brown, before they are added to it.

A CHEAP AND GOOD STEW SOUP.

Put from four to five pounds of the gristly part of the shin of beef into three quarts of cold water, and stew it very softly indeed, with the addition of the salt and vegetables directed for _bouillon_ (see page 7), until the whole is very tender; lift out the meat, strain the liquor, and put it into a large clean saucepan, add a thickening of rice-flour or arrow-root, pepper and salt if needed, and a tablespoonful of mushroom catsup. In the mean time, cut all the meat into small, thick slices, add it to the soup, and serve it as soon as it is very hot. The thickening and catsup may be omitted, and all the vegetables, pressed through a strainer, may be stirred into the soup instead, before the meat is put back into it.

SOUP IN HASTE.

Chop tolerably fine a pound of lean beef, mutton, or veal, and when it is partly done, add to it a small carrot and one small turnip cut in slices, half an ounce of celery, the white part of a moderate-sized leek, or a quarter of an ounce of onion. Mince all these together, and put the whole into a deep saucepan with three pints of cold water. When the soup boils take off the scum, and add a little salt and pepper. In half an hour it will be ready to serve with or without straining: it may be flavoured at will, with cayenne, catsup, or aught else that is preferred, or it may be converted into French spring broth, by passing it through a sieve, and boiling it again for five or six minutes, with a handful of young and well washed sorrel. Meat, 1 lb.; carrot, 2 oz.; turnip, 1-1/2 oz.; celery, 1/2 oz.; onion, 1/4 oz. water, 3 pints: half an hour. Little pepper and salt.

Obs.—Three pounds of beef or mutton, with two or three slices of ham, and vegetables in proportion to the above receipt, all chopped fine, and boiled in three quarts of water for an hour and a half, will make an excellent family soup on an emergency: additional boiling will of course improve it, and a little spice should be added after it has been skimmed and salted. It may easily be converted into carrot, turnip, or ground-rice soup after it is strained.

VEAL OR MUTTON BROTH.

To each pound of meat add a quart of cold water, bring it gently to boil, skim it very clean, add salt in the same proportion as for _bouillon_ (see page 7), with spices and vegetables also, unless _unflavoured_ broth be required, when a few peppercorns, a blade or two of mace, and a bunch of savoury herbs, will be sufficient; though for some purposes even these, with the exception of the salt, are better omitted. Simmer the broth for about four hours, unless the quantity be very small, when from two and a half to three, will be sufficient. A little rice boiled down with the meat will both thicken the broth, and render it more nutritious. Strain it off when done, and let it stand till quite cold that the fat may be entirely cleared from it: this is especially needful when it is to be served to an invalid.

Veal or mutton, 4 lbs.; water, 4 quarts; salt. (For vegetables, &c., see page 7;) rice (if used), 4 oz.: 4 hours or more.

MILK SOUP WITH VERMICELLI.

Throw into five pints of boiling milk a small quantity of salt, and then drop lightly into it five ounces of good fresh vermicelli; keep the milk stirred as this is added, to prevent its gathering into lumps, and continue to stir it very frequently from fifteen to twenty minutes, or until it is perfectly tender. The addition of a little pounded sugar and powdered cinnamon renders this a very agreeable dish. In Catholic countries, milk soups of various kinds constantly supply the place of those made with meat, on _maigre_ days; and with us they are sometimes very acceptable, as giving a change of diet for the nursery or sick room. Rice, semoulina, sago, cocoa-nut, and maccaroni may all in turn be used for them as directed for other soups in this chapter, but they will be required in rather smaller proportions with the milk.

Milk, 5 pints; vermicelli, 5 oz.: 15 to 20 minutes.

CHEAP RICE SOUP.

Place a gallon of water on the fire (more or less according to the quantity of soup required), and when it boils, throw in a moderate-sized tablespoonful of salt, and two or three onions, thickly sliced, a faggot of sweet herbs, a root of celery, and three or four large carrots split down into many divisions, and cut into short lengths. Boil these gently for an hour and a half, or two hours,

and then strain the liquor from them. When time will permit, let it become cold; then for each quart, take from three to four ounces of well washed rice, pour the soup on it, heat it _very_ slowly, giving it an occasional stir, and stew it gently until it is perfectly tender, and the potage quite thick. A moderate seasoning of pepper, and an ounce or two of fresh butter well blended with a teaspoonful of flour, may be thoroughly stirred up with the soup before it is served; or, in lieu of the butter, the yolks of two or three new-laid eggs, mixed with a little milk, may be carefully added to it.

It may be more quickly prepared by substituting vermicelli, semoulina, or soujee for the rice, as this last will require three quarters of an hour or more of stewing after it begins to boil, and the three other ingredients—either of which must be dropped gradually into the soup when it is in full ebullition—will be done in from twenty to thirty minutes; and two ounces will thicken sufficiently a quart of broth.

A large tablespoonful of Captain White's currie-paste, and a small one of flour, diluted with a spoonful or twos of the broth, or with a little milk or cream, if perfectly mixed with the rice and stewed with it for fifteen or twenty minutes before it is dished, render it excellent: few eaters would discover that it was made without meat.

Good beef or mutton broth can be used instead of water for the above soup, and in that case the vegetables sliced small, or rubbed through a strainer, may be added to it before it is served.

CARROT SOUP MAIGRE.

Throw two ounces of salt into a gallon of boiling water, then add three or four carrots quartered or thickly sliced, one onion or more according to the taste, and a faggot of parsley, or some parsley roots. When these have boiled gently for upwards of an hour, strain off the liquor and put it back into the saucepan. Have ready more carrots, nicely scraped and washed; split them down into strips about the size of large macaroni and cut them into half finger lengths. Two quarts of these will not be too much for persons who like the soup well filled with the vegetable; boil them perfectly tender, and turn them with their liquor into the tureen, first adding pepper sufficient to season it properly, and more salt if needed. The proportion of carrots may be diminished, and a quart or more of Brussels sprouts, boiled and drained, may be substituted for part of them. Some persons have these soups thickened, or enriched as they think, with flour and butter; but the latter ingredient should at least be sparingly used; and any other kind of thickening is more wholesome. A few ounces of vermicelli stewed in them for twenty minutes or rather longer, will be found a very good one. Celery, leeks, and turnips may be boiled down in the carrot-stock, or added when the fresh vegetables have been stewed in it for about ten minutes.

CHEAP FISH SOUPS.

An infinite variety of excellent soups may be made of fish, which may be stewed down for them in precisely the same manner as meat, and with the same addition of vegetables and herbs. When the skin is coarse or rank it should be carefully stripped off before the fish is used; and any oily particles which may float on the surface should be entirely removed from it.

In France, Jersey, Cornwall, and many other localities, the conger eel, divested of its skin, is sliced up into thick cutlets and made into soup, which we are assured by English families who have it often served at their tables, is extremely good. A half-grown fish is best for the purpose. After the soup has been strained and allowed to settle, it must be heated afresh, and rice and minced parsley may be added to it as for the turkey soup of page 32; or it may be thickened with rice-flour only, or served clear. Curried fish-soups, too, are much to be recommended.

When broth or stock has been made as above with conger eel, common eels, whitings, haddocks, codlings, fresh water fish, or any common kind, which may be at hand, flakes of cold salmon, cod fish, John Dories, or scallops of cold soles, plaice,[41] &c., may be heated and served in it; and the remains of crabs or lobsters mingled with them. The large oysters sold at so cheap a rate upon the coast, and which are not much esteemed for eating raw, serve admirably for imparting flavour to soup, and the softer portions of them may be served in it after a few minutes of gentle simmering. Anchovy or any other store fish-sauce may be added with good effect to many of these pottages if used with moderation. Prawns and shrimps likewise would generally be considered an improvement to them.

Footnote 41:

Some persons prefer the vegetables slowly fried to a fine brown, then drained on a sieve, and well dried before the fire; but though more savoury so, they do not improve the colour of the soup.

For more savoury preparations, fry the fish and vegetables, lay them into the soup-pot, and add boiling, instead of cold water to them.

BUCHANAN CARROT SOUP.

(_Excellent._)

Make two quarts of soup by either of the foregoing receipts, using for it good brown stock (for a common family dinner strong beef broth will do). Mix smoothly with a little liquid, a tablespoonful of fine currie-powder, and boil it in the soup for ten minutes; or instead of this, season it rather highly with cayenne pepper, and then stir into it from six ounces to half a pound of Patna rice boiled dry and tender as for a currie. The whole may then remain by the side of the fire without even simmering for ten minutes longer, and then be served immediately. As a winter _potage_ this is generally much liked. A spoonful of _Captain White's_ currie-paste will flavour it very agreeably if smoothly diluted, and simmered in it for two or three minutes: we prefer it always to the powder. Three or four ounces of pearl-barley well washed, soaked for some hours, and boiled extremely tender in broth or water, may on occasion be substituted for the rice.

Obs.—This receipt was, from inadvertence, omitted at its proper place, page 20, where it ought to have been inserted after the carrot soups which will be found there, and to which the reader is referred for the method of preparing the present one in part.

OBSERVATION.

The present chapter already so far exceeds the limits within which it ought to have been confined, that we are obliged to reserve several additions which we were desirous of making to it, for the chance of being able to insert them in an appendix.

CHAPTER II.

=Fish.=

[Illustration:

TO CHOOSE FISH.]

[Illustration:

Copper Fish or Ham Kettle.]

The cook should be well acquainted with the signs of freshness and good condition in fish, as they are most unwholesome articles of food when stale, and many of them are also dangerous eating when they are out of season. The eyes should always be bright, the gills of a fine clear red, the body stiff, the flesh firm, yet elastic to the touch, and the smell not disagreeable.

When all these marks are reversed, and the eyes are sunken, the gills very dark in hue, the fish itself flabby and of offensive odour, it is bad, and should be avoided. The chloride of soda, will, it is true, restore it to a tolerably eatable state,[42] if it be not very much over-kept, but it will never resemble in quality and wholesomeness fish which is fresh from the water.

Footnote 42:

We have known this applied very successfully to salmon which from some hours' keeping in sultry weather had acquired a slight degree of taint, of which no trace remained after it was dressed; as a general rule, however, fish which is not _wholesomely fresh_ should be rejected for the table.

[Illustration:

Mackerel Kettle.]

A good turbot is thick, and full fleshed, and the under side is of a pale cream colour or yellowish white; when this is of a bluish tint, and the fish is thin and soft, it should be rejected. The same observations apply equally to soles.

The best salmon and cod fish are known by a small head, very thick shoulders, and a small tail; the scales of the former should be bright, and its flesh of a fine red colour; to be eaten in perfection it should be dressed as soon as it is caught, before the curd (or white substance which lies between the flakes of flesh) has melted and rendered the fish oily. In that state it is really crimp, but continues so only for a very few hours; and it bears therefore a much higher price in the London market then, than when mellowed by having been kept a day or two.

The flesh of cod fish should be white and clear before it is boiled, whiter still after it is boiled, and firm though tender, sweet and mild in flavour, and separated easily into large flakes. Many persons consider it rather improved than otherwise by having a little salt rubbed along the inside of the back-bone and letting it lie from twenty-four to forty-eight hours before it is dressed,. It is sometimes served crimp like salmon, and must then be sliced as soon as it is dead, or within the shortest possible time afterwards.

Herrings, mackerel, and whitings, unless newly caught, are quite uneatable. When they are in good condition their natural colours will be very distinct and their whole appearance glossy and fresh. The herring when first taken from the water is of a silvery brightness; the back of the mackerel is of a bright green marked with dark stripes; but this becomes of a coppery colour as the fish grows stale. The whiting is of a pale brown or fawn colour with a pinkish tint; but appears dim and leaden-hued when no longer fresh.

Eels should be alive and brisk in movement when they are purchased, but the “horrid barbarity,” as it is truly designated, of skinning and dividing them while they are so, is without excuse, as they are easily destroyed “by piercing the spinal marrow close to the back part of the skull with a sharp pointed knife or skewer. If this be done in the right place all motion will instantly cease.” We quote Dr. Kitchener’s assertion on this subject; but we know that the mode of destruction which he recommends is commonly practised by the London fishmongers. Boiling water also will immediately cause vitality to cease, and is perhaps the most humane and ready method of destroying the fish.

Lobsters, prawns, and shrimps, are very stiff when freshly boiled, and the tails turn strongly inwards; when these relax, and the fish are soft and watery, they are stale; and the smell will detect their being so, instantly, even if no other symptoms of it be remarked. If bought alive, lobsters should be chosen by their weight and “liveliness.” The hen lobster is preferred for sauce and soups, on account of the coral; but the flesh of the male is generally considered of finer flavour for eating. The vivacity of their leaps will show when prawns and shrimps are fresh from the sea.

Oysters should close forcibly on the knife when they are opened: if the shells are apart ever so little they are losing their condition, and when they remain far open the fish are dead, and fit only to be thrown away. Small plump natives are very preferable to the larger and coarser kinds.

TO CLEAN FISH.

Let this be always done with the most scrupulous nicety, for nothing can more effectually destroy the appetite, or disgrace the cook, than fish sent to table imperfectly cleaned. Handle it lightly, and never throw it roughly about, so as to bruise it; wash it well, but do not leave it longer in the water than is necessary; for fish, like meat, loses its flavour from being soaked. When the scales are to be removed, lay the fish flat upon its side and hold it firmly with the left hand, while they are scraped off with the right; turn it, and when both sides are done, pour or pump sufficient water to float off all the loose scales; then proceed to empty it; _and do this without opening it more than is absolutely necessary for the purposes of cleanliness_. Be sure that not the slightest particle of offensive matter be left in the inside; wash out the blood entirely, and scrape or brush it away if needful from the back-bone. This may easily be accomplished without opening the fish so much as to render it unsightly when it is sent to table. When the scales are left on, the outside of the fish should be well washed and wiped with a coarse cloth, drawn gently from the head to the tail. Eels to be wholesome should be skinned, but they are sometimes dressed without; boiling water should then be poured upon them, and they should be left in it from five to ten minutes before they are cut up. The dark skin of the sole must be stripped off when it is fried, but it should be left on it like that of a turbot when the fish is boiled, and it should be dished with the white side upwards. Whitings are skinned before they are egged and crumbed for frying, but for boiling or broiling, the skin is left on them. The gills of all fish (the red mullet sometimes excepted), must be taken out. _The fins of a turbot_, _which are considered a great delicacy, should be left untouched_; but those of most other fish must be cut off.

TO KEEP FISH.

We find that all the smaller kinds of fish keep best if emptied and cleaned as soon as they are brought in, then wiped gently as dry as they can be, and hung separately by the head on the hooks in the ceiling of a cool larder, or in the open air when the weather will allow. When there is danger of their being attacked by flies, a wire safe, placed in a strong draught of air, is better adapted to the purpose. Soles in winter will remain good for two days when thus prepared; and even whitings and mackerel may be kept so without losing any of their excellence. Salt may be rubbed slightly over cod fish, and well along the back-bone; but it injures the flavour of salmon, the inside of which may be rubbed with vinegar and peppered instead. When excessive sultriness renders all of these modes unavailing, the fish must at once be partially cooked to preserve it, but this should be avoided if possible, as it is very rarely so good when this method is resorted to.

TO SWEETEN TAINTED FISH.

The application of strong vinegar, or of acetic acid (which may be purchased at the chemists'), will effect this when the taint is but slight. The vinegar should be used pure; and one wineglassful of the acid should be mixed with two of water. Pour either of these over the fish, and rub it on the parts which require it; then leave it untouched for a few minutes, and wash it afterwards well, changing the water two or three times. When the fish is in a worse state the chloride of soda, from its powerful anti-putrescent properties, will have more effect: it may be diluted, and applied in the same manner as the acid.

Obs.—We have retained here the substance of the directions which we had given in former editions of this book for _rendering eatable_ fish (and meat) tainted by being closely packed or overkept; and it is true that they may be deprived of their offensive flavour and odour by the application of strong acids and other disinfecting agents,—Beaufoy's chloride of soda more especially—but we are very doubtful whether they can by any process be converted into _unquestionably wholesome_ food, unless from some accidental circumstance the mere surface should be affected, or some small portion of them, which could be entirely cut away. We cannot, therefore, conscientiously recommend the _false economy_ of endangering health in preference to rejecting them for the table altogether.

THE MODE OF COOKING BEST ADAPTED TO DIFFERENT KINDS OF FISH.

It is not possible, the reader will easily believe, to insert in a work of the size of the present volume, all the modes of dressing the many varieties of fish which are suited to our tables; we give, therefore, only the more essential receipts in detail, and add to them such general information as may, we trust, enable even a moderately intelligent cook to serve all that may usually be required, without difficulty.

There is no better way of dressing a good turbot, brill, John Dory, or cod's head and shoulders, than plain but careful boiling. Salmon is excellent in almost every mode in which it can be cooked or used. Boiled entire or in crimped slices; roasted in a cradle-spit or Dutch oven; baked; fried in small collops; collared; potted; dried and smoked; pickled or soused (this is the coarsest and least to be recommended process for it, of any); made into a raised or common pie, or a potato-pasty; served cold in or with savoury jelly, or with a _Mayonnaise_ sauce; or laid on potatoes and baked, as in Ireland, it will be found Good.

Soles may be either boiled, or baked, or fried entire, or in fillets; curried; stewed in cream; or prepared by any of the directions given for them in the body of this chapter.

Plaice, unless when in full season and very fresh, is apt to be watery and insipid; but taken in its perfection and carefully cooked, it is very sweet and delicate in flavour. If large, it may be boiled with advantage either whole or in fillets; but to many tastes it is very superior when filleted, dipped into egg and bread-crumbs, and fried. The flesh may also be curried; or the plaice may be converted into water-souchy, or _soupe-maigre_: when small it is often fried whole.

Red mullet should always be _baked_, _broiled_, or _roasted_: it should on no occasion be boiled.

Mackerel, for which many receipts will be found in this chapter, when broiled _quite whole_, as we have directed, or freed from the bones, divided, egged, crumbed, and fried, is infinitely superior to the same fish cooked in the ordinary manner.

The whiting, when _very_ fresh and in season, is always delicate and good; and of all fish is considered the best suited to invalids. Perhaps _quite_ the most wholesome mode of preparing it for them, is to open it as little as possible when it is cleansed, to leave the skin on, to dry the fish well, and to broil it gently. It should be sent very hot to table, and will require no sauce: twenty minutes will usually be required to cook it, if of moderate size.

The haddock is sometimes very large. We have had it occasionally from our southern coast between two and three feet in length, and it was then remarkably good when simply boiled, even the day after it was caught, the white curd between the flakes of flesh being like that of extremely fresh salmon. As it is in full season in mid-winter, it can be sent to a distance without injury. It is a _very_ firm fish when large and in season; but, as purchased commonly at inland markets, is often neither fine in size nor quality. _One_ of the best modes of cooking it is, to take the flesh entire from the bones, to divide it, dip it into egg and bread-crumbs, mixed with savoury herbs finely minced, and a seasoning of salt and spice, and to fry it like soles. Other receipts for it will be found in the body of this chapter.

The flesh of the gurnard is exceedingly dry, and somewhat _over firm_, but when filled with well-made forcemeat and gently baked, it is much liked by many persons. At good tables, it is often served in fillets fried or baked, and richly sauced: in common cookery it is sometimes boiled.

Portions only of the skate, which is frequently of _enormous_ size, are used as food: these are in general cut out by the fisherman or by the salesman, and are called the wings. The flesh is commonly served here divided into long narrow fillets, called crimped skate, which are rolled up and fastened, to preserve them in that form, while they are cooked. In France, it is sent to table raised from the bones in large portions, sauced with _beurre-noir_ (burned or browned butter), and strewed with well-crisped parsley.

Trout, which is a delicious fish when stewed in gravy, either quite simply, or with the addition of wine and various condiments, and which when of small size is very sweet and pleasant, eating nicely fried, is poor and insipid when plainly boiled.[43]

Footnote 43:

We have been informed by Mr. Howitt, the well-known author of several highly interesting works on Germany, that this fish, when boiled the instant it was caught—as he had eaten it often on the banks of some celebrated German trout-streams—was most excellent, especially when it was of large size; but, as a general rule, almost any other mode of cooking is to be recommended for it in preference.

Pike, of which the flesh is extremely dry, is we think better baked than dressed in any other way; but it is often boiled.

Carp should either be stewed whole in the same manner as trout, or served cut in slices, in a rich sauce called a _matelote_.

Smelts, sand-eels, and white-bait, are always fried; the last two sometimes after being dipped into batter.

THE BEST MODE OF BOILING FISH.

We have left unaltered in the following receipts the greater number of our original directions for boiling fish, which were found when carefully followed, to produce a good result; but Baron Liebeg and other scientific writers explain clearly the principles on which the nutriment contained in fish or flesh is best retained by bringing the surface of either when it is cooked, into immediate contact with _boiling_ water; and then (after a few minutes of ebullition) lowering the temperature by the addition of cold water, and keeping it somewhat below the boiling point for the remainder of the process. This method is at least worthy of a trial, even if it be attended with a slight degree more of trouble than those in general use; but when fish is served with a variety of other dishes, the escape of some portion of its nutritious juices is of less importance than when it forms the principal food of any part of the community: in that case, the preservation of all the nourishment which can be derived from it, is of real consequence.

Directions.—Throw into as much water as will cover the fish entirely, a portion of the salt which is to be added in cooking it, and when it boils quickly take off the scum, lay in the fish, and let it boil moderately fast from three to ten minutes, according to its weight and thickness; then pour in as much cold water as there is of the boiling, take out a part, leaving sufficient only to keep the fish well covered until it is ready to serve; add the remainder of the salt, draw the fish-kettle to the side of the fire, and keep the water _just simmering_, and no more, until the fish is done.

The cook will understand that if a gallon of water be required to cover the fish while it is cooking, that quantity must be made to boil; and that a gallon of cold must be added to it after the fish has been laid in, and _kept boiling_ for a very few minutes. For example:—A large turbot or cod’s head for ten minutes; a moderate-sized plaice or John Dory, about five; and whitings, codlings, and other small fish, from three to four minutes. That one gallon must then be taken out of the kettle, which should immediately be drawn from the fire, and placed at the side of the stove, that the fish may be gradually heated through as the water is brought slowly to the point of simmering.

The whole of the salt may be added after a portion of the water is withdrawn, when the cook cannot entirely depend on her own judgment for the precise quantity required.

Obs.—This is the best _practical_ application that we can give of Baron Liebeg's instructions.

BRINE FOR BOILING FISH.

Fish is exceedingly insipid if sufficient salt be not mixed with the water in which it is boiled, but the precise quantity required for it will depend, in some measure, upon the kind of salt which is used. Fine common salt is that for which our directions are given; but when the Maldon salt, which is very superior in strength, as well as in other qualities, is substituted for it, a smaller quantity must be allowed. About four ounces to the gallon of water will be sufficient for small fish in general; an additional ounce, or rather more, will not be too much for cod fish, lobsters, crabs, prawns, and shrimps; and salmon will require eight ounces, as the brine for this fish should be strong: the water should always be perfectly well skimmed from the moment the scum begins to form upon the surface.

Mackerel, whiting, and other small fish, 4 ounces of salt to a gallon of water. Cod fish, lobsters, crabs, prawns, shrimps, 5 to 6 oz. Salmon, 8 ozs.

TO RENDER BOILED FISH FIRM.

Put a small bit of saltpetre with the salt into the water in which it is boiled: a quarter of an ounce will be sufficient for a gallon.

TO KNOW WHEN FISH IS SUFFICIENTLY BOILED, OR OTHERWISE COOKED.

If the _thickest_ part of the flesh separates easily from the back-bone, it is quite ready to serve, and should be withdrawn from the pan without delay, as further cooking would be injurious to it. This test can easily be applied to a fish which has been divided, but when it is entire it should be lifted from the water when the flesh of the tail breaks from the bone, and the eyes loosen from the head.

TO BAKE FISH.

A gentle oven may be used with advantage, for cooking almost every kind of fish, as we have ascertained from our own observation; but it must be subjected to a mild degree of heat only. This penetrates the flesh gradually, and converts it into wholesome succulent food; whereas, a _hot oven_ evaporates all the juices rapidly, and renders the fish hard and dry. When small, they should be wrapped in oiled or buttered paper before they are baked; and when filleted, or left in any other form, and placed in a deep dish with or without any liquid before they are put into the oven, a buttered paper should still be laid closely upon them to keep the surface moist. Large pieces of salmon, conger eel, and other fish of considerable size are sometimes in common cookery baked like meat over potatoes pared and halved.

FAT FOR FRYING FISH.

This, whether it be butter, lard, or oil should always be excellent in quality, for the finest fish will be rendered unfit for eating if it be fried in fat that is rancid. When good, and used in sufficient quantity, it will serve for the same purpose several times, if strained after each frying, and put carefully away in a clean pan, provided always that it has not been smoked nor burned in the using.

Lard renders fish more crisp than butter does; but fresh, pure olive-oil (_salad oil_, as it is commonly called in England) is the _best_ ingredient which can be used for it, and as it will serve well for the same purpose, many times in succession, if strained and carefully stored as we have already stated, it is not in reality so expensive as might be supposed for this mode of cooking. There should always be an ample quantity of it (or of any other _friture_[44]) in the pan, as the fish should be nearly covered with it, at the least; and it should cease to bubble before either fish or meat is laid into it, or it will be too much absorbed by the flesh, and will impart neither sufficient firmness, nor sufficient colour.

Footnote 44:

The French term for fat of all kinds used in frying.

TO KEEP FISH HOT FOR TABLE.

Never leave it in the water after it is done, but if it cannot be sent to table as soon as it is ready to serve, lift it out, lay the fish-plate into a large and a very hot dish, and set it across the fish-kettle; just dip a clean cloth into the boiling water, and spread it upon the fish, place a tin cover over it, and let it remain so until two or three minutes before it is wanted, then remove the cloth, and put the fish back into the kettle for an instant that it may be as hot as possible: drain, dish, and serve it immediately: the water should be kept boiling the whole time.

TO BOIL A TURBOT.

[In season all the year.]

[Illustration:

Turbot.]

A fine turbot, in full season, and well served, is one of the most delicate and delicious fish that can be sent to table; but it is generally an expensive dish, and its excellence so much depends on the manner in which it is dressed, that great care should be taken to prepare it properly. After it is emptied, wash the inside until it is perfectly cleansed, and rub _lightly_ a little fine salt over the outside, as this will render less washing and handling necessary, by at once taking off the slime; change the water several times, and when the fish is as clean as it is possible to render it, draw a sharp knife through the thickest part of the middle of the back nearly through to the bone.[45] _Never cut off the fins_ of a turbot when preparing it for table, and remember that it is the dark side of the fish in which the incision is to be made, to prevent the skin of the white side from cracking. Dissolve in a well-cleaned turbot or common fish-kettle, in as much cold spring water as will cover the fish abundantly, salt, in the proportion of four ounces to the gallon; wipe the fish-plate with a clean cloth, lay the turbot upon it with the white side upwards, place it in the kettle, bring it slowly to boil, and clear off the scum _thoroughly_ as it rises. Let the water only just simmer until the fish is done, then lift it out, drain, and slide it gently on to a very hot dish, with a hot napkin neatly arranged over the drainer. Send it immediately to table with rich lobster sauce and good plain melted butter. For a simple dinner, anchovy or shrimp sauce is sometimes served with a small turbot. Should there be any cracks in the skin of the fish, branches of curled parsley may be laid lightly over them, or part of the inside coral of a lobster, rubbed through a fine hair-sieve, may be sprinkled over the fish; but it’s better without either, when it is very white and unbroken. When garnishings are in favour, a slice of lemon and a tuft of curled parsley, may be placed alternately round the edge of the dish. A border of fried smelts or of fillets of soles, was formerly served round a turbot, and is always a very admissible addition, though no longer so fashionable as it was. From fifteen to twenty minutes will boil a moderate-sized fish, and from twenty to thirty a large one; but as the same time will not always be sufficient for a fish of the same weight, the cook must watch it attentively, and lift it out as soon as its appearance denotes its being done.

Footnote 45:

This is the common practice even of the _best_ cooks, but is very unscientific nevertheless. When the incision is made really into the flesh the turbot should be cooked altogether on Liebeg’s plan, for which see “The Best Mode of Boiling Fish,” in the preceding pages.

Moderate sized turbot, 15 to 20 minutes. Large, 20 to 30 minutes. Longer, if of unusual size.

Obs.—A lemon gently squeezed, and rubbed over the fish, is thought to preserve its whiteness. Some good cooks still put turbot into _boiling_ water, and to prevent its breaking, tie it with a cloth tightly to the fish-plate.

TURBOT À LA CRÊME.

Raise carefully from the bones the flesh of a cold turbot, and clear it from the dark skin; cut it into small squares, and put it into an exceedingly clean stewpan or saucepan; then make and pour upon it the cream sauce of Chapter V., or make as much as may be required for the fish by the same receipt, with equal proportions of milk and cream and a little additional flour. Heat the turbot slowly in the sauce, but do not allow it to boil, and send it very hot to table. The white skin of the fish is not usually added to this dish, and it is of better appearance without it; but for a family dinner, it may be left on the flesh, when it is much liked. No acid must be stirred to the sauce until the whole is ready for table.

TURBOT AU BÉCHAMEL, OR, IN BÉCHAMEL SAUCE.

Prepare the cold turbot as for the preceding receipt, but leave no portion of the skin with it. Heat it in a rich _bechamel_ sauce, and serve it in a _vol-au-vent_, or in a deep dish with a border of fried bread cut in an elegant form, and made with one dark and one light sippet, placed alternately. The surface may be covered with a half-inch layer of delicately fried bread-crumbs, perfectly well drained and dried; or they may be spread over the fish without being fried, then moistened with clarified butter, and browned with a salamander.

FOR MOULD OF COLD TURBOT WITH SHRIMP CHATNEY, see Chapter VI.

TO BOIL A JOHN DORY.

[In best season from Michaelmas to Christmas, but good all the year.]

[Illustration:

John Dory.]

The John Dory, though of uninviting appearance, is considered by some persons as the most delicious fish that appears at table; in the general estimation, however, it ranks next to the turbot, but it is far less abundant in our markets, and is not commonly to be procured of sufficient size for a handsome dish, except in some few parts of our coast which are celebrated for it. It may easily be known by its yellow gray colour, its one large dark spot on either side, the long filaments on the back, a general thickness of form, and its very ugly head. It is dressed in the same manner, and served usually with the same sauces as a turbot, but requires less time to boil it. The fins should be cut off before it is cooked.

SMALL JOHN DORIES BAKED.

(_Author's Receipt—good._)

We have found these fish when they were too small to be worth cooking in the usual way, excellent when quite simply baked in the following manner, the flesh being remarkably sweet and tender, much more so than it becomes by frying or broiling. After they have been cleaned, dry them in a cloth, season the insides slightly with fine salt, dredge a little flour on the fish, and stick a few very small bits of butter on them, but only just sufficient to prevent their becoming dry in the oven; lay them singly on a flat dish, and bake them very gently from fourteen to sixteen minutes. Serve them with the same sauce as baked soles.

When extremely fresh, as it usually is in the markets of the coast, fish thus simply dressed _au four_ is preferable to that more elaborately prepared by adding various condiments to it after it is placed in a deep dish, and covering it with a thick layer of bread-crumbs, moistened with clarified butter.

The appearance of the John Dories is improved by taking off the heads, and cutting away not only the fins but the filaments of the back.

TO BOIL A BRILL.

A fresh and full-sized brill always ranks high in the list of fish, as it is of good appearance, and the flesh is sweet and delicate. It requires less cooking than the turbot, even when it is of equal size; but otherwise may be dressed and served in a similar manner. It has not the same rich glutinous skin as that fish, nor are the fins esteemed. They must be cut off when the brill is cleaned; and it may be put into nearly boiling water, unless it be very large. Simmer it gently, and drain it well upon the fish-plate when it is lifted out; dish it on a napkin, and send lobster, anchovy, crab, or shrimp sauce to table with it. Lobster coral, rubbed through a sieve, is commonly sprinkled over it for a formal dinner. The most usual garnish for boiled flat fish is curled parsley placed round it in light tufts; how far it is _appropriate_, individual taste must decide.

Brill, moderate-sized, about 20 minutes; large, 30 minutes.

Obs.—The _precise_ time which a fish will require to be boiled cannot be given: it must be watched, and not allowed to remain in the water after it begins to crack.

TO BOIL SALMON.

[In full season from May to August: may be had much earlier, but is scarce and dear.]

To preserve the fine colour of this fish, and to _set the curd_ when it is quite freshly caught, it is usual to put it into _boiling_, instead of into cold water. Scale, empty, and wash it with the greatest nicety, and be especially careful to cleanse all the blood from the inside. Stir into the fish-kettle eight ounces of common salt to the gallon of water, let it boil quickly for a minute or two, take off all the scum, put in the salmon and boil it moderately fast, if it be small, but more gently should it be very thick; and assure yourself that it is quite sufficiently done before it is sent to table, for nothing can be more distasteful, even to the eye, than fish which is under dressed.

From two to three pounds of the thick part of a fine salmon will require half an hour to boil it, but eight or ten pounds will be done enough in little more than double that time; less in proportion to its weight should be allowed for a small fish, or for the thin end of a large one. Do not allow the salmon to remain in the water after it is ready to serve, or both its flavour and appearance will be injured. Dish it on a hot napkin, and send dressed cucumber, and anchovy, shrimp, or lobster sauce, and a tureen of plain melted butter to table with it.

To each gallon water, 8 oz. salt. Salmon, 2 to 3 lbs. (thick), 1/2 hour; 8 to 10 lbs., 1-1/4 hour; small, or thin fish, less time.

SALMON À LA GENEVESE.

A fashionable mode of serving salmon at the present day is to divide the larger portion of the body into three equal parts; to boil them in water, or in a marinade; and to serve them dished in a line, but not close together, and covered with a rich Genevese sauce (for which see Chapter V.) It appears to us that the skin should be stripped from any fish over which the sauce is poured, but in this case it is not customary.

CRIMPED SALMON.

Cut into slices an inch and a half, or two inches thick, the body of a salmon _quite newly caught_; throw them into strong salt and water as they are done, but do not let them soak in it; wash them well, lay them on a fish-plate, and put them into fast boiling water, salted and well skimmed. In from ten to fifteen minutes they will be done. Dish them on a napkin, and send them very hot to table with lobster sauce, and plain melted butter; or with the caper fish-sauce of Chapter V. The water should be salted as for salmon boiled in the ordinary way, and the scum should be cleared off with great care after the fish is in.

In boiling water, 10 to 15 minutes.

SALMON À LA ST. MARCEL.

Separate some cold boiled salmon into flakes, and free them entirely from the skin; break the bones, and boil them in a pint of water for half an hour. Strain off the liquor, put it into a clean saucepan and stir into it by degrees when it begins to boil quickly, two ounces of butter mixed with a large teaspoonful of flour, and when the whole has boiled for two or three minutes add a teaspoonful of essence of anchovies, one of good mushroom catsup, half as much lemon-juice or chili vinegar, a half saltspoonful of pounded mace, some cayenne, and a very little salt. Shell from half to a whole pint of shrimps, add them to the salmon, and heat the fish very slowly in the sauce by the side of the fire, but do not allow it boil. When it is very hot, dish and send it quickly to table. French cooks, when they re-dress fish or meat of any kind, prepare the flesh with great nicety, and then put it into a stewpan, and pour the sauce upon it, which is, we think, better than the more usual English mode of laying it into the boiling sauce. The cold salmon may also be re-heated in the cream sauce of V., or in the _Mâitre d'Hôtel_ sauce which follows it; and will be found excellent with either. This receipt is for a moderate sized dish.

SALMON BAKED OVER MASHED POTATOES.

We are informed by a person who has been a resident in Ireland, that the middle of a salmon is there often baked over mashed potatoes, from which it is raised by means of a wire stand, as meat is in England. We have not been able to have it tried, but an ingenious cook will be at no loss for the proper method of preparing, and the time of cooking it. The potatoes are sometimes merely pared and halved; the fish is then laid upon them.

SALMON PUDDING, TO BE SERVED HOT OR COLD.

(_A Scotch Receipt—Good._)

Pound or chop small, or rub through a sieve one pound of cold boiled salmon freed entirely from bone and skin; and blend it lightly but thoroughly with half a pound of fine bread-crumbs a teaspoonful of essence of anchovies, a quarter of a pint of cream, a seasoning of fine salt and cayenne, and four well whisked eggs. Press the mixture closely and evenly into a deep dish or mould, buttered in every part, and bake it for one hour in a moderate oven.

Salmon, 1 lb.; bread-crumbs, 1/2 lb.; essence of anchovies, 1 teaspoonful; cream, 1/4 pint; eggs, 4; salt and cayenne; baked 1 hour.

TO BOIL COD FISH.

[In highest season from October to the beginning of February; in perfection about Christmas.]

When this fish is large the head and shoulders are sufficient for a handsome dish, and they contain all the choicer portion of it, though not so much substantial eating as the middle of the body, which, in consequence, is generally preferred to them by the frugal housekeeper. Wash the fish, and cleanse the inside, and the back-bone in particular, with the most scrupulous care; lay it into the fish-kettle and cover it well with cold water mixed with five ounces of salt to the gallon, and about a quarter of an ounce of saltpetre to the whole. Place it over a moderate fire, clear off the scum perfectly, and let the fish boil gently until it is done. Drain it well[46] and dish it carefully upon a very hot napkin with the liver and the roe as a garnish. To these are usually added tufts of lightly scraped horseradish round the edge. Serve well-made oyster sauce and plain melted butter with it; or anchovy sauce, when oysters cannot be procured. The cream sauce of Chapter V., is also an appropriate one for this fish.

Footnote 46:

This should be done by setting the fish plate across the kettle for a minute or two.

Moderate size, 20 to 30 minutes. Large, 1/2 to 3/4 hour.

SLICES OF COD FISH FRIED.

Cut the middle or tail of the fish into slices nearly an inch thick, season them with salt and white pepper or cayenne, flour them well, and fry them of a clear equal brown on both sides; drain them on a sieve before the fire, and serve them on a well-heated napkin, with plenty of crisped parsley round them. Or, dip them into beaten egg, and then into fine crumbs mixed with a seasoning of salt and pepper (some cooks add one of minced herbs also), before they are fried. Send melted butter and anchovy sauce to table with them. 8 to 12 minutes.

Obs.—This is a much better way of dressing the thin part of the fish than boiling it, and as it is generally cheap, it makes thus an economical, as well as a very good dish: if the slices are lifted from the frying-pan into a good curried gravy, and left in it by the side of the fire for a few minutes before they are sent to table, they will be found excellent.

STEWED COD.

Put into boiling water, salted as usual, about three pounds of fresh cod fish cut into slices an inch and a half thick, and boil them gently for five minutes; lift them out, and let them drain. Have ready heated in a wide stewpan nearly a pint of veal gravy or of very good broth, lay in the fish, and stew it for five minutes, then add four tablespoonsful of extremely fine bread-crumbs, and simmer it for three minutes longer. Stir well into the sauce a large teaspoonful of arrow-root quite free from lumps, a fourth part as much of mace, something less of cayenne, and a tablespoonful of essence of anchovies, mixed with a glass of white wine and a dessertspoonful of lemon juice. Boil the whole for a couple of minutes, lift out the fish carefully with a slice, pour the sauce over, and serve it quickly.

Cod fish, 3 lbs.: boiled 5 minutes. Gravy, or strong broth, nearly 1 pint: 5 minutes. Bread-crumbs, 4 tablespoonsful: 3 minutes. Arrow-root, 1 large teaspoonful; mace, 1/4 teaspoonful; less of cayenne; essence of anchovies, 1 tablespoonful; lemon-juice, 1 dessertspoonful; sherry or Maidera, 1 wineglassful: 2 minutes.

Obs.—A dozen or two of oysters, bearded, and added with their strained liquor to this dish two or three minutes before it is served, will to many tastes vary it very agreeably.

STEWED COD FISH, IN BROWN SAUCE.

Slice the fish, take off the skin, flour it well, and fry it quickly a fine brown; lift it out and drain it on the back of a sieve, arrange it in a clean stewpan, and pour in as much good boiling brown gravy as will nearly cover it; add from one to two glasses of port wine, or rather more of claret, a dessertspoonful of Chili vinegar, or the juice of half a lemon, and some cayenne, with as much salt as may be needed. Stew the fish very softly until it just begins to break, lift it carefully with a slice into a very hot dish, stir into the gravy an ounce and a half of butter smoothly kneaded with a large teaspoonful of flour, and a little pounded mace, give the sauce a minute's boil, pour it over the fish, and serve it immediately. The wine may be omitted, good shin of beef stock substituted for the gravy, and a teaspoonful of soy, one of essence of anchovies, and two tablespoonsful of Harvey's sauce added to flavour it.

TO BOIL SALT FISH.

When very salt and dry, this must be long soaked before it is boiled, but it is generally supplied by the fishmongers nearly or quite ready to dress. When it is not so, lay it for a night into a large quantity of cold water, then let it lie exposed to the air for some time, then again put it into water, and continue thus until it is well softened. Brush it very clean, wash it thoroughly, and put it with abundance of cold water into the fish kettle, place it near the fire and let it heat very slowly indeed. Keep it just on the point of simmering, without allowing it ever to _boil_ (which would render it hard), from three quarters of an hour to a full hour, according to its weight; should it be quite small and thin, less time will be sufficient for it; but by following these directions, the fish will be almost as good as if it were fresh. The scum should be cleared off with great care from the beginning. Egg sauce and boiled parsneps are the usual accompaniment to salt fish, which should be dished upon a hot napkin, and which is sometimes also thickly strewed with chopped eggs.

SALT FISH, À LA MÂITRE D'HÔTEL.

Boil the fish by the foregoing receipt, or take the remains of that which has been served at table, flake it off clear from the bones, and strip away every morsel of the skin; then lay it into a very clean saucepan or stewpan, and pour upon it the sharp _Mâitre d'Hôtel_ sauce of Chapter IV.; or dissolve gently two or three ounces of butter with four or five spoonsful of water, and a half-teaspoonful of flour; add some pepper or cayenne, very little salt, and a dessertspoonful or more of minced parsley. Heat the fish slowly quite through in either of these sauces, and toss or stir it until the whole is well mixed; if the second be used, add the juice of half a lemon, or a small quantity of Chili vinegar just before it is taken from the fire. The fish thus prepared may be served in a deep dish, with a border of mashed parsneps or potatoes.

TO BOIL CODS' SOUNDS.

Should they be highly salted, soak them for a night, and on the following day rub off entirely the discoloured skin; wash them well, lay them into plenty of cold milk and water, and boil them gently from thirty to forty minutes, or longer should they not be quite tender. Clear off the scum as it rises with great care, or it will sink and adhere to the sounds, of which the appearance will then be spoiled. Drain them well, dish them on a napkin, and send egg sauce and plain melted butter to table with them.

TO FRY CODS' SOUNDS IN BATTER.

Boil them as directed above until they are nearly done, then lift them out, lay them on to a drainer, and let them remain till they are cold; cut them across in strips of an inch deep, curl them round, dip them into a good French or English batter, fry them of a fine pale brown, drain and dry them well, dish them on a hot napkin, and garnish them with crisped parsley.

TO FRY SOLES.

[In season all the year.]

All fish to fry well must be not only fresh but perfectly free from moisture, particularly when they are to be dressed with egg and bread-crumbs, as these will not otherwise adhere to them. Empty, skin, and wash the soles with extreme nicety, from one to two hours before they are wanted for table; and after having cleansed and wiped them very dry both inside and out, replace the roes, fold and press them gently in a soft clean cloth, and leave them wrapped in it until it is time to fry them; or suspend them singly upon hooks in a current of cool air, which is, perhaps, the better method of proceeding when it can be done conveniently. Cover them equally in every part, first with some beaten egg, and then with fine dry crumbs of bread, mixed with a _very little_ flour to make them adhere with more certainty: a small teaspoonful will be sufficient for two large soles. Melt in a large and exceedingly clean frying pan over a brisk and clear fire, as much very pure-flavoured lard as will float the fish, and let it be sufficiently hot before

they are laid in to brown them quickly; for if this be neglected it will be impossible to render them crisp or dry. When the fat ceases to bubble, throw in a small bit of bread, and if it takes a good colour immediately the soles may be put in without delay. An experienced cook will know, without this test, when it is at the proper point; but the learner will do better to avail herself of it until practice and observation shall have rendered it unnecessary to her. Before the fish are laid into the pan, take them by the head and shake the loose crumbs from them. When they are firm, and of a fine amber-colour on one side, turn them with care, passing a slice under them and a fork through the heads, and brown them on the other. Lift them out, and either dry them well on a soft cloth laid upon a sieve reversed, before the fire, turning them often, or press them lightly in hot white blotting paper. Dish them on a drainer covered with a hot napkin and send them to table without delay with shrimp or anchovy sauce, and plain melted butter.

Very small soles will be done in six minutes, and large ones in about ten. They may be floured and fried, without being egged and crumbed, but this is not a very usual mode of serving them.

Small soles, 6 minutes; large, about 10 minutes.

TO BOIL SOLES.

The flesh of a fine fresh sole, when boiled with care, is remarkably sweet and delicate: if very large it may be dressed and served as turbot, to which it will be found little inferior in flavour. Empty it, take out the gills, cut off the fins, and cleanse and wash it with great nicety, but do not skin it; then either lay it into cold water in which the usual proportion of salt has been dissolved, and heat it rather slowly, and then simmer it from five to ten minutes, according to its size; or boil it in the manner directed in the first pages of this chapter. Drain it well on the fish-plate as it is lifted out, and dish it on a napkin, the white side upwards, and serve it quickly with anchovy, shrimp, or lobster sauce. It may also be sent to table thickly covered with the Cream Fish Sauce, Caper Fish Sauce, or Lady’s Sauce, of Chapter VI.; though this is a mode of service less to be recommended, as the sauce cools more speedily when spread over the surface of the fish: it is, however, the continental fashion, and will therefore find more favour with some persons.

Very large sole, 5 to 10 minutes; moderate sized, 4 to 6 minutes.

FILLETS OF SOLES.

The word _fillet_, whether applied to fish, poultry, game, or butcher’s meat, means simply the flesh of either (or of certain portions of it), raised clear from the bones in a handsome form, and divided or not, as the manner in which it is to be served may require. It is an elegant mode of dressing various kinds of fish, and even those which are not the most highly esteemed, afford an excellent dish when thus prepared. Soles to be filletted with advantage should be large; the flesh may then be divided down the middle of the back, next, separated from the fins, and with a very sharp knife raised clear from the bones.[47] When thus prepared, the fillets may be divided, trimmed into a good form, egged, covered with fine crumbs, fried in the usual way, and served with the same sauces as the whole fish; or each fillet may be rolled up, in its entire length, if very small, or after being once divided if large, and fastened with a slight twine, or a short thin skewer; then egged, crumbed, and fried in plenty of boiling lard; or merely well floured and fried from eight to ten minutes. When the fish are not very large, they are sometimes boned without being parted in the middle, and each side is rolled from the tail to the head, after being first spread with pounded shrimps mixed with a third of their volume of butter, a few bread-crumbs, and a high seasoning of mace and cayenne; or with pounded lobster mixed with a large portion of the coral, and the same seasoning, and proportion of butter as the shrimps; then laid into a dish, with the ingredients directed for the _soles au plat_; well covered with crumbs of bread and clarified butter, and baked from twelve to sixteen minutes, or until the crumbs are coloured to a fine brown in a moderate oven.

Footnote 47:

A celebrated French cook gives the following instructions for raising these fillets:—“them up by running your knife first between the bones and the flesh, then between the skin and the fillet; by leaning pretty hard on the table they will come off very neatly.”

The fillets may likewise be cut into small strips or squares of uniform size, lightly dredged with pepper or cayenne, salt and flour, and fried in butter over a brisk fire; then well drained, and sauced with a good _béchamel_, flavoured with a teaspoonful of minced parsley.

SOLES AU PLAT.

Clarify from two to three ounces of fresh butter, and pour it into the dish in which the fish are to be served; add to it a little salt, some cayenne, a teaspoonful of essence of anchovies, and from one to two glasses of sherry, or of any other dry white wine; lay in a couple of fine soles which have been well cleaned and wiped very dry, strew over them a thick layer of fine bread-crumbs, moisten them with clarified butter, set the dish into a moderate oven, and bake the fish for a quarter of an hour. A layer of shrimps placed between the soles is a great improvement; and we would also recommend a little lemon-juice to be mixed with the sauce.

Baked, 15 minutes.

Obs.—The soles are, we think, better without the wine in this receipt. They require but a small portion of liquid, which might be supplied by a little additional butter, a spoonful of water or pale gravy, the lemon-juice, and store-sauce. Minced parsley may be mixed with the bread-crumbs when it is liked.

BAKED SOLES.

(_A simple but excellent Receipt._)

Fresh large soles, dressed in the following manner, are remarkably tender and delicate eating; much more so than those which are fried. After the fish has been skinned and cleansed in the usual way, wipe it dry, and let it remain for an hour or more, if time will permit, closely folded in a clean cloth; then mix with a slightly beaten egg about an ounce of butter, just liquefied but not _heated_ at the mouth of the oven, or before the fire; brush the fish in every part with this mixture, and cover it with very fine dry bread-crumbs, seasoned with a little salt, cayenne, pounded mace, and nutmeg. Pour a teaspoonful or two of liquid butter into a flat dish which will contain the fish well; lay it in, sprinkle it with a little more butter, press the bread-crumbs lightly on it with a broad-bladed knife, and bake it in a moderate oven for about twenty minutes. If two or more soles are required for table at the same time, they should be placed separately, quite flat, in a large dish, or each fish should be laid on a dish by itself. On our first essay of this receipt, the fish dressed by it (it was baked for twenty-five minutes in a very slack iron oven) proved infinitely nicer than one of the same size which was fried, and served with it. The difference between them was very marked, especially as regarded the exceeding tenderness of the flesh of that which was baked; its appearance, however, would have been somewhat improved by a rather quicker oven. When ready to serve, it should be gently glided on to the dish in which it is to be sent to table. About three ounces of bread-crumbs, and two and a half of butter, will be sufficient for a large pair of soles. They will be more perfectly encrusted with the bread if dipped into, or sprinkled with it a second time, after the first coating has been well moistened with the butter.

SOLES STEWED IN CREAM.

Prepare some very fresh middling sized soles with exceeding nicety, put them into boiling water slightly salted, and simmer them for two minutes only; lift them out, and let them drain; lay them into a wide stewpan with as much sweet rich cream as will nearly cover them; add a good seasoning of pounded mace, cayenne, and salt; stew the fish softly from six to ten minutes, or until the flesh parts readily from the bones; dish them, stir the juice of half a lemon to the sauce, pour it over the soles, and send them immediately to table. Some lemon-rind may be boiled in the cream, if approved; and a small teaspoonful of arrow-root, very smoothly mixed with a little milk, may be stirred to the sauce (should it require thickening) before the lemon-juice is added. Turbot and brill also may be dressed by this receipt, time proportioned to their size being of course allowed for them.

Soles, 3 or 4: boiled in water 2 minutes. Cream, 1/2 to whole pint; salt, mace, cayenne: fish stewed, 6 to 10 minutes. Juice of half a lemon.

Obs.—In Cornwall the fish is laid at once into thick clotted cream, and stewed entirely in it; but this method gives to the sauce, which ought to be extremely delicate, a coarse fishy flavour which the previous boil in water prevents.

At Penzance, grey mullet, after being scaled, are divided in the middle, just covered with cold water, and softly boiled, with the addition of branches of parsley, pepper and salt, until the flesh of the back parts easily from the bone; clotted cream, minced parsley, and lemon-juice are then added to the sauce, and the mullets are dished with the heads and tails laid even to the thick parts of the back, where the fish were cut asunder. Hake, too, is there divided at every joint (having previously been scaled), dipped into egg, then thickly covered with fine bread-crumbs mixed with plenty of minced parsley, and fried a fine brown; or, the back-bone being previously taken out, the fish is sliced into cutlets, and then fried.

TO FRY WHITINGS.

[In full season from Michaelmas to beginning of February.]

Clean, skin, and dry them thoroughly in a cloth, fasten their tails to their mouths, brush slightly beaten eggs equally over them, and cover them with the finest bread-crumbs, mixed with a little flour; fry them a clear golden brown in plenty of boiling lard, drain and dry them well, dish them on a hot napkin, and serve them with good melted butter, and the sauce cruets, or with well made shrimp or anchovy sauce. A small half-teaspoonful of salt should be beaten up with the eggs used in preparing the whitings: two will be sufficient for half a dozen fish.

5 to 8 minutes, according to their size.

FILLETS OF WHITINGS.

Empty and wash thoroughly, but do not skin the fish. Take off the flesh on both sides close to the bones, passing the knife from the tail to the head; divide each side in two, trim the fillets into good shape, and fold them in a cloth, that the moisture may be well absorbed from them; dip them into, or draw them through, some beaten egg, then dip them into fine crumbs mixed with a small portion of flour, and fry them a fine light brown in lard or clarified butter; drain them well, press them in white blotting-paper, dish them one over the other in a circle, and send the usual sauce to table with them. The fillets may also be broiled after being dipped into eggs seasoned with salt and pepper, then into crumbs of bread, next into clarified butter, and a second time into the bread-crumbs (or, to shorten the process, a portion of clarified butter may be mixed with the eggs at first), and served with good melted butter, or thickened veal gravy seasoned with cayenne, lemon-juice, and chopped parsley.

Five minutes will fry the fillets, even when very large rather more time will be required to broil them.

TO BOIL WHITINGS.

(_French Receipt_)

Having scraped, cleansed, and wiped them, lay them on a fish-plate, and put them into water at the point of boiling; throw in a handful of salt, two bay leaves, and plenty of parsley well washed and tied together; let the fish _just simmer_ from five to ten minutes, and watch them closely that they may not be overdone. Serve parsley and butter with them, and use in making it the liquor in which the whitings have been boiled.

Just simmered from 5 to 10 minutes.

BAKED WHITINGS À LA FRANÇAISE.

Proceed with these exactly as with the _soles au plat_ of this chapter; or, pour a little clarified butter into a deep dish, and strew it rather thickly with finely-minced mushrooms mixed with a teaspoonful of parsley, and (when the flavour is liked, and considered appropriate) with an eschalot or two, or the white part of a few green onions, also chopped very small. On these place the fish after they have been scaled, emptied, thoroughly washed, and wiped dry: season them well with salt and white pepper, or cayenne; sprinkle more of the herbs upon them; pour gently from one to two glasses of light white wine into the dish, cover the whitings with a thick layer of fine crumbs of bread, sprinkle these plentifully with clarified butter, and bake the fish from fifteen to twenty minutes. Send a cut lemon only to table with them. When the wine is not liked, a few spoonsful of pale veal gravy can be used instead; or a larger quantity of clarified butter, with a tablespoonful of water, a teaspoonful of lemon-pickle and of mushroom catsup, and a few drops of soy.

15 to 20 minutes.

TO BOIL MACKEREL.

[In full season in May, June, and July; may be had also in early spring.]

[Illustration:

Mackerel.]

Open the fish sufficiently to admit of the insides being _perfectly cleansed_, but not more than is necessary for this purpose; empty them with care, lay the roes apart, and wash both them and the mackerel delicately clean. It is customary now to lay these, and the

greater number of other fish as well, into cold water when they are to be boiled; formerly all were plunged at once into fast-boiling water. For such as are small and delicate, it should be hot; they should be brought gently to boil, and simmered until they are done; the scum should be cleared off as it rises, and the usual proportion of salt stirred into the water before the mackerel are put in. The roes are commonly replaced in the fish; but as they sometimes require more boiling than the mackerel themselves, it is better, when they are very large, to lay them upon the fish-plate by their sides. From fifteen to twenty minutes will generally be sufficient to boil a full-sized mackerel some will be done in less time; but they must be watched and lifted out as soon as the tails split, and the eyes are starting.

Dish them on a napkin, and send fennel or gooseberry sauce to table with them, and plain melted butter also.

Small mackerel, 10 to 15 minutes; large, 15 to 20 minutes.

TO BAKE MACKEREL.

After they have been cleaned and well washed, wipe them very dry, fill the insides with the forcemeat, No. 1 of Chapter VIII., sew them up, arrange them, with the roes, closely together in a coarse baking-dish, flour them lightly, strew a little fine salt over, and stick bits of butter upon them; or pour some equally over them, after having just dissolved it in a small saucepan. Half an hour in a moderate oven will bake them. Oyster forcemeat is always appropriate for any kind of fish which is in season while the oysters are so; but the mackerel are commonly served, and are very good with that which we have named. Lift them carefully into a hot dish after they are taken from the oven, and send melted butter and a cut lemon to table with them.

1/2 hour.

BAKED MACKEREL, OR WHITINGS.

(_Cinderella's Receipt—good._)

The fish for this receipt should be opened only so much as will permit of their being emptied and perfectly cleansed. Wash and wipe them dry, then fold them in a soft cloth, and let them remain in it awhile. Replace the roes, and put the fish into a baking-dish of suitable size, with a tablespoonful of wine, a few drops of chili vinegar, a little salt and cayenne, and about half an ounce of butter, well-blended with a saltspoonful of flour, for each fish. They must be turned round with the heads and tails towards each other, that they may lie compactly in the dish, and the backs should be placed downwards, that the sauce may surround the thickest part of the flesh. Lay two buttered papers over, and press them down upon them; set the dish into a gentle oven for twenty minutes, take off the papers, and send the fish to table in their sauce.

A few minutes more of time must be allowed for mackerel when it is large, should the oven be _very_ slow.

Full-sized whitings are _excellent_ thus dressed if carefully managed, and many eaters would infinitely prefer mackerel so prepared, to boiled ones. The writer has port-wine always used for the sauce, to which a rather full seasoning of chili vinegar, cayenne, and pounded mace, is added; but sherry, Bucellas, or any other dry wine, can be used instead; and the various condiments added to it, can be varied to the taste. This receipt is a very convenient one, as it is prepared with little trouble, and a stove-oven, if the heat be properly moderated, will answer for the baking. It is an advantage to take off the heads of the fish before they are dressed, and they may then be entirely emptied without being opened. When preferred so, they can be re-dished for table, and the sauce poured over them.

Obs.—The dish in which they are baked, should be buttered before they are laid in.

FRIED MACKEREL.

(_Common French Receipt._)

After the fish have been emptied and washed extremely clean, cut off the heads and tails, split the bodies quite open, and take out the backbones (we recommend in preference that the flesh should be taken off the bones as in the following receipt), wipe the mackerel very dry, dust fine salt and pepper (or cayenne) over them, flour them well, fry them a fine brown in boiling lard, drain them thoroughly, and serve them with the following sauce:—Dissolve in a small saucepan an ounce and a half of butter smoothly mixed with a teaspoonful of flour, some salt, pepper, or cayenne; shake these over a gentle fire until they are lightly coloured, then add by slow degrees nearly half a pint of good broth or gravy, and the juice of one large lemon; boil the sauce for a couple of

minutes, and serve it very hot. Or, instead of this, add a large teaspoonful of strong made mustard, and a dessertspoonful of chili vinegar, to some thick melted butter, and serve it with the fish. A spoonful of Harvey's sauce or of mushroom catsup can be mixed with this last at pleasure.

FILLETS OF MACKEREL.

(_Fried or Broiled._)

Take off the flesh quite whole on either side, from three fine mackerel, which have been opened and properly cleaned; let it be entirely free from bone, dry it well in a cloth, then divide each part in two, and dip them into the beaten yolks of a couple of eggs, seasoned with salt and white pepper, or cayenne; cover them equally with fine dry crumbs of bread, and fry them like soles; or dip them into clarified butter, and then again into the crumbs, and broil them over a very clear fire of a fine brown. Dish them in a circle one over the other, and send them to table with the _Mâitre d'Hôtel_ sauce of Chapter V., or with the one which follows it. The French pour the sauce into the centre of the dish; but for broiled fillets this is not so well, we think, as serving it in a tureen. The roes of the fish, after being well washed and soaked, may be dressed with them, or they may be made into patties. Minced parsley can be mixed with the bread-crumbs when it is liked.

BOILED FILLETS OF MACKEREL.

After having taken off and divided the flesh of the fish, as above, place it flat in one layer in a wide stewpan or saucepan, and just cover the fillets with cold water; throw in a teaspoonful of salt, and two or three small sprigs of parsley; bring the mackerel slowly to a boil, clear off the scum with care, and after two or three minutes of slow simmering try the fillets with a fork; if the thick part divides with a touch, they are done. Lift them out cautiously with a slice; drain, and serve them very hot with good parsley and butter; or strip off the skin quickly, and pour a _Mâitre d'Hôtel_ sauce over them.

MACKEREL BROILED WHOLE.

(_An excellent Receipt._)

Empty and cleanse perfectly a fine and very fresh mackerel, but without opening it more than is needful; dry it well, either in a cloth or by hanging it in a cool air until it is stiff; make with a sharp knife a deep incision the whole length of the fish on either side of the back bone, and about half an inch from it, and with a feather put in a little cayenne and fine salt, mixed with a few drops of good salad oil or clarified butter. Lay the mackerel over a moderate fire upon a well-heated gridiron which has been rubbed with suet; loosen it gently should it stick, which it will do unless often moved; and when it is equally done on both sides, turn the back to the fire. About half an hour will broil it well. If a sheet of thickly-buttered writing-paper be folded round it, and just twisted at the ends before it is laid on the gridiron, it will be finer eating than if exposed to the fire; but sometimes when this is done, the skin will adhere to the paper, and be drawn off with it, which injures its appearance. A cold _Mâitre d'Hôtel_ sauce (see Chapter V.), may be put into the back before it is sent to table. This is one of the very best modes of dressing a mackerel, which in flavour is quite a different fish when thus prepared to one which is simply boiled. A drop of oil is sometimes passed over the skin to prevent its sticking to the iron. It may be laid to the fire after having been merely cut as we have directed, when it is preferred so.

30 minutes; 25 if _small_.

MACKEREL STEWED WITH WINE.

(_Very good._)

Work very smoothly together a large teaspoonful of flour with two ounces of butter, put them into a stewpan, and stir or shake them round over the fire until the butter is dissolved; add a quarter of a teaspoonful of mace, twice as much salt, and some cayenne; pour in by slow degrees three glasses of claret; and when the sauce boils, lay in a couple of fine mackerel well cleaned, and wiped quite dry; stew them very softly from fifteen to twenty minutes, and turn them when half done; lift them out, and dish them carefully; stir a teaspoonful of made mustard to the sauce, give it a boil, and pour it over the fish. When more convenient, substitute port wine and a little lemon-juice, for the claret.

Mackerel, 2; flour, 1 teaspoonful; butter, 2 oz.; seasoning of salt, mace, and cayenne; claret, 3 wineglassesful; made mustard, 1 teaspoonful: 15 to 20 minutes.

FILLETS OF MACKEREL STEWED IN WINE.

(_Excellent._)

Raise the flesh entire from the bones on either side of the mackerel, and divide it once, if the fish be small, but cut the whole into six parts of equal size should they be large. Mix with flour, and dissolve the butter as in the preceding receipt; and when it has simmered for a minute, throw in the spice, a little salt, and the thinly pared rind of half a small fresh lemon, lay in the fillets of fish, shake them over a gentle fire from four to five minutes, and turn them once in the time; then pour to them in small portions a couple of large wineglassesful of port wine, a tablespoonful of Harvey's sauce, a teaspoonful of soy, and one of lemon-juice; stew the mackerel very softly until the thinner parts begin to break, lift them out with care, dish and serve them in their sauce as hot as possible. We can recommend the dish to our readers as a very excellent one. A garnish of fried sippets can be placed round the fish at will. A teaspoonful of made mustard should be stirred to the sauce before it is poured over the fish.

Fillets of mackerel, 2; butter, 2 oz.; flour, 1 teaspoonful; rind of 1/2 lemon; salt, cayenne, pounded mace: 2 minutes. Fish, 4 to 5 minutes. Port wine, two large glassesful; Harvey's sauce, 1 tablespoonful; soy and lemon-juice each, 1 teaspoonful: 4 to 6 minutes. Mustard, 1 teaspoonful.

Obs.—Trout may be dressed by this receipt.

TO BOIL HADDOCKS.

In the best season in October, November, and December.

[Illustration:

Haddock.]

Scrape the outsides very clean, open the fish, empty them, wash the insides thoroughly, take out the gillet, curl the haddocks round, fasten the tails to the mouths, arrange them on a fish-plate, and lay them into hot water salted as for mackerel. Take off all the scum, and simmer them from seven to ten minutes or longer, according to their size, which, as we have said in the directions for "the best mode of cooking various kind of fish," at the commencement of this chapter, varies greatly, as they are sometimes very large; they must then be brought more slowly to boil, and more time must be allowed for them. Send them very hot to table, with a tureen of melted butter, and one of anchovy sauce.

7 to 10 minutes.

Obs.—In Scotland haddocks are skinned before they are boiled, and the heads are taken off; but we see no advantage in this mode of dressing them. Whitings, fresh herrings, and codlings, may all be dressed by this receipt, the time only being varied according to the size of the fish.

BAKED HADDOCKS

After they have been cleaned, dry them thoroughly, then bake them, as directed in the common receipt for pike, or fill them with oyster forcemeat, or with No. 1 of Chapter VIII., if more convenient, and proceed as for baked mackerel.

20 to 30 minutes; longer if very large.

TO FRY HADDOCKS

Follow the directions given for fillets of whitings; or, should a more simple method be preferred, clean and dry the fish well, cut off the heads and tails, take out the backbones, cut each fish in three, egg and crumb them, fry them in boiling lard a fine golden brown, and serve them, well drained and dried, with the same sauces as boiled haddocks.

TO DRESS FINNAN HADDOCKS.

These are slightly salted and dried. They are excellent eating, if gently heated through upon the gridiron without being hardened; and are served usually at the breakfast or supper table; a feather dipped in oil may be passed over them before they are laid to the fire.

TO BOIL GURNARDS.

(_With directions for dressing them in other ways._)

[Illustration:

Gurnard.]

It is more usual to fill gurnards with forcemeat, and to bake them, or to have the flesh raised from the bones and dressed in fillets, than to serve them simply boiled; they may, however, be cooked in any of the modes directed for mackerel,[48] rather more time being allowed for them, as they are much firmer-fleshed, thicker in the bodies, and generally of larger size altogether. Cut off all the fins, take out the gills, and empty and cleanse them like other fish, washing the insides well; put them into hot water ready salted and skimmed, and boil them gently from twenty minutes to half an hour; serve them with anchovy sauce, or with parsley and butter rendered acid with chili vinegar, lemon-juice, or caper-pickle.

Footnote 48:

Whitings or haddocks.

FRESH HERRINGS.

(_Farleigh Receipt._)

In season from May to October.

Scale and clean the fish with the utmost nicety, split them quite open, and wash the insides with particular care; dry them well in a cloth, take off the heads and tails, and remove the backbones; rub the insides with pepper, salt, and a little pounded mace; stick small bits of butter on them, and skewer two of the fish together as flat as possible, with the skin of both outside; flour, and broil or fry them of a fine brown, and serve them with melted butter mixed with a teaspoonful or more of mustard, some salt, and a little vinegar or lemon-juice.

To broil from 20 to 25 minutes; to fry about 10 minutes.

TO DRESS THE SEA BREAM.

[Illustration:

Sea Bream.]

The sea-bream, which is common in many of our markets, is not considered a fish of first-rate quality; but if well broiled or baked, it will afford a good, and generally a _cheap_, dish of excellent appearance, the bream being of handsome size and form. Open and cleanse it perfectly, but do not remove the scales; fold it in a dry cloth to absorb the moisture which hangs about it; lay it over a gentle fire, and broil it slowly, that the heat may gradually penetrate the flesh, which is thick. Should any cracks appear on the surface, dredge a little flour upon them. If of ordinary weight, the bream will require quite half an hour’s broiling; it should be turned, of course, when partially done. Send plain melted butter and anchovy sauce to table with it. In carving it, remove the skin and scales, and serve only the flesh which lies beneath them, and which will be very white and succulent. A more usual and less troublesome mode of dressing the bream is to season the inside slightly with salt and pepper or cayenne, to dust a little more salt on the outside, spread a few bits of butter upon it, and send it to a gentle oven. It is sometimes filled with common veal-stuffing, and then requires to be rather longer baked; and it is often merely wrapped in a buttered paper, and placed in a moderate oven for twenty-five or thirty minutes.

TO BOIL PLAICE OR FLOUNDERS.

Plaice in season from May to January; flounders in September, October, and November.

[Illustration:

Plaice.]

After having emptied and well cleaned the fish, make an incision in the back as directed for turbot; lay them into cold spring water; add salt and saltpetre in the same proportion as for cod fish, and let them just simmer for four or five minutes after the water first begins to boil, or longer should their size require it, but guard against their being broken. Serve them with plain melted butter. 4 to 5 minutes; longer if needful.

TO FRY PLAICE OR FLOUNDERS.

Sprinkle them with salt, and let them lie for two or three hours before they are dressed. Wash and clean them thoroughly, wipe them very dry, flour them well, and wipe them again with a clean cloth; dip them into egg, and fine bread-crumbs, and fry them in plenty of lard. If the fish be large, raise the flesh in handsome fillets from the bones, and finish them as directed for fillets of soles. _Obs._—Plaice is said to be rendered less watery by beating it gently with a paste-roller before it is cooked. It is very sweet and pleasant in flavour while it is in the best season, which is from the end of May to about September.

TO ROAST, BAKE, OR BROIL RED MULLET.

[In best season through the summer: may be had all the year.]

[Illustration:

Red Mullet.]

First wash and then dry the fish thoroughly in a cloth, but neither scale nor open it, but take out the gills gently and carefully with the small intestine which will adhere to them; wrap it closely in a sheet of thickly buttered paper, tie this securely at the ends, and over the mullet with packthread, and roast it in a Dutch oven, or broil it over a clear and gentle fire, or bake it in a moderate oven: from twenty to twenty-five minutes will be sufficient generally to dress it in either way. For sauce, put into a little good melted butter the liquor which has flowed from the fish, a small dessertspoonful of essence of anchovies, some cayenne, a glass of port wine, or claret, and a little lemon-juice. Remove the packthread, and send the mullet to table in the paper case. This is the usual mode of serving it, but it is dished without the paper for dinners of taste. _The plain red mullet_, shown at the commencement of this receipt, is scarcely ever found upon our coast. That which abounds here during the summer months is the striped red mullet, or _surmullet_, which, from its excellence, is always in request, and is therefore seldom cheap. It rarely exceeds twelve, or at the utmost fourteen, inches in length.

20 to 30 minutes.

TO BOIL GREY MULLET.

[Illustration:

Grey Mullet.]

This fish varies so much in size and quality, that it is difficult to give exact directions for the time of cooking it. When quite young and small, it may be boiled by the receipt for whitings, haddocks, and other fish of about their size; but at its finest growth it must be laid into cold water, and managed like larger fish. We have ourselves partaken of one which was caught upon our eastern coast, that weighed ten pounds, of which the flesh was quite equal to that of salmon, but its weight was, we believe, an unusual one. Anchovy, or caper fish sauce, with melted butter, may be sent to table with grey mullet.

THE GAR-FISH.

[Illustration:

Gar-Fish.]

This is a fish of very singular appearance, elongated in form, and with a mouth which resembles the bill of the snipe, from which circumstance it is often called the snipe-fish. Its bones are all of a _bright green_ colour. It is not to be recommended for the table, as the skin contains an oil of exceedingly strong rank flavour; when entirely divested of this, the flesh is tolerably sweet and palatable. Persons who may be disposed from curiosity to taste it will find either broiling or baking in a gentle oven the best mode of cooking it. It should be curled round, and the tail fastened into the bill. As it is not of large size, from fifteen to twenty minutes will

dress it sufficiently. Anchovy sauce, parsley and butter, or plain melted butter, may be eaten with it.

SAND-LAUNCE, OR, SAND-EEL.

[Illustration:

Sand-Eel.]

The sand-launce, which is abundant on many parts of our coast, and the name of which is derived from its habit of burrowing in the sands when the tide retires, may be distinguished from the larger species, the true _sand-eel_, by its lighter colour and more transparent appearance, as well as by its inferior size. The common mode of dressing the fish, which is considered by many a great delicacy, is to divest them of their heads, and to remove the insides with the gills, to dry them well in a cloth with flour, and to fry them until crisp. They are sometimes also dipped in batter like smelts. We have not ourselves had an opportunity of testing them, but we have received the particulars which we have given here from various friends who have resided where they were plentiful. The _sand-eels_ are not so good as the smaller kind of these fish called _launces_.

TO FRY SMELTS.

[In season from beginning of November to May.]

Smelts when quite fresh have a perfume resembling that of a cucumber, and a peculiarly delicate and agreeable flavour when dressed. Draw them at the gills, as they must not be opened; wash and dry them thoroughly in a cloth; dip them into beaten egg-yolk, and then into the finest bread-crumbs, mixed with a very small quantity of flour; fry them of a clear golden brown, and serve them crisp and dry, with good melted butter in a tureen. They are sometimes dipped into batter and then fried; when this is done, we would recommend for them the French batter of Chapter V.

3 to 4 minutes.

BAKED SMELTS.

Prepare them as for frying; pour some clarified butter into the dish in which they are to be sent to table, arrange them neatly in it, with the tails meeting in the centre, strew over them as much salt, mace, and cayenne, mixed, as will season them agreeably, cover them smoothly with a rather thick layer of very fine bread-crumbs, moisten them equally with clarified butter poured through a small strainer, and bake the fish in a moderately quick oven, until the crumbs are of a fine light brown. A glass of sherry, half a teaspoonful of essence of anchovies, and a dessertspoonful of lemon-juice, are sometimes poured into the dish before the smelts are laid in.

About 10 minutes.

TO DRESS WHITE BAIT.

(_Greenwich Receipt._)

[In season in July, August, and September.]

This delicate little fish requires great care to dress it well. Do not touch it with the hands, but throw it from your dish or basket into a cloth, with three or four handsful of flour, and shake it well; then put it into a bait sieve, to separate it from the superfluous flour. Have ready a very deep frying-pan, nearly full of boiling fat, throw in the fish, which will be done in an instant: they must not be allowed to take any colour, for if browned, they are spoiled. Lift them out, and dish them upon a silver or earthenware drainer, without a napkin, piling them very high in the centre. Send them to table with a cut lemon, and slices of brown bread and butter.

WATER SOUCHY.

(_Greenwich Receipt._)

This is a very simple and inexpensive dish, much served at the regular fish-dinners for which Greenwich is celebrated, as well as at private tables. It is excellent if well prepared; and as it may be made with fish of various kinds when they are too small to present a good appearance or to be palatable dressed in any other way, it is also very economical. Flounders, perch, tench, and eels, are

said to answer best for water souchy; but very delicate soles, and several other varieties of small white fish are often used for it with good effect: it is often made also with slices of salmon, or of salmon-peel, freed from the skin.

Throw into rather more than sufficient water to just cover the quantity of fish required for table, from half to three quarters of an ounce of salt to the quart, a dozen corns of white pepper, a small bunch of green parsley, and two or three tender parsley roots, first cut into inch lengths, and then split to the size of straws. Simmer the mixture until these last are tender, which will be in from half to a whole hour; then lay in the fish delicately cleaned, cleared from every morsel of brown skin, and divided into equal portions of about two inches in width. Take off all the scum as it rises, and stew the fish softly from eight to twelve minutes, watching it that it may not break from being overdone.

Two minutes before it is dished, strew in a large tablespoonful or more of minced parsley, or some small branches of the herb boiled very green in a separate saucepan (we prefer the latter mode); lift out the fish carefully with a slice, and the parsley roots with it; pour over it the liquor in which it has been boiled, but leave out the peppercorns. For a superior water souchy, take all the bones out of the fish, and stew down the inferior portions of it to a strong broth: about an hour will be sufficient for this. Salt, parsley, and a little cayenne may be added to it. Strain it off clear through a sieve, and use it instead of water for the souchy. The juice of half a good lemon may be thrown into the stew before it is served. A deep dish will of course be required for it. The parsley-roots can be boiled apart when more convenient, but they give an agreeable flavour when added to the liquor at first. Slices of brown or white bread and butter must be sent to table always with water souchy: the first is usually preferred, but to suit all tastes some of each may be served with it.

SHAD, TOURAINE FASHION.

(_Alose à la mode de Touraine._)

[In season in April, May, and early part of June.]

Empty and wash the fish with care, but do not open it more than is needful; fill it either with the forcemeat No. 1, or No. 2 of Chapter VIII., and its own roe; then sew it up, or fasten it securely with very fine skewers, wrap it in a thickly buttered paper, and broil it gently for an hour over a charcoal fire. Serve it with caper sauce, or with chili vinegar and melted butter.

We are indebted for this receipt to a friend who has been long resident in Touraine, at whose table the fish is constantly served thus dressed, and is considered excellent. It is likewise often gently stewed in the light white wine of the country, and served covered with a rich _béchamel_. Many fish more common with us than the shad might be advantageously prepared in the same manner. The charcoal fire is not indispensable: any one that is entirely free from smoke will answer. We would suggest as an improvement, that oyster-forcemeat should be substituted for that which we have indicated, until the oyster season ends.

Broiled gently, 1 hour, more or less, according to the size.

STEWED TROUT.

(_Good common Receipt._)

[In season from May to August.]

[Illustration:

Trout.]

Melt three ounces of butter in a broad stewpan, or well tinned iron saucepan, stir to it a tablespoonful of flour, some mace, cayenne, and nutmeg; lay in the fish after it has been emptied, washed very clean, and wiped perfectly dry; shake it in the pan, that it may not stick, and when lightly browned on both sides, pour in three quarters of a pint of good veal stock, add a small faggot of parsley, one bay leaf, a roll of lemon-peel, and a little salt: stew the fish _very gently_ from half to three quarters of an hour, or more, should it be unusually fine. Dish the trout, skim the fat from the gravy, and pass it through a hot strainer over the fish, which should be served immediately. A little acid can be added to the sauce at pleasure, and a glass of wine when it is considered an improvement. This receipt is for one large or for two middling-sized fish. We can recommend it as a good one from our own experience.

Butter, 3 oz.; flour, 1 tablespoonful; seasoning of mace, cayenne, and nutmeg; trout, 1 large, or 2 moderate-sized; veal stock, 3/4 pint; parsley, _small_ faggot; 1 bay-leaf; roll of lemon-rind; little salt: 1/2 to 3/4 hour.

Obs.—Trout may be stewed in equal parts of strong veal gravy, and of red or white wine, without having been previously browned; the sauce should then be thickened, and agreeably flavoured with lemon-juice, and the usual store-sauces, before it is poured over the fish. They are also good when wrapped in buttered paper, and baked or broiled: if very small, the better mode of cooking them is to fry them whole. They should never be plain boiled, as, though naturally a delicious fish, they are then very insipid.

TO BOIL PIKE.

[In best season from September to February.]

[Illustration:

Pike.]

Take out the gills, empty and clean the fish very thoroughly, and soak it for half an hour with a cup of vinegar thrown into as much water as will cover it well, should there be any danger of its having a muddy taste.[49] Wipe the inside dry, and fill it with oyster-forcemeat, or with common veal forcemeat made either with butter or with suet (for which see Chapter VIII.); curl the fish round, and fasten it with the tail in the mouth, lay it on a fish-plate, cover it well with cold water, throw in some salt as soon as it boils, skim it well, and boil the fish gently from half to a whole hour according to its size. Some persons prefer the scales taken off the pike when it is prepared for this mode of dressing; and many cooks still put the fish into _boiling_ water well salted and skimmed. Serve it with plain melted butter, or anchovy sauce.

Footnote 49:

Soaking fish is always better avoided when it can be so; well washing the inside with strong vinegar would perhaps remove the objectionable flavour without it.

Moderate sized, 1/2 hour; large, 1 hour.

Obs.—We must repeat that it is impossible to give for fish which varies so much in quality as well as in size, directions for the exact time which is required to cook it; a few minutes, more or less, must often be allowed; and it should always be watched attentively, and lifted from the water as soon as it is done.

TO BAKE PIKE.

(_Common Receipt._)

Pour warm water over the outside of the fish, and wipe it very clean with a coarse cloth drawn from the head downwards, that the scales may not be disturbed; then wash it well in cold water, empty, and cleanse the inside with the greatest nicety, fill it either with the common forcemeat No. 1, or with No. 4 of Chapter VIII., sew it up, fasten the tail to the mouth, give it a slight dredging of flour, stick small bits of butter thickly over it, and bake it from half to three quarters of an hour, should it be of moderate size, and upwards of an hour, if it be large. Should there not be sufficient sauce with it in the dish, melted butter and a lemon, or anchovy sauce may be sent to table with it. When more convenient the forcemeat may be omitted, and a little fine salt and cayenne, with some bits of butter, put into the inside of the fish, which will then require rather less baking. A buttered paper should always be laid over it in the oven, should the outside appear likely to become too highly coloured or too dry before the fish is done; and it is better to wrap quite small pike in buttered paper at once before they are sent to the oven.

Moderate-sized pike, 30 to 45 minutes; large pike, 1 to 1-1/4 hour.

TO BAKE PIKE.

(_Superior Receipt._)

Scale and wash the fish, take out the gills, then open it just sufficiently to allow the inside to be emptied and _perfectly cleansed_, but not more than is necessary for that purpose. Wipe it as dry as possible in every part, then hang it for an hour or two on a hook in a cool larder, or wrap it in a soft cloth. Fill the body with the forcemeat No. 1 or 3, or with the oyster forcemeat of Chapter VIII.; sew it up very securely, curl it round, and fasten the tail into the mouth with a thin skewer, then dip it into the beaten yolks of two or more eggs, seasoned with nearly half a teaspoonful of salt and a little pepper or cayenne; cover it equally with the finest bread-crumbs,

dip it a second time into the egg and crumbs, then pour some clarified butter gently over it, through a small strainer, and send it to a well heated oven for an hour and a quarter or more, should it be _very_ large, but for less time if it be only of moderate size. As it is naturally a very dry fish, it should not be left in the oven after it is thoroughly done, but it should never be sent to table until it is so. The crumbs of bread are sometimes mixed with a sufficient quantity of minced parsley to give the surface of the fish a green hue. Send plain melted butter, and brown caper, or Dutch sauce to table with it.

TO STEW CARP.

(_A common Country Receipt._)

[Illustration:

Carp.]

Scale and clean the fish with exceeding care, lay it into a stewpan, and cover it with good cold beef or veal broth; add one small onion stuck with a few cloves, a faggot of savoury herbs, three or four slices of carrot, and a little salt, and stew the carp as gently as possible for nearly an hour. Have ready some good brown gravy, mixed with a couple of glassesful of port wine; add a squeeze of lemon-juice, dish the carp very carefully, pour the sauce over, and serve it immediately. We would recommend the Genevese Sauce, of Chapter V., as superior to any other for this dish.

This receipt is for a fish which averages from five to six pounds in weight, but the carp sometimes attains to a very large size; and sufficient time to cook it perfectly should always be allowed for it.

TO BOIL PERCH.[50]

Footnote 50:

The figure of this fish is very disproportioned in size to that of the carp and other kinds inserted here, as it is _quite small_ at its fullest growth compared with the carp, which sometimes attains to a great weight.

[Illustration:

Perch.]

First wipe or wash off the slime, then scrape off the scales, which adhere rather tenaciously to this fish; empty and clean the insides perfectly, take out the gills, cut off the fins, and lay the perch into equal parts of cold and of boiling water, salted as for mackerel: from eight to ten minutes will boil them unless they are very large. Dish them on a napkin, garnish them with curled parsley, and serve melted butter with them, or _Maître d'Hôtel Sauce Maigre_.

Very good French cooks put them at once into boiling water and keep them over a brisk fire for about fifteen minutes. They dress them also without taking off the scales or fins until they are ready to serve, when they strip the whole of the skin off carefully, and stick the red fins into the middle of the backs; the fish are then covered with the Steward's sauce, thickened with eggs.

In warm water, 8 to 10 minutes; in boiling, 12 to 15 minutes.

TO FRY PERCH OR TENCH.

Scale, and clean them perfectly; dry them well, flour and fry them in boiling lard. Serve plenty of crisped or fried parsley round them.

TO FRY EELS.

[In season all the year, but not so well-conditioned in April and May as in other months.]

First kill, then skin, empty, and wash them as clean as possible; cut them into four-inch lengths, and dry them well in a soft cloth. Season them with fine salt, and white pepper, or cayenne, flour them thickly, and fry them a fine brown in boiling lard; drain and dry them as directed for soles, and send them to table with plain melted butter or anchovy sauce. Eels are sometimes dipped into batter and then fried; or into egg and fine bread-crumbs (mixed with minced parsley or not, at pleasure), and served with plenty of crisped parsley round, and on them.

It is an improvement for these modes of dressing the fish to open them entirely; and remove the bones: the smaller parts should be thrown into the pan a minute or two later than the thicker portions of the bodies or they will not be equally done.

BOILED EELS.

(_German Receipt._)

Pare a fine lemon, and strip from it entirely the white inner rind; slice it, and remove the pips with care; put it with a blade of mace, a small half-teaspoonful of white peppercorns, nearly twice as much of salt, and a moderate-sized bunch of parsley, into three pints of cold water, bring them gently to boil, and simmer them for twenty minutes; let them become quite cold; then put in three pounds of eels skinned; and cleaned with great nicety, and cut into lengths of three or four inches; simmer them very softly from ten to fifteen minutes, lift them with a slice into a very hot dish, and serve them with a good Dutch sauce, or with parsley and butter acidulated with lemon-juice, or with chili vinegar.

For boiled eels with sage (German Receipt), _see Chapter of Foreign Cookery_.

EELS.

(_Cornish Receipt._)

Skin, empty, and wash as clean as possible, two or three fine eels, cut them into short lengths, and just cover them with cold water; add sufficient salt and cayenne to season them, and stew them very softly indeed from fifteen to twenty minutes, or longer should they require it. When they are nearly done, strew over them a teaspoonful of minced parsley, thicken the sauce with a teaspoonful of flour mixed with a slice of butter, and add a quarter of a pint or more of clotted cream. Give the whole a boil, lift the fish into a hot dish, and stir briskly the juice of half a lemon into the sauce; pour it upon the eels, and serve them immediately: Very sweet thick cream is, we think, preferable to clotted cream for this dish. The sauce should be of a good consistence, and a dessertspoonful of flour will be needed for a large dish of the stew, and from one and a half to two ounces of butter. The size of the fish must determine the precise quantity of liquid and of seasoning which they will require.

RED HERRINGS, À LA DAUPHIN.

Take off the heads, open the backs of the fish, and remove the backbones: soak the herrings, should they be very dry, for two or three hours in warm milk and water, drain and wipe them. Dissolve a slice of fresh butter, and mix it with the beaten yolks of a couple of eggs and some savoury herbs minced small: dip the fish into these, and spread them thickly with fine bread-crumbs; broil them of a light brown, over a moderate fire, and serve them on hot buttered toasts, sprinkled with a little cayenne.

RED HERRINGS, COMMON ENGLISH MODE.

This fish is rendered infinitely more delicate by pouring boiling water on it before it is dressed, and leaving it to soak for half an hour, or more, should it be highly dried. The fresh Yarmouth bloaters do not require this. Cut off the heads and tails, open the herrings at the back, and warm them through before the fire, or upon the gridiron. They may be rubbed with a bit of cold butter, and seasoned with a slight sprinkling of pepper or cayenne, when these are liked, or served quite plain.

ANCHOVIES FRIED IN BATTER.

Scrape very clean a dozen or more of fine anchovies, and soak them in plenty of spring water from two to six hours: then wipe them dry, open them, and take out the backbones, without dividing the fish. Season the insides highly with cayenne, close the anchovies, dip them into the French batter of Chapter V., or into a light English batter, and fry them a pale amber-colour: in from four to five minutes they will be quite sufficiently done.

CHAPTER III.

=Dishes of Shell-Fish=

[Illustration]

OYSTERS.

[In season from September to April.]

THE old-fashioned plan of _feeding_ oysters with a sprinkling of oatmeal or flour, in addition to the salt and water to which they were committed, has long been rejected by all genuine amateurs of these nutritious and excellent fish, who consider the plumpness which the oysters are supposed to gain from the process, but poor compensation for the flavour which they are sure to lose. To cleanse them when they first come up from the beds, and to keep them in good condition for four or five days, they only require to be covered with cold water, with five ounces of salt to the gallon dissolved in it before it is poured on them; this should be changed with regularity every twenty-four hours. By following this plan with exactness they may be kept alive from a week to ten days, but will remain in perfect condition scarcely more than half that time. Oysters should be eaten always the instant they are opened. Abroad they are served before the soup in the first course of a dinner, arranged usually in as many plates as there are guests at table. In England they are sometimes served _after_ the soup. A sense of _appropriateness_ must determine how far the variations of fashion should be followed in such matters.

Obs.—We were accustomed formerly to have the brine which was supplied to oysters intended to be kept for some days, changed twice in the twenty-four hours; but we were informed by an oyster merchant in an extensive business that once was sufficient.

TO SCALLOP OYSTERS.

Large coarse oysters should never be dressed in this way. Select small plump ones for the purpose, let them be opened carefully, give them a scald in their own liquor, wash them in it free from grit, and beard them neatly. Butter the scallop shells and shake some fine bread-crumbs over them; fill them with alternate layers of oysters, crumbs of bread, and fresh butter cut into small bits; pour in the oyster-liquor, after it has been strained, put a thick, smooth layer of bread-crumbs on the top, moisten them with clarified butter,[51] place the shells in a Dutch oven before a clear fire, and turn them often until the tops are equally and lightly browned: send them immediately to table.

Footnote 51:

Common cooks merely stick small bits of butter on them.

Some persons like a little white pepper or cayenne, and a flavouring of nutmeg added to the oysters; others prefer pounded mace. French cooks recommend with them a mixture of minced mushrooms stewed in butter till quite tender, and sweet herbs finely chopped. The fish is sometimes laid into the shells after having been bearded only.

SCALLOPED OYSTERS À LA REINE.

Plump and beard the oysters, after having rinsed them well in their own strained liquor; add to this about an equal quantity of very rich white sauce, and thicken it, if needful, with half a teaspoonful of flour, mixed with a small slice of butter, or with as much arrow-root only; put in the oysters, and keep them at the point of simmering for three or four minutes: lay them into the shells, and cover the tops thickly with crumbs fried a delicate brown and well dried; or heap over them instead, a layer of fine crumbs; pour clarified butter on them, and brown them with a salamander.

TO STEW OYSTERS.

A pint of small plump oysters will be sufficient for a quite moderate-sized dish, but twice as many will be required for a large one. Let them be very carefully opened, and not mangled in the slightest degree; wash them free from grit in their own _strained_ liquor, lay them into a very clean stewpan or well-tinned saucepan, strain the liquor a second time, pour it on them, and heat them slowly in it. When they are just beginning to simmer, lift them out with a slice or a bored wooden spoon, and take off the beards; add to the liquor a quarter of a pint of good cream, a seasoning of pounded mace, and cayenne, and a little salt, and when it boils, stir in from one to two ounces of good butter, smoothly mixed with a large teaspoonful of flour; continue to stir the sauce until these are perfectly blended with it, then put in the oysters, and let them remain by the side of the fire until they are very hot: they require so little cooking that, if kept for four or five minutes nearly simmering, they will be ready for table, and they are quickly hardened by being allowed to boil, or by too much stewing. Serve them garnished with pale fried sippets.

Small plump oysters, 1 pint: their own liquor: brought slowly to the point of simmering. Cream, 1/4 pint; seasoning of pounded mace and cayenne; salt as needed; butter, 1 to 2 oz.; flour, 1 large teaspoonful.

Obs.—A little lemon-juice should be stirred quickly into the stew just as it is taken from the fire. Another mode of preparing this dish, is to add the strained liquor of the oysters to about an equal quantity of rich _bechamel_, with a little additional thickening; then to heat them in it, after having prepared and plumped them properly. Or, the beards of the fish may be stewed for half an hour in a little pale gravy, or good broth, and this, when strained and mixed with the oyster-liquor, may be brought to the consistency of cream with the French thickening of Chapter V., or, with flour and butter, then seasoned with spice as above: the process should be quite the same in all of these receipts, though the composition of the sauce is varied. Essence of anchovies, cavice, chili vinegar, or yolks of eggs can be added to the taste.

For Curried Oysters see Chapter XVI.

OYSTER SAUSAGES.

(_A most excellent Receipt._)

Beard, rinse well in their strained liquor, and mince but not finely, three dozens and a half of plump native oysters, and mix them with ten ounces of fine bread-crumbs, and ten of beef-suet chopped extremely small; add a saltspoonful of salt, and one of pepper, or less than half the quantity of cayenne, twice as much pounded mace, and the third of a small nutmeg grated: moisten the whole with two unbeaten eggs, or with the yolks only of three, and a dessertspoonful of the whites. When these ingredients have been well worked together, and are perfectly blended, set the mixture in a cool place for two or three hours before it is used; make it into the form of small sausages or sausage cakes, flour and fry them in butter of a fine light brown; or throw them into boiling water for three minutes, drain, and let them become cold, dip them into egg and bread-crumbs, and broil them gently until they are lightly coloured. A small bit should be cooked and tasted before the whole is put aside, that the seasoning may be heightened if required. The sausages thus made are extremely good: the fingers should be well floured in making them up.

Small plump oysters, 3-1/2 dozens; bread-crumbs, 10 oz.; beef suet, 10 oz.; seasoning of salt, cayenne, pounded mace, and nutmeg; unbeaten eggs 2, or yolks of 3.

TO BOIL LOBSTERS.

[In full season from April to October: may be had all the year.]

Choose them by the directions given at the commencement of this chapter, and throw them into plenty of _fast-boiling_ salt and water, that life may be destroyed in an instant.

To 1 gallon of water, 5 ounces salt: moderate sized lobster, 15 to 20 minutes; large lobster, 30 to 40 minutes; _very_ large, 1 hour or more.

COLD DRESSED LOBSTER AND CRAB.

[Illustration:

Dressed Lobster.]

Before a lobster is sent to table take off the large claws, hold each of them firmly with the edge upwards, and with a quick light blow from a cutlet bat or ought else convenient for the purpose, crack the shell without disfiguring the fish. Split the tail open with a very sharp knife and dish the lobster in the manner shown in the engraving, either with, or without a napkin under it. When the soft part of the body is required to mix with the dressing, take it out before it is served, and add it to the _remoulade_, or other sauce with which it is to be mingled. The shrimp _chatney_ of Chapter VI. is a wholesome accompaniment to this fish; which we must remark here should be sparingly eaten, or altogether avoided, by persons in delicate health, and especially at night. It is too much the fashion to serve it as a supper dish at parties; and it sometimes produces dangerous attacks of indigestion and other illness. The flesh of the crab is much lighter. This is served in the shell, which should be entirely emptied and nicely cleaned out; the sides filled with the white flesh divided into small flakes, and the centre with the soft part or _cream_ as it is called.

[Illustration:

Dressed Crab.]

The flesh of two crabs can be served in one shell when a dish of handsome appearance is required, and the sauce can be mixed with it the instant before it is sent to table, though it will be whiter, and of better appearance without it. The centre may be filled with a red Imperial _Mayonnaise_, when a good effect is wanted. For other appropriate sauces see Chapter VI.

LOBSTERS, FRICASSEED, OR AU BÉCHAMEL. (ENTRÉE.)

Take the flesh from the claws and tails of two moderate-sized lobsters; cut it into small scallops or dice; heat it slowly quite through in about three quarters of a pint of good white sauce or _béchamel_; and serve it when it is at the point of boiling, after having stirred briskly to it a little lemon-juice just as it is taken from the fire. The coral, pounded and mixed gradually with a few spoonsful of the sauce, should be added previously. Good shin of beef stock made without vegetables (see page 97), and somewhat reduced by quick boiling, if mixed with an equal proportion of cream, and thickened with arrow-root, will answer extremely well in a general way for this dish, which is most excellent if well made. The sauce should never be thin; nor more than sufficient in quantity to just cover the fish. For a second course dish, only as much must be used as will adhere to the fish, which after being heated should be laid evenly into the shells, which ought to be split quite through the centre of the backs in their entire length, without being broken or divided at the joint, and nicely cleaned. When thus arranged, the lobster may be thickly covered with well dried, fine, pale fried crumbs of bread, or with unfried ones, which must then be equally moistened with clarified butter, and browned with a salamander. A small quantity of salt, mace, and cayenne, may be required to finish the flavouring of either of these preparations.

HOT CRAB, OR LOBSTER.

(_In season during the same time as Lobsters._)

Slice quite small, or pull into light flakes with a couple of forks, the flesh of either fish; put it into a saucepan with a few bits of good butter lightly rolled in flour, and heat it slowly over a gentle fire; then pour over and thoroughly mix with it, from one to two teaspoonsful or more of common or of chili vinegar; if with the former, add to it a tolerable seasoning of cayenne. Grate in a little nutmeg, and when the whole is well heated serve it immediately, either in the shell of the crab or lobster, or in scallop-shells, and serve it plain, or with bread-crumbs over, as in the preceding receipt. A spoonful or so of good meat jelly is, we think, a great improvement to this dish, for which an ounce and a half of butter will be quite sufficient.

This is sometimes called _Buttered Crab_.

POTTED LOBSTERS.

Separate carefully the flesh of freshly-boiled lobsters from the shells, and from the tough red skin of the tails, mince the fish up quickly with a very sharp knife, turn it immediately into a large mortar, and strew over it a mixed seasoning of fine cayenne, pounded mace, lightly grated nutmeg, and salt: this last should be sparingly used in the first instance, and it should be reduced to powder before it is added. Pound the lobsters to a perfect paste with from two to three ounces of firm new butter to each fish if of large size, but with less should it be small; and the lobster-coral previously rubbed through a sieve, or with a portion of it only, should any part of it be required for other purposes. When there is no coral, a fine colour may be given to the mixture by stewing the red skin of the tails very softly for ten or twelve minutes in part of the butter which is used for it, but which must be strained and left to become perfectly cold before it is mingled with the fish. The degree of seasoning given to the mixture can be regulated by the taste; but no flavour should predominate over that of the lobster itself; and for all delicate preparations, over-spicing should be particularly avoided. A quart or more of fine brown shrimps, if very fresh and quickly shelled at the instant of using, may be chopped up and pounded with the lobsters with excellent effect. Before the mixture is taken from the mortar it should be placed in a cool larder, or set over ice for a short time, to render it firm before it is pressed into the potting-pans or moulds. In putting it into these, be careful to press it into a compact, even mass; smooth the surface, run a little clarified butter over, when it is only _just liquid_, for if hot it would prevent the fish from keeping—and send the lobster to table, neatly garnished with light green foliage; or with ornamentally-cut paper fastened round the mould; or with a small damask napkin tastefully arranged about it.

Obs.—By pounding separately part of the white flesh of the fish, freed from every particle of the skin, and by colouring the remainder highly with the coral of the lobster, and then pressing the two in alternate and regular layers into a mould, a dish of pretty appearance is produced, which should be turned out of the mould for table. Ham and turkey (or any other white meat) are often potted in this way.

LOBSTER CUTLETS.

(_A Superior Entrée._)

Prepare and pound with exceeding nicety, by the preceding receipt for Potted Lobsters, about three quarters of a pound of the flesh of a couple of fine fresh lobsters, of which one must be a hen lobster; add to it, when it is partially beaten, an ounce and a half of sweet new butter, a saltspoonful of salt, and about two-thirds as much of mixed mace and cayenne, with a dessertspoonful of the inside coral, the whole of which should be rubbed with a wooden spoon through a hair sieve, to be in readiness for use. When all these ingredients are well blended, and beaten to the finest and smoothest paste, the mixture should be tested by the taste, and the seasoning heightened if needful; but, as the preparation is very delicate, it should not be over-spiced. Mould it into the form of small cutlets about the third of an inch thick, stick into each a short bit of the smallest claws, strew the coral lightly over them so as to give them the appearance of being crumbed with it, arrange them round the dish in which they are to be sent to table, place them in a very gentle oven for eight or ten minutes only to heat them through, or warm them in a Dutch or American oven, placed at some distance from the fire, that the brilliant colour of the coral may not be destroyed; and pour into the centre some good _béchamel_ (see page 108), or the Lady's Sauce, or the Cream Sauce of Chapter IV. A very white sauce best contrasts with the colour of the cutlets. This is an excellent and elegant dish, of which an admirable variety is made by the addition of three or four ounces of the freshest shrimps, quickly shelled, and chopped before they are thrown into the mortar, with half an ounce of butter and a little spice. All the coral can be added to the cutlets at pleasure; but it is generally in request for many purposes, and is required for this one only in part.

Obs.—As lobsters are well known to be the most indigestible of shell fish, and as they sometimes prove dangerously so to persons out of health, these pounded preparations are the best and safest forms in which they can be served: they should at all times be beaten to a smooth, _fibreless_ paste, before they are taken from the mortar; and no fish that is not entirely _fresh_ should ever be used for them. Prawns may be advantageously served in the same manner.

For Indian Lobster Cutlets, see Chapter of Foreign Cookery.

LOBSTER SAUSAGES.

Let the fish be pounded as for the cutlets above or for _boudinettes_, but mix half or more of the coral with the flesh of the lobsters; shape it like small sausages, sprinkle them with the powdered coral, and heat them through in a Dutch or American oven. They may be brushed with clarified butter before the coral is strewed over them, but they scarcely need it. A fierce degree of heat will destroy the excellence of _all_ these preparations.

BOUDINETTES OF LOBSTERS, PRAWNS, OR SHRIMPS. (ENTRÉE).

(_Author's Receipt._)

When the fish has been prepared as above, mould it in as many _very small_ round cups as will suffice for a dish; heat them gently through at the mouth of the oven or before the fire, and serve them dry, or with a little rich white sauce, coloured with lobster-coral poured round, but not upon them. These _boudinettes_ are delicious, made entirely of shrimps or prawns, which it is an advantage to have prepared as follows, either for this purpose or for potting simply, as they will then be firmer, and will also remain good much longer:—Shell them quickly, and touch them as little as possible in the process; put them into an enamelled saucepan with about three ounces of butter to the quart, and strew the spice upon them; place them by the side of a gentle fire that they may heat through very gradually, and shake the saucepan round occasionally to mingle the seasoning equally with them. Do not allow them to boil, as that would render them tough, but when they are heated quite through and the butter approaches the point of simmering, draw them from the fire; let them remain for a few minutes in the saucepan, then lay them very evenly and closely into the pans and pour the butter on them; but let it be clear from sediment, or from any liquid which may be perceptible at the bottom of the saucepan. When merely required for _boudinettes_, the fish may be turned into a large pan or basin and left until thoroughly cold, then chopped small upon a dish with the butter in which they are imbedded, and pounded as usual; no additional butter will be required for them, and part of that in which they have been heated may be set aside for fish-sauce when the proportion of it directed here is considered too large. As it should cover the shrimps entirely when they are potted whole, sufficient to do so should be melted with them. It is an excellent plan to dissolve it in a separate saucepan, to skim it well, and after it has stood to become clear, to pour it gently over the shrimps, leaving all the buttermilk behind. They should not be placed immediately by the fire, or they will

heat too quickly: they should be set away from it until the butter has cooled upon them. If carefully prepared, and agreeably seasoned, they will be excellent, and can be sent to a great distance without detriment if packed so as to be kept cool. The red shrimps may be substituted for the brown, when they can be more easily procured.

Obs.—Lobsters and shrimps, or prawns, in equal proportions, answer _extremely_ well for _boudinettes_ as for potting.

TO BOIL SHRIMPS OR PRAWNS.

Throw them into plenty of fast boiling water, to which salt has been added in the proportion of from five to six ounces to the gallon; take off all the scum, boil the shrimps for five or six minutes, or rather less should they be very small, and the prawns for about two minutes longer. The shrimpers[52] of the coast frequently cook them in sea-water, but the flavour is not then so agreeable as when fresh brine is used for them. They are always unwholesome when not sufficiently boiled; and even more so when they are stale. As soon as they are tender, drain them well in a cullender, and spread them out on a soft cloth to cool; or dish them on a napkin, and send them hot to table when they are liked so. The large brown shrimps are considered the best, and they are more easily shelled than the red ones: these last, however, are sometimes preferred to them. Prawns, though superior to shrimps only in _size_, are always much higher in price.

Footnote 52:

Or _pandlers_, as they are often called.

Shrimps, 5 to 6 minutes if large. Prawns, 6 to 8 minutes.

Obs.—Ready-dressed shrimps or prawns may be preserved fit for eating at least twelve hours longer than they would otherwise keep, by throwing them for an instant into boiling salt and water, when they first begin to lose their freshness, and then draining them as above.

TO DISH COLD PRAWNS.

When they are quite cold, dish them singly upon a very white napkin neatly arranged over a saucer or small basin reversed in a dish, and garnish the base with a wreath of curled parsley, or with small leaves of the purple endive.

TO SHELL SHRIMPS AND PRAWNS QUICKLY AND EASILY.

This, though a most simple process, would appear, from the manner in which it is performed by many people, to be a very difficult one; indeed it is not unusual for persons of the lower classes, who, from lack of a little skill, find it slow and irksome, to have resource to the dangerous plan of eating the fish entire. It need scarcely be remarked that very serious consequences may accrue from the shells being swallowed with them, particularly when they are taken in large quantities. Unless the fish be stale, when they are apt to break, they will quit the shells easily if the head be held firmly in the right hand and the tail in the other, and the fish be straightened entirely, then the two hands pressed quickly towards each other, and the shell of the tail broken by a slight vibratory motion of the right hand, when it will be drawn of with the head adhering to it: a small portion, only will then remain on at the other end, which can be removed in an instant.

CHAPTER IV.

=Gravies.=

INTRODUCTORY REMARKS.

[Illustration:

Gravy Kettle.]

GRAVIES are not often required either in great variety, or in abundant quantities, when only a moderate table is kept, and a clever cook will manage to supply, at a trifling cost, all that is generally needed for plain family dinners; while an unskilful or extravagant one will render them sources of unbounded expense.[53] But however small the proportions in which they are made, their _quality_

should be particularly attended to, and they should be well adapted in flavour to the dishes they are to accompany. For some, a high degree of savour is desirable, but for fricassees, and other preparations of delicate white meats, this should be avoided, and a soft, smooth sauce of refined flavour should be used in preference to any of more piquant relish.

Footnote 53:

We know of an instance of a cook who stewed down two or three pounds of beef to make gravy for a single brace of partridges; and who complained of the meanness of her employers (who were by no means affluent) because this was objected to.

Instead of frying the ingredients for brown gravies, which is usually done in common English kitchens, French cooks pour to them at first a small quantity of liquid, which is reduced by rapid boiling to what is technically called _glaze_; particular directions for which will be found in the next receipt to this, and also at pages 10 and 104. When the glaze has acquired the proper colour, boiling broth should be added in small portions, and well shaken round the stewpan to detach it entirely; the meat may then be stewed gently for three or four hours with a few mushrooms, should they be at hand, a bunch of parsley, and some green onions, or with a Portugal onion instead.

A thick slice or two of an unboiled ham, is an almost indispensable addition to rich soup or gravy, and to supply it in the most economical manner, a large, highly cured one, or more, not over fatted, should be kept for the purpose, and cut as required. The bones of undressed meat will supply almost, or quite as good gravy-stock as the meat itself, if well boiled down, particularly those of the loin, or neck of veal; and as the flesh of these may be dressed in many ways advantageously without them, the whole joint may be turned to excellent account by so dividing it.

The necks of poultry, with the feet properly skinned, a few herbs, a morsel or two of ham or of lean bacon, and such slight flavourings beside as the spice-box can supply, with a few drops of good mushroom catsup, will of themselves, if well managed, produce sufficient gravy to serve with the birds from which they are taken; and if not wanted for the purpose, they should always be stewed down, or thrown into the stock pot, for which the shank bones of legs of mutton, and all trimmings of meats should likewise be reserved. Excellent broth for the sick or for the needy, may also be made of them at little cost, when they are not required for other uses.

To deepen the colour of gravies, the thick mushroom _pressings_ of Chapter VII., or a little soy (when its flavour is admissible), or cavice [TN: illegible], or Harvey's sauce, may be added to it; and for some dishes, a glass of claret, or of port wine.

Vermicelli, or rasped cocoa-nut, lightly, and _very_ gently browned in a small quantity of butter, will both thicken and enrich them, if about an ounce of either to the pint of gravy be stewed gently in it, from half an hour to an hour, and then strained out.

All the ingredients indicated at page 4, for giving consistency to soups, will answer equally for gravies, which should not, however, be too much thickened, particularly with the unwholesome mixture of flour and butter, so commonly used for the purpose. Arrow-root or rice-flour, or common flour gradually browned in a slow oven, are much better suited to a delicate stomach. No particle of fat should ever be perceptible upon them when they are sent to table; and when it cannot be removed by skimming, they should be allowed to become sufficiently cold for it to congeal, and be taken off at once without trouble. It may be cleared from such as have not been thickened by passing them through a closely woven cloth, which has previously been laid into, and well wrung from, some cold water.

JEWISH SMOKED BEEF.

(_Extremely useful for giving flavour to soup and gravy._)

This beef, of which we have more fully spoken in Chapter XXXIV.[TN: chapter missing], imparts a remarkably fine flavour to soup or gravy; but great care must be taken in using it to cut _quite away_ all the external parts which have been discoloured in the drying: the whole of the surface, indeed, should be rather thickly pared off, or it will give a _smoky_ taste to the gravy. An ounce or two of the lean thus cleared from the outsides and from all skin and fat, and divided first into thick slices, and then into small squares, will flavour a pint or more of stock of any kind: it may be added to the meat in making Liebeg gravy when it is first put into the stewpan.

TO HEIGHTEN THE COLOUR AND THE FLAVOUR OF GRAVIES.

This is best done by the directions given for making _Espagnole_. An ounce or two of the lean of unboiled ham, cut into dice and coloured slowly in a small stewpan, or smoothly-tinned iron saucepan, with less than an ounce of butter, a blade of mace, two or

three cloves, a bay-leaf, a few small sprigs of savoury herbs, and an eschalot or two, or about a teaspoonful of minced onion, and a little young parsley root, when it can be had, will convert common shin of beef stock, or even strong broth, into an excellent gravy, if it be gradually added to them after they have stewed slowly for quite half an hour, and then boiled with them for twenty minutes or more. The liquid should not be mixed with the other ingredients until the side of the stewpan is coloured of a reddish brown; and should any thickening be required, a teaspoonful of flour should be stirred in well, and simmered for three or four minutes before the stock is added; the pan should be strongly shaken round afterwards, to detach the browning from it, and this must be done often while the ham is stewing.

Obs.—The cook who is not acquainted with this mode of preparing or enriching gravies, will do well to make herself acquainted with it; as it presents no difficulties, and is exceedingly convenient and advantageous when they are wanted in small quantities, very highly flavoured and well coloured. An unboiled ham, kept in cut, will be found, as we have already said, a great economy for this, and other purposes, saving much of the expense commonly incurred for gravy-meats. As eschalots, when sparingly used, impart a much finer savour than onions, though they are not commonly so much used in England, we would recommend that a small store of them should always be kept.

BARON LIEBEG's BEEF GRAVY.

(_Most excellent for hashes, minces, and other dishes made of cold meat._)

For particulars of this most useful receipt, for extracting all its juices from fresh meat of every kind in the best manner, the cook is referred to the first part of the chapter on soups. The preparation, for which minute directions are given there, if poured on a few bits of lean ham lightly browned, with the other ingredients indicated above, will be converted into gravy of fine flavour and superior quality.

With no addition, beyond that of a little thickening and spice, it will serve admirably for dressing cold meat, in all the usual forms of hashes, minces, _blanquettes_, &c., &c., and convert it into dishes as nourishing as those of meat freshly cooked, and it may be economically made in small quantities with any trimmings of _undressed_ beef, mutton, or veal, mixed together, which are free from fat, and not sinewy: flavour may be given to it at once by chopping up with them the lean part only of a slice or two of ham, or of highly-cured beef.

SHIN OF BEEF STOCK FOR GRAVIES.

There is no better foundation for strong gravies than shin of beef stewed down to a jelly (which it easily becomes), with the addition only of some spice, a bunch of savoury herbs, and a moderate proportion of salt; this, if kept in a cool larder, boiled softly for two or three minutes every second or third day, and each time put into a clean, well-scalded pan, will remain good for many days, and may easily be converted into excellent soup or gravy. Let the bone be broken in one or two places, take out the marrow, which, if not wanted for immediate use, should be clarified, and stored for future occasions; put a pint and a half of cold water to the pound of beef, and stew it very gently indeed for six or seven hours, or even longer should the meat not then be quite in fragments. The bones of calf's feet which have been boiled down for jelly, the liquor in which the head has been cooked, and any remains of ham quite freed from the smoky parts, from rust, and fat, will be serviceable additions to this stock. A couple of pounds of the neck of beef may be added to six of the shin with very good effect; but for white soup or sauces this is better avoided.

Shin of beef, 6 lbs.; water, 9 pints; salt, 1 oz.; large bunch of savoury herbs; peppercorns, 1 teaspoonful; mace, 2 blades.

RICH PALE VEAL GRAVY, OR CONSOMMÉ.

The French, who have always at hand their stock-pot of good _bouillon_ (beef soup or broth), make great use of it in preparing their gravies. It is added instead of water to the fresh meat, and when this, in somewhat larger proportions, is boiled down in it, with the addition only of a bunch of parsley, a few green onions, and a moderate seasoning of salt, a strong and very pure-flavoured pale gravy is produced. When the best joints of fowls, or of partridges have been taken for fricassees or cutlets, the remainder may be stewed with a pound or two of veal into a _consommé_, which then takes the name of chicken or of game gravy. For a large dinner it is always desirable to have in readiness such stock as can easily and quickly be converted into white and other sauces. To make this, arrange a slice or two of lean ham in a stewpan or saucepan with three pounds of the neck of veal once or twice divided (unless the thick fleshy part of the knuckle can be had), and pour to them three full pints of strong beef or veal broth; or, if this cannot conveniently be done, increase the proportion of meat or diminish that of the liquid, substituting water for the broth; throw in

some salt after the boiling has commenced, and the gravy has been well skimmed, with one mild onion, a bunch of savoury herbs, a little celery, a carrot, a blade of mace, and a half-saltspoonful of peppercorns; stew those very gently for four hours; then, should the meat be quite in fragments, strain off the gravy, and let it become sufficiently cold to allow the fat to be entirely cleared from it. A handful of nicely prepared mushroom-buttons will much improve its flavour; and the bones of boiled calf's feet, or the fresh ones of fowls, will be found excellent additions to it. A better method of making it, when time and trouble are not regarded, is to heat the meat, which ought to be free of bones, quite through, with from a quarter to half a pint of broth only, and when on probing it with the point of a knife no blood issues from it, and it has been turned and equally done, to moisten it with the remainder of the broth, which should be boiling.

Lean of ham, 6 to 8 oz.; neck or knuckle of veal, 3 lbs.; strong broth, 3 pints (or veal, 4 lbs., and water, 3 pints); salt; bunch of savoury herbs; mild onion, 1; carrot, 1 large or 2 small; celery 1/2 small head; mace, 1 large blade; peppercorns, 1/2 saltspoonful; 4 hours or more. Or: ham, 1/2 lb.; veal, 4 lbs.; broth, third of a pint; nearly 1 hour. Additional broth, 3 pints: 3-1/2 to 4-1/2 hours.

RICH DEEP-COLOURED VEAL GRAVY.

Lay into a large thick stewpan or saucepan, from half to three quarters of a pound of undressed ham, freed entirely from fat, and from the smoked edges, and sliced half an inch thick; on this place about four pounds of lean veal, cut from the best part of the knuckle or from the neck (part of the fillet, which in France is often used for it instead, not being generally purchasable here, the butchers seldom dividing the joint); pour to them about half a pint of good broth,[54] and place the pan over a brisk fire until it is well reduced; then thrust a knife into the meat, and continue the stewing more gently until a glaze is formed as we have described at page 10. The latter part of the process must be _very slow_; the stewpan must be frequently shaken, and the gravy closely watched that it may not burn: when it is of a fine _deep_ amber colour, pour in sufficient boiling broth to cover the meat, add a bunch of parsley, and a few mushrooms and green onions. A blade or two of mace, a few white peppercorns, and a head of celery, would, we think, be very admissible additions to this gravy, but it is extremely good without. Half the quantity can be made, but it will then be rather more troublesome to manage.

Footnote 54:

When there is no provision of this in the house, the quantity may be made with a small proportion of beef, and the trimmings of the veal, by the directions for _Bouillon_, Chapter I.

Undressed ham, 8 to 12 oz.; lean veal, 4 lbs.; broth, 1/2 pint; 1 to 2 hours. Broth, 3 to 4 pints: bunch of parsley and green onions, or 1 Portugal onion; mushrooms, 1/4 to 1/2 pint: 1-1/2 to 2 hours.

GOOD BEEF OR VEAL GRAVY. (ENGLISH RECEIPT.)

Flour and fry lightly in a bit of good butter a couple of pounds of either beef or veal; drain the meat well from the fat, and lay it into a small thick stewpan or iron saucepan; pour to it a quart of boiling water; add, after it has been well skimmed and salted, a large mild onion sliced, very delicately fried, and laid on a sieve to drain, a carrot also sliced, a small bunch of thyme and parsley, a blade of mace, and a few peppercorns; stew these gently for three hours or more, pass the gravy through a sieve into a clean pan, and when it is quite cold clear it entirely from fat, heat as much as is wanted for table, and if not sufficiently thick stir into it from half to a whole teaspoonful of arrow-root mixed with a little mushroom catsup. Beef or veal, 2 lbs.; water, 2 pints; fried onion, 1 large; carrot, 1; small bunch of herbs; salt, 1 small teaspoonful or more; mace, 1 blade; peppercorns, 20: 3 to 3-1/2 hours.

A RICH ENGLISH BROWN GRAVY.

Brown lightly and carefully from four to six ounces of lean ham, thickly sliced and cut into large dice; lift these out, and put them into the pan in which the gravy is to be made; next, fry lightly also, a couple of pounds of neck of beef dredged moderately with flour, and slightly with pepper; put this, when it is done, over the ham; and then brown gently and add to them two or three eschalots, or a Portugal onion; should neither of these be at hand, one _not_ large common onion must be used instead. Pour over these ingredients a quart of boiling water, or of weak but well-flavoured broth; bring the whole slowly to a boil, clear off the scum with great care, throw in a saltspoonful of salt, four cloves, a blade of mace, twenty corns of pepper, a bunch of savoury herbs, a carrot, and a few slices of celery: these last two may be fried or not as is most convenient. Boil the gravy very softly until it is reduced to little more than a pint; strain, and set it by until the fat can be taken from it. Heat it anew, add more salt if needed and a little mushroom catsup, cayenne-vinegar, or whatever flavouring it may require for the dish with which it is to be served; it will seldom

require any thickening. A dozen small mushrooms prepared as for pickling, or two or three morels, previously well washed and soaked, may be added to it at first with advantage. Half this quantity of gravy will be sufficient for a single tureen, and the economist can diminish a little the proportion of meat when it is thought too much.

PLAIN GRAVY FOR VENISON.

Trim away the fat from some cutlets, and lay them into a stewpan; set them over a clear fire, and let them brown a little in their own gravy; then add a pint of boiling water to each pound of meat. Take off the scum, throw in a little salt, and boil the gravy until reduced one half. Some cooks broil the cutlets lightly, boil the gravy one hour, and reduce it after it is strained. For appropriate gravy to serve with venison, see “Haunch of Venison,” Chapter XV.

A RICH GRAVY FOR VENISON.

There are few eaters to whom this would be acceptable, the generality of them preferring infinitely the flavour of the venison itself to any which the richest gravy made of other meats can afford; but when the flavour of a well-made _Espagnole_ is likely to be relished, prepare it by the receipt of the following page, substituting plain _strong_ mutton stock for the veal gravy.

SWEET SAUCE, OR GRAVY FOR VENISON.

Add to a quarter-pint of common venison gravy a couple of glasses of port wine or claret, and half an ounce of sugar in lumps. Christopher North’s sauce, mixed with three times its measure of gravy, would be an excellent substitute for this.

ESPAGNOLE (SPANISH SAUCE).

A highly-flavoured Gravy.

Dissolve a couple of ounces of good butter in a thick stewpan or saucepan, throw in from four to six sliced eschalots, four ounces of the lean of an undressed ham, three ounces of carrot, cut in small dice, one bay leaf, two or three branches of parsley, and one or two of thyme, but these last must be small; three cloves, a blade of mace, and a dozen corns of pepper; add part of a root of parsley, if it be at hand, and keep the whole stirred or shaken over a moderate fire for twenty minutes, then add by degrees one pint of very strong veal stock or gravy, and stew the whole gently from thirty to forty minutes; strain it, skim off the fat, and it will be ready to serve.

Butter, 2 oz.; eschalots, 4 to 6; lean of undressed ham, 4 oz.; carrots, 3 oz.; bay leaf, 1; little thyme and parsley, in branches; cloves, 3; mace, 1 blade; peppercorns, 12; little parsley root: fried gently, 20 minutes. Strong veal stock, or gravy, 1 pint: stewed very softly, 30 to 40 minutes.

ESPAGNOLE, WITH WINE.

Take the same proportions of ingredients as for the preceding _Espagnole_, with the addition, if they should be at hand, of a dozen small mushrooms prepared as for stewing; when these have fried gently in the stewpan until it appears of a reddish colour all round, stir in a tablespoonful of flour, and when it is lightly browned, add in small portions, letting each one boil up before the next is poured in, and shaking the pan well round, three quarters of a pint of hot and _good_ veal gravy, and nearly half a pint of Madeira or sherry. When the sauce has boiled gently for half an hour, add to it a small quantity of cayenne and some salt, if this last be needed; then strain it, skim off the fat entirely should any appear upon the surface, and serve it very hot. A smaller proportion of wine added a few minutes before the sauce is ready for table, would perhaps better suit with English taste, as with longer boiling its flavour passes off almost entirely. Either of these _Espagnoles_, poured over the well bruised remains of pheasants, partridges, or moor fowl, and boiled with them for an hour, will become most admirable game gravy, and would generally be considered a superlative addition to other roast birds of their kind, as well as to the hash or salmi, for which see Chapter XV.

Ingredients as in preceding receipt, with mushrooms 12 to 18; Madeira, or good sherry, 1/4 to 1/2 pint.

JUS DES ROGNONS, OR, KIDNEY GRAVY.

Strip the skin and take the fat from three fresh mutton kidneys, slice and flour them; melt two ounces of butter in a deep saucepan, and put in the kidneys, with an onion cut small, and a teaspoonful of fine herbs stripped from the stalks. Keep these well shaken over a clear fire until nearly all the moisture is dried up; then pour in a pint of boiling water, add half a teaspoonful of salt, and a little

cayenne or common pepper, and let the gravy boil gently for an hour and a half, or longer, if it be not thick and rich. Strain it through a fine sieve, and take off the fat. Spice or catsup may be added at pleasure.

Mutton kidneys, 3; butter, 2 oz.; onion, 1; fine herbs, 1 teaspoonful: 1/2 hour. Water, 1 pint; salt, 1/2 teaspoonful; little cayenne, or black pepper: 1-1/2 hour.

Obs.—This is an excellent cheap gravy for haricots, curries, or hashes of mutton; it may be much improved by the addition of two or three eschalots, and a small bit or two of lean meat.

GRAVY IN HASTE.

Chop fine a few bits of lean meat, a small onion, a few slices of carrot and turnip, and a little thyme and parsley; put these with half an ounce of butter into a thick saucepan, and keep them stirred until they are slightly browned; add a little spice, and water in the proportion of a pint to a pound of meat; clear the gravy from scum, let it boil half an hour, then strain it for use.

Meat, 1 lb.; 1 small onion; little carrot, turnip, thyme, and parsley; butter, 1/2 oz.; cloves, 6; corns of pepper, 12; water, 1 pint: 1/2 hour.

CHEAP GRAVY FOR A ROAST FOWL.

When there is neither broth nor gravy to be had, nor meat of which either can be made, boil the neck of the fowl after having cut it small, in half a pint of water, with any slight seasonings of spice or herbs, or with a little salt and pepper only; it should stew very softly for an hour or more, or the quantity will be too much reduced. When the bird is just ready for table, take the gravy from the dripping-pan, and drain off the fat from it as closely as possible; strain the liquor from the neck to it, mixing them smoothly, pass the gravy again through the strainer, heat it, add salt and pepper or cayenne, if needed, and serve it extremely hot. When this is done, the fowl should be basted with good butter only, and well floured when it is first laid to the fire. Many cooks always mix the gravy from the pan when game is roasted, with that which they send to table with it, as they think that it enriches the flavour; but to many persons it is peculiarly distasteful.

Neck of fowl; water, 1/2 pint; pepper, salt (little vegetable and spice at choice): stewed gently, 1 hour; strained, stirred to the gravy of the roast, well cleared from fat.

ANOTHER CHEAP GRAVY FOR A FOWL.

A little good broth added to half a dozen dice of lean ham, lightly browned in a morsel of butter, with half a dozen corns of pepper and a small branch or two of parsley, and stewed for half an hour, will make excellent gravy of a common kind. When there is no broth, the neck of the chicken must be stewed down to supply its place.

GRAVY OR SAUCE FOR A GOOSE.

Mince, and brown in a small saucepan, with a slice of butter, two ounces of mild onion,. When it begins to brown, stir to it a teaspoonful of flour, and in five or six minutes afterwards, pour in by degrees the third of a pint of good brown gravy; let this simmer fifteen minutes; strain it, bring it again to the point of boiling, and add to it a teaspoonful of made mustard mixed well with a glass of port wine. Season it with cayenne and pepper and _salt_, if this last be needed. Do not let the sauce _boil_ after the wine is added, but serve it _very_ hot.

Onions, 2 oz.; butter, 1-1/2 oz.: 10 to 15 minutes. Flour, 1 teaspoonful: 5 to 6 minutes. Gravy, 1/3 pint: 15 minutes. Mustard, 1 teaspoonful; port wine, 1 glassful; cayenne pepper; salt. See also Christopher North’s own sauce, page 119.

ORANGE GRAVY FOR WILD FOWL.

Boil for about ten minutes, in half a pint of rich and highly-flavoured brown gravy, or _Espagnole_, half the rind of a Seville orange, pared as thin as possible, and a small strip of lemon-rind, with a bit of sugar the size of a hazel-nut. Strain it off, add to it a quarter pint of port or claret, the juice of half a lemon, and a tablespoonful of Seville orange-juice: season it with cayenne, and serve it as hot as possible.

Gravy, 1/2 pint; 1/2 the rind of a Seville orange; lemon-peel, 1 small strip; sugar, size of hazel-nut: 10 minutes. Juice of 1/2 a lemon; Seville orange-juice, 1 tablespoonful; cayenne. See also Christopher North's own sauce, page 119.

MEAT JELLIES FOR PIES AND SAUCES.

A very firm meat jelly is easily made by stewing slowly down equal parts of shin of beef, and knuckle or neck of veal, with a pint of cold water to each pound of meat; but to give it flavour, some thick slices of lean unboiled ham should be added to it, two or three carrots, some spice, a bunch of parsley, one mild onion, or more, and a moderate quantity of salt; or part of the meat may be omitted, and a calf's head, or the scalp of one, very advantageously substituted for it, though the flavouring must then be heightened, because, though very gelatinous, these are in themselves exceedingly insipid to the taste. If rapidly boiled, the jelly will not be clear, and it will be difficult to render it so without clarifying it with the whites of eggs, which it ought never to require; if very gently stewed, on the contrary, it will only need to be passed through a fine sieve, or cloth. The fat must be carefully removed, after it is quite cold. The shin of beef recommended for this and other receipts, should be from the middle of the leg of young heifer beef, not of that which is large and coarse.

Middle of small shin of beef, 3 lbs.; knuckle or neck of veal, 3 lbs.; lean of ham, 1/2 lb.; water, 3 quarts; carrots, 2 large, or 3 small; bunch of parsley; 1 mild onion, stuck with 8 cloves; 2 small bay-leaves; 1 large blade of mace; small saltspoonful of peppercorns; salt, 3/4 oz. (more if needed): 5 to 6 hours' very gentle stewing.

Obs.—A finer jelly may be made by using a larger proportion of veal than of beef, and by adding clear beef or veal broth to it instead of water, in a small proportion at first, as directed in the receipt for _consommé_, see page 98, and by pouring in the remainder when the meat is heated through. The necks of poultry, any inferior joints of them omitted from a fricassee or other dish, or an old fowl, will further improve it much; an eschalot or two may at choice be boiled down in it, instead of the onion, but the flavour should be scarcely perceptible.

A CHEAPER MEAT JELLY.

One calf's foot, a pound and a half or two pounds of neck of veal or beef, a small onion, a carrot, a bunch of parsley, a little spice, a bit or two of quite lean ham, dressed or undressed, and five half pints of water, boiled _very_ slowly for five or six hours will give a strong, though not a highly-flavoured jelly. More ham, any bones of unboiled meat, poultry, or game will, in this respect, improve it; and the liquor in which fowls or veal have been boiled for table should, when at hand, be used for it instead of water. These jellies keep much better and longer when no vegetables are stewed down in them.

GLAZE.

This is merely _strong_, clear gravy or jelly boiled quickly down to the consistence of thin cream; but this reduction must be carefully managed that the glaze may be brought to the proper point without being burned; it must be attentively watched, and stirred without being quitted for a moment from the time of its beginning to thicken; when it has reached the proper degree of boiling, it will jelly in dropping from the spoon, like preserve, and should then be poured out immediately, or it will burn. When wanted for use, melt it gently by placing the vessel which contains it (see article _Glazing_, Chapter IX.) in a pan of boiling water, and with a paste-brush lay it on to the meat, upon which it will form a sort of clear varnish. In consequence of the very great reduction which it undergoes, salt should be added to it sparingly when it is made. Any kind of stock may be boiled down to glaze; but unless it be strong, a pint will afford but a spoonful or two: a small quantity of it, however, is generally sufficient, unless a large repast is to be served. Two or three layers must be given to each joint. The jellies which precede this will answer for it extremely well; and it may be made also with shin of beef stock, for common occasions, when no other is at hand.

ASPIC, OR CLEAR SAVOURY-JELLY.

Boil a couple of calf's feet, with three or four pounds of knuckle of veal, three quarters of a pound of lean ham, two large onions, three whole carrots, and a large bunch of herbs, in a gallon of water, till it is reduced more than half. Strain it off; when perfectly cold, remove every particle of fat and sediment, and put the jelly into a very clean stewpan, with four whites of eggs well beaten; keep it stirred until it is nearly boiling; then place it by the side of the fire to simmer for a quarter of an hour. Let it settle, and pour it through a jelly-bag until it is quite clear. Add, when it first begins to boil, three blades of mace, a teaspoonful of white peppercorns, and sufficient salt to flavour it properly, allowing for the ham, and the reduction. French cooks flavour this jelly with tarragon vinegar when it is clarified; cold poultry, game, fish, plovers' eggs, truffles, and various dressed vegetables, with many other things often

elaborately prepared, and highly ornamental, are moulded and served in it, especially at large _dejeuners_ and similar repasts. It is also much used to decorate raised pies, and hams; and for many other purposes of the table.

Calf's feet, 2; veal, 4 lbs.; ham, 3/4 lb.; onions, 2; carrots, 3; herbs, large bunch; mace, 3 blades; white whole pepper, 1 teaspoonful; water, 1 gallon: 5 to 6 hours. Whites of eggs, 4: 15 minutes.

CHAPTER V.

=Sauces.=

INTRODUCTORY REMARKS.

[Illustration:

Bain Marie, or Water Bath.]

THE difference between good and bad cookery can scarcely be more strikingly shown than in the manner in which sauces are prepared and served. If well made, appropriate to the dishes they accompany, and sent to table with them as hot as possible, they not only give a heightened relish to a dinner, but they prove that both skill and taste have been exerted in its arrangements. When coarsely or carelessly prepared, on the contrary, as they too often are, they greatly discredit the cook, and are anything but acceptable to the eaters. Melted butter, the most common of all—the "_one sauce of England_," as it is called by foreigners, and which forms in reality the basis of a large number of those which are served in this country—is often so ill prepared, being either oiled or lumpy, or composed principally of flour and water, that it says but little for the state of cookery amongst us. We trust that the receipts in the present chapter are so far clearly given, that if strictly followed they will materially assist the learner in preparing tolerably palatable sauces at the least. The cut at the commencement of the chapter exhibits a vessel called a _bain marie_, in which saucepans are placed when it is necessary to keep their contents hot without allowing them to boil: it is extremely useful when dinners are delayed after they are ready to serve.

TO THICKEN SAUCES.

When this is done with the yolks of eggs, they should first be well beaten, and then mixed with a spoonful of cold stock should it be at hand, and with one or two of the boiling sauce, which should be stirred very quickly to them, and they must in turn be stirred briskly to the sauce, which may be held over the fire, and well shaken for an instant afterwards, but never placed upon it, nor allowed to boil.

To the _roux_ or French thickening (which follows), the gravy or other liquid which is to be mixed with it should be poured boiling and in small quantities, the saucepan being often well shaken round, and the sauce made to boil up after each portion is added. If this precaution be observed, the butter will never float upon the surface, but the whole will be well and smoothly blended: it will otherwise be difficult to clear the sauce from it perfectly.

For invalids, or persons who object to butter in their soups or sauces, flour only mixed to a smooth batter, and stirred into the boiling liquid may be substituted for other thickening: arrow-root also used in the same way, will answer even better than flour.

FRENCH THICKENING, OR BROWN ROUX.

For ordinary purposes this may be made as it is wanted for use; but when it is required for various dishes at the same time or for cookery upon a large scale, it can be prepared at once in sufficient quantity to last for several days, and it will remain good for some time. Dissolve, with a very gentle degree of heat, half a pound of good butter, then draw it from the fire, skim it well, give time for it to settle, pour it gently from the sediment into a very clean frying-pan, and place it over a slow but clear fire. Put into a dredging box about seven ounces of fine dry flour; add it gradually to the butter, shake the pan often as it is thrown in, and keep the thickening constantly stirred until it has acquired a clear light brown colour. It should be very slowly and equally done, or its flavour will be unpleasant. Pour it into a jar, and stir a spoonful or two as it is needed into boiling soup or gravy. When the butter is not clarified it will absorb an additional ounce of flour, the whole of which ought to be fine and dry. This thickening may be made in a well-tinned stewpan even better than in a frying-pan, and if simmered over a coal fire it should be placed high above it, and well guarded from

smoke.

WHITE ROUX, OR FRENCH THICKENING.

Proceed exactly as for the preceding receipt, but dredge in the flour as soon as the butter is in full simmer, and be careful not to allow the thickening to take the slightest colour: this is used for white gravies or sauces.

SAUCE TOURNÉE, OR PALE THICKENED GRAVY.

Sauce tournée is nothing more than rich pale gravy made with veal or poultry (see _Consommé_, Chapter IV.) and thickened with delicate white _roux_. The French give it a flavouring of mushrooms and green onions, by boiling some of each in it for about half an hour before the sauce is served: it must then be strained, previously to being dished. Either first dissolve an ounce of butter, and then dredge gradually to it three-quarters of an ounce of flour, and proceed as for the preceding receipt; or blend the flour and butter perfectly with a knife before they are thrown into the stewpan, and keep them stirred without ceasing over a clear and gentle fire until they have simmered for some minutes, then place the stewpan high over the fire, and shake it constantly until the _roux_ has lost the raw taste of the flour; next, stir very gradually to it a pint of the gravy, which should be boiling. Set it by the side of the stove for a few minutes, skim it thoroughly, and serve it without delay.

Butter, 1 oz.; flour, 3/4 oz.; strong pale gravy, seasoned with mushrooms and green onions, 1 pint.

Obs. 3.—With the addition of three or four yolks of very fresh eggs, mixed with a seasoning of mace, cayenne, and lemon-juice, this becomes _German sauce_, now much used for fricassees, and other dishes; and minced parsley (boiled) and chili vinegar, each in sufficient quantity to flavour it agreeably, convert it into a good fish sauce.

BÉCHAMEL.

This is a fine French white sauce, now very much served at good English tables. It may be made in various ways, and more or less expensively; but it should always be thick, smooth, and rich, though delicate in flavour. The most ready mode of preparing it is to take an equal portion of very strong, pale veal gravy, and of good cream (a pint of each for example), and then, by rapid boiling over a very clear fire, to reduce the gravy nearly half; next, to mix with part of the cream a tablespoonful of fine dry flour, to pour it to the remainder, when it boils, and to keep the whole stirred for five minutes or more over a slow fire, for if placed upon a fierce one it would be liable to burn; then to add the gravy, to stir and mix the sauce perfectly, and to simmer it for a few minutes longer. All the flavour should be given by the gravy, in which French cooks boil a handful of mushrooms, a _few_ green onions, and some branches of parsley before it is reduced: but a good _béchamel_ may be made without them, with a strong _consommé_ (see pale veal gravy, page 98) well reduced.

Strong pale veal gravy (flavoured with mushrooms or not), 1 pint: reduced half. Rich cream, 1 pint; flour, 1 tablespoonful: 5 minutes. With gravy, 4 or 5 minutes.

Obs.—_Velouté_, which is a rather thinner sauce or gravy, is made by simply well reducing the cream and stock separately, and then mixing them together without any thickening.

BÉCHAMEL MAIGRE.

(_A cheap White Sauce._)

A good _béchamel_ may be made entirely without meat, when economy is an object, or when no gravy is at hand. Put into a stewpan, or a well-tinned and thick saucepan, with from two to three ounces of butter, a carrot, and a couple of small onions, cut in slices, with a handful of nicely-cleaned mushroom buttons, when these last can be easily procured; and when they have stewed slowly for half an hour, or until the butter is nearly dried up, stir in two tablespoonsful of flour, and pour in a pint of new milk, a little at a time, shaking the stewpan well round, that the sauce may be smooth. Boil the _béchamel_ gently for half an hour; add a little salt, and cayenne; strain, and reduce it, if not quite thick, or pour it boiling to the yolks of two fresh eggs.

ANOTHER COMMON BÉCHAMEL.

Cut half a pound of veal, and a slice of lean ham or smoked beef, into small dice, and stew them in butter, with vegetables, as directed in the foregoing receipt: stir in the same proportion of flour, then add the milk, and let the sauce boil very gently for an hour.

It should not be allowed to thicken too much before it is strained.

Obs.—Common _béchamel_, with the addition of a spoonful of made-mustard, is an excellent sauce for boiled mutton.

RICH MELTED BUTTER.

This is more particularly required in general for lobster sauce, when it is to be served with turbot or brill, and for good oyster sauce. Salmon is itself so rich, that less butter is needed for it than for sauce which is to accompany a drier fish. Mix to a very smooth batter a dessertspoonful of flour, a half-saltspoonful of salt, and half a pint of cold water: put these into a delicately clean saucepan, with from four to six ounces of well-flavoured butter, cut into small bits, and shake the sauce strongly round, almost without cessation, until the ingredients are perfectly blended, and it is on the point of boiling; let it simmer for two or three minutes, and it will be ready for use. The best French cooks recommend its not being allowed to _boil_, as they say it tastes less of flour if served when it is just at the point of simmering.

Cold water, 1/2 pint; salt, 1/2 spoonful; flour, 1 dessertspoonful: 3 to 4 minutes. Butter, 4 to 6 oz.

MELTED BUTTER.

(_A good common Receipt._)

Put into a basin a large teaspoonful of flour, and a little salt, then mix with them very gradually and very smoothly a quarter of a pint of cold water; turn these into a small clean saucepan, and shake or stir them constantly over a clear fire until they have boiled a couple of minutes, then add an ounce and a half of butter cut small, keep the sauce stirred until this is entirely dissolved, give the whole a minute's boil, and serve it quickly. The more usual mode is to put the butter in at first with the flour and water; but for inexperienced or unskilful cooks the safer plan is to follow the present receipt.

Water, 1/4 pint; flour, 1 teaspoonful: 2 minutes. Butter, 1-1/2 oz.; 1 minute.

Obs.—To render this a _rich_ sauce, increase or even _double_ the proportion of butter.

FRENCH MELTED BUTTER.

Pour half a pint of good but not very thick, boiling melted butter to the well-beaten yolks of two or three fresh eggs, and stir them briskly as it is added; put the sauce again into the saucepan, and shake it high over the fire for an instant, but do not allow it to boil or it will curdle. Add a little lemon-juice or vinegar, and serve it immediately.

NORFOLK SAUCE, OR RICH MELTED BUTTER WITHOUT FLOUR.

Put three tablespoonsful of water into a small saucepan, and when it boils add four ounces of fresh butter; as soon as this is quite dissolved, take the saucepan from the fire, and shake it round until the sauce looks thick and smooth. It must not be allowed to boil after the butter is added.

Water, 3 tablespoonsful; butter, 4 oz.

WHITE MELTED BUTTER.

Thicken half a pint of new milk with rather less flour than is directed for the common melted butter, or with a little arrow-root, and stir into it by degrees after it has boiled, a couple of ounces of fresh butter cut small; do not cease to stir the sauce until this is entirely dissolved, or it may become oiled, and float upon the top Thin cream, substituted for the milk, and flavoured with a few strips of lemon-rind cut extremely thin, some salt, and a small quantity of pounded mace, if mixed with rather less flour, and the same proportion of butter, will make an excellent sauce to serve with fowls or other dishes, when no gravy is at hand to make white sauce in the usual way.

BURNT OR BROWNED BUTTER.

Melt in a frying-pan three ounces of fresh butter, and keep it stirred slowly over a gentle fire until it is of a dark brown colour; then pour to it a couple of tablespoonsful of good _hot_ vinegar, and season it with black pepper and a little salt. In France this is a favourite sauce with boiled skate, which is served with plenty of crisped parsley, in addition, strewed over it. It is also often poured

over poached eggs there: it is called _beurre noir_.

Butter, 3 oz.; vinegar, 2 tablespoonsful; pepper; salt.

CLARIFIED BUTTER.

Put the butter into a very clean and well-tinned saucepan or enamelled stewpan, and melt it gently over a clear fire; when it just begins to simmer, skim it thoroughly, draw it from the fire, and let it stand a few minutes that the buttermilk may sink to the bottom; then pour it clear of the sediment through a muslin strainer or a fine hair-sieve; put it into jars, and store them in a cool place. Butter thus prepared will answer for all the ordinary purposes of cookery, and remain good for a great length of time. In France, large quantities are melted down in autumn for winter use. The clarified butter ordered for the various receipts in this volume, is merely dissolved with a gentle degree of heat in a small saucepan, skimmed, and poured out for use, leaving the thick sediment behind.

VERY GOOD EGG SAUCE.

Boil four fresh eggs for quite fifteen minutes, then lay them into plenty of fresh water, and let them remain until they are perfectly cold. Break the shells by rolling them on a table, take them off, separate the whites from the yolks, and divide all of the latter into quarter-inch dice; mince two of the whites tolerably small, mix them lightly, and stir them into the third of a pint of rich melted butter or of white sauce: serve the whole as hot as possible.

Eggs, 4: boiled 15 minutes, left till cold. The yolks of all, whites of 2; third of pint of good melted butter or white sauce. Salt as needed.

SAUCE OF TURKEYS' EGGS.

(_Excellent._)

The eggs of the turkey make a sauce much superior to those of the common fowl. They should be gently boiled in plenty of water for twenty minutes. The yolks of three, and the whites of one and a half, will make a very rich sauce if prepared by the directions of the foregoing receipt. The eggs of the guinea fowl also may be converted into a similar sauce with ten minutes' boiling. Their delicate size will render it necessary to increase the number taken for it.

COMMON EGG SAUCE.

Boil a couple of eggs hard, and when quite cold cut the whites and yolks separately; mix them well, put them into a very hot tureen, and pour boiling to them a quarter of a pint of melted butter, stir, and serve the sauce immediately.

Whole eggs, 2; melted butter, 1/4 pint.

EGG SAUCE FOR CALF'S HEAD.

This is a provincial sauce, served sometimes with fish, and with calf's head likewise. Thicken to the proper consistence with flour and butter some good pale veal gravy, throw into it when it boils from one to two large teaspoonsful of minced parsley, add a slight squeeze of lemon-juice, a little cayenne, and then the eggs.

Veal gravy, 1/2 pint; flour, 1-1/2 oz.; butter, 2 oz.; minced parsley, 1 dessertspoonful; lemon-juice, 1 teaspoonful; little cayenne; eggs, 3 to 4.

ENGLISH WHITE SAUCE.

Boil softly in half a pint of well-flavoured pale veal gravy a few very thin strips of fresh lemon-rind, for just sufficient time to give their flavour to it; stir in a thickening of arrow-root, or of flour and butter, add salt if needed, and mix with the gravy a quarter of a pint of boiling cream. For the best kind of white sauce, see béchamel, page 107.

Good pale veal gravy, 1/2 pint; third of 1 lemon-rind: 15 to 20 minutes. Freshly pounded mace, third of saltspoonful; butter, 1 to 2 oz.; flour, 1 teaspoonful (or arrow-root an equal quantity); cream, 1/4 pint.

VERY COMMON WHITE SAUCE.

The neck and the feet of a fowl, nicely cleaned, and stewed down in half a pint of water, until it is reduced to less than a quarter of a pint, with a thin strip or two of lemon-rind, a small blade of mace, a small branch or two of parsley, a little salt, and half a dozen corns of pepper, then strained, thickened, and flavoured by the preceding receipt, and mixed with something more than half the quantity of cream, will answer for this sauce extremely well; and if it be added, when made, to the liver of the chicken, previously boiled for six minutes in the gravy, then bruised to a smooth paste, and passed through a sieve, an excellent liver sauce. A little strained lemon-juice is generally added to it when it is ready to serve: it should be stirred very briskly in.

DUTCH SAUCE.

Put into a small saucepan the yolks of three fresh eggs, the juice of a large lemon, three ounces of butter, a little salt and nutmeg, and a wineglassful of water. Hold the saucepan over a clear fire, and keep the sauce stirred until it _nearly_ boils: a little cayenne may be added. The safest way of making all sauces that will curdle by being allowed to boil, is to put them into a jar, and to set the jar over the fire in a saucepan of boiling water, and then to stir the ingredients constantly until the sauce is thickened sufficiently to serve.

Yolks of eggs, 3; juice, 1 lemon; butter, 3 oz.; little salt and nutmeg; water, 1 wineglassful; cayenne at pleasure.

Obs.—A small cupful of veal gravy, mixed with plenty of blanched and chopped parsley, may be used instead of water for this sauce, when it is to be served with boiled veal, or with calf's head.

FRICASSEE SAUCE.

Stir briskly, but by degrees, to the well-beaten yolks of two large or of three small fresh eggs, half a pint of common English white sauce; put it again into the saucepan, give it a shake over the fire, but be extremely careful not to allow it to boil, and just before it is served stir in a dessertspoonful of strained lemon-juice. When meat or chickens are fricasseed, they should be lifted from the saucepan with a slice, drained on it from the sauce, and laid into a very hot dish before the eggs are added, and when these are just set, the sauce should be poured on them.

BREAD SAUCE.

Pour quite boiling, on half a pint of the finest bread-crumbs, an equal measure of new milk; cover them closely with a plate, and let the sauce remain for twenty or thirty minutes; put it then into a delicately clean saucepan, with a small saltspoonful of salt, half as much pounded mace, a little cayenne, and about an ounce of fresh butter; keep it stirred constantly over a clear fire for a few minutes, then mix with it a couple of spoonsful of good cream, give it a boil, and serve it immediately. When cream is not to be had, an additional spoonful or two of milk must be used. The bread used for sauce should be _stale_, and lightly grated down into extremely small crumbs, or the preparation will look rough when sent to table. Not only the crust, but all heavy-looking or imperfectly baked portions of it, should be entirely pared off, and it should be pressed against the grater only so much as will reduce it easily into crumbs. When stale bread cannot be procured, the new should be sliced thin, or broken up small, and beaten quite smooth with a fork after it has been soaked. As some will absorb more liquid than others, the cook must increase a little the above proportion should it be needed. Equal parts of milk and of thin cream make an excellent bread sauce: more butter can be used to enrich it when it is liked.

Bread-crumbs and new milk, each 1/2 pint (or any other measure); soaked 20 to 30 minutes, or more. Salt, small saltspoonful; mace, half as much; little cayenne; butter, 1 oz.; boiled 4 to 5 minutes. 2 to 4 spoonsful of good cream (or milk): 1 minute. Or: bread-crumbs, 1/2 pint; milk and cream, each 1/4 pint; and from 2 to 4 spoonsful of either in addition.

Obs.—Very pale, strong veal gravy is sometimes poured on the bread-crumbs, instead of milk; and these, after being soaked, are boiled extremely dry, and then brought to the proper consistence with rich cream. The gravy may be highly flavoured with mushrooms when this is done.

BREAD SAUCE WITH ONION.

Put into a very clean saucepan nearly half a pint of fine bread-crumbs, and the white part of a large _mild_ onion cut into quarters; pour to these three-quarters of a pint of new milk, and boil them very gently, keeping them often stirred until the onion is perfectly tender, which will be in from forty minutes to an hour. Press the whole through a hair-sieve, which should be as clean as possible; reduce the sauce by quick boiling should it be too thin; add a seasoning of salt and grated nutmeg, an ounce of butter, and four

spoonsful of cream; and when it is of a proper thickness, dish, and send it quickly to table.

Bread-crumbs, nearly 1/2 pint; white part of 1 large mild onion; new milk, 3/4 pint: 40 to 60 minutes. Seasoning of salt and grated nutmeg; butter, 1 oz.; cream, 4 tablespoonsful: to be boiled till of a proper consistence.

Obs.—This is an excellent sauce for those who like a _subdued_ flavour of onion in it; but as many persons object to any, the cook should ascertain whether it be liked before she follows this receipt.

COMMON LOBSTER SAUCE.

Add to half a pint of good melted butter a tablespoonful of essence of anchovies, a small half-saltspoonful of freshly pounded mace, and less than a quarter one of cayenne. If a couple of spoonsful of cream should be at hand, stir them to the sauce when it boils; then put in the flesh of the tail and claws of a small lobster cut into dice (or any other form) of equal size. Keep the saucepan by the side of the fire until the fish is quite heated through, but do not let the sauce boil again: serve it very hot. A small quantity can be made on occasion with the remains of a lobster which has been served at table.

Melted butter, 1/2 pint; essence of anchovies, 1 tablespoonful; pounded mace, small 1/2 saltspoonful; less than 1/4 one of cayenne; cream (if added), 2 tablespoonsful; flesh of small lobster.

GOOD LOBSTER SAUCE.

Select for this a perfectly fresh hen lobster; split the tail carefully, and take out the inside coral; pound half of it in a mortar very smoothly with less than an ounce of butter, rub it through a hair-sieve, and put it aside. Cut the firm flesh of the fish into dice of not less than half an inch in size; and when these are ready, make as much _good_ melted butter as will supply the quantity of sauce required for table, and if to be served with a turbot or other large fish to a numerous company, let it be plentifully provided. Season it slightly with essence of anchovies, and well with cayenne, mace, and salt; add to it a few spoonsful of rich cream, and then mix a small portion of it very gradually with the pounded coral; when this is sufficiently liquefied pour it into the sauce, and stir the whole well together; put in immediately the flesh of the fish, and heat the sauce thoroughly by the side of the fire without allowing it to boil, for if it should do so its fine colour would be destroyed. The whole of the coral may be used for the sauce when no portion of it is required for other purposes.

CRAB SAUCE.

The flesh of a fresh well-conditioned crab of moderate size is more tender and delicate than that of a lobster, and may be converted into an excellent fish sauce. Divide it into small flakes, and add it to some good melted butter, which has been flavoured as for either of the sauces above. A portion of the cream contained in the fish may first be smoothly mingled with the sauce.

GOOD OYSTER SAUCE.

At the moment they are wanted for use, open three dozen of fine plump native oysters; save carefully and strain their liquor, rinse them separately in it, put them into a very clean saucepan, strain the liquor again, and pour it to them; heat them slowly, and keep them from one to two minutes at the simmering point, without allowing them to _boil_, as that will render them hard. Lift them out and beard them neatly; add to the liquor three ounces of butter smoothly mixed with a large dessertspoonful of flour; stir these without ceasing until they boil, and are perfectly mixed; then add to them gradually a quarter of a pint, or rather more, of new milk, or of thin cream (or equal parts of both), and continue the stirring until the sauce boils again; add a little salt, should it be needed, and a small quantity of cayenne in the finest powder; put in the oysters, and keep the saucepan by the side of the fire until the whole is thoroughly hot and begins to simmer, then turn the sauce into a well-heated tureen, and send it immediately to table.

Small plump oysters, 3 dozen; butter, 3 oz.; flour, 1 large dessertspoonful; the oyster liquor; milk or cream, full 1/4 pint; little salt and cayenne.

COMMON OYSTER SAUCE.

Prepare and plump two dozen of oysters as directed in the receipt above; add their strained liquor to a quarter of a pint of _thick_ melted butter made with milk, or with half milk and half water; stir the whole until it boils, put in the oysters, and when they are quite heated through send the sauce to table without delay. Some persons like a little cayenne and essence of anchovies added to it when it is served with fish; others prefer the unmixed flavour of the oysters.

Oysters, 2 dozens; their liquor; melted butter, 1/4 pint. (Little cayenne and 1 dessertspoonful of essence of anchovies when liked.)

SHRIMP SAUCE.

The fish for this sauce should be very fresh. Shell quickly one pint of shrimps and mix them with half a pint of melted butter, to which a few drops of essence of anchovies and a little mace and cayenne have been added. As soon as the shrimps are heated through, dish, and serve the sauce, which ought not to boil after they are put in. Many persons add a few spoonsful of rich cream to all shell-fish sauces. Shrimps, 1 pint; melted butter, 1/2 pint; essence of anchovies, 1 teaspoonful; mace, 1/4 teaspoonful; cayenne, very little.

ANCHOVY SAUCE.

To half a pint of good melted butter add three dessertspoonsful of essence of anchovies, a quarter of a teaspoonful of mace, and a rather high seasoning of cayenne; or pound the flesh of two or three fine mellow anchovies very smooth, mix it with the boiling butter, simmer these for a minute or two, strain the sauce if needful, add the spices, give it a boil, and serve it.

Melted butter, 1/2 pint; essence of anchovies, 3 dessertspoonsful; mace, 1/4 teaspoonful; cayenne, to taste. Or, 3 large anchovies finely pounded, and the same proportions of butter and spice.

CREAM SAUCE FOR FISH.

Knead very smoothly together with a strong-bladed knife, a _large_ teaspoonful of flour with three ounces of good butter; stir them in a very clean saucepan or stewpan over a gentle fire until the butter is dissolved, then throw in a little salt and some cayenne, give the whole one minute’s simmer, and add, very gradually, half a pint of good cream; keep the sauce constantly stirred until it boils, then mix with it a dessertspoonful of essence of anchovies, and half as much chili vinegar or lemon-juice. The addition of shelled shrimps or lobsters cut in dice, will convert this at once into a most excellent sauce of either. Pounded mace may be added to it with the cayenne; and it may be thinned with a few spoonsful of milk should it be too thick. Omit the essence of anchovies, and mix with it some parsley boiled very green and minced, and it becomes a good sauce for poultry.

Butter, 3 oz.; flour, 1 _large_ teaspoonful: 2 to 3 minutes. Cream, 1/2 pint; essence of anchovies, 1 large dessertspoonful (more if liked); chili vinegar or lemon-juice, 1 teaspoonful; salt, 1/4 saltspoonful.

SHARP MAÎTRE D’HÔTEL SAUCE.

(_English Receipt._)

For a rich sauce of this kind, mix a dessertspoonful of flour with four ounces of good butter, but with from two to three ounces only for common occasions; knead them together until they resemble a smooth paste, then proceed exactly as for the sauce above, but substitute good pale veal gravy, or strong, pure-flavoured veal broth, or shin of beef stock (which if well made has little colour), for the cream; and when these have boiled for two or three minutes, stir in a tablespoonful of common vinegar and one of chili vinegar, with as much cayenne as will flavour the sauce well, and some salt, should it be needed; throw in from two to three dessertspoonsful of finely-minced parsley, give the whole a boil, and it will be ready to serve. A tablespoonful of mushroom catsup or of Harvey’s sauce may be added with the vinegar when the colour of the sauce is immaterial. It may be served with boiled calf’s head, or with boiled eels with good effect; and various kinds of cold meat and fish may be re-warmed for table in it, as we have directed in another part of this volume. With a little more flour, and a flavouring of essence of anchovies, it will make, without the parsley, an excellent sauce for these last, when they are first dressed.

Butter, 2 to 4 oz.; flour, 1 dessertspoonful; pale veal gravy or strong broth, or shin of beef stock, 1/2 pint; cayenne; salt, if needed; common vinegar, 1 tablespoonful; chili vinegar, 1 tablespoonful. (Catsup or Harvey’s sauce, according to circumstances.)

FRENCH MAÎTRE D’HÔTEL,[55] OR STEWARD’S SAUCE.

Footnote 55:

The Maître d’Hôtel is, properly, the _House Steward_.

Add to half a pint of rich, pale veal gravy, well thickened with the white _roux_ of page 108, a good seasoning of pepper, salt, minced parsley, and lemon-juice; or make the thickening with a small tablespoonful of flour, and a couple of ounces of butter; keep these stirred constantly over a very gentle fire from ten to fifteen minutes, then pour the gravy to them boiling, in small portions, mixing the whole well as it is added, and letting it boil up between each, for unless this be done the butter will be likely to float upon the surface. Simmer the sauce for a few minutes, and skim it well, then add salt should it be needed, a tolerable seasoning of pepper or of cayenne in fine powder, from two to three teaspoonsful of minced parsley, and the strained juice of a small lemon. For some dishes, this sauce is thickened with the yolks of eggs, about four to the pint. The French work into their sauces generally a small bit of fresh butter just before they are taken from the fire, to give them mellowness: this is done usually for the _Maître d'Hôtel Sauce_.

MAÎTRE D'HÔTEL SAUCE MAIGRE,[56] OR WITHOUT GRAVY.

Footnote 56:

Maigre, made without meat.

Substitute half a pint of good melted butter for the gravy, and add to it the same seasonings as above. A double quantity of these sauces will be needed when they are required to cover a large fish; in that case they should be thick enough to adhere to it well. Melted butter, 1/2 pint; seasoning of salt and pepper, or cayenne; minced parsley, 2 to 3 teaspoonsful; juice, 1 small lemon.

For COLD MAÎTRE D'HÔTEL SAUCE, see Chapter VI.

THE LADY'S SAUCE.

(_For Fish._)

Pound to a very smooth paste the inside coral of a lobster with a small slice of butter, and some cayenne; rub it through a hair-sieve, gather it together, and mix it very smoothly with from half to three-quarters of a pint of _sauce tournée_ or of cream fish-sauce, previously well seasoned with cayenne and salt, and moderately with pounded mace; bring it to the _point_ of boiling only; stir in quickly, but gradually, a tablespoonful of strained lemon-juice, and serve it very hot. When neither cream nor gravy is at hand, substitute _rich_ melted butter mixed with a dessertspoonful or two of essence of anchovies, and well seasoned. The fine colour of the coral will be destroyed by boiling. This sauce, which the French call _Sauce à l'Aurore_, may be served with brill, boiled soles, gray mullet, and some few other kinds of fish: it is quickly made when the lobster butter of Chapter VI. is in the house.

Coral of lobster, pounded; cream sauce, or _sauce tournée_ (thickened pale veal gravy), 1/2 to 3/4 pint; lemon-juice, 1 tablespoonful; salt, cayenne, and mace, as needed. Or: _rich_ melted butter, instead of other sauce; essence of anchovies, 2 dessertspoonsful; other seasoning, as above.

Obs.—The proportion of spices here must, of course, depend on the flavouring which the gravy or sauce may already have received.

GENEVESE SAUCE, OR SAUCE GÉNÉVOISE.

Cut into dice three ounces of the lean of a well-flavoured ham, and put them with half a small carrot, four cloves, a blade of mace, two or three very small sprigs of lemon thyme and of parsley, and rather more than an ounce of butter, into a stewpan; just simmer them from three-quarters of an hour to a whole hour, then stir in a teaspoonful of flour; continue the slow stewing for about five minutes, and pour in by degrees a pint of good boiling veal gravy, and let the sauce again simmer softly for nearly an hour. Strain it off, heat it in a clean saucepan, and when it boils, stir in a wineglassful and a half of good sherry or Madeira, two tablespoonsful of lemon-juice, some cayenne, a little salt if needed, and a small tablespoonful of flour very smoothly mixed with two ounces of butter. Give the whole a boil after the thickening is added, pour a portion of the sauce over the fish (it is served principally with salmon and trout), and send the remainder very hot to table in a tureen.

Lean of ham, 3 oz.; 1/2 small carrot; 4 to 6 cloves; mace, 1 large blade; thyme and parsley, 3 or 4 _small_ sprigs of each; butter, 1 to 1-1/2 oz.: 50 to 60 minutes. Veal gravy, 1 pint: 3/4 to 1 hour. Sherry or Madeira, 1-1/2 glassful; lemon-juice, 2 tablespoonsful; seasoning of cayenne and salt; flour, 1 tablespoonful; butter, 2 oz.: 1 minute.

Obs.—A teaspoonful or more of essence of anchovies is usually added to the sauce, though it is scarcely required.

SAUCE ROBERT.

Cut four or five large onions into small dice, and brown them in a stewpan, with three ounces of butter and a dessertspoonful of flour. When of a deep yellow brown, pour to them half a pint of beef or of veal gravy, and let them simmer for fifteen minutes; skim the sauce, add a seasoning of salt and pepper, and at the moment of serving, mix a dessertspoonful of made mustard with it.

Large onions, 4 or 5; butter, 3 oz.; flour, dessertspoonful; 10 to 15 minutes. Gravy, 1/2 pint: 15 minutes. Mustard, dessertspoonful.

SAUCE PIQUANTE.

Brown lightly in an ounce and a half of butter a tablespoonful of minced eschalots or three of onions; add a teaspoonful of flour when they are partially done; pour to them half a pint of gravy or of _good_ broth, and when it boils add three chilies, a bay-leaf, and a very small bunch of thyme. Let these simmer for twenty minutes; take out the thyme and bay-leaf, add a high seasoning of black pepper, and half a wineglassful of the best vinegar. A quarter of a teaspoonful of cayenne may be substituted for the chilies.

Eschalots, 1 tablespoonful, or three of onions; flour, 1 teaspoonful; butter, 1-1/2 oz.: 10 to 15 minutes. Gravy or broth, 1/2 pint; chilies, 3; bay-leaf; thyme, small bunch: 20 minutes. Pepper, plenty; vinegar, 1/2 wineglassful.

EXCELLENT HORSERADISH SAUCE.

(_To serve hot or cold with roast beef._)

Wash and wipe a stick of _young_ horseradish, scrape off the outer skin, grate it as small as possible on a fine grater, then with two ounces (or a couple of large tablespoonsful) of it mix a small teaspoonful of salt and four tablespoonsful of good cream; stir in briskly, and by degrees, three dessertspoonsful of vinegar, one of which should be chili vinegar when the horseradish is mild. To heat the sauce, put it into a small and delicately clean saucepan, hold it over, but do not place it _upon_ the fire, and stir it without intermission until it is near the point of simmering; but do not allow it to boil, or it will curdle instantly.

Horseradish pulp, 2 oz. (or 2 _large_ tablespoonsful); salt, 1 teaspoonful; good cream, 4 tablespoonsful; vinegar, 3 dessertspoonsful (of which one should be chili when the root is mild).

Obs.—Common English salad-mixture is often added to the grated horseradish when the sauce is to be served cold.

HOT HORSERADISH SAUCE.

(_To serve with boiled or stewed meat or fish._)

Mix three ounces of young tender grated horseradish with half a pint of good brown gravy, and let it stand by the side of the fire until it is on the point of boiling; add salt if required, a teaspoonful of made mustard, and a dessertspoonful of garlic or of eschalot vinegar; or the same quantity of chili vinegar, or twice as much common vinegar.

Some cooks stew the horseradish in vinegar for ten minutes, and, after having drained it from this, mix it with nearly half a pint of thick melted butter.

Horseradish, grated, 3 oz.; brown gravy, 1/2 pint; made mustard, 1 teaspoonful; eschalot or garlic vinegar, 1 dessertspoonful (or chili vinegar, the same quantity, or common vinegar twice as much).

CHRISTOPHER NORTH’S OWN SAUCE FOR MANY MEATS.

Throw into a small basin a heaped saltspoonful of _good_ cayenne pepper, in very fine powder, and half the quantity of salt;[57] add a small dessertspoonful of well-refined, pounded, and sifted sugar; mix these thoroughly; then pour in a tablespoonful of the strained juice of a fresh lemon, two of Harvey’s sauce, a teaspoonful of the very best mushroom catsup (or of cavice), and a small wineglassful of port wine. Heat the sauce by placing the basin in a saucepan of boiling water, or turn it into a jar, and place this in the water. Serve it directly it is ready with geese or ducks, tame or wild; roast pork, venison, fawn, a grilled blade-bone, or any other broil. A slight flavour of garlic or eschalot vinegar may be given to it at pleasure. Some persons eat it with fish. It is good cold; and, if bottled directly it is made, may be stored for several days. It is the better for being mixed some hours before it is served. _The proportion of cayenne may be doubled when a very pungent sauce is desired._

Footnote 57:

Characteristically, the salt of this sauce ought, perhaps, to prevail more strongly over the _sugar_, but it will be found for most tastes sufficiently _piquant_ as it is.

Good cayenne pepper in fine powder, 1 _heaped_ saltspoonful; salt, half as much; pounded sugar, 1 small dessertspoonful; strained lemon-juice, 1 tablespoonful; Harvey's sauce, 2 tablespoonsful; best mushroom catsup (or cavice), 1 teaspoonful; port wine, 3 tablespoonsful, or small wineglassful. (Little eschalot, or garlic vinegar at pleasure.)

Obs.—This sauce is exceedingly good mixed with the brown gravy of a hash or stew, or with that which is served with game or other dishes.

GOOSEBERRY SAUCE FOR MACKEREL.

Cut the stalks and tops from half to a whole pint of quite young gooseberries, wash them well, just cover them with cold water, and boil them very gently indeed, until they are tender; drain and mix them with a small quantity of melted butter, made with rather less flour than usual. Some eaters prefer the mashed gooseberries without any addition; others like that of a little ginger. The best way of making this sauce is to turn the gooseberries into a hair-sieve to drain, then to press them through it with a wooden spoon, and to stir them in a clean stewpan or saucepan over the fire with from half to a whole teaspoonful of sugar, just to soften their extreme acidity, and a bit of fresh butter about the size of a walnut. When the fruit is not passed through the sieve it is an improvement to seed it.

COMMON SORREL SAUCE.

Strip from the stalks and the large fibres, from one to a couple of quarts of freshly-gathered sorrel; wash it very clean, and put it into a well-tinned stewpan or saucepan (or into an enamelled one, which would be far better), without any water; add to it a small slice of good butter, some pepper and salt, and stew it gently, keeping it well stirred until it is exceedingly tender, that it may not burn; then drain it on a sieve, or press the liquid well from it; chop it as fine as possible, and boil it again for a few minutes with a spoonful or two of gravy, or the same quantity of cream or milk, mixed with a half-teaspoonful of flour, or with only a fresh slice of good butter. The beaten yolk of an egg or two stirred in just as the sorrel is taken from the fire will soften the sauce greatly, and a saltspoonful of pounded sugar will also be an improvement.

ASPARAGUS SAUCE, FOR LAMB CUTLETS.

Green cut the tender points of some young asparagus into half-inch lengths, or into the size of peas only; wash them well, then drain and throw them into plenty of boiling salt and water. When they are quite tender, which may be in from ten to fifteen minutes, turn them into a hot strainer and drain the water thoroughly from them; put them, at the instant of serving, into half a pint of thickened veal gravy (see _sauce tournée_, page 106), mixed with the yolks of a couple of eggs, and well seasoned with salt and cayenne, or white pepper, or into an equal quantity of good melted butter: add to this last a squeeze of lemon-juice. The asparagus will become yellow if reboiled, or if left long in the sauce before it is served.

Asparagus points, 1/2 pint: boiled 10 to 15 minutes, longer if not quite tender. Thickened veal gravy, 1/2 pint; yolks of eggs, 2. Or: good melted butter, 1/2 pint; lemon-juice, small dessertspoonful, seasoning of salt and white pepper.

CAPER SAUCE.

Stir into the third of a pint of good melted butter from three to four dessertspoonsful of capers; add a little of the vinegar, and dish the sauce as soon as it boils. Keep it stirred after the berries are added: part of them may be minced and a little chill vinegar substituted for their own. Pickled nasturtiums make a very good sauce, and their flavour is sometimes preferred to that of the capers. For a large joint, increase the quantity of butter to half a pint.

Melted butter, third of pint; capers, 3 to 4 dessertspoonsful.

BROWN CAPER SAUCE.

Thicken half a pint of good veal or beef gravy as directed for _sauce tournée_, and add to it two tablespoonsful of capers, and a dessertspoonful of the pickle liquor, or of chili vinegar, with some cayenne if the former be used, and a proper seasoning of salt.

Thickened veal, or beef gravy, 1/2 pint; capers, 2 tablespoonsful; caper liquor or chili vinegar, 1 dessertspoonful.

CAPER SAUCE FOR FISH.

To nearly half a pint of very rich melted butter add six spoonsful of _strong_ veal gravy or jelly, a tablespoonful of essence of anchovies, and some chili vinegar or cayenne, and from two to three tablespoonsful of capers. When there is no gravy at hand substitute a half wineglassful of mushroom catsup, or of Harvey's sauce; though these deepen the colour more than is desirable.

COMMON CUCUMBER SAUCE.

Pare, slice, dust slightly with pepper and with flour, two or three young cucumbers, and fry them a fine brown in a little butter, or dissolve an ounce and a half in a small stewpan or iron saucepan, and shake them in it over a brisk fire from twelve to fifteen minutes; pour to them by degrees nearly half a pint of strong beef broth, or of brown gravy; add salt, and more pepper if required; stew the whole for five minutes, and send the sauce very hot to table. A minced onion may be browned with the cucumbers when it is liked, and a spoonful of vinegar added to them before they are served.

Cucumbers, 2 or 3; butter, 1-1/2 oz.; broth or gravy, nearly 1/2 pint; salt, pepper.

ANOTHER COMMON SAUCE OF CUCUMBERS.

Cucumbers which have the fewest seeds are best for this sauce. Pare and slice _two_ or _three_, should they be small, and put them into a saucepan, in which two ounces, or rather more, of butter have been dissolved, and are beginning to boil; place them high over the fire, that they may stew as softly as possible, without taking colour, for three-quarters of an hour, or longer should they require it; add to them a good seasoning of white pepper and some salt, when they are half done; and just before they are served stir to them half a teaspoonful of flour, mixed with a morsel of butter; strew in some minced parsley, give it a boil, and finish with a spoonful of good vinegar.

WHITE CUCUMBER SAUCE.

Quarter some young quickly-grown cucumbers, without many seeds in them; empty them of these, and take off the rinds. Cut them into inch lengths, and boil them from fifteen to eighteen minutes in salt and water; press the water from them with the back of a spoon, and work them through a sieve; mix them with a few spoonsful of _béchamel_, or thick white sauce; do not let them _boil_ again, but serve them very hot. A sauce of better flavour is made by boiling the cucumbers in veal gravy well seasoned, and stirring in the beaten yolks of two or three eggs, and a little chili vinegar or lemon-juice, at the instant of serving. Another also of cucumbers sliced, and stewed in butter, but without being at all browned, and then boiled in pale veal gravy, which must be thickened with rich cream, is excellent. A _morsel_ of sugar improves this sauce.

Cucumbers, 3: 15 to 18 minutes. White sauce, 1/4 pint.

WHITE MUSHROOM SAUCE.

Cut off the stems closely from half a pint of small button mushrooms; clean them with a little salt and a bit of flannel, and throw them into cold water, slightly salted, as they are done; drain them well, or dry them in a soft cloth, and throw them into half a pint of boiling _béchamel_ (see page 108), or of white sauce made with very fresh milk, or thin cream, thickened with a tablespoonful of flour and two ounces of butter. Simmer the mushrooms from ten to twenty minutes, or until they are quite tender, and dish the sauce, which should be properly seasoned with salt, mace, and cayenne.

Mushrooms, 1/2 pint; white sauce, 1/2 pint; seasoning of salt, mace, and cayenne: 10 minutes.

ANOTHER MUSHROOM SAUCE.

Prepare from half to a whole pint of very small mushroom-buttons with great nicety, and throw them into an equal quantity of _sauce tournée_; when they are tender add a few spoonsful of rich cream, give the whole a boil, and serve it. Either of these sauces may be sent to table with boiled poultry, breast of veal, or veal cutlets: the _sauce tournée_ should be thickened rather more than usual when it is to be used in this receipt.

Mushrooms and _sauce tournée_ each, 1/2 to whole pint: stewed till tender. Cream, 4 to 8 tablespoonsful.

BROWN MUSHROOM SAUCE.

Very small flaps, peeled and freed entirely from the fur, will answer for this sauce. Leave them whole or quarter them, and stew them tender in some rich brown gravy; give a full seasoning of mace and cayenne, add thickening and salt if needed, and a tablespoonful of good mushroom catsup.

COMMON TOMATA SAUCE.

Tomatas are so juicy when ripe that they require little or no liquid to reduce them to a proper consistence for sauce; and they vary so exceedingly in size and quality that it is difficult to give precise directions for the exact quantity which in their unripe state is needed for them. Take off the stalks, halve the tomatas, and gently squeeze out the seeds and watery pulp; then stew them softly with a few spoonsful of gravy or of strong broth until they are quite melted. Press the whole through a hair-sieve, and heat it afresh with a little additional gravy should it be too thick, and some cayenne, and salt. Serve it very hot.

Fine ripe tomatas, 6 or 8; gravy or strong broth, 4 tablespoonsful: 1/2 to 3/4 hour, or longer if needed. Salt and cayenne sufficient to season the sauce, and two or three spoonsful more of gravy if required.

Obs.—For a large tureen of this sauce, increase the proportions; and should it be at first too liquid, reduce it by quick boiling. When neither gravy nor broth is at hand, the tomatas may be stewed perfectly tender, but very gently, in a couple of ounces of butter, with some cayenne and salt only, or with the addition of a very little finely minced onion; then rubbed through a sieve, and heated, and served without any addition, or with only that of a teaspoonful of chili vinegar; or, when the colour is not a principal consideration, with a few spoonsful of rich cream, smoothly mixed with a little flour to prevent its curdling. The sauce must be stirred without ceasing should the last be added, and boiled for four or five minutes.

A FINER TOMATA SAUCE.

Stew very gently a dozen fine red tomatas, prepared as for the preceding receipt, with two or three sliced eschalots, four or five chilies or a capsicum or two (or in lieu of either, with a quarter of a teaspoonful of cayenne pepper), a few small dice of lean ham, and half a cupful of rich gravy. Stir these often, and when the tomatas are reduced quite to a smooth pulp, rub them through a sieve; put them into a clean saucepan, with a few spoonsful more of rich gravy, or _Espagnole_, add salt if needed, boil the sauce stirring it well for ten minutes, and serve it very hot. When the gravy is exceedingly good and highly flavoured, the ham may be omitted: a dozen small mushrooms nicely cleaned may also be sliced and stewed with the tomatas, instead of the eschalots, when their flavour is preferred, or they may be added with them. The exact proportion of liquid used is immaterial, for should the sauce be too thin it may be reduced by rapid boiling, and diluted with more gravy if too thick.

BOILED APPLE SAUCE.

Apples of a fine cooking sort require but a very small portion of liquid to boil down well and smoothly for sauce, if placed over a gentle fire in a close-shutting saucepan, and simmered as softly as possible until they are well broken; and their flavour is injured by the common mode of adding so much to them, that the greater part must be drained off again before they are sent to table. Pare the fruit quickly, quarter it, and be careful entirely to remove the cores; put one tablespoonful of water into a saucepan before the apples are thrown in, and proceed, as we have directed, to simmer them until they are nearly ready to serve: finish the sauce by the receipt which follows.

Apples, 1/2 lb.; water, 1 tablespoonful; stewed very softly: 30 to 60 minutes.

Obs.—These proportions are sufficient only for a small tureen of the sauce, and should be doubled for a large one.

For this, and all other preparations, apples will be whiter if just dipped into fresh water the instant before they are put into the stewpan. They should be quickly lifted from it, and will stew down easily to sauce with only the moisture which hangs about them. They should be watched and often gently stirred, that they may be equally done.

BAKED APPLE SAUCE.

(_Good._)

Put a tablespoonful of water into a quart basin, and fill it with good boiling apples, pared, quartered, and _carefully_ cored: put a plate over, and set them into a moderate oven for about an hour, or until they are reduced quite to a pulp; beat them smooth with a clean wooden spoon, adding to them a little sugar and a morsel of fresh butter, when these are liked, though they will scarcely be required.

The sauce made thus is far superior to that which is boiled. When no other oven is at hand, a Dutch or an American one would probably answer for it; but we cannot assert this on our own experience.

Good boiling apples, 1 quart: baked 1 hour (more or less according to the quality of the fruit, and temperature of the oven); sugar, 1 oz.; butter, 1/2 oz.

BROWN APPLE SAUCE.

Stew gently down to a thick and perfectly smooth marmalade, a pound of pearmains, or of any other well-flavoured boiling apples, in about the third of a pint of rich brown gravy: season the sauce rather highly with black pepper or cayenne, and serve it very hot. Curry sauce will make an excellent substitute for the gravy when a very piquant accompaniment is wanted for pork or other rich meat.

Apples pared and cored, 1 lb.; good brown gravy, third of pint 3/4 to 1-1/4 hour. Pepper or cayenne as needed.

WHITE ONION SAUCE.

Strip the skin from some large white onions, and after having taken off the tops and roots cut them in two, throw them into cold water as they are done, cover them plentifully with more water, and boil them very tender; lift them out, drain, and then press the water thoroughly from them; chop them small, rub them through a sieve or strainer, put them into a little rich melted butter mixed with a spoonful or two of cream or milk, and a seasoning of salt, give the sauce a boil, and serve it very hot. Portugal onions are superior to any others, both for this and for most other purposes of cookery.

For the finest kind of onion sauce, see _Soubise_, page 126, which follows.

BROWN ONION SAUCE.

Cut off both ends of the onions, and slice them into a saucepan in which two ounces of butter have been dissolved; keep them stewing gently over a clear fire until they are lightly coloured; then pour to them half a pint of brown gravy, and when they have boiled until they are perfectly tender, work the sauce altogether through a strainer, season it with a little cayenne, and serve it very hot.

ANOTHER BROWN ONION SAUCE.

Mince the onions, stew them in butter until they are well coloured, stir in a dessertspoonful of flour, shake the stewpan over the fire for three or four minutes, pour in only as much broth or gravy as will leave the sauce tolerably thick, season, and serve it.

SOUBISE.

(_English Receipt._)

Skin, slice, and mince quickly two pounds' weight of the white part only of some fine mild onions, and stew them in from two to three ounces of good butter over a very gentle fire until they are reduced to a pulp, then pour to them three-quarters of a pint of rich veal gravy; add a seasoning of salt and cayenne, if needed; skim off the fat entirely, press the sauce through a sieve, heat it in a clean stewpan, mix it with a quarter of a pint of rich boiling cream, and serve it directly.

Onions, 2 lbs.; butter, 2 to 3 oz.: 30 minutes to 1 hour. Veal gravy, 3/4 pint; salt, cayenne: 5 minutes. Cream, 1/4 pint.

SOUBISE.

(_French Receipt._)

Peel some fine white onions, and trim away all tough and discoloured parts; mince them small, and throw them into plenty of boiling water; when they have boiled quickly for five minutes drain them well in a sieve, then stew them very softly indeed in an ounce or

two of fresh butter until they are dry and perfectly tender; stir to them as much _béchamel_ as will bring them to the consistence of very thick pea-soup, pass the whole through a strainer, pressing the onion strongly that none may remain behind, and heat the sauce afresh, without allowing it to boil. A small half-teaspoonful of pounded sugar is sometimes added to this _soubise_.

White part of onions, 2 lbs.: blanched 5 minutes. Butter, 2 oz.: 30 to 50 minutes. Béchamel, 3/4 to 1 pint, or more.

Obs.—These sauces are served more frequently with lamb or mutton cutlets than with any other dishes; but they would probably find many approvers if sent to table with roast mutton, or boiled veal. Half the quantity given above will be sufficient for a moderate-sized dish.

MILD RAGOUT OF GARLIC, OR, L'AIL À LA BORDELAISE.

Divide some fine cloves of garlic, strip off the skin, and when all are ready throw them into plenty of boiling water slightly salted; in five minutes drain this from them, and pour in as much more, which should also be quite boiling; continue to change it every five or six minutes until the garlic is quite tender: throw in a moderate proportion of salt the last time to give it the proper flavour. Drain it thoroughly, and serve it in the dish with roast mutton, or put it into good brown gravy or white sauce for table. By changing very frequently the water in which it is boiled, the root will be deprived of its naturally pungent flavour and smell, and rendered extremely mild: when it is not wished to be quite so much so, change the water every ten minutes only.

Garlic, 1 pint: 15 to 25 minutes, or more. Water to be changed every 5 or 6 minutes; or every 10 minutes when not wished so _very_ mild. Gravy or sauce, 1 pint.

MILD ESCHALOT SAUCE.

Prepare and boil from half to a whole pint of eschalots by the preceding receipt; unless very large, they will be tender in about fifteen minutes, sometimes in less, in which case the water must be poured from them shortly after it has been changed for the second time. When grown in a suitable soil, and cultivated with care, the eschalots are sometimes treble the size that they are under other circumstances; and this difference must be allowed for in boiling them. Drain them _well_, and mix them with white sauce or gravy, or with good melted butter, and serve them very hot.

A FINE SAUCE, OR PURÉE OF VEGETABLE MARROW.

Pare one or two half-grown marrows and cut out all the seeds; take a pound of the vegetable, and slice it, with one ounce of mild onion, into a pint of strong veal broth or of pale gravy; stew them very softly for nearly or quite an hour; add salt and cayenne, or white pepper, when they are nearly done; press the whole through a fine and delicately clean hair-sieve; heat it afresh, and stir to it when it boils about the third of a pint of rich cream. Serve it with boiled chickens, stewed or boiled veal, lamb cutlets, or any other delicate meat. When to be served as a purée, an additional half-pound of the vegetable must be used; and it should be dished with small fried sippets round it. For a _maigre_ dish, stew the marrow and onion quite tender in butter, and dilute them with half boiling water and half cream.

Vegetable marrow, 1 lb.; mild onion, 1 oz.; strong broth or pale gravy, 1 pint: nearly or quite 1 hour. Pepper or cayenne, and salt as needed; good cream, from 1/4 to 3/4 of pint. For purée, 1/2 lb. more of marrow.

EXCELLENT TURNIP, OR ARTICHOKE SAUCE FOR BOILED MEAT.

Pare, slice, and boil quite tender, some finely-grained mild turnips, press the water from them thoroughly, and pass them through a sieve. Dissolve a slice of butter in a clean saucepan, and stir to it a large teaspoonful of flour, or mix them smoothly together before they are put in, and shake the saucepan round until they boil: pour to them very gradually nearly a pint of thin cream (or of good milk mixed with a portion of cream), add the turnips with a half-teaspoonful or more of salt, and when the whole is well mixed and very hot, pour it over boiled mutton, veal, lamb, or poultry. There should be sufficient of the sauce to cover the meat entirely;[58] and when properly made it improves greatly the appearance of a joint. A little cayenne tied in a muslin may be boiled in the milk before it is mixed with the turnips. Jerusalem artichokes make a more delicate sauce of this kind even than turnips; the weight of both vegetables must be taken after they are pared.

Footnote 58:

The objection to _masking_ a joint with this or any other sauce is, that it speedily becomes cold when spread over its surface: a portion of it at least should be served very hot in a tureen.

Pared turnips or artichokes, 1 lb.; fresh butter, 1-1/2 oz.; flour, 1 large teaspoonful (twice as much if all milk be used); salt, 1/2 teaspoonful or more; cream, or cream and milk mixed, from 3/4 to 1 pint.

OLIVE SAUCE.

Remove the stones from some fine French or Italian olives by paring the fruit close to them, round and round in the form of a corkscrew: they will then resume their original shape when done. Weigh six ounces thus prepared, throw them into boiling water, let them blanch for five minutes; then drain, and throw them into cold water, and leave them in it from half an hour to an hour, proportioning the time to their saltness; drain them well, and stew them gently from fifteen to twenty-five minutes in a pint of very rich brown gravy or _Espagnole_ (see Chapter IV.); add the juice of half a lemon, and serve the sauce very hot. Half this quantity will be sufficient for a small party.

Olives, stoned, 6 oz.; rich gravy, 1 pint: 15 to 25 minutes. Juice, 1/2 lemon.

Obs.—In France this sauce is served very commonly with ducks, and sometimes with beef-steaks, and with stewed fowl.

CELERY SAUCE.

Slice the white part of from three to five heads of young tender celery; peel it if not very young, and boil it in salt and water for twenty minutes. If for white sauce put the celery, after it has been well drained, into half a pint of veal broth or gravy, and let it stew until it is quite soft; then add an ounce and a half of butter, mixed with a dessertspoonful of flour, and a quarter of a pint of thick cream or the yolks of three eggs. The French, after boiling the celery, which they cut very small, for about twenty minutes, drain and _chop_ it; then put it with a slice of butter into a stewpan, and season it with pepper, salt, and nutmeg; they keep these stirred over the fire for two or three minutes, and then dredge in a dessertspoonful of flour: when this has lost its raw taste, they pour in a sufficient quantity of white gravy to moisten the celery, and to allow for twenty minutes' longer boiling. A very good common celery sauce is made by simply stewing the celery cut into inch-lengths in butter, until it begins to be tender; and then adding a spoonful of flour, which must be allowed to brown a little, and half a pint of _good_ broth or beef gravy, with a seasoning of pepper or cayenne.

Celery, 3 to 5 heads: 20 minutes. Veal broth, or gravy, 1/2 pint; 20 to 40 minutes. Butter, 1-1/2 oz.; flour, 1 dessertspoonful; cream, 1/4 pint, or three yolks of eggs.

WHITE CHESTNUT SAUCE.

Strip the outer rind from six ounces of sound sweet chestnuts, then throw them into boiling water, and let them simmer for two or three minutes, when the second skin will easily peel off. Add to them three quarters of a pint of good cold veal gravy, and a few strips of lemon rind, and let them stew gently for an hour and a quarter. Press them, with the gravy, through a hair-sieve reversed and placed over a deep dish or pan, as they are much more easily rubbed through thus than in the usual way: a wooden spoon should be used in preference to any other for the process. Add a little cayenne and mace, some salt if needed, and about six tablespoonsful of rich cream. Keep the sauce stirred until it boils, and serve it immediately.

Chestnuts without their rinds, 6 oz.; veal gravy, 1 pint; rind of 1/2 lemon: 1-1/4 hour. Salt; spice; cream, 6 tablespoonsful.

Obs.—This sauce may be served with turkey, with fowls, or with stewed veal cutlets.

BROWN CHESTNUT SAUCE.

Substitute rich brown gravy for the veal stock, omit the lemon-rind and cream, heighten the seasonings, and mix the chestnuts with a few spoonsful of _Espagnole_ or highly flavoured gravy, after they have been passed through the sieve.

PARSLEY-GREEN, FOR COLOURING SAUCES.

Gather a quantity of young parsley, strip it from the stalks, wash it very clean, shake it as dry as possible in a cloth, pound it in a mortar, press all the juice closely from it through a hair-sieve reversed, and put it into a clean jar; set it into a pan of boiling water, and in about three minutes, if _gently_ simmered, the juice will be poached sufficiently; lay it then upon a clean sieve to drain, and it

will be ready for use.

Spinach-green, for which particular directions will be found at the commencement of Chapter XXIV., is prepared in the same manner. The juice of various herbs pounded together may be pressed from them through a sieve and added to cold sauces.

TO CRISP PARSLEY.

Wash some branches of young parsley well, drain them from the water, and swing them in a clean cloth until they are quite dry; place them on a sheet of writing paper in a Dutch oven, before a brisk fire, and keep them frequently turned until they are quite crisp. They will become so in from six to eight minutes.

FRIED PARSLEY.

When the parsley has been prepared as for crisping, and is _quite_ dry, throw it into plenty of lard or butter, which is on the point of boiling; take it up with a skimmer the instant it is crisp, and drain it on a cloth spread upon a sieve reversed, and placed before the fire.

MILD MUSTARD.

Mustard for instant use should be mixed with milk, to which a spoonful or two of very thin cream may be added.

MUSTARD THE COMMON WAY.

The great art of mixing mustard is to have it perfectly smooth, and of a proper consistency. The liquid with which it is moistened should be added to it in small quantities, and the mustard should be well rubbed, and beaten with a spoon. Mix half a teaspoonful of salt with two ounces of the flour of mustard, and stir to them by degrees sufficient boiling water to reduce it to the appearance of a thick batter: do not put it into the mustard-glass until it is cold. Some persons like a half-teaspoonful of sugar in the finest powder mixed with it. It ought to be sufficiently diluted always to drop easily from the spoon; and to bring it to this state more than a quarter of a pint, and less than _half_ a pint of liquid will be needed for four ounces of the best Durham mustard.

For Tartar mustard see Chapter VII.

FRENCH BATTER.

(_For frying vegetables, and for apple, peach, or orange fritters._)

Cut a couple of ounces of good butter into small bits, pour on it less than a quarter of a pint of boiling water, and when it is dissolved add three quarters of a pint of cold water, so that the whole shall not be quite milk warm; mix it then by degrees and very smoothly with twelve ounces of fine dry flour and a _small_ pinch of salt if the batter be for fruit fritters, but with more if for meat or vegetables. Just before it is used, stir into it the whites of two eggs beaten to a solid froth; but previously to this, add a little water should it appear too thick, as some flour requires more liquid than other to bring it to the proper consistence; this is an exceedingly light crisp batter, excellent for the purposes for which it is named.

Butter, 2 oz.; water, from 3/4 to nearly 1 pint; little salt; flour, 3/4 lb.; whites of 2 eggs, beaten to snow.

TO PREPARE BREAD FOR FRYING FISH.

Cut thick slices from the middle of a loaf of light stale bread, pare the crust entirely from them, and dry them gradually in a cool oven until they are crisp quite through; let them become cold, then roll or beat them into fine crumbs, and keep them in a dry place for use. To strew over hams or cheeks of bacon, the bread should be left all night in the oven, which should be sufficiently heated to brown, as well as to harden it: it ought indeed to be entirely converted into equally-coloured crust. It may be sifted through a dredging-box on to the hams after it has been reduced almost to powder.

BROWNED FLOUR FOR THICKENING SOUPS AND GRAVIES.

Spread it on a tin or dish and colour it, without burning, in a gentle oven or before the fire in a Dutch or American oven: turn it often, or the edges will be too much browned before the middle is enough so. This, blended with butter, makes a convenient thickening for soups or gravies of which it is desirable to deepen the colour; and it requires less time and attention than the French _roux_ of

FRIED BREAD-CRUMBS.

Grate lightly into very fine crumbs four ounces of stale bread, and _shake_ them through a cullender;[59] without rubbing or touching them with the hands. Dissolve two ounces of fresh butter in a frying-pan, throw in the crumbs, and stir them constantly over a moderate fire, until they are all of a clear golden colour; lift them out with a skimmer, spread them on a soft cloth, or upon white blotting paper, laid upon a sieve reversed, and dry them before the fire. They may be more delicately prepared by browning them in a gentle oven without the addition of butter.

Footnote 59:

This is not necessary when they are lightly and finely grated of uniform size.

Bread, 4 oz.; butter, 2 oz.

FRIED BREAD FOR GARNISHING.

Cut the crumb of a stale loaf in slices a quarter of an inch thick; form them into diamonds or half diamonds, or shape them with a paste-cutter in any another way; fry them in fresh butter, some of a very pale brown and others a deeper colour; dry them well, and place them alternately round the dish that is to be garnished. They may be made to adhere to the edge of the dish when they are required for _ornament_ only, by means of a little flour and white of egg brushed over the side which is placed on it: this must be allowed to dry before they are served.

For SWEET-PUDDING SAUCES, see Chapter XX.

CHAPTER VI.

=Cold Sauces, Salads, etc.=

SUPERIOR MINT-SAUCE.

(_To serve with lamb._)

THE mint for this sauce should be fresh and young, for when old it is tough and indigestible. Strip the leaves from the stems, wash them with great nicety, and drain them on a sieve, or dry them in a cloth; chop them very fine, put them into a sauce-tureen, and to three heaped tablespoonsful of the mint add two of pounded sugar; let them remain a short time well mixed together, then pour to them gradually six tablespoonsful of good vinegar. The sauce thus made is excellent, and far more wholesome than when a larger proportion of vinegar and a smaller one of sugar is used for it; but, after the first trial, the proportions can easily be adapted to the taste of the eaters.

COMMON MINT-SAUCE.

Two tablespoonsful of mint, one _large_ tablespoonful of pale brown sugar, well mixed together, and a quarter of a pint of vinegar, stirred until the sugar is entirely dissolved.

STRAINED MINT SAUCE.

Persons with whom the mint in substance disagrees can have the flavour of the herb without it, by mixing the ingredients of either of the preceding receipts, and straining the sauce after it has stood for two or three hours; the mint should be well pressed when this is done. The flavour will be the more readily extracted if the mint and sugar are well mixed, and left for a time before the vinegar is added.

FINE HORSERADISH SAUCE.

(_To serve with cold, roast, stewed, or boiled beef._)

The root for this excellent sauce should be young and tender, and grated down on a very fine bright grater, quite to a pulp, after it has been washed, wiped, and scraped free from the outer skin. We have given the proportions for it in the preceding chapter, but repeat them here.

Horseradish, 2 heaped tablespoonsful; salt, 1 moderate teaspoonful; rich cream, 4 tablespoonsful; good vinegar, 3 dessertspoonsful (of which one may be chili vinegar when the root is mild.) When the other ingredients are smoothly mingled, the vinegar must be stirred briskly to them in very small portions. A few drops of garlic or shalot vinegar can be added to them when it is liked.

COLD MAÎTRE D'HÔTEL, OR STEWARD'S SAUCE.

Work well together until they are perfectly blended, two or three ounces of good butter, some pepper, salt, minced parsley, and the strained juice of a sound lemon of moderate size. The sauce thus prepared is often put into broiled fish; and laid in the dish _under_ broiled kidneys, beef-steaks, and other meat.

For 2 oz. butter, 1 _heaped_ teaspoonful young minced parsley; juice of 1 lemon; 1 small saltspoonful salt; seasoning of white pepper.

Obs.—The proportion of parsley may be doubled when a larger quantity is liked: a little fine cayenne would often be preferred to the pepper.

COLD DUTCH OR AMERICAN SAUCE, FOR SALADS OF DRESSED VEGETABLES, SALT FISH, OR HARD EGGS.

Put into a saucepan three ounces of good butter very smoothly blended with a quite small teaspoonful of flour, and add to them a large wineglassful of cold water, half as much sharp vinegar (or very fresh, strained, lemon-juice) a saltspoonful of salt, and half as much cayenne in fine powder. Keep these shaken briskly round, or stirred over a clear fire, until they form a smooth sauce and boil rapidly; then stir them very quickly to the beaten yolks of four fresh eggs, which will immediately give the sauce the consistence of custard; pour it hot over the salad, and place it on ice, or in a very cool larder until it is quite cold: if properly made, it will be very thick and smooth, and slightly _set_, as if it contained a small portion of isinglass. A dessertspoonful of parsley,—or of tarragon,—can be mingled with it at _pleasure_, or any flavour given to it with store-sauces which is liked. It converts flakes of salt-fish, sliced potatoes (new or old), and hard eggs, into excellent salads.

ENGLISH SAUCE FOR SALAD, COLD MEAT, OR COLD FISH.

The first essential for a smooth, well-made English salad dressing is to have the yolks of the eggs used for it sufficiently hard to be reduced easily to a perfect paste. They should be boiled at least fifteen minutes, and should have become _quite_ cold before they are taken from the shells; they should also be well covered with water when they are cooked, or some parts of them will be tough, and will spoil the appearance of the sauce by rendering it lumpy, unless they be worked through a sieve, a process which is always better avoided if possible. To a couple of yolks broken up and mashed to a paste with the back of a wooden spoon, add a small saltspoonful of salt, a large one of pounded sugar, a few grains of fine cayenne, and a teaspoonful of cold water; mix these well, and stir to them by degrees a quarter of a pint of sweet cream; throw in next, stirring the sauce briskly, a tablespoonful of strong chili vinegar, and add as much common or French vinegar as will acidulate the mixture agreeably. A tablespoonful of either will be sufficient for many tastes, but it is easy to increase the proportion when more is liked. Six tablespoonsful of olive oil, of the purest quality, may be substituted for the cream: it should be added in very small portions to the other ingredients, and stirred briskly as each is added until the sauce resembles custard. When this is used, the water should be omitted. The piquancy of this preparation—which is very delicate, made by the directions just given—may be heightened by the addition of a little eschalot vinegar, Harvey's sauce, essence of anchovies, French mustard, or tarragon vinegar; or by bruising with the eggs a morsel of garlic, half the size of a hazel-nut: it should always, however, be rendered as appropriate as may be to the dish with which it is to be served.

Obs. 1.—As we have before had occasion to remark, garlic, when very sparingly and judiciously used, imparts a remarkably fine savour to a sauce or gravy, and neither a strong nor a coarse one, as it does when used in larger quantities. The veriest morsel (or, as the French call it, a mere _soupçon_) of the root, is sufficient to give this agreeable piquancy, but unless the proportion be extremely small, the effect will be quite different. The Italians dress their salads upon a round of delicately toasted bread, which is rubbed with garlic, saturated with oil, and sprinkled with cayenne, before it is laid into the bowl: they also eat the bread thus

prepared, but with less of oil, and untoasted often, before their meals, as a digester.

Obs. 2.—French vinegar is so infinitely superior to English in strength, purity, and flavour, that we cannot forbear to recommend it in preference for the use of the table. We have for a long time past been supplied with some of most excellent quality (labelled _Vinaigre de Bordeaux_) imported by the Messrs. Kent & Sons, of Upton-on-Severn, who supply it largely, we believe, both to wholesale and retail venders in town and country.

THE POET'S RECEIPT FOR SALAD.[60]

Footnote 60:

Note.—This receipt, though long privately circulated amongst the friends and acquaintance of its distinguished and regretted author, now (with permission) appears for the first time in print. We could not venture to deviate by a word from the original, but we would suggest, that the mixture forms almost a substitute for salad, instead of a mere dressing. It is, however, an admirable compound for those to whom the slight flavouring of onion is not an objection.

"Two large potatoes, passed through kitchen sieve Unwonted softness to the salad give; Of mordent mustard, add a single spoon, Distrust the condiment which bites so soon; But deem it not, thou man of herbs, a fault, To add a double quantity of salt; Three times the spoon with oil of Lucca crown, And once with vinegar, procured from town; True flavour needs it, and your poet begs The pounded yellow of two well-boiled eggs; Let onion atoms lurk within the bowl, And, scarce suspected, animate the whole; And lastly, in the flavoured compound toss A magic teaspoon of anchovy sauce: Then, though green turtle fail, though venison's tough, And ham and turkey are not boiled enough, Serenely full, the epicure may say— Fate cannot harm me,—I have dined to-day."

Two well-boiled potatoes, passed through a sieve; a teaspoonful of mustard; two teaspoonsful of salt; one of essence of anchovy; about a quarter of a teaspoonful of very finely-chopped onions, well bruised into the mixture; three tablespoonsful of oil; one of vinegar; the yolks of two eggs, hard boiled. Stir up the salad immediately before dinner, and stir it up thoroughly.

N.B.—As this salad is the result of great experience and reflection, it is hoped young salad makers will not attempt to make any improvements upon it.

SAUCE MAYONNAISE.

(_For salads, cold meat, poultry, fish, or vegetables._)

This is a very fine sauce when all the ingredients used for it are good; but it will prove an uneatable compound to a delicate taste unless it be made with oil of the purest quality.

Put into a large basin the yolks only of two very fresh eggs, carefully freed from specks, with a little salt and cayenne; stir these well together, then add about a teaspoonful of the purest salad oil, and work the mixture round with a wooden spoon until it appears like cream. Pour in by slow degrees nearly half a pint of oil, continuing at each interval to work the sauce as at first until it resumes the smoothness of cream, and not a particle of the oil remains visible; then add a couple of tablespoonsful of plain French or of tarragon vinegar, and one of cold water to whiten the sauce. A bit of clear veal jelly the size of an egg will improve it greatly. The reader who may have a prejudice against the unboiled eggs which enter into the composition of the Mayonnaise, will find that the most fastidious taste would not detect their being raw, if the sauce be well made; and persons who dislike oil may partake of it in this form, without being aware of its presence, provided always that it be perfectly fresh, and pure in flavour, for otherwise it will be easily perceptible.

Yolks of fresh unboiled eggs, 2; salt, 1/2 saltspoonful, or rather more; cayenne; oil, full third of pint; French or tarragon vinegar, 2 tablespoonsful; cold water, 1 tablespoonful; meat jelly (if at hand), size of an egg.

RED OR GREEN MAYONNAISE SAUCE.

Colour may be given either to the preceding or to the following _Sauce Mayonnaise_ by mingling with it some hard lobster-coral reduced to powder by rubbing it through a very fine hair-sieve: the red hue of this is one of the most brilliant and beautiful that can be seen, but the sauce for which it is used can only be appropriately served with fish or fish-salads. Spinach-green will impart a fine tint to any preparation, but its flavour is objectionable: that of parsley-green is more agreeable. Directions for both of these are contained in the previous chapter.

IMPERIAL MAYONNAISE.

(_An elegant jellied sauce, or salad-dressing._)

Put into a bowl half a pint of aspic, or of any very clear pale jellied stock (that made usually for good white soup will serve for the purpose excellently); add to it a couple of spoonsful of the purest olive-oil, one of sharp vinegar, and a little fine salt and cayenne. Break up the jelly quite small with the points of a whisk of osier-twigs, stir the ingredients well together, and then whisk them gently until they are converted into a smooth white sauce. This receipt was derived originally from an admirable French cook,[61] who stood _quite_ at the head of his profession; but as he was accustomed to purvey for the tables of kings and emperors, his directions require some curtailment and simplifying to adapt them to the resources of common English life. He directs the preparation to be mixed and worked—to use a technical expression—over _ice_, which cannot always be commanded, except in opulent establishments, and in large towns. It is not, however, essential to the success of this sauce, which will prove extremely good if made and kept in a cool larder; or, if the bowl in which it is mingled be placed in a pan of cold water, into which plenty of saltpetre and sal-ammoniac, roughly powdered, are thrown at the moment it is set into it. In this country a smaller proportion of oil, and a larger one of acid, are usually preferred to the common French salad-dressings, in which there is generally a very small portion of vinegar. To some tastes a spoonful or two of cream would improve the present Mayonnaise, which may be varied also with chili, tarragon, or other flavoured vinegar. It should be served heaped high in the centre of the salad, for which, if large, double the quantity directed _here_ should be prepared.

Footnote 61:

Monsieur Carême, to whose somewhat elaborate but admirable works, published thirty years or more since, all modern cooks appear to be specially indebted.

REMOULADE.

This differs little from an ordinary English salad-dressing. Pound very smoothly indeed the yolks of two or three hard-boiled eggs with a teaspoonful of mustard, half as much salt, and some cayenne, or white pepper. Mix gradually with them, working the whole well together, two or three tablespoonsful of oil and two of vinegar. Should the sauce be curdled, pour it by degrees to the yolk of a raw egg, stirring it well round as directed for the Mayonnaise. A spoonful of tarragon, cucumber, or eschalot-vinegar, may be added with very good effect; and to give it increased relish, a teaspoonful of cavice, or a little of Harvey’s sauce, and a dessertspoonful of chili vinegar may be thrown into it. This last is an excellent addition to all cold sauces, or salad-dressings.

Hard yolks of 2 or of 3 eggs; mustard, 1 teaspoonful (more when liked); salt, 1/2 teaspoonful; pepper or cayenne; oil, 3 tablespoonsful; vinegar, 2. If curdled, yolk of 1 raw egg. Good additions: tarragon or eschalot, or cucumber-vinegar, 1 tablespoonful; chili vinegar, 1 dessertspoonful; cavice or Harvey’s sauce at pleasure.

Obs.—A dessertspoonful of eschalots, or a _morsel_ of garlic, very finely minced, are sometimes pounded with the yolks of eggs for this sauce.

OXFORD BRAWN SAUCE.

Mingle thoroughly a tablespoonful of brown sugar with a teaspoonful of made mustard, a third as much of salt, some pepper, from three to four tablespoonsful of very fine salad-oil, and two of strong vinegar; or apportion the same ingredients otherwise to the taste.

FORCED EGGS FOR GARNISHING SALAD.

Pound and press through the back of a hair-sieve the flesh of three very fine, or of four moderate-sized anchovies, freed from the bones and skin. Boil six fresh eggs for twelve minutes, and when they are perfectly cold, halve them lengthwise, take out the yolks, pound them to a paste with a third of their volume of fresh butter, then add the anchovies, a quarter of a teaspoonful of mace, and as much cayenne as will season the mixture well; beat these together thoroughly, and fill the whites of egg neatly with them. A _morsel_ of garlic, perfectly blended with the other ingredients, would to some tastes improve this preparation: a portion of anchovy-butter, or of potted ham, will supply the place of fish in it very advantageously.

Eggs, 6; anchovies, 4; butter, size of 2 yolks; mace, 1/4 teaspoonful; cayenne, third as much.

ANCHOVY BUTTER.

(_Excellent._)

Scrape the skin quite clear from a dozen fine mellow anchovies, free the flesh entirely from the bones, and pound it as smooth as possible in a mortar; rub it through the back of a hair-sieve with a wooden spoon; wipe out the mortar, and put back the anchovies with three quarters of a pound of very fresh butter, a small half-saltspoonful of cayenne, and more than twice as much of finely grated nutmeg, and freshly pounded mace; and beat them together until they are thoroughly blended. If to serve cold at table, mould the butter in small shapes, and turn it out. A little rose pink (which is sold at the chemists') is sometimes used to give it a fine colour, but it must be sparingly used, or it will impart an unpleasant flavour, and we cannot much recommend its use: it should be well pounded, and very equally mixed with it. For kitchen use, press the butter down into jars or pattypans, and keep it in a cool place.

Fine anchovies, 12; butter, 3/4 lb.; cayenne, small 1/2 saltspoonful; nutmeg and mace, each more than twice as much; rose pink (if used), 1/2 teaspoonful.

This proportion differs from potted anchovies only in the larger proportion of butter mixed with the fish, and the milder seasoning of spice. It will assist to form an elegant dish if made into pats, and stamped with a tasteful impression, then placed alternately with pats of lobster-butter, and decorated with light foliage. It is generally eaten with much relish when carefully compounded, and makes excellent sandwiches. To convert it into a good fish sauce, mix two or three ounces of it with a teaspoonful of flour and a few spoonsful of cold water, or of pale veal stock, and keep them constantly stirred until they boil. The butter should not be moulded directly it is taken from the mortar, as it is then very soft from the beating. It should be placed until it is firm in a very cool place or over _ice_, when it can be done conveniently.

LOBSTER BUTTER.

Pound to the smoothest possible paste the coral of one or two fresh hen lobsters, mix with it about an equal proportion of fresh firm butter, and a moderate seasoning of mace and cayenne, with a little salt if needed. Let the whole be thoroughly blended, and set it aside in a cool larder, or place it over ice until it is sufficiently firm to be made into pats. Serve it garnished with curled parsley, or with any light foliage which will contrast well with its brilliant colour. The coral may be rubbed through a fine sieve before it is put into the mortar, and will then require but little pounding.

An excellent preparation is produced by mingling equal proportions of lobster and of anchovy butter in the mortar, or one-third of the anchovy with two of lobster: to this some of the white flesh of the latter can be added to give another variety, after it has been prepared by the receipt for _boudirettes_, Chapter III.

TRUFFLED BUTTER (AND TRUFFLES POTTED IN BUTTER.)

(_For the breakfast or luncheon table._)

Cut up a pound of sweet fresh butter, and dissolve it gently over a clear fire; take off the scum which will gather thickly upon it, and when it has simmered for three or four minutes, draw it from the fire, and let it stand until all the buttermilk has subsided; pour it softly from this upon six ounces of ready-pared sound French truffles, cut into small, but rather thick, slices, and laid into a delicately clean enamelled saucepan; add a full seasoning of freshly pounded mace and fine cayenne, a small saltspoonful of salt, and half a not large nutmeg. When the butter has become quite cold, proceed to heat the truffles slowly, shaking the saucepan often briskly round, and stew them as gently as possible for twenty minutes, or longer should they not then be very tender. If allowed to heat, and to boil quickly, they will become _hard_, and the preparation, as regards the _truffles_, will be a comparative failure. Lift them with a spoon into quite dry earthen or china pans, and pour the butter on them; or add to them sufficient of it only to cover them well and to exclude the air, and pot the remainder of the butter apart: it will be finely flavoured, and may be eaten by delicate persons to whom the truffle itself would be injurious. It may also be used in compounding savoury sauces, and for moistening small _croustades_ before they are fried or baked. The truffles themselves will remain good for months when thus prepared, if kept free from damp; and in flavour they will be found excellent. The parings taken from them will also impart a very agreeable savour to the butter, and will serve extremely well for it for immediate use. They will also be valuable as additions to gravies or to soups.

We should observe, that the juice which will have exuded from the truffles in the stewing will cause the preparation to become mouldy, or otherwise injure it, if it be put into the pans either with them or with the butter. The truffles must be well drained from it when they are taken from the saucepan, and the butter must remain undisturbed for a few minutes, when it can be poured clear from the juice, which will have subsided to the bottom of the pan. We have given here the result of our first experiment, which we found on further trial to answer perfectly.

ENGLISH SALADS.

The herbs and vegetables for a salad cannot be too freshly gathered; they should be carefully cleared from insects and washed with scrupulous nicety; they are better when not prepared until near the time of sending them to table, and should not be sauced until the instant before they are served. Tender lettuces, of which the stems should be cut off, and the outer leaves be stripped away, mustard and cress, young radishes, and occasionally chives or small green onions (when the taste of a party is in favour of these last) are the usual ingredients of summer salads. (In early spring, as we have stated in another chapter, the young white leaves of the dandelion will supply a very wholesome and excellent salad, of which the slight bitterness is to many persons as agreeable as that of the endive.) Half-grown cucumbers sliced thin, and mixed with them, are a favourite addition with many persons. In England it is customary to cut the lettuces extremely fine; the French, who object to the _flavour of the knife_, which they fancy this mode imparts, break them small instead. Young celery alone, sliced and dressed with a rich salad mixture, is excellent: it is still in some families served thus always with roast pheasants.

Beet-root, baked or boiled, blanched endive, small salad-herbs which are easily raised at any time of the year, celery, and hardy lettuces, with any ready-dressed vegetable, will supply salads through the winter. Cucumber vinegar is an agreeable addition to these.

FRENCH SALAD.

In winter this is made principally of beautifully-blanched endive, washed delicately clean and broken into small branches with the fingers, then taken from the water and shaken dry in a basket of peculiar form, appropriated to the purpose,[62] or in a fine cloth; then arranged in the salad bowl, and strewed with herbs (tarragon generally, when in season) minced small: the dressing is not added until just before the salad is eaten. In summer, young lettuces are substituted for the endive, and intermixed with a variety of herbs, some of which are not generally cultivated in England.

Footnote 62:

Salad-baskets are also to be found in many good English kitchens, but they are not in such general use here as on the continent.

FRENCH SALAD DRESSING.

Stir a saltspoonful of salt and half as much pepper into a large spoonful of oil, and when the salt is dissolved, mix with them four additional spoonsful of oil, and pour the whole over the salad; let it be _well_ turned, and then add a couple of spoonsful of tarragon vinegar; mix the whole thoroughly, and serve it without delay. The salad should not be dressed in this way until the instant before it is wanted for table: the proportions of salt and pepper can be increased at pleasure, and common or cucumber vinegar may be substituted for the tarragon, which, however, is more frequently used in France than any other.

Salt, 1 spoonful: pepper, 1/2 as much; oil, 5 saladspoonsful; tarragon, or other vinegar, 2 spoonsful.

DES CERNEAUX, OR WALNUT SALAD.

This is a common summer salad in France, where the growth of walnuts is generally abundant, but is not much served in England; though the sweet flavour of the just-formed nut is very agreeable. Take the walnuts when a pin will pierce them _easily_, pare them down to the kernels, and toss them gently, just before they are served, in a French or English salad-dressing (the former would generally be preferred we think), and turn them into the salad-bowl for table.

SUFFOLK SALAD.

Fill a salad-bowl from half to three parts full with very tender lettuces shred small, minced lean of ham, and hard-boiled eggs, or their yolks only also minced, placed in alternate layers; dress the mixture with English salad sauce, but do not pour it into the bowl until the instant of serving. A portion of cold chicken (or veal), cut in thin slices about the size of a shilling, may be added when

convenient; the ham and eggs also may be sliced instead of being minced, and the whole neatly arranged in a chain or otherwise round the inside of the bowl.

YORKSHIRE PLOUGHMAN'S SALAD.

Mix treacle and vinegar, in the proportion of one tablespoonful of the first to two of the latter; add a little black pepper, and eat the sauce with lettuces shred small (with an intermixture of young onions when they are liked).

AN EXCELLENT SALAD OF YOUNG VEGETABLES.

Pare off the coarse, fibrous parts from four or five artichoke bottoms, boiled quite tender, well drained, and freed carefully from the insides; cut them into quarters, and lay them into the salad-bowl; arrange over them some cold new potatoes and young carrots sliced moderately thin, strew minced tarragon, chervil, or any other herbs which may be better liked, thickly over the surface, and sauce the salad with an English or French dressing just before it is sent to table. Very young French beans cut into short lozenge-shaped lengths, or asparagus points, can be added to this dish at pleasure; or small tufts of cauliflower may be placed round it. When these additions are made, the herbs are better omitted: a little of the liquor of pickled Indian mangoes may be advantageously mixed with the sauce for this salad, or in lieu of it some chili vinegar or cayenne pepper. The Dutch or American sauce of the previous pages would also make an appropriate dressing for it.

SORREL SALAD.

(_To serve with Lamb-cutlets, Veal cutlets, or Roast Lamb_.)

This, though a very agreeable and refreshing salad, is not to be recommended when there is the slightest tendency to disorder of the system; for the powerful acid of the uncooked sorrel might in that case produce serious consequences.[63]

Footnote 63:

It should be especially avoided when dysentery, or other diseases of a similar nature, are prevalent. We mention this, because if more general precaution were observed with regard to diet, great suffering would, in many instances, be avoided.

Take from the stems some very young tender sorrel, wash it delicately clean, drain it well, and shake it dry in a salad-basket, or in a soft cloth held by the four corners; arrange it lightly in the bowl, and at the instant of serving, sauce it simply with the preceding French dressing of oil with a small portion of vinegar, or with a _Mayonnaise_ mixed with _chili_ instead of a milder vinegar. The sorrel may be divided with the fingers and mingled with an equal proportion of very tender lettuces; and, when it is not objected to,[64] mixed tarragon may be strewed thickly upon them. To some tastes a _small_ quantity of green onions or of eschalots would be more agreeable.

Footnote 64:

The peculiar flavour of this fine aromatic herb is less generally relished in England than in many other countries; but when it is not disliked it may be used with great advantage in our cookery: it is easily cultivated, and quite deserves a nook in every kitchen-garden.

LOBSTER SALAD.

First, prepare a sauce with the coral of a hen lobster, pounded and rubbed through a sieve, and very gradually mixed with a good _mayonnaise_, _remoulade_, or English salad-dressing of the present chapter. Next, half fill the bowl or more with small salad herbs, or with young lettuces finely shred, and arrange upon them spirally, or in a chain, alternate slices of the flesh of a large lobster, or of two middling-sized ones, and some hard-boiled eggs cut thin and evenly. Leave a space in the centre, pour in the sauce, heap lightly some small salad on the top, and send the dish immediately to table. The coral of a second lobster may be intermingled with the white flesh of the fish with very good effect; and the forced eggs of page 137 may be placed at intervals round the edge of the bowl as a decoration, and an excellent accompaniment as well. Another mode of making the salad is to lay the split bodies of the fish round the bowl, and the claws, freed carefully from the shells, arranged high in the centre on the herbs; the soft part of the bodies may be mixed with the sauce when it is liked; but the colour will not then be good.

Obs.—The addition of cucumber in ribbons (see Author's Receipt, Chapter XVII.), laid lightly round it, is always an agreeable one to lobster salad: they may previously be sauced, and then drained from their dressing a little.

A more wholesome and safer mode of imparting the flavour of the cucumber, however, is to use for the salad vinegar in which that vegetable has been steeped for some hours after having been cut up small.

AN EXCELLENT HERRING SALAD.

(_Swedish Receipt._)

Soak, skin, split, and bone a large Norway herring; lay the two sides along a dish, and slice them slopingly (or substitute for this one or two fine Dutch herrings). Arrange in symmetrical order over the fish slices of cooked beet-root, cold boiled potatoes, and pickled gherkins; then add one or two sharp apples chopped small, and the yolks and whites, separately minced, of some hard-boiled eggs, with any thing else which may be at hand, and may serve to vary tastefully the decoration of the dish. Place these ingredients in small heaps of well-contrasting colours on the surface of the salad, and lay a border of curled celery leaves or parsley round the bowl. For sauce, rub the yolk of one hard-boiled egg quite smooth with some salt; to this add oil and vinegar as for an ordinary salad, and dilute the whole with some thick sour cream.

Obs.—"Sour cream" is an ingredient not much approved by English taste, but it enters largely into German cookery, and into that of Sweden, and of other northern countries also. About half a pound of cold beef cut into small thin shavings or collops, is often added to a herring-salad abroad: it may be either of simply roasted or boiled, or of salted and smoked meat.

TARTAR SAUCE.

(_Sauce à la Tartare_).

Add to the preceding _remoulade_, or to any other sauce of the same nature, a teaspoonful or more of made mustard, one of finely-minced shalots, one of parsley or tarragon, and one of capers or of pickled gherkins, with a rather high seasoning of cayenne, and some salt if needed. The tartar-mustard of the previous chapter, or good French mustard, is to be preferred to English for this sauce, which is usually made very pungent, and for which any ingredients can be used to the taste which will serve to render it so. Tarragon vinegar, _minced tarragon_ and eschalots, and plenty of oil, are used for it in France, in conjunction with the yolks of one or two eggs, and chopped capers, or gherkins, to which olives are sometimes added.

SHRIMP CHATNEY.

(_Mauritian Receipt._)

Shell with care a quart of fresh shrimps (for the mode of doing this see Chapter III.), mince them quickly upon a dish with a large sharp knife, then turn them into a mortar and pound them to a perfectly smooth paste. Next, mix with them very gradually two or three spoonsful of salad oil of the best quality, some young green chilies chopped small (or when these cannot be procured, some _good_ cayenne pepper as a substitute), some young onions finely minced, a little salt if required, and as much vinegar or strained lemon juice as will render the sauce pleasantly acid. Half a saltspoonful or more of powdered ginger is sometimes used in addition to the above ingredients.

When they are preferred, two or three small shalots minced and well bruised with the shrimps may be substituted for the onions.[65] The proportion of oil should be double that of the vinegar used; but in this preparation, as in all others of the same nature, individual taste must regulate the proportion of the most powerful condiments which enter into its composition. All chatneys should be _quite thick_, almost of the consistence of mashed turnips, or stewed tomatas, or stiff bread sauce. They are served with curries; and also with steaks, cutlets, cold meat, and fish. In the East the native cooks crush to a pulp upon a stone slab, and with a stone roller, the ingredients which we direct to be pounded. On occasion the fish might be merely minced. When beaten to a paste, they should be well separated with a fork as the chilies, &c., are added.

Footnote 65:

The sauce can be made without either when their flavour is not liked.

CAPSICUMB CHATNEY.

Slice transversely and very thin, into a bowl or pan of spring water, some large tender green capsicumbs, and let them steep for an hour or two; then drain, and dress with oil, vinegar, and salt.

For TOMATA and SAUSAGE CHATNEY, see CHAPTER OF FOREIGN COOKERY.

CHAPTER VII.

=Store Sauces.=

[Illustration:

Mushrooms, Eschalots, and Tomatas.]

OBSERVATIONS.

A WELL selected stock of these will always prove a convenient resource in simple cookery for giving colour and flavour to soups, gravies, and made dishes; but unless the consumption be considerable, they should not be over-abundantly provided, as few of them are improved by age, and many are altogether spoiled by long keeping, especially if they be not perfectly secured from the air by sound corking, or if stored where there is the slightest degree of damp. To prevent loss, they should be examined at short intervals, and at the first appearance of mould or fermentation, such as will bear the process should be reboiled, and put, when again quite cold, into clean bottles; a precaution often especially needful for mushroom catsup when it has been made in a wet season, or when it has not been very carefully prepared. This, with essence of anchovies, walnut catsup, Harvey's sauce, cavice, lemon-pickle, chili, cucumber, and eschalot vinegar, will be all that is commonly needed for family use; but there is at the present day an extensive choice of these stores on sale, some of which are excellent.

CHETNEY SAUCE.

(_Bengal Receipt_).

[Illustration:

Garlic.]

Stone four ounces of good raisins, and chop them small, with half a pound of crabs, sour apples, unripe bullaces,[66] or of any other hard acid fruit. Take four ounces of coarse brown sugar, two of powdered ginger, and the same quantity of salt and cayenne pepper; grind these ingredients separately in a mortar, as fine as possible; then pound the fruits well, and mix the spices with them, one by one; beat them together until they are perfectly blended, and add gradually as much vinegar as will make the sauce of the consistence of thick cream. Put it into bottles with an ounce of garlic, divided into cloves, and cork it tightly.

Footnote 66:

Hard acid fruit in a crude state is, we think, an ingredient not much to be recommended; and it is always better to deviate a little from "an approved receipt" than to endanger health by the use of ingredients of a questionable character. Gooseberries or tomatas, after being subjected to a moderate degree of heat, might be eaten with far less hazard.

Stoned raisins, 4 oz.; crabs, or other acid fruit, 1/2 lb.; coarse sugar, 4 oz.; powdered ginger, 2 oz.; salt, 2 oz.; cayenne pepper, 2 oz.; garlic, 1 oz.; vinegar, enough to dilute it properly.

Obs.—This favourite oriental sauce is compounded in a great variety of ways; but some kind of acid fruit is essential to it. The mango is used in India; here gooseberries, while still hard and green, are sometimes used for it; and ripe red chilies and tomatas are mixed with the other ingredients. The sauce keeps better if it be exposed to a gentle degree of heat for a week or two, either by the side of the fire, or in a full southern aspect in the sun: the heat of a _very slow_ oven, in which it might be left for a night, would probably have a still better effect. In this case it must be put into a jar or bottles, and well secured from the air. Half a pound of gooseberries, or of these and tamarinds from the shell, and green apples mixed, and the same weight of salt, stoned raisins, brown sugar, powdered ginger, chilies, and garlic, with a pint and a half of vinegar, and the juice of three large lemons, will make another genuine Bengal chetney.

FINE MUSHROOM CATSUP.

One of the very best and most useful of store sauces is good _home-made_ mushroom catsup, which, if really well prepared, imparts an agreeable flavour to any soup or sauce with which it is mingled, and at the same time heightens the colour without imparting the “bitter sweetness” which the burnt sugar used as “browning” in clumsy cookery so often does. The catsup ought, in fact, to be rather the pure _essence of mushrooms_, made with so much salt and spice only as are required to preserve it for a year or longer, than the compound of mushroom-juice, anchovies, shalots, allspice, and other condiments of which it is commonly composed, especially for sale.

Directions to be observed in making and for keeping the catsup.—Let the mushrooms be collected when the weather is dry, for if gathered during, or immediately after rain, the catsup made with them will not keep well.

Cut off the stalk-ends to which the earth adheres, before the mushrooms are broken up, and throw them aside, as they should never be used for the catsup. Reject also such of the flaps as are worm-eaten or decayed. Those which are too stale for use may be detected by the smell, which is very offensive.

When the mushroom first opens, the underside is of a fine pale salmon colour; this changes soon to a sort of ashy-brown, which deepens almost to black as the mushroom passes from its maturity to a state of decay. As it yields a greater abundance of juice when it is fully ripe, it is usually taken in that state for these sauces; but catsup of fine and delicate flavour, though somewhat pale in colour, can be made even of mushroom-buttons if they be sliced up small and turned often in the liquid which will be speedily drawn from them by the application of salt; a rather smaller proportion of which should be mingled with them than is directed for the following receipt.

Every thing used in preparing the catsup should be delicately clean and _very dry_. The bottles in which it is stored, after being dried in the usual way, should be laid into a cool oven for an hour or two before they are filled, to ensure their being free from the slightest degree of moisture, but they must be _quite cold_ before the catsup is poured into them. If the corks be sealed so as to exclude the air effectually, or if well-cleansed bits of bladder first dried, and then rendered flexible with a little spirit of any kind (spirits of wine is convenient for such purposes), be tied closely over them, and the bottles can be kept in a cool place free from damp, the catsup will remain good for a long time.

MUSHROOM CATSUP.

Receipt:—Break up small into a deep earthen pan, two gallons of large ripe mushroom-flaps, and strew amongst them three quarters of a pound of salt, reserving the larger portion of it for the top. Let them remain two days, and stir them gently with a wooden spoon often during the time; then turn them into a large stewpan or enamelled saucepan, heat them slowly, and simmer them for fifteen or twenty minutes. Strain the liquor closely from them without pressure; strain and measure it; put it into a very clean stewpan, and boil it quickly until it is reduced nearly half. For every quart allow half an ounce of black peppercorns and a drachm of mace; or, instead of the pepper, a quarter of a teaspoonful (ten grains) of _good_ cayenne; pour the catsup into a clean jug or jar, lay a folded cloth over it, and keep it in a cool place until the following day; pour it gently from the sediment, put into small bottles, cork them well, and rosin them down. A teaspoonful of salad oil may be poured into each bottle before it is corked, the better to exclude the air from the catsup.

Mushrooms, 2 gallons; salt, 3/4 lb.; to macerate three or four days. To each quart of liquor, 1/2 oz. black pepper, or quarter of a teaspoonful of cayenne; and 1 drachm of mace: to be reduced nearly half.

Obs. 1.—Catsup made thus will not be too salt, nor will the flavour of the mushrooms be overpowered by that of the spices; of which a larger quantity, and a greater variety, can be used at will.

We can, however, answer for the excellence of the present receipt from long experience of it. When the catsup is boiled down quite early in the day, it may be bottled the same night: it is necessary only, that it should _perfectly cold_ before this is done.

Obs. 2.—When the mushrooms are crushed, or mashed, as some authors direct, the liquor will necessarily be very thick; it is better to proceed as above, and then to boil the liquor which may afterwards be extracted from the mushrooms by pressure, with the sediment of the catsup, and sufficient cloves, pepper, allspice, and ginger, to flavour it highly: this _second_ catsup will be found very useful to mix with common thickened sauces, hashes, and stews.

MUSHROOM CATSUP.

(_Another Receipt._)

Break a peck of large mushrooms into a deep earthenpan; strew three quarters of a pound of salt amongst them, and set them into a very cool oven for one night, with a fold of cloth or paper over them. The following day strain off the liquor, measure, and boil it for fifteen minutes; then, for each quart, add an ounce of black pepper, a quarter of an ounce of allspice, half an ounce of ginger, and two large blades of mace, and let it boil fast for twenty minutes longer. When thoroughly cold, put it into bottles, cork them well, and dip the necks into melted bottle-cement, or seal them so as to secure the catsup from the air.

Mushrooms, 1 peck; salt, 3/4 lb. Liquor to boil, 15 minutes. To each quart, 1/2 oz. black pepper; 1/4 oz. allspice; 1/2 oz. ginger; 2 blades mace: 20 minutes.

DOUBLE MUSHROOM CATSUP.

On a gallon of fresh mushrooms strew three ounces of salt, and pour to them a quart of ready-made catsup (that which is a year old will do if it be perfectly good); keep these stirred occasionally for four days, then drain the liquor very dry from the mushrooms, and boil it for fifteen minutes with an ounce of whole black pepper, a drachm of mace, an ounce of ginger, and three or four grains only of cayenne.

Mushrooms, 1 gallon; salt, 3 oz.; mushroom catsup, 1 quart; peppercorns, 1 oz.; mace, 1 drachm; ginger, 1 oz.; cayenne, 3 to 4 grains: 15 minutes.

COMPOUND, OR COOK'S CATSUP.

Take a pint and a half of mushroom catsup when it is first made, and ready boiled (the double is best for the purpose), simmer in it for five minutes an ounce of small eschalots nicely peeled; add to these half a pint of walnut catsup, and a wineglassful of cayenne vinegar, or of chili vinegar; give the whole one boil, pour it out, and when cold, bottle it with the eschalots in it.

Mushroom catsup, 1-1/2 pint; eschalots, 1 oz.; walnut catsup or pickle, 1/2 pint; cayenne or chili vinegar, 1 wineglassful.

WALNUT CATSUP.

The vinegar in which walnuts have been pickled, when they have remained in it a year, will generally answer all the purposes for which this catsup is required, particularly if it be drained from them and boiled for a few minutes, with a little additional spice, and a few eschalots; but where the vinegar is objected to, it may be made either by boiling the expressed juice of young walnuts for an hour, with six ounces of fine anchovies, four ounces of eschalots, half an ounce of black pepper, a quarter of an ounce of cloves, and a drachm of mace, to every quart; or as follows:—

Pound in a mortar a hundred young walnuts, strewing amongst them as they are done half a pound of salt; then pour to them a quart of strong vinegar, and let them stand until they have become quite black, keeping them stirred three or four times a day; next add a quart of strong old beer, and boil the whole together for ten minutes; strain it, and let it remain until the next day; then pour it off clear from the sediment, add to it half a pound of anchovies, one large head of garlic bruised, half an ounce of nutmegs bruised, the same quantity of cloves and black pepper, and two drachms of mace: boil these together for half an hour, and the following day bottle and cork the catsup well. It will keep for a dozen years. Many persons add to it, before it is boiled, a bottle of port wine; and others recommend a large bunch of sweet herbs to be put in with the spice.

1st Recipe. Expressed juice of walnuts, 1 quart; anchovies, 6 oz.; eschalots, 4 oz.; black pepper, 1/2 oz.; cloves, 1/4 oz.; mace, 1 drachm: 1 hour.

2nd. Walnuts, 100; salt, 1/2 lb.; vinegar, 1 quart; to stand till black. Strong beer, 1 quart; anchovies, 1/2 lb.; 1 head garlic; nutmegs, 1/2 oz.; cloves, 1/2 oz.; black pepper, 1/2 oz.; mace, 2 drachms: 1/2 hour.

ANOTHER GOOD RECEIPT FOR WALNUT CATSUP.

Beat a hundred green walnuts in a large marble mortar until they are thoroughly bruised and broken, and then put them into a stone jar, with half a pound of eschalots, cut in slices, one head of garlic, half a pound of salt, and two quarts of vinegar; let them stand for

ten days, and stir them night and morning. Strain off the liquor, and boil it for half an hour with the addition of two ounces of anchovies, two of whole pepper, half an ounce of cloves, and two drachms of mace; skim it well, strain it off, and when it is quite cold pour it gently from the sediment (which may be reserved for flavouring common sauces) into small dry bottles, secure it from air by sound corking, and store it in a dry place.

Walnuts, 100; eschalots, 1/2 lb.; garlic, 1 head, salt, 1/2 lb.; vinegar, 2 quarts: 10 days. Anchovies, 2 oz.; black pepper, 2 oz.; mace, 1/4 oz.; cloves, 1/2 oz.: 1/2 hour.

LEMON PICKLE OR CATSUP.

Either divide six small lemons into quarters, remove all the pips that are in sight, and strew three ounces of salt upon them, and keep them turned in it for a week, or, merely make deep incisions in them, and proceed as directed for pickled lemons. When they have stood in a warm place for eight days, put into a stone jar two ounces and a half of finely-scraped horseradish, and two ounces of eschalots, or one and a half of garlic; to these add the lemons with all their liquor, and pour on them a pint and a half of boiling vinegar in which half an ounce of bruised ginger, a quarter of an ounce of whole white pepper, and two blades of mace have been simmered for two or three minutes. The pickle will be fit for use in two or three months, but may stand four or five before it is strained off.

Small lemons, 6; salt, 3 oz.: 8 days. Horseradish, 2-1/2 oz.; eschalots, 2 oz., or garlic 1-1/2 oz.; vinegar, 1-1/2 pint; ginger, 1/2 oz.; whole white pepper, 1/4 oz.; mace, 2 blades: 3 to 6 months.

Obs.—These highly-flavoured compounds are still much in favour with a certain class of housekeepers; but they belong exclusively to _English_ cookery: they are altogether opposed to the practice of the French _cuisine_, as well as to that of other foreign countries.

PONTAC CATSUP FOR FISH.

On one pint of ripe elderberries stripped from the stalks, pour three quarters of a pint of boiling vinegar, and let it stand in a cool oven all night; the next day strain off the liquid without pressure, and boil it for five minutes with a half-teaspoonful of salt, a small race of ginger, a blade of mace, forty corns of pepper, twelve cloves and four eschalots. Bottle it with the spice when it is quite cold.

BOTTLED TOMATAS, OR TOMATA CATSUP.

Cut half a peck of ripe tomatas into quarters; lay them on dishes and sprinkle over them half a pound of salt. The next day drain the juice from them through a hair-sieve into a stewpan, and boil it for half an hour with three dozens of small capsicums and half a pound of eschalots; then add the tomatas, which should be ready pulped through a strainer. Boil the whole for thirty minutes longer; have some clean wide-necked bottles, kept warm by the fire, fill them with the catsup while it is quite hot; cork, and dip the necks into melted bottle-resin or cement.

Tomatas, 1/2 peck; salt, 1/2 lb.; capsicums, 3 doz.; eschalots, 1/2 lb.: 1/2 hour. After pulp is added, 1/2 hour.

Obs.—This receipt has been kindly contributed by a person who makes by it every year large quantities of the catsup, which is considered excellent: for sauce it must be mixed with gravy or melted butter. We have not ourselves been able to make trial of it.

EPICUREAN SAUCE.

Mix well, by shaking them in a bottle, a wineglassful of Indian soy, half a pint of chili vinegar, half a pint of walnut catsup, and a pint and a half of the best mushroom catsup. These proportions make an excellent sauce, either to mix with melted butter, and to serve with fish, or to add to different kinds of gravy; but they can be varied, or added to, at pleasure.

Indian soy, 1 wineglassful; chili vinegar, 1/2 pint; walnut catsup, 1/2 pint; mushroom catsup, 1-1/2 pint.

TARRAGON VINEGAR.

Gather the tarragon just before it blossoms, which will be late in July, or early in August; strip it from the larger stalks, and put it into small stone jars or wide-necked bottles, and in doing this twist some of the branches so as to bruise the leaves and wring them

asunder; then pour in sufficient distilled or very pale vinegar to cover the tarragon; let it infuse for two months, or more: it will take no harm even by standing all the winter. When it is poured off, strain it very clear, put it into small dry bottles, and cork them well. Sweet basil vinegar is made in exactly the same way, but it should not be left on the leaves more than three weeks. The jars or bottles should be filled to the neck with the tarragon before the vinegar is added: its flavour is strong and peculiar, but to many tastes very agreeable. It imparts quite a foreign character to the dishes for which it is used.

GREEN MINT VINEGAR.

Slightly chop, or bruise, freshly-gathered mint, and put it into bottles; fill them nearly to the necks, and add vinegar as for tarragon: in forty days, strain it off, and bottle it for use. The mint itself, ready minced for sauce, will keep well in vinegar, though the colour will not be very good. The young leaves stripped from the stems, should be used for this preparation.

CUCUMBER VINEGAR.

First wipe, and then, without paring, slice into a stone jar some young and quickly-grown cucumbers; pour on them as much boiling vinegar as will cover them well, with a teaspoonful of salt, and two-thirds as much of peppercorns to the pint and a half of vinegar: it may remain on them for a month, or even for two, if well defended from the air: it should then be strained, allowed to settle, and poured quite clear into small dry bottles, which should be well corked. A mild onion can be intermixed with the cucumbers, when its flavour is considered an improvement.

CELERY VINEGAR.

Throw into a pint and a half of ready boiling vinegar a few grains of cayenne, or half an ounce of peppercorns, a large saltspoonful of salt, and a pint of the white part of the roots and stems of some fine fresh celery sliced up thin: let it boil for two or three minutes, turn it into a stone jar, and secure it well from the air as soon as it is cold. It may be strained off and bottled in three or four weeks, but may remain as many months in the jar without injury.

ESCHALOT, OR GARLIC VINEGAR.

On from four to six ounces of eschalots or on two of garlic peeled and bruised, pour a quart of the best vinegar; stop the jar or bottle close, and in a fortnight or three weeks the vinegar may be strained off for use: a few drops will give a sufficient flavour to a sauce, or to a tureen of gravy.

Eschalots, 4 to 6 oz.; or, garlic, 2 to 4 oz.; vinegar, 1 quart: 15 to 21 days.

Obs.—These roots may be used in smaller or in larger proportion, as a slighter or a stronger flavour of them is desired, and may remain longer in the vinegar without any detriment to it.

ESCHALOT WINE.

This is a far more useful preparation even than the preceding one, since it can be used to impart the flavour of the eschalot to dishes for which acid is not required. Peel and slice, or bruise, four ounces of eschalots, put them into a bottle, and add to them a pint of sherry; in a fortnight pour off the wine, and should it not be strongly flavoured with the eschalots, steep in it two ounces more, for another fortnight; a half-teaspoonful of cayenne may be added at first. The bottle should be shaken occasionally, while the eschalots are infusing, but should remain undisturbed for the last two or three days, that the wine may be clear when it is poured off to bottle for keeping. Sweet-basil wine is made by steeping the fresh leaves of the herb in wine, from ten to fifteen days.

Eschalots, 4 oz.; sherry, 1 pint: 15 days, or more.

HORSERADISH VINEGAR.

On four ounces of young and freshly-scraped horseradish pour a quart of boiling vinegar, and cover it down closely: it will be ready for use in three or four days, but may remain for weeks, or months, before the vinegar is poured off. An ounce of minced eschalot may be substituted for one of the horseradish, if the flavour be liked.

CAYENNE VINEGAR.

Put from a quarter to half an ounce of the best cayenne pepper into a bottle, and pour on it a pint of pale vinegar. Cork it closely, and shake it well every two or three days. It may remain any length of time before it is poured off, but will very soon be ready for use.

Good cayenne pepper, 1/4 to 1/2 oz.; vinegar, 1 pint: infuse from 2 weeks to 12 months.

LEMON BRANDY.

(_For flavouring sweet dishes._)

Fill any sized wide-necked bottle lightly with the very thin rinds of fresh lemons, and cover them with good brandy; let them remain for a fortnight or three weeks only, then strain off the spirit and keep it well corked for use: a few apricot-kernels blanched and infused with the lemon-rind will give it an agreeable flavour.

DRIED MUSHROOMS.

Peel small, sound, freshly-gathered flaps, cut off the stems, and scrape out the fur entirely; then arrange the mushrooms singly on tins or dishes, and dry them as gradually as possible in a gentle oven. Put them, when they are done, into tin canisters, and store them where they will be secure from damp. French cooks give them a single boil in water, from which they then are well drained, and dried, as usual. When wanted for table, they should be put into cold gravy, slowly heated, and gently simmered, until they are tender.

MUSHROOM POWDER.

When the mushrooms have been prepared with great nicety, and dried, as in the foregoing receipt, pound them to a very fine powder; sift it, and put it immediately into small and _perfectly dry_ bottles; cork and seal them without delay, for if the powder be long exposed to the air, so as to imbibe any humidity, or if it be not well secured from it in the bottles, it will be likely to become putrid: much of that which is purchased, even at the best Italian warehouses, is found to be so, and, as it is sold at a very high price, it is a great economy, as well as a surer plan, to have it carefully prepared at home. It is an exceedingly useful store, and an excellent addition to many dishes and sauces. To insure its being good, the mushrooms should be gathered in dry weather, and if any addition of spices be made to the powder (some persons mix with it a seasoning of mace and cayenne), they should be put into the oven for a while before they are used: but even these precautions will not be sufficient, unless the powder be stored in a very dry place after it is bottled. A teaspoonful of it, with a quarter of a pint of strong veal gravy, as much cream, and a small dessertspoonful of flour, will make a good _béchamel_ or white sauce.

EXCELLENT POTATO FLOUR, OR ARROW-ROOT.

(_Fecule de Pommes de terre._)

Grate into a large vessel full of cold water, six pounds of sound mealy potatoes, and stir them well together. In six hours pour off the water, and add fresh, stirring the mixture well; repeat this process every three or four hours during the day, change the water at night, and the next morning pour it off; put two or three quarts more to the potatoes, and turn them directly into a hair-sieve, set over a pan to receive the flour, which may then be washed through the sieve, by pouring water to it. Let it settle in the pan, drain off the water, spread the potato-sediment on dishes, dry it in a slow oven, sift it, and put it into bottles or jars, and cork or cover them closely. The flour thus made will be beautifully white, and perfectly flavourless. It will remain good for years.

Obs.—This admirable farina, or _starch_ of potatoes, is now much more widely known and vended in England than it was some years since. It can at present be procured at most foreign warehouses and general grocers'; but we would recommend its being _home-made_ by the directions given above, which we have had closely followed for many years with the best possible success.

TO MAKE FLOUR OF RICE.

Take any quantity of whole rice, wash it thoroughly, changing the water several times; drain and press it in a cloth, then spread it on a dish, and dry it perfectly; beat it in a mortar to a smooth powder, and sift it through a fine sieve. When used to thicken soup or

sauces, mix it with a small quantity of cold water or of broth, and pour it to them while they are boiling.

This flour, when newly made, is of much purer flavour than any usually prepared for sale.

POWDER OF SAVOURY HERBS.

All herbs which are to be dried for storing should be gathered in fine weather; cleared from dirt and decayed leaves; and dried quickly, but without scorching, in a Dutch oven before the fire, or in any other that is not too much heated. The leaves should then be stripped from the stalks, pounded, sifted, and closely corked in separate bottles; or several kinds may be mixed and pounded together for the convenience of seasoning in an instant gravies, soups, forcemeats, and made dishes: appropriate spices, celery-seed, and dried lemon-peel, all in fine powder, can be added to the herbs.

TARTAR MUSTARD.

Rub four ounces of the best Durham mustard very smooth with a full teaspoonful of salt, and wet it by degrees with strong horseradish vinegar, a dessertspoonful of cayenne, or of chili vinegar, and one or two of tarragon vinegar when its flavour is not disliked. A quarter of a pint of vinegar poured boiling upon an ounce of scraped horseradish, and left for one night, closely covered, will be ready to use for this mustard, but it will be better for standing two or three days.

Durham mustard, 4 oz.; salt, large teaspoonful; cayenne, or chili vinegar, 1 dessertspoonful; horseradish vinegar, third of pint.

Obs.—This is an exceedingly pungent compound, but has many approvers.

ANOTHER TARTAR MUSTARD.

Mix the salt and mustard smoothly, with equal parts of horseradish vinegar, and of chili vinegar. Mustard made by these receipts will keep long, if put into jars or bottles and closely corked. Cucumber, eschalot, or any other of the flavoured vinegars for which we have given receipts, may in turn be used for it, and mushroom, gherkin, or India pickle-liquor, likewise.

CHAPTER VIII.

=Forcemeats.=

GENERAL REMARKS.

[Illustration:

Weighing Machine.]

THE coarse and unpalatable compounds so constantly met with under the denomination of forcemeat, even at tables otherwise tolerably well served, show with how little attention they are commonly prepared.

Many very indifferent cooks pique themselves on never doing any thing by rule, and the consequence of their throwing together at random (or “by guess” as they call it) the ingredients which ought to be proportioned with exceeding exactness is repeated failure in all they attempt to do. Long experience, and a very correct eye may, it is true, enable a person to dispense with weights and measures without hazarding the success of their operations; but it is an experiment which the learner will do better to avoid.

A large marble or Wedgwood mortar is indispensable in making all the finer kinds of forcemeat; and equally so indeed for many other purposes in cookery; no kitchen, therefore, should be without one;[67] and for whatever preparation it may be used, the pounding should be continued with patience and perseverance until not a single lump or fibre be perceptible in the mass of the articles beaten together. This particularly applies to potted meats, which should resemble the smoothest paste; as well as to several varieties of forcemeat. Of these last it should be observed, that such as are made by the French method (see _quenelles_, page 163) are the most appropriate for an elegant dinner, either to serve in soups or to fill boned poultry of any kind; but when their exceeding lightness, which to foreigners constitutes one of their great excellences, is objected to, it may be remedied by substituting dry crumbs of bread for the panada, and pounding a small quantity of the lean of a boiled ham, with the other

ingredients: however, this should be done only for the balls.

Footnote 67:

Two or three mortars, varying in size, should be in every household where it is expected that the cookery should be well conducted: they are often required also for many other domestic purposes, yet it is not unusual to find both these and scales, weights, and measures of every kind, altogether wanting in English kitchens.

No particular herb or spice should be allowed to predominate powerfully in these compositions; but the whole of the seasonings should be taken in such quantity only as will produce an agreeable savour when they are blended together.

NO. 1. GOOD COMMON FORCEMEAT, FOR ROAST VEAL, TURKEYS, &C.

Grate very lightly into exceedingly fine crumbs, four ounces of the inside of a stale loaf, and mix thoroughly with it, a quarter of an ounce of lemon-rind pared as thin as possible, and minced extremely small; the same quantity of savoury herbs, of which two-thirds should be parsley, and one-third thyme, likewise finely minced, a little grated nutmeg, a half teaspoonful of salt, and as much common pepper or cayenne as will season the forcemeat sufficiently. Break into these, two ounces of good butter in very small bits, add the unbeaten yolk of one egg, and with the fingers work the whole well together until it is smoothly mixed. It is usual to chop the lemon-rind, but we prefer it lightly grated on a fine grater. It should always be _fresh_ for the purpose, or it will be likely to impart a very unpleasant flavour to the forcemeat. Half the rind of a moderate-sized lemon will be sufficient for this quantity; which for a large turkey must be increased one-half.

Bread-crumbs, 4 oz.; lemon-rind, 1/4 oz. (or grated rind of 1/2 lemon); mixed savoury herbs, minced, 1/4 oz.; salt, 1/2 teaspoonful; pepper, 1/4 to 1/3 of teaspoonful; butter, 2 oz.; yolk, 1 egg.

Obs.—This, to our taste, is a much nicer and more delicate forcemeat than that which is made with suet, and we would recommend it for trial in preference. Any variety of herb or spice may be used to give it flavour, and a little minced onion or eschalot can be added to it also; but these last do not appear to us suited to the meats for which the forcemeat is more particularly intended. Half an ounce of the butter may be omitted on ordinary occasions: and a portion of marjoram or of sweet basil may take the place of part of the thyme and parsley when preferred to them.

NO. 2. ANOTHER GOOD COMMON FORCEMEAT.

Add to four ounces of bread-crumbs two of the lean of a boiled ham, quite free from sinew, and _very_ finely minced; two of good butter, a dessertspoonful of herbs, chopped small, some lemon-grate, nutmeg, a little salt, a good seasoning of pepper or cayenne and one whole egg, or the yolks of two. This may be fried in balls of moderate size, for five minutes, to serve with roast veal, or it may be put into the joint in the usual way.

Bread-crumbs, 4 oz.; lean of ham, 2 oz.; butter, 2 oz.; minced herbs, 1 dessertspoonful; lemon-grate, 1 teaspoonful; nutmeg, mace, and cayenne, together, 1 small teaspoonful; little salt; 1 whole egg, or yolks of 2.

NO. 3. SUPERIOR SUET FORCEMEAT, FOR VEAL, TURKEYS, &C.

Mix well together six ounces of fine stale crumbs, with an equal weight of beef-kidney suet, chopped extremely small, a large dessertspoonful of parsley, mixed with a little lemon-thyme, a teaspoonful of salt, a quarter one of cayenne, and a saltspoonful or rather more of mace and nutmeg together; work these up with three unbeaten egg-yolks, and three teaspoonsful of milk; then put the forcemeat into a large mortar, and pound it perfectly smooth. Take it out, and let it remain in a cool place for half an hour at least before it is used; then roll it into balls, if it be wanted to serve in that form; flour and fry them gently from seven to eight minutes, and dry them well before they are dished.

Beef suet finely minced, 6 oz.; bread-crumbs, 6 oz.; parsley, mixed with little thyme, 1 large dessertspoonful; salt, 1 teaspoonful; mace, large saltspoonful, and one fourth as much cayenne; unbeaten egg-yolks, 3; milk, 3 teaspoonsful: well pounded. Fried in balls, 7 to 8 minutes, or poached, 6 to 7.

Obs.—The finely grated rind of half a lemon can be added to this forcemeat at pleasure; and for some purposes a _morsel_ of garlic, or three or four minced eschalots, may be mixed with it before it is put into the mortar.

NO. 4. COMMON SUET FORCEMEAT.

Beef suet is commonly used in the composition of this kind of forcemeat, but we think that veal-kidney suet, when it could be obtained, would have a better effect; though the reader will easily comprehend that it is scarcely possible for us to have every variety of every receipt which we insert put to the test; in some cases we are compelled merely to suggest what appear to us likely to be improvements. Strip carefully every morsel of skin from the suet, and mince it small; to six ounces add eight of bread-crumbs, with the same proportion of herbs, spice, salt, and lemon-peel, as in the foregoing receipt, and a couple of whole eggs, which should be very slightly beaten, after the specks have been taken out with the point of a small fork. Should more liquid be required, the yolk of another egg, or a spoonful or two of milk, may be used. Half this quantity will be sufficient for a small joint of veal, or for a dozen balls, which, when it is more convenient to serve it in that form, may be fried or browned beneath the roast, and then dished round it, though this last is not a very refined mode of dressing them. From eight to ten minutes will fry them well.

NO. 5. OYSTER FORCEMEAT.

Open carefully a dozen of fine plump natives, take off the beards, strain their liquor, and rinse the oysters in it. Grate four ounces of the crumb of a stale loaf into fine light crumbs, mince the oysters but not too small, and mix them with the bread; add an ounce and a half of good butter broken into minute bits, the grated rind of half a small lemon, a small saltspoonful of pounded mace, some cayenne, a little salt, and a large teaspoonful of parsley. Mingle these ingredients well, and work them together with the unbeaten yolk of one egg and a little of the oyster liquor, the remainder of which can be added to the sauce which usually accompanies this forcemeat.

Oysters, 1 dozen; bread-crumbs, 4 oz.; butter, 1-1/2 oz.; rind 1/2 small lemon; mace, 1 saltspoonful; some cayenne and salt; minced parsley, 1 large teaspoonful; yolk 1 egg; oyster-liquor, 1 dessertspoonful: rolled into balls, and fried from 7 to 10 minutes, or poached from 5 to 6 minutes.

Obs. 1.—In this preparation the flavour of the oysters should prevail entirely over that of all the other ingredients which are mixed with them.

Obs. 2.—The oyster-sausages of Chapter III. will serve excellently for forcemeat also.

NO. 6. A FINER OYSTER FORCEMEAT.

Pound the preceding forcemeat to the smoothest paste, with the addition only of half an ounce of fresh butter, should it be sufficiently dry to allow of it. It is remarkably good when thus prepared, and may be poached or fried in balls for soups or made dishes, or used to fill boned fowls, or the breasts of boiled turkeys with equally good effect.

NO. 7. MUSHROOM FORCEMEAT.

Cut closely off the stems of some small, just-opened mushrooms, peel them, and take out the fur. Dissolve an ounce and a half of good butter in a saucepan, throw them into it with a little cayenne and a slight sprinkling of mace, and stew them softly, keeping them well shaken, from five to seven minutes; then turn them into a dish, spread them over it, and raise one end, that the liquid may drain from them. When they are quite cold, mince, and then mix them with four ounces of fine bread-crumbs, an ounce and a half of good butter, and _part_ of that in which they were stewed should the forcemeat appear too moist to admit of the whole, as the yolk of one egg, at the least, must be added, to bind the ingredients together; strew in a saltspoonful of salt, a third as much of cayenne, and about the same quantity of mace and nutmeg, with a teaspoonful of grated lemon-rind. The seasonings must be rather sparingly used, that the flavour of the mushrooms may not be overpowered by them. Mix the whole thoroughly with the unbeaten yolk of one egg, or of two, and use the forcemeat poached in small balls for soup, or fried and served in the dish with roast fowls, or round minced veal; or to fill boiled fowls, partridges, or turkeys.

Small mushrooms, peeled and trimmed, 4 oz.; butter 1-1/2 oz.; slight sprinkling mace and cayenne: 5 to 7 minutes. Mushrooms minced; bread-crumbs, 4 oz.; butter, 1-1/2 oz. (with part of that used in the stewing); salt, 1 saltspoonful; third as much of cayenne, of mace, and of nutmeg; grated lemon-rind, 1 teaspoonful; yolk of 1 or 2 eggs. In balls, poached, 5 to 6 minutes; fried, 6 to 8 minutes.

Obs.—This, like most other forcemeats, is improved by being well beaten in a large mortar after it is entirely mixed.

NO. 8. FORCEMEAT FOR HARE.

The first receipt of this chapter will be found very good for hare without any variation; but the liver boiled for three minutes and finely minced, may be added to it when it is thought an improvement: another half ounce of butter, and a small portion more of egg will then be required. A couple of ounces of rasped bacon, and a glass of port-wine, are sometimes recommended for this forcemeat, but we think it is better without them, especially when slices of bacon are used to line the hare. A flavouring of minced onion or eschalot can be added when the taste is in its favour; or the forcemeat No. 3 may be substituted for this altogether.

NO. 9. ONION AND SAGE STUFFING, FOR PORK, GEESE, OR DUCKS.

Boil three large onions from ten to fifteen minutes, press the water from them, chop them small, and mix with them an equal quantity of bread-crumbs, a heaped tablespoonful of minced sage, an ounce of butter, a half saltspoonful of pepper, and twice as much of salt, and put them into the body of the goose; part of the liver boiled for two or three minutes and shred fine, is sometimes added to these, and the whole is bound together with the yolk of one egg or two; but they are quite as frequently served without. The onions can be used raw, when their very strong flavour is not objected to, but the odour of the whole dish will then be somewhat overpowering.

Large onions, 3; boiled 20 to 30 minutes. Sage, 2 to 3 dessertspoonsful (or 1/2 to 3/4 oz.); butter, 1 oz.; pepper, 1/2 teaspoonful; salt, 1 teaspoonful.

The body of a goose is sometimes entirely filled with mashed potatoes, seasoned with salt and pepper only; or mixed with a small quantity of eschalot, onion, or herb-seasonings.

NO. 10. MR. COOKE'S FORCEMEAT FOR DUCKS OR GEESE.

Two parts of chopped onion, two parts of bread-crumbs, three of butter, one of pounded sage, and a seasoning of pepper and salt. This receipt we have not proved.

NO. 11. FORCEMEAT BALLS FOR MOCK TURTLE SOUPS.

The French forcemeat, No. 17 of the present Chapter, is the most refined and appropriate forcemeat to serve in mock turtle, but a more solid and highly seasoned one is usually added to it in this country. In very common cookery the ingredients are merely chopped small and mixed together with a moistening of eggs; but when the trouble of pounding and blending them properly is objected to, we would recommend the common veal forcemeat No. 1, in preference; as the undressed veal and suet, when merely minced, do not produce a good effect. Four ounces each of these, with an ounce or so of the lean of a boiled ham, and three ounces of bread-crumbs, a large dessertspoonful of minced parsley, a small portion of thyme or marjoram, a saltspoonful of white pepper, twice as much or more of salt, a little cayenne, half a small nutmeg, and a couple of eggs, well mixed with a fork first to separate the meat, and after the moistening is added, with the fingers, then rolled into balls, and boiled in a little soup for twelve minutes, is the manner in which it is prepared; but the reader will find the following receipt very superior to it:—Rasp, that is to say, scrape with a knife clear from the fibre, four ounces of veal, which should be cut into thick slices, and taken quite free from skin and fat; chop it fine, and then pound it as smoothly as possible in a large mortar, with three ounces of the rasped fat of an unboiled ham of good flavour or of the finest bacon, and one of butter, two ounces of bread-crumbs, a tablespoonful of the lean of a boiled ham, should it be at hand, a good seasoning of cayenne, nutmeg, and mace, mixed together, a heaped dessertspoonful of minced herbs, and the yolks of two eggs; poach a small bit when it is mixed, and add any further seasoning it may require; and when it is of good flavour, roll it into balls of moderate size, and boil them twelve minutes; then drain and drop them into the soup. No forcemeat should be boiled in the soup itself, on account of the fat which would escape from it in the process; a little stock should be reserved for the purpose.

Very common:—Lean of neck of veal, 4 oz.; beef-kidney suet, 4 oz., both finely chopped; bread-crumbs, 3 oz.; minced parsley, large dessertspoonful; thyme or marjoram, _small_ teaspoonful; lean of boiled ham, 1 to 2 oz.; white pepper, 1 saltspoonful; salt, twice as much; 1/2 small nutmeg; eggs, 2: in balls, 12 minutes.

Better forcemeat:—Lean veal rasped, 4 oz.; fat of unboiled ham, or finest bacon, 3 oz; butter, 1 oz.; bread-crumbs, 2 oz.; lean of boiled ham, minced, 1 large tablespoonful; minced herbs, 1 heaped dessertspoonful; full seasoning of mace, nutmeg, and cayenne, mixed; yolks of eggs, 2: 12 minutes.

NO. 12. EGG BALLS.

Boil four or five new-laid eggs for ten or twelve minutes, and lay them into fresh water until they are cold. Take out the yolks, and pound them smoothly with the beaten yolk of one raw egg, or more, if required; add a little salt and cayenne, roll the mixture into balls the size of marbles, and boil them for two minutes. Half a teaspoonful of flour is sometimes worked up with the eggs.

Hard yolks of eggs, 4; 1 raw; little salt and cayenne: 2 minutes.

NO. 13. BRAIN CAKES.

Wash and soak the brains well in cold water, and afterwards in hot; free them from the skin and large fibres, and boil them in water, slightly salted, from two to three minutes; beat them up with a teaspoonful of sage very finely chopped, or with equal parts of sage and parsley, half a teaspoonful or rather more of salt, half as much mace, a little white pepper or cayenne, and one egg; drop them in small cakes into the pan, and fry them in butter a fine light brown: two yolks of eggs will make the cakes more delicate than the white and yolk of one. A teaspoonful of flour and a little lemon-grate are sometimes added.

NO. 14. ANOTHER RECEIPT FOR BRAIN CAKES.

Boil the brains in a little good veal gravy very gently for ten minutes; drain them on a sieve, and when cold cut them into thick dice; dip them into beaten yolk of egg, and then into very fine bread-crumbs, mixed with salt, pounded spices, and fine herbs minced extremely small; fry them of a light brown, drain and dry them well, and drop them into the soup or hash after it is dished. When broth or gravy is not at hand, the brains may be boiled in water.

NO. 15. CHESTNUT FORCEMEAT.

Strip the outer skin from some fine sound chestnuts, then throw them into a saucepan of hot water, and set them over the fire for a minute or two, when they may easily be blanched like almonds. Put them into cold water as they are peeled. Dry them in a cloth, and weigh them. Stew six ounces of them _very_ gently from fifteen to twenty minutes, in just sufficient strong veal gravy to cover them. Take them up, drain them on a sieve, and when cold pound them perfectly smooth with half their weight of the nicest bacon rasped clear from all rust or fibre, or with an equal quantity of fresh butter, two ounces of dry bread-crumbs, a small teaspoonful of grated lemon rind, one of salt, half as much mace or nutmeg, a moderate quantity of cayenne, and the unbeaten yolks of two or of three eggs. This mixture makes most excellent forcemeat cakes, which must be moulded with a knife, a spoon, or the fingers, dipped in flour; more should be dredged over, and pressed upon them, and they should be slowly fried from ten to fifteen minutes.

Chestnuts, 6 oz.; veal gravy, 1/3 of a pint: 15 to 20 minutes. Bacon or butter, 3 oz.; bread-crumbs, 2 oz.; lemon-peel and salt, 1 teaspoonful each.

NO. 16. AN EXCELLENT FRENCH FORCEMEAT.

Take six ounces of veal free from fat and skin, cut it into dice and put it into a saucepan with two ounces of butter, a large teaspoonful of parsley finely minced, half as much thyme, salt, and grated lemon-rind, and a sufficient seasoning of nutmeg, cayenne, and mace, to flavour it pleasantly. Stew these _very_ gently from twelve to fifteen minutes, then lift out the veal and put into the saucepan two ounces of bread-crumbs; let them simmer until they have absorbed the gravy yielded by the meat; keep them stirred until they are as dry as possible; beat the yolk of an egg to them while they are hot, and set them aside to cool. Mince and pound the veal, add the bread to it as soon as it is cold, beat them well together, with an ounce and a half of fresh butter, and two of the finest bacon, quite freed from rust, and scraped clear of skin and fibre; put to them the yolks of two small eggs and mix them well; then take the forcemeat from the mortar, and set it in a very cool place until it is wanted for use. Veal, 6 oz.; butter, 2 oz.; minced parsley, 1 teaspoonful; thyme, salt, and lemon-peel, each 1/2 teaspoonful; little nutmeg, cayenne, and mace: 12 to 15 minutes. Bread-crumbs, 2 oz.; butter, 1-1/2 oz.; rasped bacon, 2 oz.; yolk of eggs, 2 to 3.

Obs.—When this forcemeat is intended to fill boned fowls, the livers of two or three boiled for four minutes, or stewed with the veal for the same length of time, then minced and pounded with the other ingredients, will be found a great improvement; and, if mushrooms can be procured, two tablespoonsful of them chopped small, should be stewed and beaten with it also. A small portion of the best end of the neck will afford the quantity of lean required for this receipt, and the remains of it will make excellent gravy.

NO. 17. FRENCH FORCEMEAT CALLED QUENELLES.

This is a peculiarly light and delicate kind of forcemeat, which by good French cooks is compounded with exceeding care. It is served abroad in a variety of forms, and is made of very finely-grained white veal, or of the undressed flesh of poultry, or of rabbits, rasped quite free from sinew, then chopped and pounded to the finest paste, first by itself, and afterwards with an equal quantity of boiled calf's udder or of butter, and of _panada_, which is but another name for bread soaked in cream or gravy and then dried over the fire until it forms a sort of paste. As the three ingredients should be equal in _volume_, not in weight, they are each rolled into a separate ball before they are mixed, that their size may be determined by the eye. When the fat of the fillet of veal (which in England is not often divided for sale, as it is in France) is not to be procured, a rather less proportion of butter will serve in its stead. The following will be found a very good, and not a troublesome receipt for veal forcemeat of this kind.

Rasp quite clear from sinew, after the fat and skin have been entirely cleared from it, four ounces of the finest veal; chop, and pound it well: if it be carefully prepared there will be no necessity for passing it through a sieve, but this should otherwise be done. Soak in a small saucepan two ounces of the crumb of a stale loaf in a little rich but pale veal gravy or white sauce; then press and drain as much as possible of the moisture from it, and stir it over a gentle fire until it is as dry as it will become without burning: it will adhere in a ball to the spoon, and leave the saucepan quite dry when it is sufficiently done. Mix with it, while it is still hot, the yolk of one egg, and when it is quite cold, add it to the veal with three ounces of very fresh butter, a quarter of a teaspoonful of mace, half as much cayenne, a little nutmeg, and a saltspoonful of salt. When these are perfectly beaten and well blended together, add another whole egg after having merely taken out the specks: the mixture will then be ready for use, and may be moulded into balls, or small thick oval shapes a little flattened, and poached in soup or gravy from ten to fifteen minutes. These _quenelles_ may be served by themselves in a rich sauce as a corner dish, or in conjunction with other things. They may likewise be first poached for three or four minutes, and left on a drainer to become cold; then dipped into egg and the finest bread-crumbs and fried, and served as _croquettes_.

NO. 18. FORCEMEAT FOR RAISED AND OTHER COLD PIES.

The very finest sausage-meat highly seasoned, and made with an equal proportion of fat and lean, is an exceedingly good forcemeat for veal, chicken, rabbit, and some few other pies; savoury herbs minced small may be added to heighten its flavour if it be intended for immediate eating; but it will not then remain good quite so long, unless they should have been previously dried. To prevent its being too dry, two or three spoonsful of cold water should be mixed with it before it is put into the pie. One pound of lean veal to one and a quarter of the pork-fat is sometimes used, and smoothly pounded with a high seasoning of spices, herbs, and eschalots, or garlic; but we cannot recommend the introduction of these last into pies unless they are especially ordered: mushrooms or truffles may be mixed with any kind of forcemeat with far better effect. Equal parts of veal and fat bacon, will also make a good forcemeat for pies, if chopped finely, and well spiced.

Sausage-meat, well seasoned. Or: veal, 1 lb.; pork-fat, 1-1/2 lb.; salt, 1 oz.; pepper, 1/4 to 1/2 oz.; fine herbs, spice, &c., as in forcemeat No. 1, or sausage-meat. Or: veal and bacon, equal weight, seasoned in the same way.

PANADA.

This is the name given to the soaked bread which is mixed with the French forcemeats, and which renders them so peculiarly delicate. Pour on the crumb of two or three rolls, or on that of any other very light bread, as much good boiling broth, milk, or cream, as will cover and moisten it well; put a plate over to keep in the steam, and let it remain for half an hour, or more; then drain off the superfluous liquid, and squeeze the panada dry by wringing it in a thin cloth into a ball; put it into a small stewpan or enamelled saucepan, and pour to it as much only of rich white sauce or of gravy as it can easily absorb, and stir it constantly with a wooden spoon over a clear and gentle fire, until it forms a very dry paste and adheres in a mass to the spoon; when it is in this state, mix with it thoroughly the unbeaten yolks of two fresh eggs, which will give it firmness, and set it aside to become quite cold before it is put into the mortar. The best French cooks give the highest degree of savour that they can to this panada, and add no other seasoning to the forcemeats of which it forms a part: it is used in an equal proportion with the meat, and with the calf's udder or butter of which they are composed, as we have shown in the preceding receipt for _quenelles_. They stew slowly for the purpose, a small bit of lean ham, two or three minced eschalots, a bay-leaf, a few mushrooms, a little parsley, a clove or two, and a small blade of mace in a little good butter, and when they are sufficiently browned, pour to them as much broth or gravy as will be needed for the panada; and when this has simmered from twenty to thirty minutes, so as to have acquired the proper flavour without being much reduced, they strain it over, and boil it into the bread. The common course of cookery in an English kitchen does not often

require the practice of the greater niceties and refinements of the art: and _trouble_ (of which the French appear to be perfectly regardless when the excellence of their preparations is concerned) is there in general so much thought of, and exclaimed against, that a more summary process would probably meet with a better chance of success.

A quicker and rougher mode of making the panada, and indeed the forcemeat altogether, is to pour strong veal broth or gravy upon it, and after it has soaked, to boil it dry, without any addition except that of a little fine spice, lemon-grate, or any other favourite English seasoning. Minced herbs, salt, cayenne, and mace, may be beaten with the meat, to which a small portion of well-pounded ham may likewise be added at pleasure.

CHAPTER IX.

=Boiling, Roasting, etc.=

A THOROUGH practical knowledge of the processes described in the present chapter will form a really good cook far sooner and more completely than any array of mere receipts can do, however minutely they may be explained; they should, therefore, be well studied and comprehended, before any attempt is made to compound difficult dishes; and the principles of roasting, boiling, stewing, and baking, at least, ought to be clearly understood by every servant who undertakes the duties of what is called _plain cookery_, which is, in fact, of more importance than any other, because it is in almost universal request in this country for families of moderate fortune; and any person who excels in it will easily become expert in what are considered the higher branches of the art.

In a vast number of English kitchens the cookery fails from the hurried manner in which it is conducted, and from the excess of heat produced by the enormous coal-fires constantly kept burning there at all seasons, without which ignorant servants imagine no dinner can be properly cooked; a mistake which cannot fail quickly to become apparent to the most inexperienced reader who will give a patient trial to the slow methods of cooking recommended in the following pages. These will be found to combine exceeding economy in the consumption of fuel, with a degree of superiority in the food prepared by them, which would scarcely be credited unless it were put to the test. In stewing, and baking in closely covered vessels, this superiority is more particularly remarkable; and we would willingly give a far larger space to so useful a subject than our limits will permit: we are, however, compelled, though with regret, to restrict ourselves to such details as we have now supplied in various parts of this volume.

TO BOIL MEAT.

[Illustration:

Iron Boiler.]

Boiling, in the usual English manner, is the least advantageous of all modes of cooking meat, because a large portion of the nourishment which it contains is withdrawn from it in the process, and it is usually very insipid in flavour.

We have already given, at the commencement of Chapter I., the substance of Liebeg’s instructions for scientific boiling; but for the convenience of the reader, we will briefly recapitulate them here, with such additions as our own observation has enabled us to supply.

In making soup, gravy, or savoury jelly of any kind, the principal object is to extract from the meat used for the preparation, all the nutriment and savour which it can be made to yield. This is effected by putting it into _cold_ water, and heating it very slowly indeed, and then keeping it for a specified time at the point of boiling, or letting it simmer in the gentlest manner; but when the meat itself is required for food, its nutritious juices must be prevented from escaping as much as possible, which is done by plunging it into fast boiling water for a few minutes, to contract the pores of the surface (to harden it, in fact), and adding immediately afterwards as much cold water as will reduce the whole to a moderate temperature. Part of the water should then be taken away, as meat should never be cooked in a larger quantity than is absolutely needed to keep it entirely covered until it is ready to serve; for this reason it should be always boiled in a vessel nearly of its own size.

Large joints should be neatly trimmed, washed extremely clean, and skewered or bound firmly into good shape, when they are of a nature to require it; brought to boil over a moderate fire, and simmered until they are done, the scum being carefully and entirely cleared from the surface of the water, as it gathers there, which will be principally from within a few minutes of its beginning to boil,

and during a few minutes afterwards. If not thoroughly skimmed off at the proper time, it will sink, and adhere to the joint, giving it a very uninviting appearance.

Pickled or salted meat requires longer boiling than fresh; and that which is smoked and dried longer still: this last should always be laid into _cold_ water, slowly heated, and if, from any circumstances, time cannot have been allowed for soaking it properly and there is a probability of its being too salt when served, it should be brought very softly to boil in a large quantity of water, which should in part be changed as soon as it becomes quite briny, for as much more that is ready boiling.

It is customary to lay rounds of beef, and other large joints, upon a fish-plate, or to throw some wooden skewers under them, to prevent their sticking to the vessel in which they are cooked; and it is as well to take the precaution, though unless they be placed over a very fierce fire, they cannot be in danger of this. The time allowed for them is about the same as for roasting, from fifteen to twenty minutes to the pound. For cooking rounds of beef, and other ponderous joints, a pan of this form is very convenient.

[Illustration:

Large Stock-pot.]

By means of two almost equally expensive preparations, called a _poêlée_, and a _blanc_, the insipidity which results from boiling meat or vegetables in water only may be removed, and the whiteness of either will be better preserved. Turkeys, fowls, sweetbreads, calf's brains, cauliflowers, and artichoke bottoms, are the articles for which the _poêlée_ and the _blanc_ are more especially used in expensive foreign cookery: the reader will judge by the following receipts how far they are admissible into that of the economist.

POÊLÉE.

Cut into large dice two pounds of lean veal, and two pounds of fat bacon cured without saltpetre, two large carrots, and two onions; to these add half a pound of fresh butter, put the whole into a stewpan, and stir it with a wooden spoon over a gentle fire until the veal is very white, and the bacon is partially melted; then pour to them three pints of clear boiling broth or water, throw in four cloves, a small bunch or two of thyme and parsley, a bay-leaf, and a few corns of white pepper; boil these gently for an hour and a half, then strain the _poêlée_ through a fine sieve, and set it by in a cool place. Use it instead of water for boiling the various articles we have already named: it will answer for several in succession, and will remain good for many days. Some cooks order a _pound_ of butter in addition to the bacon, and others substitute beef-suet in part for this last.

A BLANC.

Put into a stewpan one pound of fat bacon rasped, one pound of beef-suet cut small, and one pound of butter; the strained juice of two lemons, a couple of bay-leaves, three cloves, three carrots, and three onions divided into dice, and less than half a pint of water. Simmer these gently, keeping them often stirred, until the fat is well melted, and the water has evaporated; then pour in rather more than will be required for the dish which is to be cooked in the _blanc_; boil it softly until all the ingredients have given out their full flavour, skim it well, add salt if needed, and strain it off for use. A calf's head is often boiled in this.

ROASTING.

[Illustration:

Bottle Jack.[68]]

Footnote 68:

The bottle-jack is wound up like a watch, by means of a key, and turns very regularly until it has run down.

Roasting, which is quite the favourite mode of dressing meat in this country, and one in which the English are thought to excel, requires unremitting attention on the part of the cook rather than any great exertion of skill. Large kitchens are usually fitted with a smoke-jack, by means of which several spits if needful can be kept turning at the same time; but in small establishments, a roaster which allows of some economy in point of fuel is more commonly used. That shown in the print is of very advantageous construction in this respect, as a joint may be cooked in it with a comparatively small fire, the heat being strongly reflected from the screen upon the meat: in consequence of this, it should never be placed very close to the grate, as the surface of the joint would

then become dry and hard.

[Illustration:

Improved Spring Jack.]

A more convenient form of roaster, with a spit placed horizontally, and turned by means of a wheel and chain, of which the movement is regulated by a spring contained in a box at the top, is of the same economical order as the one above; but eaters of very delicate taste urge, as an objection to this apparatus, as well as to that shown above, that the meat cooked in either, derives from the tin by which it is closely surrounded, the flavour of _baked_ meat. The bottle-jack, with a common roasting-screen containing shelves for warming plates and dishes, and other purposes, is not liable to the same objection. To roast well with it (or with a smoke-jack), make up a fire proportioned in width and height to the joint which is to be roasted, and which it should surpass in dimensions every way, by two or three inches. Place some moderate-sized lumps of coal on the top; let it be free from smoke and ashes in front; and so compactly arranged that it will neither require to be disturbed, nor supplied with fresh fuel, for some considerable time after the meat is laid down. Spit or suspend the joint, and place it very far from the fire at first; keep it constantly basted, and when it is two parts done, move it nearer to the fire that it may be properly browned; but guard carefully against its being burned. A few minutes before it is taken from the spit, sprinkle a little fine salt over it, baste it thoroughly with its own dripping, or with butter, and dredge it with flour: as soon as the froth is well risen, dish, and serve the meat. Or, to avoid the necessity of the frothing which is often greatly objected to on account of the raw taste retained by the flour, dredge the roast liberally soon after it is first laid to the fire; the flour will then form a savoury incrustation upon it, and assist to prevent the escape of its juices. When meat or poultry is wrapped in buttered paper it must not be floured until this is removed, which should be fifteen or twenty minutes before either is served.

Baron Liebeg, whom we have already so often quoted, says, that roasting should be conducted on the same principle as boiling; and that sufficient heat should be applied to the surface of the meat at once, to contract the pores and prevent the escape of its juices; and that the remainder of the process should be _slow_. When a joint is first laid to the fire, therefore, it should be placed for twenty minutes or half an hour sufficiently near to effect this, without any part, and the fat especially, being allowed to acquire more than the slightest colour, and then drawn back and finished by the directions at the end of this section.

The speedy application of very hot basting-fat to every part of the meat, would probably be attended with the same result as subjecting it to the full action of the fire. It is certain that roasts which are constantly and carefully basted are always very superior to those which are neglected in this respect.

Remember always to draw back the dripping-pan when the fire has to be stirred, or when fresh coals are thrown on, that the cinders and ashes may not fall into it.

When meat is very lean, a slice of butter, or a small quantity of clarified dripping, should be melted in the pan to baste it with at first; though the use of the latter should be scrupulously avoided for poultry, or any delicate meats, as the flavour it imparts is to many persons peculiarly objectionable. Let the spit be kept bright and clean, and wipe it before the meat is put on; balance the joint well upon it, that it may turn steadily, and if needful secure it with screw-skewers. A cradle spit, which is so constructed that it contains the meat in a sort of framework, instead of passing through it, may be often very advantageously used instead of an ordinary one, as the perforation of the meat by this last must always occasion some escape of the juices; and it is, moreover, particularly to be objected to in roasting joints or poultry which have been boned and filled with forcemeat. The cradle spit (for which see “Turkey Boned and Forced,” Chapter XIV.) is much better suited to these, as well as to a sucking pig, sturgeon, salmon, and other large fish; but it is not very commonly to be found in our kitchens, many of which exhibit a singular scantiness of the conveniences which assist the labours of the cook.

For heavy and substantial joints, a quarter of an hour is generally allowed for every pound of meat; and with a sound fire and frequent basting, will be found sufficient when the process is conducted in the usual manner; but by the _slow method_, as we shall designate it, almost double the time will be required. Pork, veal, and lamb, should always be well roasted; but many eaters prefer mutton and beef rather underdressed, though some persons have a strong objection to the sight even of any meat that is not thoroughly cooked.

Joints which are thin in proportion to their weight, require less of the fire than thick and solid ones. Ribs of beef, for example, will be sooner ready to serve than an equal weight of the rump, round, or sirloin; and the neck or shoulder of mutton, or spare rib of pork,

than the leg.

When to preserve the succulence of the meat is more an object than to economise fuel, beef and mutton should be laid at twice the usual distance from the fire, after the surface has been thoroughly heated, as directed by Liebeg, and allowed to remain so until they are perfectly heated through; the roasting, so managed, will of course be _slow_; and from three hours and a half to four hours will be necessary to cook by this method a leg of mutton of ordinary size, for which two hours would amply suffice in a common way; but the flesh will be remarkably tender, and the flow of gravy from it most abundant. It should not be drawn near the fire until within the last half or three quarters of an hour, and should then be placed only so close as to brown it properly. No kind of roast indeed should at any time be allowed to take colour too quickly; it should be heated gradually, and kept at least at a moderate distance from the fire until it is nearly done, or the outside will be dry and hard, if not burned while the inside will be only half cooked.

STEAMING.

[Illustration:

Saucepan with Steamer.]

[Illustration]

The application of steam to culinary purposes is becoming very general in our kitchens at the present day, especially in those of large establishments, many of which are furnished with apparatus for its use, so admirably constructed and so complete, that the process may be conducted on an extensive scale with very slight trouble to the cook; and with the further advantage of being _at a distance from the fire_, the steam being conveyed by pipes to the vessels intended to receive it. Fish, butcher's meat, poultry, vegetables, puddings, maccaroni, and rice, are all subjected to its action, instead of being immersed in water, as in simple boiling: and the result is to many persons perfectly satisfactory; though, as there is a difference of opinion amongst first-rate cooks, with regard to the comparative merits of the two modes of dressing _meat_ and _fish_, a trial should be given to the steaming on a small scale, before any great expenses are incurred for it, which may be done easily with a common saucepan or boiler, fitted like the one shown above, with a simple tin steamer. Servants not accustomed to the use of these, should be warned against boiling in the vessel itself any thing of coarse or strong flavour, when the article steamed is of a delicate nature. The vapour from soup containing onions, for example, would have a very bad effect on a sweet pudding, and on many other dishes. Care and discretion, therefore, must be exercised on this point. By means of a kettle fixed over it, the steam of the boiler in the kitchen range may be made available for cooking, in the way shown by the engraving, which exhibits fish, potatoes, and their sauces, all in progress of steaming at the same time.[69] The limits of our work do not permit us to enter at much length upon this subject, but the reader who may wish to understand the nature of steam, and the various modes in which its agency may be applied to domestic purposes, will do well to consult Mr. Webster's excellent work,[70] of which we have more particularly spoken in another chapter. The quite inexperienced cook may require to be told, that any article of food which is to be cooked by steam in a saucepan of the form exhibited in the first of the engravings of this section, must be prepared exactly as for boiling, and laid into the sort of strainer affixed to the top of the saucepan; and that water, or some other kind of liquid, must be put into the saucepan itself, and kept boiling in it, the lid being first closely fixed into the steamer.

Footnote 69:

Invented and sold by Mr. EVANS, Fish-street Hill.

Footnote 70:

Encyclopædia of Domestic Economy. LONGMAN & CO.

Footnote 71:

Securely closed with a band of paste passed round the edges, and pressed tightly over them. The lute or luting used for chemical apparatus is of a kind of clay.

STEWING.

[Illustration:

Hot Plate.]

This very wholesome, convenient, and _economical_ mode of cookery is by no means so well understood nor profited by in England as on the continent, where its advantages are fully appreciated. So very small a quantity of fuel is necessary to sustain the gentle degree of ebullition which it requires, that this alone would recommend it to the careful housekeeper; but if the process be skilfully conducted, meat softly stoved or stewed, in close-shutting, or luted[71] vessels, is in every respect equal, if not superior, to that which is roasted; but it must be _simmered_ only, and in the gentlest possible manner, or, instead of being tender, nutritious, and highly palatable, it will be dry, hard, and indigestible. The common cooking stoves in this country, as they have hitherto been constructed, have rendered the exact regulation of heat which stewing requires rather difficult; and the smoke and blaze of a large coal fire are very unfavourable to many other modes of cookery as well. The French have generally the advantage of the embers and ashes of the wood which is their ordinary fuel; and they have always, in addition, a stove of this construction, in which charcoal or _braise_ (for explanation of this word, see remarks on preserving, Chapter XXV.) only is burned; and upon which their stewpans can, when there is occasion, be left uncovered, without the danger of their contents being spoiled, which there generally is with us. It is true, that of late great improvements have been made in our own stoves; and the hot plates, or _hearths_ with which the kitchens of good houses are always furnished, are admirably adapted to the simmering system; but when the cook has not the convenience of one, the stewpans must be placed on trivets high _above_ the fire, and be constantly watched, and moved, as occasion may require, nearer to, or further from the flame.

[Illustration]

No copper vessels from which the inner tinning is in the slightest degree worn away should be used ever for this or for any other kind of cookery; or not health only, but life itself, may be endangered by them.[72] We have ourselves seen a dish of acid fruit which had been boiled without sugar in a copper pan from which the tin lining was half worn away, _coated with verdigris_ after it had become cold; and from the careless habits of the person who had prepared it, the chances were greatly in favour of its being served to a family afterwards, if it had not been accidentally discovered. Salt acts upon the copper in the same manner as acids: vegetables, too, from the portion of the latter which they contain, have the same injurious effect, and the greatest danger results from allowing preparations containing any of these to become cold (or cool) in the stewpan, in contact with the exposed part of the copper in the inside. Thick, well-tinned iron saucepans will answer for all the ordinary purposes of common English cookery, even for stewing, provided they have tightly-fitting lids to prevent the escape of the steam; but the copper ones are of more convenient form, and better adapted to a superior order of cookery.

Footnote 72:

Sugar, being an antidote to the poisonous effects of verdigris, should be plentifully taken, dissolved in water, so as to form a syrup, by persons who may unfortunately have partaken of any dish into which this dangerous ingredient has entered.

The enamelled stewpans and saucepans which have now very much superseded the old-fashioned metal ones for many purposes, are peculiarly suited, from the nicety of the composition with which they are lined, and which resembles earthenware, to the preparation of fine preserves, and all very delicate compounds, as well as to those of milk, and of various articles of diet adapted to invalids; and they possess the further advantage of being easily kept beautifully clean. Care should be taken not to allow anything which they may contain to burn to them, which it will quickly do if they be placed flat upon a fierce fire; and when this has once occurred, there will always be some difficulty in preventing their contents from adhering to them where they have been burned. They should always be filled with water immediately after being emptied, and will then merely require to be well washed and rinsed with more boiling water; but when they have been neglected, strong soda and water should be boiled in them for a few minutes.

BROILING.

[Illustration:

A Conjuror.]

Broiling is the best possible mode of cooking and of preserving the flavour of several kinds of fish, amongst which we may specify mackerel and whitings; it is also incomparably superior to frying for steaks and cutlets, especially of beef and mutton; and it is far better adapted also, to the preparation of food for invalids; but it should be carefully done, for if the heat be too fierce, the outside of the meat will be scorched and hardened so as to render it uneatable; and if, on the contrary, it be too gentle, the gravy will be drawn out, and yet the flesh will remain so entirely without firmness, as to be unpleasant eating. A brisk fire, _perfectly free from smoke_,

a very clean gridiron, tender meat, a dish and plates as hot as they can be, and great despatch in sending it to table when done, all are essential to the serving of a good broil. The gridiron should be heated, and rubbed with mutton suet before the meat is laid on, and it should be placed slopingly over the fire, that the fat may run off to the back of the grate, instead of falling on the live coals and smoking the meat; if this precaution should not prevent its making an occasional blaze, lift the gridiron quickly beyond the reach of the smoke, and hold it away until the fire is clear again. Steaks and chops should be turned often, that the juices may be kept in, and that they may be equally done in every part. If, for this purpose, it should be necessary for want of steak-tongs to use a fork, it should be passed through the outer skin or fat of the steak, but never stuck into the lean, as by that means much of the gravy will escape. Most eaters prefer broiled beef or mutton, rather underdressed; but lamb or pork cutlets should always be thoroughly cooked. When a fowl or any other bird is cut asunder before it is broiled, the inside should first be laid to the fire: this should be done with kidneys also. Fish is less dry and of better flavour, as well as less liable to be smoked, if it be wrapped in a thickly buttered sheet of writing paper before it is placed on the gridiron. For the more delicate-skinned kinds, the bars should be rubbed with chalk instead of suet when the paper is omitted. Cutlets, or meats of any other form, when egged and crumbed for broiling, should afterwards be dipped into clarified butter or sprinkled with it plentifully, as the egg-yolk and bread will otherwise form too dry a crust upon it. French cooks season their cutlets both with salt and pepper, and brush a little oil or butter over them to keep them moist; but unless this be done, no seasoning of salt should be given them until they are just ready to be dished: the French method is a very good one. Steaks or cutlets may be quickly cooked with a sheet or two of lighted paper only, in the apparatus shown in the preceding page, and called a conjuror. Lift off the cover and lay in the meat properly seasoned, with a small slice of butter under it, and insert the lighted paper in the aperture shown in the plate; in from eight to ten minutes the meat will be done, and found to be remarkably tender, and very palatable: it must be turned and moved occasionally during the process. This is an especially convenient mode of cooking for persons whose hours of dining are rendered uncertain by the nature of their avocations. For medical men engaged in extensive country practice it has often proved so; and we would especially recommend it to the notice of emigrants, to whom it would often prove invaluable. The part in which the meat is placed is of block tin, and fits closely into the stand, which is of sheet iron. The conjuror from which our design was drawn, was purchased in a country town in Essex, and was exceedingly well made, and very cheap. We find on inquiry that the maker has quitted the place, or we would insert his address.

FRYING.

[Illustration:

Sauté Pan.]

This is an operation, which, though apparently very simple, requires to be more carefully and skilfully conducted than it commonly is. Its success depends principally on allowing the fat to attain the exact degree of heat which shall give firmness, without too quick browning or scorching, before anything is laid into the pan; for, if this be neglected, the article fried will be saturated with fat, and remain pale and flaccid. When the requisite degree of colour is acquired before the cooking is complete, the pan should be placed high above the fire, that it may be continued slowly to the proper point. Steaks and cutlets should be seasoned with salt and pepper and dredged on both sides lightly with flour before they are laid into the pan, in which they should be often moved and turned that they may be equally done, and that they may not stick nor burn to it. From ten to fifteen minutes will fry them. They should be evenly sliced, about the same thickness as for broiling, and neatly trimmed and divided in the first instance. Lift them into a hot dish when done; pour the fat from the pan, and throw in a small slice of butter; stir to this a large teaspoonful of flour, brown it gently, and pour in by degrees a quarter of a pint of hot broth or water; shake the pan well round, add pepper, salt, and a little good catsup, or any other store sauce which may be preferred to it, and pour the gravy over the steaks: this is the most common mode of saucing and serving them.

Minute directions for fish, vegetables, omlets, and different preparations of batter, are given in their proper places; but we must again observe, that a very small frying pan (scarcely larger than a dinner-plate) is necessary for many of these; and, indeed, the large and _thick_ one suited to meat and fish, and used commonly for them is altogether unfit for nicer purposes.

The _sauté-pan_, shown in the preceding page, is much used by French cooks instead of a frying-pan; it is more particularly convenient for tossing quickly over the fire small collops, or aught else which requires but little cooking.

All fried dishes, which are not sauced, should be served extremely dry upon a neatly-folded damask cloth: they are best drained upon a sieve reversed placed before the fire.

[Illustration:

Wire Basket for Frying.]

A wire basket of this form is convenient for frying parsley and other herbs. It must be placed in a pan well filled with fat, and lifted out quickly when the herbs are done: they may likewise be crisped in it over a clear fire, without any fat.

[Illustration:

Wire Lining of Frying-pan.]

[Illustration:

Modern Sauté Pan.]

The frying-pans fitted with wire linings that lift in and out of them, which have lately come much into use in good kitchens, are so excellently adapted to save trouble, and so convenient for preparing delicately light patties, _croquettes_, _rissoles_, and other dishes of a similar nature, that no cook who is expected to serve them in the best manner should be without one. They should all be arranged upon this wire lining, and plunged together into the boiling fat; and well drained on it when they are lifted out.

BAKING, OR OVEN COOKERY.

[Illustration:

Nottingham Jar.]

The improved construction of the ovens connected with all modern cooking stoves, gives great facility at the present day for _home baking_, even in very small establishments; and without this convenience it is impossible for justice to be done to the person who conducts the cookery; as many and great disadvantages attend the sending to a public oven; and it is very discouraging to a servant who has prepared her dishes with nicety and skill, to have them injured by the negligence of other persons. One of the best modes of cooking with which we are acquainted is by means of a jar, resembling in form that shown above, well pasted down, and covered with a fold of thick paper, and then placed in a gentle oven. Rice is most excellent when thus slowly baked with a certain proportion of liquid, either by itself, or mingled with meat, fish, or fruit; but we must reserve for another volume particulars of this little system of _slow oven-cookery_, in which for some years past we have had numberless experiments made with almost uniform success: it is especially suited to invalids, from preserving the _entire_ amount of nourishment contained in the articles of food dressed by it; and it is to their use that we hope to appropriate it.

[Illustration:

American Oven.[73]]

Footnote 73:

We have scarcely done justice in the former editions of this work to these very useful little ovens, which we have found, after long trial, better adapted to some purposes than brick or iron ones, because preparations which require it, (those of Indian corn, for example) can be heated in them more gradually; and when once the management of them is understood, they will answer admirably for delicate sweet puddings, and for cakes, with the advantage of requiring but a very moderate fire.

The oven may be used with advantage for many purposes for which it is not commonly put into requisition. Calves' feet, covered with a proper proportion of water, may be reduced to a strong jelly if left in it for some hours; the half-head, boned and rolled, will be found excellent eating, if laid, with the bones, into a deep pan and baked quite tender in sufficient broth or water, to keep it covered in every part until done; good soup also may be made in the same way, the usual ingredients being at once added to the meat, with the exception of the vegetables, which will not become tender if put into cold liquid, and should therefore be thrown in after it begins to simmer. Baking is likewise one of the best modes of dressing various kinds of fish: pike and red mullet amongst others. Salmon cut into thick slices, freed from the skin, well seasoned with spice, mixed with salt (and with minced herbs, at pleasure), then arranged evenly in a dish, and covered thickly with crumbs of bread, moistened with clarified butter, as directed in Chapter II., for baked soles, and placed in the oven for about half an hour, will be found very rich and highly flavoured. Part of the middle of the salmon left entire, well cleaned, and thoroughly dried, then seasoned, and securely wrapped in two or three folds of thickly buttered paper, will also prove excellent eating, if gently baked. (This may likewise be roasted in a Dutch oven, either folded in the paper, or left without it, and basted with butter.) Hams, when freshly cured, and not over salted, if neatly trimmed, and covered with a coarse

paste, are both more juicy, and of finer flavour baked than boiled. Savoury or pickled beef too, put into a deep pan with a little gravy, and plenty of butter or chopped suet on the top, to prevent the outside from becoming dry; then covered with paste, or with several folds of thick paper, and set into a moderate oven for four or five hours, or even longer, if it be of large weight, is an excellent dish. A goose, a leg of pork, and a sucking pig, if properly attended to while in the oven, are said to be nearly, or quite as good as if roasted; but baking is both an unpalatable and an unprofitable mode of cooking joints of meat in general, though its great convenience to many persons who have but few other facilities for obtaining the luxury of a hot dinner renders it a very common one. It is usual to raise meat from the dish in which it is sent to the oven by placing it, properly skewered, on a stand, so as to allow potatoes or a batter pudding to be baked under it. A few button onions, freed from the outer skin, or three or four large ones, cut in halves, are sometimes put beneath a shoulder of mutton. Two sheets of paper spread separately with a thick layer of butter, clarified marrow, or any other fat, and fastened securely over the outside of a joint, will prevent its being too much dried by the fierce heat of the oven. A few spoonsful of water or gravy should be poured into the dish with potatoes, and a little salt sprinkled over them. A celebrated French cook recommends _braising in the oven_; that is to say, after the meat has been arranged in the usual manner, and just brought to boil over the fire, that the braising pan, closely stopped, should be put into a moderate oven, for the same length of time as would be required to stew the meat perfectly tender.

BRAISING.

[Illustration:

English Braising-pan.]

Braising is but a more expensive mode of stewing meat. The following French recipe will explain the process. We would observe, however, that the layers of beef or veal, in which the joint to be braised is imbedded, can afterwards be converted into excellent soup, gravy, or glaze; and that there need, in consequence, be no waste nor any unreasonable degree of expense attending it; but it is a troublesome process, and quite as good a result may be obtained by simmering the meat in very strong gravy. Should the flavour of the bacon be considered an advantage, slices of it can be laid over the article braised, and secured to it with a fillet of tape.

“_To braise the inside_ (or _small fillet_, as it is called in France) _of a sirloin of beef_: Raise the fillet clean from the joint; and with a sharp knife strip off all the skin, leaving the surface of the meat as smooth as possible; have ready some strips of unsmoked bacon, half as thick as your little finger, roll them in a mixture of thyme finely minced, spices in powder, and a little pepper and salt. Lard the fillet quite through with these, and tie it round with tape in any shape you choose. Line the bottom of a stewpan (or braising-pan) with slices of bacon; next put in a layer of beef or veal, four onions, two bay-leaves, two carrots, and a bunch of sweet herbs, and place the fillet on them. Cover it with slices of bacon, put some trimmings of meat all round it, and pour on to it half a pint of good beef broth or gravy. Let it stew as gently as possible for two hours and a half; take it up, and keep it very hot; strain, and reduce the gravy by quick boiling until it is thick enough to glaze with; brush the meat over with it; put the rest in the dish with the fillet, after the tape has been removed from it, and send it directly to table.”

Equal parts of Madeira and gravy are sometimes used to moisten the meat.

No attempt should be made to braise a joint in any vessel that is not very nearly of its own size.

[Illustration:

Copper Stewpan.[74]]

Footnote 74:

The line which passes round this stewpan just above the handle, is a mistake of the designer, and conveys an erroneous idea of the form of the cover, and it ought to have been omitted.

A round of buttered paper is generally put over the more delicate kinds of braised meat, to prevent their being browned by the fire, which in France is sometimes put round the lid of the braising-pan, in a groove made on purpose to contain it. The embers of a wood fire mixed with the hot ashes, are best adapted to sustain the regular but gentle degree of heat required for this mode of cooking.

Braising pans are of various forms. They are often shaped like a ham-kettle, and sometimes like the design at the commencement of this section; but a stewpan of modern form, or any other vessel which will admit of embers being placed upon the lid, will answer for the purpose as well. Common cooks sometimes stew meat in a mixture of butter and water, and _call it braising._

LARDING.

[Illustration:

Larding Pins.]

Cut into slices, of the same length and thickness, some bacon of the finest quality; trim away the outsides, place the slices evenly upon each other, and with a sharp knife divide them obliquely into small strips of equal size. For pheasants, partridges, hares, fowls, and _fricandeaux_, the bacon should be about the eighth of an inch square, and two inches in length; but for meat which is to be larded quite through, instead of on the outside merely, the bits of bacon (properly called lardoons) must be at least the third of an inch square.

In general, the breasts only of birds are larded, the backs and thighs of hares, and the whole of the upper surface of a _fricandeau_: these should be thickly covered with small lardoons, placed at regular intervals, and in lines which intersect each other, so as to form rather minute diamonds.

The following directions for larding a pheasant will serve equally for poultry, or for other kinds of game:—

Secure one end of the bacon in a slight larding-needle, and on the point of this take up sufficient of the flesh of the bird to hold the lardoon firmly; draw the needle through it, and part of the bacon, of which the two ends should be left of equal length. Proceed thus, until the breast of the pheasant is entirely garnished with lardoons, when it ought to resemble in appearance a cake thickly stuck with strips of almonds.

The larger strips of bacon, after being rolled in a high seasoning of minced herbs and spices, are used to lard the _inside_ of meat, and they should be proportioned to its thickness, as they must be passed quite through it. For example: a four-inch slice from a rump of beef will require lardoons of very nearly that length, which must be drawn through with a large larding-pin, and left in it, with the ends just out of sight on either side.

In France, truffles, anchovies, slices of tongue, and of fat, all trimmed into proper shape, are occasionally used for larding. The bacon employed there for the purpose is cured without any saltpetre (as this would redden the white meats), and it is never smoked: the receipt for it will be found in Chapter XIII.

A turkey is sometimes larded with alternate lardoons of fat bacon and of bullock’s tongue, which has been pickled but not dried: we apprehend that the lean of a half-boiled ham, of good colour, would answer the purpose quite as well, or better.

Larding the surface of meat, poultry, or game, gives it a good appearance, but it is a more positive improvement to meat of a dry nature to interlard the inside with large lardoons of well-seasoned, delicate, striped English bacon.

BONING.

Very minute directions being given in other parts of our volume for this, we confine ourselves here to the following rules:—in disengaging the flesh from it, work the knife always _close to the bone_, and take every care not to pierce the outer skin.

TO BLANCH MEAT OR VEGETABLES.

This is merely to throw either into a pan of boiling water for a few minutes, which gives firmness to the first, and is necessary for some modes of preparing vegetables.

The breast only of a bird is sometimes held in the water while it boils, to render it firm for larding. To preserve the whiteness of meat, and the bright green of vegetables, they are lifted from the water after they have boiled a few minutes, and are thrown immediately into spring water, and left till cold.

5 to 10 minutes.

GLAZING

[Illustration]

This process we have explained at the article _Glaze_, Chapter IV. The surface of the meat should be covered evenly, with two or three separate layers of the glaze, which, if properly made, soon becomes firm. A ham should be well dried in the oven before it is laid on. Cutlets of all kinds may be glazed before they are sent to table, with very good effect. The figure above represents a glaze-pot and brush, used for heating and applying the preparation: a jar placed in a pan of boiling water may be substituted for the first, when it is not at hand.

TOASTING.

[Illustration]

A very cheap apparatus, by which chops can be dressed before a clear fire, is shown by the first of these figures; and the second is peculiarly convenient when bread or muffins are required to be toasted expeditiously and in large quantities, without much time and attention being bestowed upon them.

TO BROWN THE SURFACE OF A DISH WITHOUT BAKING OR PLACING IT AT THE FIRE.

This is done with a salamander, as it is called, formed like the engraving below; it is heated in the fire, and held over the dish sufficiently near to give it colour. It is very much used in a superior order of cookery. A kitchen shovel is sometimes substituted for it on an emergency.

[Illustration]

CHAPTER X.

=Beef.=

[Illustration]

No. 1. Sirloin. 2. Rump. 3. Edge-bone. 4. Buttock, or Round. 5. Mouse Buttock. 6. Veiny Piece. 7. Thick Flank. 8. Thin Flank. 9. Leg. 10. Fore Rib. (Five Ribs.) 11. Middle Rib. (Four Ribs.) 12. Chuck Rib. (Three Ribs.) 13. Shoulder, or Leg of Mutton Piece. 14. Brisket. 15. Clod. 16. Neck. 17. Shin. 18. Cheek.

TO CHOOSE BEEF.

Beef is in reality in season through the entire year, but it is best during the winter months, when it will hang a sufficient time to become tender before it is dressed. Meat of a more delicate nature is better adapted for the table in summer. The _Christmas beef_ of England is too much celebrated to require any mention here.

If young and freshly killed, the lean of ox-beef will be smoothly grained, and of a fine, healthy, carnation-red, the fat rather white than yellow, and the suet white and firm. Heifer-beef is more closely grained, and rather less bright of colour, the bones are considerably smaller, and the fat of a purer white.

Of bull-beef we only speak to warn our readers that it is of all meat the coarsest and the most rank in flavour. It may be known by its dark hue, its close tough fibre, and the scanty proportion, bad appearance, and strong odour of its fat.

In choice and well-fed beef, the lean will be found intergrained with fat: very lean meat is generally of an inferior quality.

The ribs, the sirloin, and the rump, are the proper joints for roasting. The round, or buttock, the edgebone, the second round, or mouse-buttock, the shin, the brisket, the shoulder or leg of mutton piece, and the clod, may be boiled or stewed. The neck is generally used for soup or gravy; and the thin flank for collaring. The best steaks are cut from the middle of the rump; the next best from the veiny piece, or from the chuck-rib. The inside of the sirloin, commonly used for the purpose in France, makes by far the most delicate steaks; but though _exceedingly_ tender, they are considered by some English epicures to be wanting in flavour.

The finest part of the sirloin is the chump-end, which contains the larger portion of the fillet; of the ribs, the middle ones are those generally preferred by experienced housekeepers.

TO ROAST SIRLOIN, OR RIBS OF BEEF.

Let the joint hang as long as it can possibly be kept perfectly sweet. When it is first brought in, remove the pipe of marrow which runs along the back-bone; and cut out the kernels from the fat. Be very careful in summer to guard it from flies; examine it frequently in warm or damp weather; and scrape off with a knife, or wipe away with a dry cloth, any moisture which may appear on the surface: when this has been done, dust some powdered ginger or pepper over it. Unless the joint should be very large, its appearance will be improved by taking off the ends of the bones, which may then be salted for a few days, and afterwards boiled. Spit the beef firmly; place it near the fire to render the surface firm, as directed in the article _Roasting_, of Chapter IX.; then draw it to a distance and let it remain so until the heat has well penetrated the interior; and, if from prejudice the old method be still preferred, heat it very gradually in the first instance (in either case baste it constantly), and let it be drawn nearer to the fire for the last half hour or more of roasting, merely to brown it well. Persons who object to meat being _frothed_ for table, have it dredged with flour when it is first placed at the fire, and sprinkled with fine salt when it is nearly done. It is not necessary to paper the fat of beef, as many cooks direct, if proper attention be given to it while roasting.

As a general rule, it may be observed, that when the steam from the meat draws strongly towards the fire, it is nearly or quite ready to serve. The time required to roast it will depend on the state of the weather,[75] the size and strength of the fire, the thickness of the joint, the use or non-use of a meat-screen or reflector, the general temperature of the kitchen, and other contingencies. A quarter of an hour for each pound of meat is commonly allowed for solid, heavy joints, and, if the directions we have given be attended to, this will not be found too much even for persons who prefer beef somewhat rare: it must be left longer at the fire if wished very thoroughly roasted, and quite double the usual time when the plan we have noticed at page 172, is adopted. When likely to be sent to table hashed, minced, or dressed a second time in any way, the juices of the meat should be dried up as little as possible when it is first cooked.

Footnote 75:

The meat will be much sooner done in hot weather than in cold. If frozen, it must be thawed _very gradually_ before it is put to the fire, or no length of time will roast it; this will be effected better by laying it into cold water for some hours before it is wanted, than by any other means.

ROAST RUMP OF BEEF.

As this joint is generally too much to serve whole, as much of it as will form a handsome dish should be cut from the chump end to roast. It must be managed as the sirloin, to which it is commonly preferred by connoisseurs. When boned and rolled into the form of a fillet of veal, as it sometimes is, nearly or quite an additional hour should be allowed to dress it.

TO ROAST PART OF A ROUND OF BEEF.

The natural division of the meat will show where the silver side of the round is to be separated from the upper or tongue side, which is the proper part for roasting, and which will be found equally good and profitable for the purpose, if allowed to hang as long as it can be kept sweet before it is dressed. Care should be taken in dividing the meat, not to pierce the inner skin. The silver side, with the udder, if there should be one to the joint, may be pickled, spiced, or simply salted, and will be excellent either way. The outside fat should be drawn tightly round the remainder of the beef, which must be firmly skewered, or bound with tape, to keep it in form. It will require long roasting at a strong, steady fire, and should be kept constantly basted.

Beef, 14 lbs.: 4-1/2 to 5 hours.

Obs.—We think that larding the beef quite through with large lardoons of firm fat, of udder, or of bacon, would be an improvement; and we ought also to observe, that unless it be delicate and of fine quality, it will not answer well for roasting.

TO ROAST A FILLET OF BEEF.

Raise the fillet from the inside of the sirloin, or from part of it, with a sharp knife; leave the fat on, trim off the skin, lard it through, or all over, or roast it quite plain; baste it with butter, and send it very hot to table, with tomata sauce, or _sauce piquante_, or eschalot

sauce, in a tureen. It is sometimes served with brown gravy and currant jelly; it should then be garnished with forcemeat-balls, made as for hare. If not very large, an hour and a quarter will roast it well with a brisk fire.

Obs.—The remainder of the joint may be boned, rolled, and roasted, or braised; or made into meat cakes; or served as a miniature round of beef.

1-1/4 hour.

ROAST BEEF STEAK.

If extremely tender, a large slice from the middle of the rump will make an excellent small dish of roast meat, when a joint is not easily to be procured. Let it be smoothly cut, from an inch to an inch and a half thick, flattened on a table, and the inside sprinkled with a little fine salt and cayenne, or common pepper. Make a roll of forcemeat, as No. 1, Chapter VIII., adding, at pleasure, a flavouring of minced onion or eschalot, and increasing the quantity of spices; place this on one end of the steak, and roll it up tightly in it; skewer and bind the meat so that the forcemeat cannot escape; fasten a buttered paper over it, and roast it an hour and a half, or more, according to its size. Twenty minutes before it is served, take off the paper and flour the meat, which should be kept well basted with butter all the time it is roasting. Send brown gravy to table with it, and pour a little over the beef.

1-1/2 hour, or more.

TO BROIL BEEF STEAKS.

The steaks should be from half to three quarters of an inch thick, equally sliced, and freshly cut from the middle of a well kept, finely grained, and tender rump of beef. They should be neatly trimmed, and once or twice divided, if very large. The fire, as we have already said in the general directions for broiling (page 175), must be strong and clear. The bars of the gridiron should be thin, and not very close together. When they are thoroughly heated, without being sufficiently burning to scorch the meat, wipe and rub them with fresh mutton suet; next pepper the steaks slightly, but never season them with salt before they are dressed; lay them on the gridiron, and when done on one side, turn them on the other, being careful to catch, in the dish in which they are to be sent to table, any gravy which may threaten to drain from them when they are moved. Let them be served the _instant_ they are taken from the fire; and have ready at the moment, dish, cover, and plates, as hot as they can be. From eight to ten minutes will be sufficient to broil steaks for the generality of eaters, and more than enough for those who like them but partially done.

Genuine amateurs seldom take prepared sauce or gravy with their steaks, as they consider the natural juices of the meat sufficient. When any accompaniment to them is desired, a small quantity of choice mushroom catsup may be warmed in the dish that is heated to receive them; and which, when the not very refined flavour of a raw eschalot is liked, as it is by some eaters, may previously be rubbed with one, of which the large end has been cut off. A thin slice or two of fresh butter is sometimes laid under the steaks, where it soon melts and mingles with the gravy which flows from them. The appropriate tureen sauces for broiled beef steaks are onion, tomata, oyster, eschalot, hot horseradish, and brown cucumber, or mushroom sauce.

Obs. 1.—We have departed a little in this receipt from our previous instructions for broiling, by recommending that the steaks should be turned but _once_, instead of “often,” as all great authorities on the subject direct. By trying each method, our readers will be able to decide for themselves upon the preferable one: we can only say, that we have never eaten steaks so excellent as those which have been dressed _exactly_ in accordance with the receipt we have just given, and we have taken infinite pains to ascertain the really best mode of preparing this very favourite English dish, which so constantly makes its appearance both carelessly cooked and ill served, especially at private tables.

Obs. 2.—It is a good plan to throw a few bits of charcoal on the fire some minutes before the steaks are laid down, as they give forth a strong heat without any smoke: a coke fire is also advantageous for broiling them.

The upright gridirons, by which meat is rather _toasted_ than broiled, though used in many kitchens, and generally pronounced exceedingly convenient where they have been tried, do not appear to as so well adapted for dressing steaks as those of less modern fashion, which are placed _over_, instead of before the fire.

BEEF STEAKS À LA FRANÇAISE.

The inside of the sirloin freed from skin and cut evenly into round quarter-inch slices, should properly be used for these; but when it cannot be obtained, part of the rump must be substituted for it. Season the steaks with fine salt and pepper, brush them with a little

clarified butter, and broil them over a clear brisk fire. Mix a teaspoonful of parsley minced extremely fine, with a large slice of fresh butter, a little cayenne, and a small quantity of salt. When the steaks are done, put the mixture into the dish intended for them, lay them upon it, and garnish them plentifully with fried potatoes. It is an improvement to squeeze the juice of half a lemon on the butter before the meat is heaped over it. The potatoes should be sliced rather thin, coloured of a fine brown, and placed evenly round the meat.

BEEF STEAKS À LA FRANÇAISE (ENTRÉE).

(_Another Receipt._)

Cut the beef into small thin steaks as above, season them with fine salt and pepper, dredge them lightly with flour, and fry them in butter over a brisk fire; arrange them in a chain round a very hot dish, and pour into the centre the olive sauce of Chapter V.

STEWED BEEF STEAK (ENTRÉE).

This may be cut from one to two inches thick, and the time of stewing it must be proportioned to its size. Dissolve a slice of butter in a large saucepan or stewpan, and brown the steak on both sides, moving it often that it may not burn; then shake in a little flour, and when it is coloured pour in by degrees rather more than sufficient broth or water to cover the meat. When it boils, season it with salt, take off the scum, slice in one onion, a carrot or two, and half a turnip; add a small bunch of sweet herbs, and stew the steak very softly from two hours and a half to three hours. A quarter of an hour before it is served, stir well into the gravy three teaspoonsful of rice flour smoothly mixed with a little cayenne, half a wineglassful of mushroom catsup, and a slight seasoning of spice. A teaspoonful of currie powder, in addition, will improve both the flavour and the appearance of the sauce. The onion is sometimes browned with the meat; and the quantity is considerably increased. Eschalots may be used instead, where their strong flavour is approved. A few button-mushrooms, stewed from twenty to thirty minutes with the meat, will render the catsup unnecessary. Wine, or any favourite store sauce, can be added at will.

2-1/2 to 3 hours.

FRIED BEEF STEAK.

We have little to add here to the directions of Chapter IX., which are sufficient to enable the cook to send a dish of fried steaks to table properly dressed. Currie sauce, highly _onioned_, is frequently served with them.

BEEF STEAK STEWED IN ITS OWN GRAVY.

(_Good and wholesome._)

Trim all the fat and skin from a rump steak of nearly an inch thick, and divide it once or twice; just dip it into cold water, let it drain for an instant, sprinkle it on both sides with pepper, and then flour it rather thickly; lay it quite flat into a well-tinned iron saucepan or stewpan, which has been rinsed with cold water, of which three or four tablespoonsful should be left in it. Place it over (not upon) a _very_ gentle fire, and keep it just simmering from an hour and a half to an hour and three quarters, when, if the meat be good, it will have become perfectly tender. Add salt to it when it first begins to boil, and turn it when rather more than half done. A couple of spoonsful of gravy, half as much catsup, and a slight seasoning of spice, would, to many tastes, improve this dish, of which, however, the great recommendation is its wholesome simplicity, which renders it suitable to the most delicate stomach. A thick mutton cutlet from the middle of the leg is excellent dressed thus.

1-1/2 to 1-3/4 hour.

BEEF OR MUTTON CAKE.

(_Very good._)

Chop two pounds of lean and very tender beef or mutton, with three quarters of a pound of beef suet; mix them well, and season them with a dessertspoonful of salt, nearly as much pounded cloves, a teaspoonful of pounded mace, and half a teaspoonful of cayenne. Line a round baking dish with thin slices of fat bacon, press the meat closely into it, smooth the top, and cover it with bacon, set a plate on it with a weight, and bake it two hours and a quarter. Take off the bacon, and serve the meat hot, with a little rich brown gravy, or set it by until cold, when it will be equally good. The fat of the meat which is used for this dish can be chopped

up with it instead of suet, where it is liked as well; and onion, or eschalot, shred fine, minced savoury herbs, grated lemon-peel, rasped bacon, or mushrooms cut small, may in turn be added to vary it in flavour.

Lean beef or mutton, 2 lbs.; suet, 3/4 lb.; salt and cloves in powder, each a dessertspoonful; mace, 1 teaspoonful; half as much cayenne: baked 2-1/4 hours.

Obs.—A larger portion of suet or of fat will render these cakes lighter, but will not otherwise improve them: they may be made of veal or of venison, but one-third of mutton suet or of fat bacon should be mixed with this last.

GERMAN STEW.

Cut into about three-inch squares, two pounds and a half of the leaner part of the veiny piece of beef, or of any joint which is likely to be tender, and set it on to stew, with rather less than a quart of cold broth or water, and one large onion sliced. When these begin to boil, add a teaspoonful of salt, and a third as much of pepper, and let them simmer gently for an hour and a half. Have ready some young white cabbages, parboiled; press the water well from them, lay them in with the beef, and let the whole stew for another hour. More onions, and a seasoning of mixed spices, or a few bits of lean bacon, or of ham, can be added to this stew when a higher flavour is desired; but it is very good without.

Beef, 2-1/2 lbs.; water, or broth, 1-3/4 pint; onion, 1; salt, 1 teaspoonful; third as much pepper: 1-1/2 hour. Parboiled cabbages, 3 or 4: 1 hour.

WELSH STEW.

Take the same proportions of beef, and of broth or water, as for the German Stew. When they have simmered gently for an hour, add the white part of from twenty to thirty leeks, or two dozens of button onions, and five or six young mild turnips, cut in slices, a small lump of white sugar, nearly half a teaspoonful of white pepper and more than twice as much salt. Stew the whole softly from an hour and a quarter to an hour and a half, after the vegetables are added.

Beef and water as above: 1 hour. Leeks, 20 to 30: or small onions, 24; young turnips, 6; small lump of sugar; white pepper, nearly 1/2 teaspoonful; salt, twice as much: 1-1/4 to 1-1/2 hour.

A GOOD ENGLISH STEW.

On three pounds of tender rump of beef, freed from skin and fat, and cut down into about two-inch squares, pour rather more than a quart of cold broth or gravy. When it boils add salt if required, and a little cayenne, and keep it just simmering for a couple of hours; then put to it the grated rind of a large lemon, or of two small ones, and half an hour after, stir to it a tablespoonful of rice-flour, smoothly mixed with a wineglassful of mushroom catsup, a dessertspoonful of lemon-juice, and a teaspoonful of soy: in fifteen minutes it will be ready to serve. A glass and a half of port, or of white wine, will greatly improve this stew, which may likewise be flavoured with the store-sauce of page 146, or with another, which we find excellent for the purpose, made with half a pint of port wine, the same of mushroom-catsup, a quarter pint of walnut pickle, a tablespoonful of the best soy, and a dessertspoonful of cayenne-vinegar, all well shaken together and poured into a bottle containing the thin rind of a lemon and two fine mellow anchovies, of moderate size. A few delicately fried forcemeat-balls may be slipped into it after it is dished.

Obs.—The limits of our work will not permit us to devote a further space to this class of dishes, but an intelligent cook will find it easy to vary them in numberless ways. Mushrooms, celery, carrots, sweet herbs, parboiled new potatoes, green peas, rice, and currie-powder may be advantageously used for that purpose. Ox-tails, just blanched and cut into joints, will be found excellent substitutes for the beef: mutton and veal also may be dressed in the same way. The meat and vegetables can be browned before broth or water is poured to them; but though, perhaps, more savoury, the stew will then be much less delicate. Each kind of vegetable should be allowed something more than sufficient time to render it perfectly tender, but not so much as would reduce it to pulp.

TO STEW SHIN OF BEEF.

Wash, and set it on to stew in sufficient cold water to keep it just covered until it is done. When it boils, take off the scum and put an ounce and a quarter of salt to the gallon of water. It is usual to add a few cloves and some black pepper, slightly bruised and tied up loosely in a fold of muslin, two or more onions, a root of celery, a bunch of savoury herbs, four or five carrots, and as many turnips,

either whole or sliced: if to be served with the meat, the two last will require a little more than the ordinary time of boiling, but otherwise they may be simmered with the meat from the beginning. Give the beef from four to five hours' gentle stewing; and serve it with part of its own liquor thickened and flavoured, or quite plain. An excellent dish for a family may be made by stewing the thick fleshy part of the shin or leg, in stock made of the knuckle, with a few bits of lean ham, or a slice of hung beef from which the smoked edges have been carefully pared away, and some spice, salt, and vegetables: by frying these last before they are thrown into the soup-pot the savour of the stew will be greatly heightened; and a tureen of good soup may be made of its remains, after it has been served at table.

Ox-cheek, after having been soaked for four or five hours, and washed with great nicety, may be dressed like the shin; but as it has little flavour, the gravy should be strained, and quite cleared from fat, then put into a clean saucepan, and thickened as soon as it boils, with the following mixture:—three dessertspoonsful of rice-flour, nearly a wineglassful of catsup, a teaspoonsful of currie-powder, or a little powdered ginger and cayenne. When these have stewed for ten minutes, dish the head, pour the sauce over, and serve it.

Shin of beef, 4 to 5 hours. Ox-cheek, 2 to 3 hours.

FRENCH BEEF À LA MODE.

(_A common Receipt._)

Take seven or eight pounds of a rump of beef (or of any other tender joint), free from bone, and skewer it firmly into a good shape. Put two ounces of butter into a thick saucepan or stewpan, and when it boils stir to it a tablespoonful of flour; keep these well shaken over a gentle fire until they are of a fine amber colour; then lay in the beef, and brown it on both sides, taking care that it shall not stick to the pan. Pour to it by slow degrees, letting each portion boil before the next is added or the butter will float upon the surface and be difficult to clear off afterwards, three quarters of a pint of hot water or gravy; add a bunch of savoury herbs, one large or two small carrots cut in thick slices, two or three moderate-sized onions, two bay-leaves, and sufficient pepper and salt to season the gravy. Let the meat simmer gently from four to five hours, and turn it when it is half done. When ready to serve, lift the beef into a hot dish, lay the vegetables round, and pour the gravy over it, after having taken out the herbs and skimmed away the fat. In France, half or the whole of a calf's foot is stewed with the beef, which is there generally larded with thick lardoons of fat bacon. (For larding, see Chapter X.) Veal dressed in this way is even better than beef. The stewpan used for either should be as nearly of the size of the meat as possible.

Beef, 7 to 8 lbs.: 4 to 5 hours.

STEWED SIRLOIN OF BEEF.

As a matter of convenience we have occasionally had this joint stewed instead of roasted, and have found it excellent. Cut out the inside or fillet as entire as possible, and reserve it for a separate dish; then remove the bones with care, or let the butcher do this. Spread the meat flat on a table and cover the inside with thin slices of striped bacon, after having first strewed over it a mixed seasoning of a small teaspoonful of salt, half as much mace or nutmeg, and a moderate quantity of pepper or cayenne. Roll and bind the meat up firmly, lay it into a stewpan or thick iron saucepan nearly of its size, and add the bones and as much good beef broth as will nearly cover the joint. Should this not be at hand, put a few slices of lean ham or bacon under the beef, and lay round it three pounds of neck or knuckle of veal, or of stewing beef divided into several parts; then pour to it cold water instead of broth. In either case, so soon as it has boiled a few minutes and been well cleaned from scum, throw in a large faggot of savoury herbs, three or four carrots, as many leeks, or a large onion stuck with a dozen cloves; and an hour later two blades of mace, and half a teaspoonful of peppercorns. Stew the beef _very_ gently indeed from four to five hours, and longer, should the joint be large: serve it with a good _Espagnole sauce piquante_, or brown caper sauce. Add what salt may be needed before the vegetables are thrown in; and, after the meat is lifted out, boil down to soup or gravy the liquor in which it has been stewed. To many tastes it would be an improvement to flour and brown the outside of the beef in butter before the broth or water is poured to it: it may also be stewed (but somewhat longer) half-covered with rich gravy, and turned when partially done. Minced eschalots may be strewed over the inside before it is rolled, when their strong savour is relished, or veal forcemeat may supply their place.

TO STEW A RUMP OF BEEF.

This joint is more easily carved, and is of better appearance when the bones are removed before it is dressed. Roll and bind it firmly with a fillet of tape, cover it with strong cold beef broth or gravy, and stew it very gently indeed from six hours to between seven and eight; add to it, after the scum has been well cleared off, one large or two moderate-sized onions stuck with thirty cloves, a head of celery, two carrots, two turnips, and a large faggot of savoury herbs. When the beef is perfectly tender quite through, which may be known by probing it with a sharp thin skewer, remove the fillets of tape, dish it neatly, and serve it with a rich _Espagnole_, and a garnish of forced tomatas, or with a highly-flavoured brown English gravy, and stewed carrots in the dish: for these last the mild preparation of garlic or eschalots, of page 122, may be substituted with good effect. They should be well drained, laid round the meat, and a little brown gravy should be poured over the whole.

This is the most simple and economical manner of stewing the beef; but should a richer one be desired, half roast the joint, and stew it afterwards in strong gravy to which a pint of mushrooms, and a pint of sherry or Madeira, should be added an hour before it is ready for table. Keep it hot while a portion of the gravy is thickened with a well-made brown roux (see Chapter IV.), and seasoned with salt, cayenne, and any other spice it may require. Garnish it with large balls of forcemeat highly seasoned with minced eschalots, rolled in egg and bread-crumbs, and fried a fine golden brown.

Plainly stewed from 6 to 7 or 8 hours. Or: half roasted then stewed from 4 to 5 hours.

Obs.—Grated horseradish, mixed with some well-thickened brown gravy, a teaspoonful of mustard, and a little lemon-juice or vinegar, is a good sauce for stewed beef.

BEEF PALATES. (ENTRÉE.)

First rub them well with salt, to cleanse them well; then wash them thoroughly in several waters, and leave them to soak for half an hour before they are dressed. Set them over the fire in cold water, and boil them gently until the skin will peel off, and the palates are tolerably tender. It is difficult to state the exact time required for this, as some will be done in two hours and a half, and others in not less than from four to five hours. When thus prepared, the palates may be cut into various forms, and simmered until fit to serve in rich brown gravy, highly flavoured with ham, cayenne, wine, and lemon-peel; or they will make an excellent currie. As they are very insipid of themselves, they require a sauce of some piquancy, in which, after they have been peeled and trimmed, they should be stewed from twenty to thirty minutes, or until they are perfectly tender. The black parts of them must be cut away, when the skin is taken off. An onion, stuck with a few cloves, a carrot sliced, a teaspoonful of whole white pepper, a slice of butter, and a teaspoonful of salt, may be boiled with the palates in the first instance; and they will be found very good, if sent to table in the curried gravy of Chapter XVI., or in the Soubise of Chapter VI., made thinner than the receipts direct.

Boiled from 2-1/2 to 4 or 5 hours. Stewed from 20 to 30 minutes.

Obs.—A French cook of some celebrity, orders the palates to be laid on the gridiron until the skin can be easily peeled or scraped off; the plan seems a good one, but we have not tried it.

BEEF PALATES.

(_Neapolitan Mode._)

Boil the palates until the skin can be easily removed, then stew them very tender in good veal broth, lay them on a drainer and let them cool; cut them across obliquely into strips of about a quarter-inch in width, and finish them by either of the receipts for dressing maccaroni, which will be found in Chapters XVIII. and XX.

STEWED OX-TAILS.

They should be sent from the butcher ready jointed. Soak and wash them well, cut them into joints or into lengths of two or three joints, and cover them with cold broth or water. As soon as they boil remove the scum, and add a half-teaspoonful of salt or as much more as may be needed, and a little common pepper or cayenne, an onion stuck with half a dozen cloves, two or three small carrots, and a branch or two of parsley. When these have simmered for two hours and a quarter, try the meat with a fork, and should it not be perfectly tender, let it remain over the fire until it is so. Ox-tails sometimes require nearly or quite three hours' stewing: they may be served with the vegetables, or with the gravy strained from them, and thickened like the English stew of the present chapter.

Ox-tails, 2; water or broth to cover them; salt, 1/2 teaspoonful, or more; little pepper or cayenne; onion, 1; cloves, 6; carrots, 2 or 3; parsley, 2 or 3 branches: 2-1/2 to 3 hours.

BROILED OX-TAIL. (ENTRÉE.)

(_Very good._)

When the ox-tail is ready for the stewpan, throw it into plenty of boiling water slightly salted, and simmer it for fifteen minutes; then take it up and put it into fresh water to cool; wipe it, and lay it round in a small stewpan without dividing it, just cover it with good beef gravy, and stew it gently until very tender; drain it a little, sprinkle over it a small quantity of salt and cayenne, dip it into clarified butter and then into some fine bread-crumbs, with which it should be thickly covered, lay it on the gridiron, and when equally browned all over serve it immediately. If more convenient the ox-tail may be set into the oven or before the fire, until properly coloured: it may likewise be sent to table without broiling, dished upon stewed cabbage or in its own gravy thickened, and with tomata sauce, in a tureen.

TO SALT AND PICKLE BEEF, IN VARIOUS WAYS.

Let the meat hang a couple of days in mild weather, and four or five in winter, before it is salted or pickled. During the heat of summer it is better to immerse it entirely in brine, that it may be secured alike from the flies, and from the danger of becoming putrid. Trim it, and take out the kernels from the fat; then rub a little fine dry salt over it, and leave it until the following day; drain it well from the blood, which will be found to have flowed from it, and it will be ready for any of the following modes of curing, which are all excellent of their kind, and have been well proved.

In very cold weather, the salt may be applied quite warm to the meat: it should always be perfectly dry, and reduced to powder.

Saltpetre hardens and renders the meat indigestible; sugar, on the contrary, mellows and improves it much; and it is more tender when cured with bay salt than when common salt is used for it.

TO SALT AND BOIL A ROUND OF BEEF.

Mix an ounce of saltpetre, finely powdered, with half a pound of very coarse sugar, and rub the beef thoroughly with them; in two days add three quarters of a pound of common salt, well dried and beaten; turn and rub the meat well in every part with the pickle for three weeks, when it will be fit to dress. Just wash off the salt, and skewer the beef as round and as even as possible; bind it tightly with broad tape, cover it with cold water, place it over a rather brisk fire, and after it boils draw it to the side of the stove and let it simmer gently for at least five hours. Carrots, mashed turnips, or cabbages, are usually served with boiled beef; and horseradish stewed for ten minutes in equal parts of vinegar and water, then pressed well from them, and mixed with some rich melted butter, is a good sauce for it.

Beef, 20 lbs.; coarse sugar, 1/2 lb.; saltpetre, 1 oz.: 2 days. Salt, 3/4 lb.: 21 days. Boil 5 hours, or more.

Obs.—Beef cured by this receipt if properly boiled, is tender, of good colour and flavour, and not over salt. The rump, edgebone, and brisket may be salted, or pickled in the same way as the round.

HAMBURGH PICKLE FOR BEEF, HAMS, AND TONGUE.

Boil together, for twenty minutes, two gallons of water, three pounds of bay salt, two pounds of coarse sugar, two ounces of saltpetre, and two of black pepper, bruised, and tied in a fold of muslin; clear off the scum thoroughly, as it rises, pour the pickle into a deep earthen pan, and when it is quite cold lay in the meat, of which every part must be perfectly covered with it. A moderate-sized round of beef will be ready for table in a fortnight; it should be turned occasionally in the brine. Five pounds of common salt may be substituted for the quantity of bay salt given above; but the meat will not be so finely flavoured.

Water, 2 gallons; bay-salt, 3 lbs.; saltpetre, 2 oz.; black pepper, 2 oz.; sugar, 2 lbs.: 20 minutes.

ANOTHER PICKLE FOR TONGUES, BEEF, AND HAMS.

To three gallons of spring water add six pounds of common salt, two pounds of bay-salt, two pounds of common loaf sugar, and two ounces of saltpetre. Boil these over a gentle fire, and be careful to take off all the scum as it rises: when quite cold it will be fit

for use. Rub the meat to be cured, with fine salt, and let it drain for a day in order to free it from the blood; then immerse it in the brine, taking care that every part of it shall be covered. Young pork should not remain more than from three to five days in the pickle; but hams for drying may be left in it for a fortnight at least; tongues will be ready in rather less time. Beef may remain from one week to two, according to its size, and the degree of saltness desired for it. A little experience will soon teach the exact time required for the different kinds of meat. When the pickle has been in use for about three months, boil it up again gently, and take the scum carefully off. Add to it three pounds of common salt, four ounces of sugar, and one of saltpetre: it will remain good for many months.

Water, 3 gallons; common salt, 6 lbs.; bay salt, 2 lbs.; loaf sugar, 2 lbs.; saltpetre, 2 oz.: boil 20 to 30 minutes.

DUTCH, OR HUNG BEEF.

For fourteen pounds weight of the round, the rump, or the thick flank of beef, mix two ounces of saltpetre with the same quantity of coarse sugar; rub the meat with them in every part, and let it remain for two days, then add one pound of bay salt, four ounces of common salt, and one ounce of ground black pepper. Rub these ingredients thoroughly into the beef, and in four days pour over it a pound of treacle; rub and turn it daily for a fortnight; drain, and send it to be smoked. When wanted for table, put it into plenty of boiling water, boil it slowly, and press it under a heavy weight while hot. A slice of this beef, from which the edges have been carefully trimmed, will serve to flavour soups or gravies as well as ham.

Beef, 14 lbs.; saltpetre and coarse sugar, each 2 oz.: 2 days. Bay salt, 1 lb.; common salt, 4 oz.: pepper, 1 oz.: 4 days. Treacle, 1 lb.: 14 days.

Obs.—Three quarters of a pound of coarse sugar may be rubbed into the meat at first, and the treacle may be altogether omitted; cloves and mace, too, may be added in the same proportion as for spiced beef.

COLLARED BEEF.

Only the thinnest part of the flank, or the ribs, which are not so generally used for it, will serve conveniently for collaring. The first of these should be hung in a damp place for a day or two, to soften the outer skin; then rubbed with coarse sugar, and left for a couple of days; when, for eight pounds of the meat, one ounce of saltpetre and half a pound of salt should be added. In ten days it will be fit to dress. The bones and tough inner skin must be removed, and the beef sprinkled thickly on the under side with parsley and other savoury herbs shred small, before it is rolled, which should be done very tightly: it must then be secured with a cloth, and bound as closely as possible with broad tape. It will require nearly or quite five hours of gentle boiling, and should be placed while hot under a weight, or in a press, without having the tape and cloth removed.

Beef, 8 lbs.; sugar, 3 oz.; salt, 8 oz.: 10 days. Boil 5 hours.

COLLARED BEEF.

(_Another way._)

Mix half an ounce of saltpetre with the same quantity of pepper, four ounces of bay salt, and four of common salt; with these rub well from six to seven pounds of the thin flank, and in four days add seven ounces of treacle; turn the beef daily in the pickle for a week or more; dip it into water, bone it and skin the inside, roll and bind it up very tightly, lay it into cold water, and boil it for three hours and a half. We have found beef dressed by this receipt extremely good: herbs can, of course, be added to it as usual. Spices and juniper berries would to many tastes improve it, but we give the receipt simply as we have been accustomed to have it used.

Thin flank, 6 to 7 lbs.; bay salt, and common salt, each 4 oz.; saltpetre, 1/2 oz.; pepper, 1/2 oz.: 4 days. Treacle, 7 oz.: 8 to 10 days. Boiled 3-1/2 hours.

A COMMON RECEIPT FOR SALTING BEEF.

One ounce of saltpetre, and a pound of common salt, will be sufficient for sixteen pounds of beef. Both should be well dried, and finely powdered; the saltpetre rubbed first equally over the meat, and the salt next applied in every part. It should be rubbed thoroughly with the pickle and turned daily, from a week to ten days. An ounce or two of sugar mixed with the saltpetre will render the beef more tender and palatable.

Beef, 16 lbs.; saltpetre, 1 oz.; salt, 1 lb.: 7 to 10 days.

SPICED ROUND OF BEEF.

(_Very highly flavoured._)

Rub the beef well in every part with half a pound of coarse brown sugar, and let it remain two days; then reduce to powder, and mix thoroughly before they are applied to the meat, two ounces of saltpetre, three quarters of a pound of common salt, a quarter of a pound of black pepper, three ounces of allspice, and four of bruised juniper-berries. Rub these ingredients strongly and equally over the joint, and do so daily for three weeks, turning it at the same time. Just wash off the spice, and put the beef into a tin, or covered earthen pan as nearly of its size as possible, with a cup of water or gravy; cover the top thickly with chopped beef-suet, and lay a coarse thick crust over the pan; place the cover on it, and bake the meat from five to six hours in a moderate oven, which should not, however, be sufficiently fierce to harden the outside of the joint, which, if properly managed will be exceedingly tender. Let it cool in the pan; and clear off the suet before it is dished. It is to be served cold, and will remain good for a fortnight.

Beef, 20 to 25 lbs. weight; sugar, 3 oz.: 2 days. Saltpetre, 2 oz.; common salt, 3/4 lb.; black pepper, 4 oz.; allspice, 3 oz.; juniper-berries, 4 oz.: 21 days. Baked 5 to 6 hours.

Obs.—We have not ourselves tested this receipt, but the meat cured by it has received such high commendation from several of our friends who have partaken of it frequently, that we think we may safely insert it without. The proportion of allspice appears to us more than would be agreeable to many tastes, and we would rather recommend that part of it should be omitted, and that a portion of nutmeg, mace, and cloves, should be substituted for it; as we have found these spices to answer well in the following receipt.

SPICED BEEF.

(_Good and wholesome._)

For twelve pounds of the round, rump, or thick flank of beef, take a large teaspoonful of freshly-pounded mace, and of ground black pepper, twice as much of cloves, one small nutmeg, and a quarter of a teaspoonful of cayenne, all in the finest powder. Mix them well with seven ounces of brown sugar, rub the beef with them and let it lie three days; add to it then half a pound of fine salt, and rub and turn it once in twenty-four hours for twelve days. Just wash, but do not soak it; skewer, or bind it into good form, put it into a stewpan or saucepan nearly of its size, pour to it a pint and a half of good beef broth, and when it begins to boil, take off the scum, and throw in one small onion, a moderate-sized faggot of thyme and parsley, and two large, or four small carrots. Let it simmer quite softly for four hours and a half, and if not wanted to serve hot, leave it in its own liquor until it is nearly cold. This is an excellent and far more wholesome dish than the hard, bright-coloured beef which is cured with large quantities of salt and saltpetre: two or three ounces of juniper-berries may be added to it with the spice, to heighten its flavour.

Beef, 12 lbs.; sugar, 7 oz.; mace and black pepper, each, 1 large teaspoonful; cloves, in powder, 1 large dessertspoonful; nutmeg, 1; cayenne, 1/4 teaspoonful: 3 days. Fine salt, 1/2 lb.: 12 days. Beef broth (or bouillon), 1-1/2 pint; onion, 1 small; bunch of herbs; carrots, 2 large, or 4 small: stewed 4-1/2 hours.

Obs.—We give this receipt _exactly_ as we have often had it used, but celery and turnips might be added to the gravy; and when the appearance of the meat is much considered, three-quarters of an ounce of saltpetre may be mixed with the spices; the beef may also be plainly boiled in water only, with a few vegetables, or baked in a deep pan with a little gravy. No meat must ever be left to cool in the stewpan or saucepan in which it is cooked; it must be lifted into a pan of its own depth, and the liquor poured upon it.

A MINIATURE ROUND OF BEEF.

“Select a fine rib of beef, and have it cut small or large in width according to your taste; it may thus be made to weigh from five to twelve pounds, or more. Take out the bone, and wrap the meat round like a fillet of veal, securing it with two or three wooden skewers; place it in a strong pickle for four or five days, and then cook it, taking care that it does not boil, but only simmers, from forty minutes, or more, according to its size. It is best to put it on in hot water, as it will not draw the gravy so much as cold. Many persons adjust a rib of beef in this way for roasting: let them try it salted, and they need not envy the possessor of the finest round of beef.” We give the receipt to our readers in its original form, and we can assure them, from our own experience, that it is a good one; but we would recommend that, in dressing the meat, quite the usual time for each pound of it should be allowed. When boned and rolled at the butcher’s, the skewers should be removed when it is first brought in; it should be well wiped with a dry cloth, or

washed with a little fresh brine, and a small quantity of salt and saltpetre should be rubbed over the inside, it may then be firmly bound with tape, and will be quite ready to boil when taken from the pickle. The sirloin, after the inside fillet is removed, may be cured and dressed in the same way, and will be found super-excellent if the beef be well fatted and properly kept. The Hamburgh pickle (see page 197) is perhaps the best for these joints. Part of the rump, taken clear of bone, answers admirably when prepared by this receipt.

BEEF ROLL, OR CANELLON DE BŒUF. (ENTRÉE.)

Chop and mix thoroughly two pounds of lean and very tender beef with one pound of slightly striped bacon; season them with a large teaspoonful of pepper, a little salt, a small nutmeg, or two-thirds as much mace, the grated rind of a lemon, or a teaspoonful of thyme and parsley finely minced. Form the whole into a thick rouleau, wrap a buttered paper round it, enclose it in a paste made of flour and water, and send it to a moderate oven for a couple of hours. Remove the paper and the crust, and serve the meat with a little brown gravy. Lamb and veal are excellent dressed in this way, particularly when mixed with plenty of mushrooms. Brown cucumber sauce should be served with the lamb; and currie, or oyster sauce, when there are no mushrooms, with the veal. A flavouring of onion or of eschalot, where it is liked, can be added at pleasure to the beef: suet, or the fat of the meat, may be substituted for the bacon.

Beef, 2 lbs.; bacon, 1 lb.; pepper, 1/4 oz.; little salt; small nutmeg; rind of 1 lemon, or savoury herbs, 1 tablespoonful: baked 2 hours.

MINCED COLLOPS AU NATUREL.

Mince finely a pound of very tender rump steak, free from fat or skin; season it with a moderate quantity of pepper and salt, set it over a gentle fire, and keep it stirred with a fork until it is quite hot that it may not gather into lumps. Simmer it very slowly in its own gravy from ten to twelve minutes, and then, should it be too dry, add a little boiling water, broth, or gravy; stew it for two minutes longer, and serve it directly.

These collops are particularly suited to persons in delicate health, or of weak digestion; and when an extra dish is required at a short notice, from the expedition with which they may be dressed, they are a convenient resource.

10 to 12 minutes.

SAVOURY MINCED COLLOPS.

Make a little thickening (see Brown _Roux_, Chapter V.) with about an ounce and a half of butter, and a dessertspoonful of flour; when it begins to be coloured, shake lightly into it a large teaspoonful of finely-shred parsley or mixed savoury herbs, two-thirds as much of salt, and half the quantity of pepper. Keep these stirred over a gentle fire until the thickening is of a deep yellow brown; then add a pound of rump-steak, finely minced, and keep it well separated with a fork until it is quite hot; next pour to it gradually half a cupful of boiling water, and stew the collops very gently for ten minutes. Before they are served, stir to them a little catsup, chili vinegar or lemon-juice: a small quantity of minced onion, eschalot, or a _particle_ of garlic, may be added at first to the thickening when the flavour is not objected to.

A RICHER VARIETY OF MINCED COLLOPS.

Omit the minced herbs from the thickening, and season it with cayenne and a small quarter of a teaspoonful of pounded mace. Substitute beef gravy for the boiling water, and when the collops are nearly done, fill a wineglass with one fourth of mushroom catsup, and three of port wine, and stir these to the meat. Serve the collops very hot, and garnish them with alternate forcemeat balls (see No. 1, Chapter VIII.) and fried sippets. If flavoured with a little gravy made from the bones of a roast hare, and served with currant jelly, these collops will scarcely be distinguished from game.

SCOTCH MINCED COLLOPS.

“Chop the beef small, season it with salt and pepper, put it, in its raw state, into small jars, and pour on the top some clarified butter. When wanted for use put the clarified butter into a frying-pan, and slice some onions into the pan and fry them. Add a little water to them, and put in the minced meat. Stew it well, and in a few minutes it will be fit to serve.”

BEEF TONGUES.

These may be cured by any of the receipts which we have already given for pickling beef, or for those which will be found further on for hams and bacon. Some persons prefer them cured with salt and saltpetre only, and dried naturally in a cool and airy room. For such of our readers as like them highly and richly flavoured we give our own method of having them prepared, which is this:—“Rub over the tongue a handful of fine salt, and let it drain until the following day; then, should it weigh from seven to eight pounds, mix thoroughly an ounce of saltpetre, two ounces of the coarsest sugar, and half an ounce of black pepper; when the tongue has been well rubbed with these, add three ounces of bruised juniper-berries; and when it has laid two days, eight ounces of bay salt, dried and pounded; at the end of three days more, pour on it half a pound of treacle, and let it remain in the pickle a fortnight after this; then hang it to drain, fold it in brown paper, and send it to be smoked over a wood fire for two or three weeks. Should the peculiar flavour of the juniper-berries prevail too much, or be disapproved, they may be in part, or altogether, omitted; and six ounces of sugar may be rubbed into the tongue in the first instance when it is liked better than treacle.”

Tongue, 7 to 8 lbs.; saltpetre, 1 oz.; black pepper, 1/2 oz.; sugar, 2 oz.; juniper-berries, 3 oz.: 2 days. Bay salt, 8 oz.: 3 days. Treacle, 1/2 lb.: 14 days.

Obs.—Before the tongue is salted, the root end, which has an unsightly appearance, should be trimmed away: it is indeed usual to take it off entirely, but some families prefer part of it left on for the sake of the fat.

BEEF TONGUES.

(_A Suffolk Receipt._)

For each very large tongue, mix with half a pound of salt two ounces of saltpetre and three quarters of a pound of the coarsest sugar; rub the tongues daily, and turn them in the pickle for five weeks, when they will be fit to be dressed, or to be smoked.

1 large tongue; salt, 1/2 lb.; sugar, 3/4 lb.; saltpetre, 2 oz.: 5 weeks.

TO DRESS BEEF TONGUES.

When taken fresh from the pickle they require no soaking, unless they should have remained in it much beyond the usual time, or have been cured with a more than common proportion of salt; but when they have been smoked and highly dried, they should be laid for two or three hours into cold, and as much longer into tepid water, before they are dressed: if extremely dry, ten or twelve hours must be allowed to soften them, and they should always be brought very slowly to boil. Two or three carrots and a large bunch of savoury herbs, added after the scum is cleared off, will improve them. They should be simmered until they are extremely tender, when the skin will peel from them easily. A highly dried tongue of moderate size will usually require from three and a half to four hours’ boiling; an unsmoked one about an hour less; and for one which has not been salted at all a shorter time will suffice.

BORDYKE RECEIPT FOR STEWING A TONGUE.

After the tongue has been soaked, trimmed, and washed with extreme nicety, lay it into a vessel of fitting size, and place round it three or four pounds of the neck, or of any other lean cuttings of beef, with some bones of undressed veal, and pour in sufficient cold water to keep it covered until it is done; or, instead of this, use strong unseasoned beef broth made with the shin, and any odd bits or bones of veal which may be at hand. Let the tongue be brought to boil very gradually, that it may be plump and tender. Remove the scum when it first rises, and when it is quite cleared off add a large faggot of parsley, thyme, and winter savoury, three carrots, a small onion, and one mild turnip. After three hours and a half of gentle simmering, probe the tongue, and if sufficiently done peel off the skin and serve it quickly. If not wanted hot for table, lay it upon a very clean board or trencher, and fasten it down to it by passing a carving fork through the root, and a smaller one through the tip, drawing the tongue straight with the latter before it is fixed in the board; let it remain thus until it is quite cold. It is much the fashion at present to glaze hams and tongues, but this should never be attempted by a cook not well acquainted with the manner of doing it, and the proper flavour and appearance of the glaze. For directions to make it, see page 104. Where expense is not regarded, three or four pounds of veal may be added to the beef in this receipt, or the tongue may be stewed in a prepared gravy made with equal parts of beef and veal, and vegetables as above, but without salt: this may afterwards be converted into excellent soup. A fresh or an unsmoked tongue may be dressed in this way, but will require less time: for the former, salt must be added to the gravy.

TO ROAST A BEEF HEART.

Wash and soak the heart very thoroughly, cut away the lobes, fill the cavities with a veal forcemeat (No. 1, Chapter VIII.), secure it well with a needle and twine, or very coarse thread, and roast it at a good fire for an hour and a half, keeping it basted plentifully with butter. Pour melted butter over it, after it is dished, and send it to table as hot as possible. Many persons boil the heart for three quarters of an hour before it is put to the fire, and this is said to render it more delicate eating; the time of roasting must of course be proportionately diminished. Good brown gravy may be substituted for the melted butter, and currant jelly also may be served with it.

1-1/2 hour, or more.

BEEF KIDNEY.

Slice the kidney rather thin, after having stripped off the skin and removed the fat; season it with pepper, salt, and grated nutmeg, and sprinkle over it plenty of minced parsley, or equal parts of parsley and eschalots chopped very small. Fry the slices over a brisk fire, and when nicely browned on both sides, stir amongst them a teaspoonful of flour, and pour in by degrees a cup of gravy and a glass of white wine; bring the sauce to the point of boiling, add a morsel of fresh butter and a tablespoonful of lemon-juice, and pour the whole into a hot dish garnished with fried bread. This is a French receipt, and a very excellent one.

BEEF KIDNEY.

(_A plainer way._)

Trim, and cut the kidney into slices; season them with salt and pepper, and dredge them well with flour; fry them on both sides, and when they are done through lift them out, empty the pan, and make gravy for them with a small slice of butter, a dessertspoonful of flour, pepper and salt, and a cup of boiling water; shake these round and give them a minute's simmering: add a little mushroom catsup, lemon juice, eschalot vinegar, or any store sauce that will give a good flavour. Minced herbs are to many tastes an improvement to this dish, to which a small quantity of onion shred fine can be added when it is liked.

6 to 9 minutes.

AN EXCELLENT HASH OF COLD BEEF.

Put a slice of butter into a thick saucepan, and when it boils throw in a dessertspoonful of minced herbs, and an onion (or two or three eschalots) shred small: shake them over the fire until they are lightly browned, then stir in a tablespoonful of flour, a little cayenne, some mace or nutmeg, and half a teaspoonful of salt. When the whole is well coloured, pour to it three-quarters of a pint or more of broth or gravy, according to the quantity of meat to be served in it. Let this boil gently for fifteen minutes; then strain it, add half a wineglassful of mushroom or of compound catsup, lay in the meat, and keep it by the side of the fire until it is heated through and is on the point of simmering, but be sure not to let it boil. Serve it up in a very hot dish, and garnish it with fried or toasted sippets of bread.

A COMMON HASH OF COLD BEEF OR MUTTON.

Take the meat from the bones, slice it small, trim off the brown edges, and stew down the trimmings with the bones well broken, an onion, a bunch of thyme and parsley, a carrot cut into thick slices, a few peppercorns, four cloves, some salt, and a pint and a half of water. When this is reduced to little more than three quarters of a pint, strain it, clear it from the fat, thicken it with a large dessertspoonful of rice flour, or rather less of arrow-root, add salt and pepper if needed, boil the whole for a few minutes, then lay in the meat and heat it well. Boiled potatoes are sometimes sliced hot into a very common hash.

Obs.—The cook should be reminded that if the meat in a hash or mince be allowed to boil, it will immediately become hard, and can then only be rendered eatable by very _long stewing_, which is by no means desirable for meat which is already sufficiently cooked.

BRESLAW OF BEEF.

(_Good._)

Trim the brown edges from half a pound of undressed roast beef, shred it small, and mix it with four ounces of fine bread-crumbs, a teaspoonful of minced parley, and two-thirds as much of thyme, two ounces of butter broken small, half a cupful of gravy or cream, a high seasoning of pepper and cayenne and mace or nutmeg, a small teaspoonful of salt, and three large eggs well whisked. Melt

a little butter in a deep dish, pour in the beef, and bake it half an hour; turn it out, and send it to table with brown gravy in a tureen. When cream or gravy is not at hand, an additional egg or two and rather more butter must be used. We think that grated lemon-rind improves the breslaw. A portion of fat from the joint can be added where it is liked. The mixture is sometimes baked in buttered cups.

Beef, 1/2 lb.; bread-crumbs, 4 oz.; butter, 2 oz.; gravy or cream, 1/2 cupful; parsley, 1 teaspoonful; thyme, two-thirds of teaspoonful; eggs, 3 or 4, if small; salt, 1 teaspoonful; pepper and nutmeg, 1/2 teaspoonful each: bake 1/2 hour.

NORMAN HASH.

Peel and fry two dozens of button onions in butter until they are lightly browned, then stir to them a tablespoonful of flour, and when the whole is of a deep amber shade, pour in a wineglassful and a half of red wine, and a large cup of boiling broth or water; add a seasoning of salt and common pepper or cayenne, and a little lemon-pickle catsup or lemon-juice, and boil the whole until the onions are quite tender; cut and trim into small handsome slices the remains of either a roast or boiled joint of beef, and arrange them in a clean saucepan; pour the gravy and onions on them, and let them stand for awhile to imbibe the flavour of the sauce; then place the hash near the fire, and when it is thoroughly hot serve it immediately, without allowing it to boil.

FRENCH RECEIPT FOR HASHED BOUILLI.

Shake over a slow fire a bit of butter the size of an egg, and a tablespoonful of flour; when they have simmered for a minute, stir to them a little finely-chopped onion, and a dessertspoonful of minced parsley; so soon as the whole is equally browned, add sufficient pepper, salt, and nutmeg to season the hash properly, and from half to three quarters of a pint of boiling water or of bouillon. Put in the beef cut into small but thick slices; let it stand by the fire and heat gradually; and when near the point of boiling thicken the sauce with the yolks of three eggs, mixed with a tablespoonful of lemon-juice. For change, omit the eggs, and substitute a tablespoonful of catsup, and another of pickled gherkins minced or sliced.

BAKED MINCED BEEF.

Mince tolerably fine, with a moderate proportion of its own fat, as much of the inside of a cold roast joint as will suffice for a dish: that which is least done is best for the purpose. Season it rather highly with cayenne and mace or nutmeg, and moderately with salt; add, when they are liked, one or two eschalots minced small, with a few chopped mushrooms either fresh or pickled, or two tablespoonsful of mushroom catsup. Mix the whole well with a cupful of _good_ gravy, and put it into a deep dish. Place on the top an inch-thick layer of bread-crumbs, moisten these plentifully with clarified butter passed through a small strainer over them, and send the mince to a slow oven for twenty minutes, or brown it in a Dutch oven.

SAUNDERS.

Spread on the dish in which the saunders are to be served, a layer of smoothly mashed potatoes, which have been seasoned with salt and mixed with about an ounce of butter to the pound. On these spread equally and thickly some underdressed beef or mutton minced and mixed with a little of the gravy that has run from the joint, or with a few spoonsful of any other; and season it with salt, pepper, and a small quantity of nutmeg. Place evenly over this another layer of potatoes, and send the dish to a moderate oven for half an hour. A very superior kind of saunders is made by substituting fresh meat for roasted; but this requires to be baked an hour or something more. Sausage-meat highly seasoned may be served in this way, instead of beef or mutton.

TO BOIL MARROW BONES.

Let the large ends of the bones be sawed by the butcher, so that when they are dished they may stand upright; and if it can be done conveniently, let them be placed in the same manner in the vessel in which they are boiled. Put a bit of paste, made with flour and water, over the ends where the marrow is visible, and tie a cloth tightly over them; take the paste off before the bones are sent to table, and serve them, placed upright in a napkin, with slices of dry toasted bread apart. When not wanted for immediate use, they may be partially boiled, and set into a cool place, where they will remain good for many days.

Large marrow bones, 2 hours; moderate sized, 1-1/2 hour. To keep; boil them 1-1/2 hour, and from 1/2 to 3/4 hour more when wanted for table.

BAKED MARROW BONES.

When the bones have been sawed to the length of a deep pie-dish, wash and wipe them dry, lay them into it, and cover them entirely with a good batter. Send them to a moderate oven for an hour or more, and serve them in the batter.

CLARIFIED MARROW FOR KEEPING.

Take the marrow from the bones while it is as fresh as possible; cut it small, put it into a very clean jar, and melt it with a gentle heat, either in a pan of water placed over the fire, or at the mouth of a cool oven; strain it through a muslin, let it settle for a minute or two, and pour it, clear of sediment, into small jars. Tie skins, or double folds of thick paper, over them as soon as the marrow is cold, and store it in a cool place. It will remain good for months.

OX-CHEEK STUFFED AND BAKED.

(_Good, and not expensive._)

Cleanse, with the greatest nicety, a fresh ox-cheek by washing, scraping it lightly with a knife, and soaking out the blood; then put it into plenty of warm water, and boil it gently for about an hour. Throw in a large teaspoonful of salt, and carefully remove all the scum as it rises to the surface. Let it cool after it is lifted out, and then take away the bones, remembering always to work the knife close to them, and to avoid piercing the skin. When the cheek has become cold, put into it a good roll of forcemeat, made by the receipt Nos. 1, 2, or 3, of Chapter IX., or substitute the oyster or mushroom forcemeat which follows; but in any case increase the quantity one-half at least: then skewer or bind up the cheek securely, and send it to a moderate oven for an hour or an hour and a half. It should be baked until it is exceedingly tender quite through. Drain it well from fat, dish it, withdraw the skewers, or unbind it gently, and either sauce it with a little good brown gravy, or send it to table with melted butter in a tureen, a cut lemon, and cayenne, or with any sauce of Chapter V., which may be considered more appropriate.

CHAPTER XI.

=Veal.=

[Illustration]

No. 1. Loin, Best End. 2. Loin, Chump End. 3. Fillet. 4. Hind Knuckle. 5. Fore Knuckle. 6. Neck, Best End. 7. Neck, Scrag End. 8. Blade Bone. 9. Breast, Best End. 10. Breast, Brisket End.

In season all the year, but scarce and expensive in mid-winter, and very early spring.

TO CHOOSE VEAL.

VEAL should be fat, finely grained, white, firm, and not overgrown: for when very large it is apt to be coarse and tough. It is more difficult to keep than any other meat except pork, and should never be allowed to acquire the slightest taint before it is dressed, as any approach to putridity renders it equally unwholesome and offensive to the taste. The fillet, the loin, the shoulder, and the best end of the neck, are the parts generally selected for roasting; the breast and knuckle are more usually stewed or boiled, although the former is excellent roasted. The udder or firm white fat of the fillet, is much used by French cooks instead of butter, in the composition of their forcemeats: for these, it is first well boiled, then left until quite cold, and afterwards thoroughly pounded before it is mixed with the other ingredients. The head and feet of the calf are valuable articles of food, both for the nutriment which the gelatinous parts of them afford, and for the great variety of modes in which they may be dressed. The kidneys, with the rich fat that surrounds them, and the sweetbreads, are well known delicacies; the liver and the heart also are very good eating; and no meat is so generally useful for rich soups and gravies as veal.

TO TAKE THE HAIR FROM A CALF'S HEAD WITH THE SKIN ON.

It is better to do this before the head is divided; but if only the half of one with the skin on can be procured, it must be managed in the same way. Put it into plenty of water which is on the point of simmering but which does not positively boil, and let it remain in until it does so, and for five or six minutes afterwards, but at the first full bubble draw it from the fire and let it merely scald; then lift it out, and with a knife that is _not_ sharp scrape off the hair as closely as possible. The butchers have an instrument on purpose for

the operation; but we have had the head look quite as well when done in the manner we have just described, as when it has been sent in ready prepared by them. After the hair is off, the head should be _well_ washed, and if it cannot be cooked the same day, it must be wiped extremely dry before it is hung up; and when it has not been divided, it should be left whole until the time approaches for dressing it. The brain must then be taken out, and both that and the head well soaked and washed with the greatest nicety. When the half head only is scalded, the brain should first be removed. Calves' feet are freed from the hair easily in the same manner; indeed, we find it a better mode of having it cleared from them than the one we have given in Chapter XXII., though that is practised by many good butchers.

BOILED CALF'S HEAD.

When the head is dressed with the skin on, which many persons prefer, the ear must be cut off quite close to it; it will require three quarters of an hour or upwards of additional boiling, and should be served covered with fried crumbs: the more usual mode, however, is to boil it without the skin. In either case first remove the brain, wash the head delicately clean, and soak it for a quarter of an hour; cover it plentifully with cold water, remove the scum as it rises with great care, throw in a little salt, and boil the head gently until it is perfectly tender. In the mean time, wash and soak the brains first in cold and then in warm water, remove the skin or film, boil them in a small saucepan from fourteen to sixteen minutes, according to their sage, and when they are done, chop and mix them with eight or ten size leaves boiled tender and finely minced; or, if preferred, with boiled parsley instead; warm them in a spoonful or two of melted butter, or white sauce; skin the tongue, trim off the root, and serve it in a small dish with the brains round it. Send the head to table very hot with parsley and butter poured over it, and some more in a tureen. A cheek of bacon, or very delicate pickled pork, is the usual accompaniment to boiled calf's head.

We have given here the common English mode of serving this dish, by some persons considered the best, and by others, as exceedingly insipid. On the continent, tomata sauce takes place of the parsley and butter; and rich oyster or Dutch sauce, are varieties often substituted for it in this country.

With the skin on, from 2-1/4 to 2-3/4 hours; without the skin, from 1-1/4 to 1-3/4 hour.

CALF'S HEAD, THE WARDER'S WAY.

(_An excellent Receipt._)

Boil the half-head until tolerably tender; let it cool, and bone it entirely; replace the brain, lay the head into a stewpan, and simmer it gently for an hour in rich gravy. From five-and-twenty to thirty minutes before it is dished, add half a pint of mushroom-buttons. Thicken the gravy, if needful, with rice flour or with flour and butter, and serve plenty of forcemeat-balls round the head. For dishes of this kind, a little sweet-basil wine, or a few sprigs of the herb itself, impart a very agreeable flavour. When neither these nor mushrooms are within reach, the very thin rind of a small but fresh lemon may be boiled in the gravy, and the strained juice added at the instant of serving.

Boiled from 1 to 2 hours; stewed 1 hour.

Obs.—The skin, _with the ear_, may be left on the head for this receipt, and the latter slit into narrow strips from the tip to within an inch and a half of the base; which will give it a feathery and ornamental appearance, the head may then be glazed or not at pleasure.

PREPARED CALF'S HEAD.

(_The Cook's Receipt._)

Take away the brains and tongue from the half of a calf's head, and then remove the bones, being careful in doing so to keep the knife as close to them as possible, and to avoid piercing the outer skin: in this consists the whole art of boning, in which an attentive cook may easily render herself expert. Next wash the head and dry it in a clean cloth; sprinkle over the inside a little pounded mace, and cayenne or white pepper; roll it up tightly, and bind it round with tape or twine. Lay into a small stewpot three or four pounds of neck of veal or of beef, twice or thrice divided, and place the head upon it with the bones well broken; pour in half a gallon of cold water, or as much as will suffice to keep the head covered until it is done, and simmer it very gently from an hour and a quarter to an hour and three quarters. When it is extremely tender, lift it out, and if wanted for table, remove the binding, and serve it very hot, with currie sauce, rich oyster sauce, or egg sauce and brown gravy; but should the remains, or the whole of it be required for the

following receipts, pour no gravy over it: in the latter case do not take off the tape for several hours. The tongue may be stewed with the head, but will require rather less time. We do not think it needful to repeat in every receipt our directions for adding salt to, and removing carefully the scum from, meat that is stewed or boiled, but the cook must not neglect either. When the trouble of boning is objected to, it can be dispensed with for some of the dishes which follow, but not for all. After the head is taken out, boil the gravy until it is well reduced, and rich: it should be strongly jellied when cold. A bone of ham, or a slice of hung beef will much improve its flavour; but vegetables must be avoided if it be wanted to keep: a little spice and a faggot of parsley may be added to it, and a calf's foot will be sure to give it the requisite degree of firmness. This receipt is for a head without the skin.

BURLINGTON WHIMSEY.

Set aside until quite cold half a calf's head dressed by the preceding receipt. If, on cutting it, the gelatinous part should not appear perfectly tender, pare it off closely from the head, weigh, and mince it; put it into a pint of good gravy, and stew it gently from ten to fifteen minutes. Mince as much more of the head as will make up a pound in weight after the edges are trimmed off, and part of the fat is taken away; add to this three ounces of the lean of a boiled ham finely chopped, the grated rind of a large lemon, three teaspoonsful of parsley and one of thyme shred very small, three quarters of a teaspoonful of mace, half a small nutmeg grated, a teaspoonful of salt, and a half-quarter one of cayenne; stir the whole well together, and put it, with half a pint more of gravy, to the portion which has been already simmered. When the whimsey has boiled _softly_ from four to five minutes, pour it into moulds or pans, in which slices of the tongue have been evenly arranged, and when quite cold it will turn out very firmly. It may be garnished, before it is sent to table, with branches of parsley, which should, however, be perfectly dry; and when served for supper or luncheon, it may be accompanied by a salad dressing.

Calf's head, 1 lb.; lean of ham, 3 oz.; gravy, 1-1/2 pint; rind of 1 large lemon; parsley, 3 teaspoonsful; thyme and salt, each 1 teaspoonful; mace, 3/4 teaspoonful; 1/2 nutmeg; cayenne, 1/8 part of teaspoonful: 5 minutes.

Obs.—The remains of a plain boiled head may be made to serve for this dish, provided the gravy used with it be well jellied and of high flavour. Slices from the small end of a boiled and smoked ox-tongue, from their bright colour improve greatly its appearance. It should be tasted before it is poured out, that salt or any other seasoning may be added if needful. After three or four days' keeping, should any mould appear upon the surface, take it off, re-melt the whimsey, and give it two minutes' boil. For change, the herbs may be omitted, and the quantity of ham increased, or some minced tongue substituted for it.

CUTLETS OF CALF'S HEAD.

Prepare, by the Cook's Receipt, half a calf's head with or without the skin on; only, in the latter case, allow more time for the boiling. When it is quite cold, remove the fillets of tape, and cut the head into slices of half an inch thick, brush them with yolk of egg, and dip them into fine bread-crumbs, seasoned with the grated rind of half a lemon, half a teaspoonful of minced savoury herbs, some cayenne, and a little of the lean of a boiled ham chopped very small, should this last be at hand. Fry the cutlets in butter of a fine light brown, make some gravy in the pan as for veal cutlets, and add to it the juice of half a lemon; or mix a large teaspoonful of currie-powder, and one of flour, very smoothly with the butter, shake them over the fire for four or five minutes, and let the gravy simmer as much longer, after the water is added; or serve the cutlets, covered with good mushroom sauce.

HASHED CALF'S HEAD. (REMOVE.)

When the whole of this dish has to be prepared, make for it a quart of stock, and proceed in all else as directed for mock turtle soup (page 24); but after the head has been parboiled, cut down a full pound and a half of it for the hash, and slice it small and thick, instead of dividing it into dice. Make the brains into cakes (see page 162), and garnish the dish with forcemeat-balls, rolled in egg, and in the finest bread-crumbs, then fried a delicate brown, and well drained, and dried upon a warm sieve reversed. The wine and other seasonings should be the same as for the soup. Rich gravy, 1 quart; flesh of calf's head, full 1-1/2 lb.; wine, and other seasonings, as for mock turtle soup. _Obs._—The gravy for this should be stewed with ham, eschalots, &c., exactly as for the soup.

CHEAP HASH OF CALF'S HEAD.

Take the flesh from the bone of a cold boiled head, and put it aside until wanted; take about three pints of the liquor in which it was cooked; break the bones, and stew them down with a small bunch of savoury herbs, a carrot, or two should they be small, a little carefully fried onion, four cloves, a dozen corns of pepper, and either a slice or two of lean ham or of smoked beef. When the liquid

is reduced nearly half, strain it, take off the fat, thicken it with a little well made roux, or, if more convenient, with flour and butter, stirred into it, when it boils, or with rice flour or arrow-root, mixed with a little spice, mushroom catsup, or Harvey's sauce, and a small quantity of lemon pickle or chili vinegar. Heat the meat slowly in the sauce when it is ready, but do not allow it to boil. The forcemeat, No. 1, of Chapter VIII., may be rolled into balls, fried, and served round it. The gravy should be _well_ seasoned. A little of Liebeg's extract of beef (see Chapter I.), or as much good beef broth as may be required for the hash, will convert this into a really good dish. For preparations which are of themselves insipid, the _Jewish_ beef, of which we have often already spoken, is an admirable addition.

TO DRESS COLD CALF'S HEAD OR VEAL

À LA MÂITRE D'HÔTEL. (GOOD.)

(_English Receipt._)

Cut into small delicate slices, or into scollops of equal size, sufficient cold calf's head or veal for a dish. Next knead very smoothly together with a knife two ounces of butter, and a small dessertspoonful of flour; put these into a stewpan or well tinned saucepan, and keep them stirred or shaken over a gentle fire until they have simmered for a minute or two, but do not let them take the slightest colour; then add to them in very small portions (letting the sauce boil up after each is poured in) half a pint of pale veal gravy, or of good shin-of-beef stock, and when the whole is very smoothly blended, and has boiled for a couple of minutes, mix together and stir to it a tablespoonful of common vinegar, a dessertspoonful of chili vinegar, a little cayenne, a tablespoonful of good mushroom catsup, and a _very small_ bit of sugar; and when the sauce again boils, strew a tablespoonful of minced parsley over the meat, lay it in, and let it stand by the fire until it is quite heated through, but do not allow it to boil: if kept just at the simmering point for ten or twelve minutes it may be served perfectly hot without. The addition of the mushroom catsup converts this into an English sauce, and renders it in colour, as well as in flavour, unlike the French one which bears the same name, and which is acidulated generally with lemon-juice instead of vinegar. Pickled mushrooms are sometimes added to the dish: the parsley when it is objected to may be omitted, and the yolks of two or three eggs mixed with a little cream may be stirred in, but not allowed to boil, just before the meat is served. When veal is used for this hash instead of calf's, it should be cut into slices not much larger than a shilling, and freed entirely from fat, sinew, and the brown edges. When neither broth nor gravy is at hand, a morsel or two of lean ham, and a few of the trimmings or bones of the head or joint, may be boiled down to supply its place.

Sufficient cold calf's head, or meat, for a dish; butter, 2 oz.; flour, 1 small dessertspoonful; gravy, or strong broth, 1/2 pint; vinegar, and mushroom catsup, of each 1 tablespoonful; chili vinegar, 1 dessertspoonful; _small_ bit of sugar; little cayenne, and salt if needed; parsley, 1 tablespoonful (pickled mushrooms or not at pleasure).

Obs.—Soles or cod-fish are very good, if raised neatly from the bones, or _flaked_, and heated in this _Mâitre d'Hôtel_ sauce.

CALF'S HEAD BRAWN.

(_Author's Receipt._)

The half of a fine large calf's head with the skin on, will best answer for this brawn. Take out the brains, and bone it entirely, or get the butcher do this; rub a little fine salt over, and leave it to drain for ten or twelve hours; next wipe it dry, and rub it well in every part with three quarters of an ounce of saltpetre finely powdered (or with an ounce should the head be _very_ large) and mixed with four ounces of common salt, and three of bay-salt, also beaten fine; turn the head daily in this pickle for four or five days, rubbing it a little each time; and then pour over it four ounces of treacle, and continue to turn it every day, and baste it with the brine very frequently for a month. Hang it up for a night to drain, fold it in brown paper, and send it to be smoked where wood only is burned, from three to four weeks. When wanted for table, wash and scrape it very clean, but do not soak it; lay it, with the rind downwards, into a saucepan or stewpan, which will hold it easily; cover it _well_ with cold water, as it will swell considerably in the cooking; let it heat rather slowly, skim it thoroughly when it first begins to simmer, and boil it as gently as possible from an hour and three quarters to a couple of hours or more, should it not then be _perfectly_ tender quite through; for unless sufficiently boiled, the skin, which greatly resembles brawn, will be unpleasantly tough when cold. When the fleshy side of the head is done, which will be twenty minutes or half an hour sooner than the outside, pour the water from it, leaving so much only in the stewpan as will just cover the gelatinous part, and simmer it until this is thoroughly tender. The head thus cured is very highly flavoured, and most excellent eating. The receipt for it is entirely new, having originated with ourselves. We give the reader, in addition, the result of our _first_ experiment with it, which was entirely successful:—"A half calf's head, not very large, without the skin, pickled with three ounces of

common salt, two of bay-salt, half an ounce of saltpetre, one ounce of brown sugar, and _half an ounce of pepper_, left four days; then three ounces of treacle added, and the pickling continued for a month; smoked nearly as long, and boiled between one hour and a half, and two hours." The pepper was omitted in our second trial, because it did not improve the appearance of the dish, although it was an advantage in point of flavour. Juniper-berries might, we think, be added with advantage, when they are liked; and cayenne tied in a muslin might supply the place of the pepper. It is an infinite improvement to have the skin of the head left on.

TO ROAST A FILLET OF VEAL.

Take out the bone and put a good roll of forcemeat (No. 1, Chapter VIII.) under the flap, dividing first, with a sharp knife, the skin from the meat sufficiently to admit the quantity required; secure it well, truss the veal firmly into good shape, place it at a distance from the fire at first, and baste it with butter. The outside will have a richer crust of browning if the meat be washed, wiped tolerably dry, and well floured before it is laid to the fire. It should be carefully watched, and basted often, that the fat may not burn. Pour melted butter over it after it is dished, and serve with it a boiled cheek of bacon and a lemon. Roast it from three hours and a half, to four hours and a half, according to its size.

FILLET OF VEAL, AU BÉCHAMEL, WITH OYSTERS.

Roast, in the usual way, a delicate fillet of veal, and in preparing it for the spit be careful to bind it up tightly, so that no cavity may be left where the bone has been taken out. While it is at the fire, plump gently in their own strained liquor, without allowing them to boil, half a pint of fine native oysters, and, after having freed them from the beards, set them aside; then boil the beards for fifteen or twenty minutes in nearly three quarters of a pint of good veal stock, or in strong veal broth, made for the purpose; strain them out, add the liquor of the oysters, also passed through a muslin or other fine strainer, and convert the broth into rich white sauce, of which there should be a full pint. When the veal is ready to serve, take it from the spit, dish it in a very hot dish, and cut out quickly from the centre in a cup-like form, about a pound of the meat, leaving a wide margin round the joint, to be carved in the usual way. Mince, as rapidly as possible, the white part of the veal which has been cut from the fillet, and the plumped oysters; put the whole into the white sauce, which should be ready heated, bring it to the _point_ of boiling, pour it into the fillet, and send it immediately to table. The joint should be placed under a well-heated cover, while the mince is in course of preparation, and be kept near the fire.

When the knuckle of veal has been sent in with the fillet, a few thick slices from it may be taken for the sauce; but it should be boiled down sufficiently early to allow it to cool, and to have every particle of fat removed from it before it is used. A pound of the meat ought to make, with the addition of the oyster liquor, sufficient gravy for the sauce. When expense is not a consideration, the _béchamel_ of Chapter V. may be made for it, and the fillet may be filled up entirely with whole oysters heated in it; or these may be intermixed with the veal cut into shilling-sized collops. Mushroom-buttons, stewed white in butter, can be substituted for the oysters, when their season is past; and very small forcemeat balls, delicately fried, may then be piled entirely over the open part of the fillet.

Persons who may take exception at the idea of _oysters with roast veal_, as not being in accordance with the common etiquette of the table, are recommended to give the innovation a trial before they reject its adoption.

BOILED FILLET OF VEAL.

A small and delicately white fillet should be selected for this purpose. Bind it round with tape, after having washed it thoroughly; cover it well with cold water, and bring it gently to boil; watch, and clear off carefully, the scum as it rises, and be, at the same time, very cautious not to allow the water to become smoked. Let the meat be _gently simmered_ from three hours and a half to four and a half, according to its weight. Send it to table with rich white sauce, and a boiled tongue; or make for it in the first instance the oyster forcemeat of Chapter VIII., and serve with the veal a tureen of well-made oyster sauce.

3-1/2 to 4-1/2 hours.

ROAST LOIN OF VEAL.

It is not usual to stuff a loin of veal, but we greatly recommend the practice, as an infinite improvement to the joint. Make the same forcemeat as for the fillet; and insert it between the skin and the flesh just over the ends of the bones. Skewer down the flap, place the joint at a moderate distance from a sound fire, keep it constantly basted, and be especially careful not to allow the kidney fat to burn: to prevent this, and to ensure the good appearance of the joint, a buttered paper is often fastened round the loin, and

removed about half an hour before it is taken from the fire. It is the fashion in some counties to serve _egg-sauce_ and brown gravy with roast loin, or breast of veal.

The cook will scarcely need to be told that she must separate the skin from the flank, with a sharp knife, quite from the end, to the place where the forcemeat is to be put, and then skewer the whole very securely. When the veal is not papered, dredge it well with flour soon after it is laid to the fire.

2 to 2-1/2 hours.

BOILED LOIN OF VEAL.

If dressed with care and served with good sauces, this, when the meat is small and white is an excellent dish, and often more acceptable to persons of delicate habit than roast veal. Take from eight to ten pounds of the best end of the loin, leave the kidney in with all its fat, skewer or bind down the flap, lay the meat into cold water, and boil it _as gently as possible_ from two hours and a quarter to two and a half, clearing off the scum perfectly, as in dressing the fillet. Send it to table with well-made oyster sauce, or _béchamel_, or with white sauce well flavoured with lemon-juice, and with parsley, boiled, pressed dry, and finely chopped.

2-1/4 to 2-1/2 hours.

STEWED LOIN OF VEAL.

Take part of a loin of veal, the chump end will do; put into a large, thick, well-tinned iron saucepan, or into a stewpan, about a couple of ounces of butter, and shake it over a moderate fire until it begins to brown; flour the veal well all over, lay it into the saucepan, and when it is of a fine, equal, light brown, pour gradually in veal broth, gravy, or boiling water to nearly half its depth; add a little sauce, one or two sliced carrots, a small onion, or more when the flavour is much liked, and a bunch of parsley; stew the veal very softly for an hour or rather more; then turn it, and let it stew for nearly or quite another hour, or longer should it not be perfectly tender. As none of our receipts have been tried with large, coarse veal, the cooking must be regulated by that circumstance, and longer time allowed should the meat be of more than moderate size. Dish the joint, skim all the fat from the gravy, and strain it over the meat; or keep the joint hot while it is rapidly reduced to a richer consistency. This is merely a plain family stew.

BOILED BREAST OF VEAL.

Let both the veal and the sweetbread be washed with exceeding nicety, cover them with cold water, clear off the scum as it rises, throw in a _little_ salt, add a bunch of parsley, a large blade of mace, and twenty white peppercorns; simmer the meat from an hour to an hour and a quarter, and serve it covered with rich onion sauce. Send it to table very hot. The sweetbread may be taken up when half done, and curried, or made into cutlets, or stewed in brown gravy. When onions are objected to, substitute white sauce and a cheek of bacon for them, or parsley and butter, if preferred to it.

1 to 1-1/4 hour.

TO ROAST A BREAST OF VEAL.

Let the caul remain skewered over the joint till with within half an hour of its being ready for table: place it at a moderate distance from a brisk fire, baste it constantly, and in about an hour and a half remove the caul, flour the joint, and let it brown. Dish and pour melted butter over it, and serve it with a cut lemon, and any other of the usual accompaniments to veal. It may be garnished with fried balls of the forcemeat (No. 1, Chapter VIII.) about the size of a walnut.

2 to 2-1/2 hours.

TO BONE A SHOULDER OF VEAL, MUTTON, OR LAMB.

[Illustration:

Shoulder of Veal boned.]

Spread a clean cloth upon a table or dresser, and lay the joint flat upon it, with the skin downwards; with a sharp knife cut off the flesh from the inner side nearly down to the blade bone, of which detach the edges first, then work the knife _under_ it, keeping it

always _close to the bone_, and using all possible precaution not to pierce the outer skin; when it is in every part separated from the flesh, loosen it from the socket with the point of the knife, and remove it; or, without dividing the two bones, cut round the joint until it is freed entirely from the meat, and proceed to detach the second bone. That of the knuckle is frequently left in, but for some dishes it is necessary to take it out; in doing this, be careful not to tear the skin. A most excellent grill may be made by leaving sufficient meat for it upon the bones of a shoulder of mutton, when they are removed from the joint: it will be found very superior to the broiled blade-bone of a _roast_ shoulder, which is so much liked by many people.

STEWED SHOULDER OF VEAL.

(_English Receipt._)

Bone a shoulder of veal, and strew the inside thickly with savoury herbs minced small; season it well with salt, cayenne, and pounded mace; and place on these a layer of ham cut in thin slices and freed from rind and rust. Roll up the veal, and bind it tightly with a fillet; roast it for an hour and a half, then simmer it gently in good brown gravy for five hours; add forcemeat balls before it is dished; skim the fat from the gravy, and serve it with the meat. This receipt, for which we are indebted to a correspondent on whom we can depend, and which we have not therefore considered it necessary to test ourselves, is for a joint which weighs ten pounds before it is boned.

ROAST NECK OF VEAL.

The best end of the neck will make an excellent roast. A forcemeat may be inserted between the skin and the flesh, by first separating them with a sharp knife; or the dish may be garnished with the forcemeat in balls. From an hour and a half to two hours will roast it. Pour melted butter over it when it is dished, and serve it like other joints. Let it be floured when first laid to the fire, kept constantly basted, and always at a sufficient distance to prevent its being scorched.

1-1/2 to 2 hours.

For the forcemeat, see No. 1, Chapter VIII. From 8 to 10 minutes will fry the balls.

NECK OF VEAL À LA CRÊME.

(_Or Au Béchamel._)

Take the best end of a neck of white and well-fed veal, detach the flesh from the ends of the bones, cut them sufficiently short to give the joint a good square form, fold and skewer the skin over them, wrap a buttered paper round the meat, lay it at a moderate distance from a clear fire, and keep it well basted with butter for an hour and a quarter; then remove the paper and continue the basting with a pint, or more, of _béchamel_ or of rich white sauce, until the veal is sufficiently roasted, and well encrusted with it. Serve some _béchamel_ under it in the dish, and send it very hot to table. For variety, give the _béchamel_ in making it a high flavour of mushrooms, and add some small buttons stewed very white and tender, to the portion reserved for saucing the joint.

2 to 2-1/4 hours.

VEAL GOOSE.

(_City of London receipt._)

“This is made with the upper part of the flank of a loin of veal (or sometimes that of the fillet) covered with a stuffing of sage and onions, then rolled, and roasted or broiled. It is served with brown gravy and apple sauce, is extremely savoury, and has many admirers.” We transcribe the exact receipt for this dish, which was procured for us from a house in the city, which is famed for it. We had it tested with the skin of the best end of a fine _neck_ of veal, from which it was pared with something more than an inch depth of the flesh adhering to it. It was roasted one hour, and answered extremely well. It is a convenient mode of dressing the flank of the veal for eaters who do not object to the somewhat coarse savour of the preparation. When the _tendrons_ or gristles of a breast, or part of a breast of veal, are required for a separate dish, the remaining portion of the joint may be dressed in this way after the bones have been taken out; or, without removing them, the stuffing may be inserted under the skin.

KNUCKLE OF VEAL EN RAGOUT.

Cut in small thick slices the flesh of a knuckle of veal, season it with a little fine salt and white pepper, flour it lightly, and fry it in butter to a pale brown, lay it into a very clean stewpan or saucepan, and just cover it with boiling water; skim it clean, and add to it a faggot of thyme and parsley, the white part of a head of celery, a small quantity of cayenne, and a blade or two of mace. Stew it very softly from an hour and three quarters to two hours and a half. Thicken and enrich the gravy if needful with rice-flour and mushroom catsup or Harvey's sauce, or with a large teaspoonful of flour, mixed with a slice of butter, a little good store-sauce and a glass of sherry or Madeira. Fried forcemeat balls of No. 1, Chapter VIII. may be added at pleasure. With an additional quantity of water, or of broth (made with the bones of the joint), a pint and a half of young green peas stewed with the veal for an hour will give an agreeable variety of this dish.

BOILED KNUCKLE OF VEAL.

After the joint has been trimmed and well washed, put it into a vessel well adapted to it in size, for if it be very large, so much water will be required that the veal will be deprived of its flavour; it should be well covered with it, and _very gently_ boiled until it is perfectly tender in every part, but not so much done as to separate from the bone. Clear off the scum with scrupulous care when the simmering first commences, and throw in a small portion of salt; as this, if sparingly used, will not redden the meat, and will otherwise much improve it. Parsley and butter is usually both poured over, and sent to table with a knuckle of veal, and boiled bacon also should accompany it. From the sinewy nature of this joint, it requires more than the usual time of cooking, a quarter of an hour to the pound not being sufficient for it.

Veal 6 to 7 lbs.: 2 hours or more.

KNUCKLE OF VEAL WITH RICE.

Pour over a small knuckle of veal rather more than sufficient water to cover it; bring it slowly to a boil; take off all the scum with great care, throw in a teaspoonful of salt, and when the joint has simmered for about half an hour, throw in from eight to twelve ounces of well washed rice, and stew the veal gently for an hour and a half longer, or until both the meat and rice are perfectly tender. A seasoning of cayenne and mace in fine powder with more salt, should it be required, must be added twenty or thirty minutes before they are served. For a superior stew good veal broth may be substituted for the water.

Veal, 6 lbs.; water, 3 to 4 pints; salt, 1 teaspoonful: 30 to 40 minutes. Rice, 8 to 12 oz.: 1-1/2 hour.

Obs.—A quart or even more of full grown green peas added to the veal as soon as the scum has been cleared off will make a most excellent stew. It should be well seasoned with white pepper, and the mace should be omitted. Two or three cucumbers, pared and freed from the seeds, may be sliced into it when it boils, or four or five young lettuces shred small may be added instead. Green onions also, when they are liked, may be used to give it flavour.

SMALL PAIN DE VEAU, OR, VEAL CAKE.

Chop separately and very fine, a pound and a quarter of veal quite free from fat and skin, and six ounces of beef kidney-suet; add a teaspoonful of salt, a full third as much of white pepper and of mace or nutmeg, with the grated rind of half a lemon, and turn the whole well together with the chopping-knife until it is thoroughly mixed; then press it smoothly into a small round baking dish, and send it to a _moderate_ oven for an hour and a quarter. Lift it into a clean hot dish, and serve it plain, or with a little brown gravy in a tureen. Three ounces of the lean of a boiled ham minced small, will very much improve this cake, of which the size can be increased at will, and proportionate time allowed for dressing it. If baked in a _hot_ oven, the meat will shrink to half its proper size, and be very dry. When done, it should be of a fine light brown, and like a cake in appearance.

Veal, 1-1/4 lb.; beef-suet, 6 oz.; salt, 1 teaspoonful; pepper and mace, or nutmeg, 3/4 teaspoonful each; rind of 1/2 lemon; ham (when added) 3 oz.; baked 1-1/4 hour.

BORDYKE VEAL CAKE.

(_Good._)

Take a pound and a half of veal perfectly clear of fat and skin, and eight ounces of the nicest striped bacon; chop them separately, then mix them well together with the grated rind of a small lemon, half a teaspoonful of salt, a fourth as much of cayenne, the third part of a nutmeg grated, and a half-teaspoonful of freshly pounded mace When it is pressed into the dish, let it be somewhat higher

in the centre than at the edge; and whether to be served hot or cold, lift it out as soon as it comes from the oven, and place it on a strainer that the fat may drain from it; it will keep many days if the under side be dry. The bacon should be weighed after the rind, and any rust it may exhibit, have been trimmed from it. This cake is excellent cold, better indeed than the preceding one; but slices of either, if preferred hot, may be warmed through in a Dutch oven, or on the gridiron, or in a few spoonsful of gravy. The same ingredients made into small cakes, well floured, and slowly fried from twelve to fifteen minutes, then served with gravy made in the pan as for cutlets, will be found extremely good.

Veal, 1-1/2 lb.; striped bacon, 8 oz.; salt and mace, 1 teaspoonful each; rind of lemon, 1; third of 1 nutmeg; cayenne, 4 grains; baked 1-1/4 to 1-1/2 hour.

FRICANDEAU OF VEAL. (ENTRÉE).

French cooks always prefer for this dish, which is a common one in their own country, that part of the fillet to which the fat or udder is attached;[76] but the flesh of the finer part of the neck or loin, raised clear from the bones, may be made to answer the purpose nearly or quite as well, and often much more conveniently, as the meat with us is not divided for sale as in France; and to purchase the entire fillet for the sake of the fricandeau would render it exceedingly expensive. Lay the veal flat upon a table or dresser, with the skin uppermost, and endeavour, with one stroke of an exceedingly sharp knife, to clear this off, and to leave the surface of the meat extremely smooth; next lard it thickly with small _lardoons_, as directed for a pheasant (page 181), and make one or two incisions in the underside with the point of a knife, that it may the better imbibe the flavour of the seasonings. Take a stewpan, of sufficient size to hold the fricandeau, and the proper quantity of vegetables compactly arranged, without much room being left round the meat. Put into it a couple of large carrots, cut in thick slices, two onions of moderate size, two or three roots of parsley, three bay leaves, two small blades of mace, a branch or two of lemon thyme, and a little cayenne, or a saltspoonful of white peppercorns. Raise these high in the centre of the stewpan, so as to support the meat, and prevent its touching the gravy. Cover them with slices of very fat bacon, and place the fricandeau gently on them; then pour in as much good veal broth, or stock, as will nearly cover the vegetables without reaching to the veal. A calf's foot, split in two, may with advantage be laid under them in the first instance. Stew the fricandeau _very_ gently for upwards of three hours, or until it is found to be extremely tender when probed with a fine skewer or a larding-pin. Plenty of live embers must then be put on the lid of the stewpan for ten minutes or a quarter of an hour, to render the lardoons firm. Lift out the fricandeau and keep it hot; strain and reduce the gravy very quickly, after having skimmed off every particle of fat; glaze the veal, and serve it on a ragout of sorrel, cucumbers, or spinach. This, though rather an elaborate receipt, is the best we can offer to the reader for a dish, which is now almost as fashionable with us as it is common on the Continent. Some English cooks have a very summary method of preparing it; they merely lard and boil the veal until they can "cut it with a spoon." then glaze and serve it with "brown gravy in the dish." This may be very tolerable eating, but it will bear small resemblance to the French fricandeau.

Footnote 76:

Called by them the _noix_.

3-1/2 to 4 hours.

SPRING-STEW OF VEAL.

Cut two pound of veal, free from fat, into small half-inch thick cutlets; flour them well, and fry them in butter with two small cucumbers sliced, sprinkled with pepper, and floured, one moderate sized lettuce, and twenty-four green gooseberries cut open lengthwise and seeded. When the whole is nicely browned, lift it into a thick saucepan, and pour gradually into the pan half a pint, or rather more, of boiling water, broth, or gravy. Add as much salt and pepper as it requires. Give it a minute's simmer, and pour it over the meat, shaking it well round the pan as this is done. Let the veal stew gently from three quarters of an hour to an hour. A bunch of green onions cut small may be added to the other vegetables if liked; and the veal will eat better, if slightly seasoned with salt and pepper before it is floured; a portion of fat can be left on it if preferred.

Veal 2 lbs.; cucumbers, 2; lettuce, 1; green gooseberries, 24; water or broth, 1/2 pint or more: 3/4 to 1 hour.

NORMAN HARRICO.

Brown in a stewpan or fry lightly, after having sprinkled them with pepper, salt, and flour, from two to three pounds of veal cutlets. If taken from the neck or loin, chop the bones very short, and trim away the greater portion of the fat. Arrange them as flat as they can

be in a saucepan; give a pint of water a boil in the pan in which they have been browned, and pour it on them; add a small faggot of parsley, and, should the flavour be liked, one of green onions also. Let the meat simmer softly for half an hour; then cover it with small new potatoes which have had a single boil in water, give the saucepan a shake, and let the harrico stew very gently for another half hour, or until the potatoes are quite done, and the veal is tender. When the cutlets are thick and the potatoes approaching their full size, more time will be required for the meat, and the vegetables may be at once divided: if extremely young they will need the previous boil. Before the harrico is served, skim the fat from it, and add salt and pepper should it not be sufficiently seasoned. A few bits of lean ham, or shoulder of bacon browned with the veal, will much improve this dish, and for some tastes, a little acid will render it more agreeable. Very delicate pork chops may be dressed in the same way. A cutlet taken from the fillet and freed from fat and skin, answers best for this dish. Additional vegetables, cooked apart, can be added to it after it is dished. Peas boiled very green and well drained, or young carrots sliced and stewed tender in butter, are both well suited to it.

Veal, 2 to 3 lbs.; water (or gravy), 1 pint; new potatoes 1-1/2 to 2 lbs.; faggot, parsley, and green onions: 1 hour or more.

PLAIN VEAL CUTLETS.

Take them if possible free from bone, and after having trimmed them into proper shape, beat them with a cutlet-bat or paste-roller until the fibre of the meat is thoroughly broken; flour them well to prevent the escape of the gravy, and fry them from twelve to fifteen minutes over a fire which is not sufficiently fierce to burn them before they are quite cooked through: they should be of a fine amber brown, and _perfectly done_. Lift them into a hot dish, pour the fat from the pan, throw in a slice of fresh butter, and when it is melted, stir or dredge in a dessertspoonful of flour; keep these shaken until they are well-coloured, then pour gradually to them a cup of gravy or of boiling water; add pepper, salt, a little lemon-pickle or juice, give the whole a boil, and pour it over the cutlets: a few forcemeat balls fried and served with them, is usually a very acceptable addition to this dish, even when it is garnished or accompanied with rashers of ham or bacon. A morsel of _glaze_, or of the jelly of roast meat, should when at hand be added to the sauce, which a little mushroom powder would further improve: mushroom sauce, indeed, is considered by many epicures, as indispensable with veal cutlets. We have recommended in this one instance that the meat should be thoroughly _beaten_, because we find that the veal is wonderfully improved by the process, which, however, we still deprecate for other meat.

12 to 15 minutes.

VEAL CUTLETS A L'INDIENNE, OR INDIAN FASHION. (ENTRÉE.)

Mix well together four ounces of very fine stale bread-crumbs, a teaspoonful of salt, and a tablespoonful of the best currie powder. Cut down into small well-shaped cutlets or collops, two pounds of veal free from fat, skin, or bone; beat the slices flat, and dip them first into some beaten egg-yolks, and then into the seasoned crumbs; moisten them again with egg, and pass them a second time through bread-crumbs. When all are ready, fry them in three or four ounces of butter over a moderate fire, from twelve to fourteen minutes. For sauce, mix smoothly with a knife, a teaspoonful of flour and an equal quantity of currie-powder, with a small slice of butter; shake these in the pan for about five minutes, pour to them a cup of gravy or boiling water, add salt and cayenne if required and the strained juice of half a lemon; simmer the whole till well flavoured, and pour it round the cutlets. A better plan is, to have some good currie sauce ready prepared to send to table with this dish; which may likewise be served with only well-made common cutlet gravy, from the pan, when much of the pungent flavour of the currie-powder is not desired.

Bread-crumbs, 4 oz.; salt, 1 teaspoonful; currie powder, 1 tablespoonful; veal, 2 lbs.: 12 to 14 minutes.

Obs.—These cutlets may be broiled; they should then be well beaten first, and dipped into clarified butter instead of egg before they are passed through the curried seasoning.

VEAL CUTLETS, OR COLLOPS, À LA FRANÇAISE. (ENTRÉE.)

Cut the veal into small, thin, round collops of equal size, arrange them evenly in a sauté-pan, or in a small frying-pan, and sprinkle a little fine salt, white pepper, and grated nutmeg on them. Clarify, or merely dissolve in a clean saucepan with a gentle degree of heat, an ounce or two of good butter, and pour it equally over the meat. Set the pan aside until the dinner-hour, then fry the collops over a clear fire, and when they are lightly browned, which will be in from four to five minutes, lift them into a hot dish, and sauce them with a little _Espagnole_, or with a gravy made quickly in the pan, and flavoured with lemon-juice and cayenne. They are excellent even without any sauce.

3 to 4 minutes.

SCOTCH COLLOPS. (ENTRÉE.)

Prepare the veal as for the preceding receipt, but dip the collops into beaten egg and seasoned bread-crumbs, and fry them directly in good butter, over a moderate fire, of a light golden brown; drain them well in lifting them from the pan, and sauce them like the collops _à la Française_.

VEAL CUTLETS À LA MODE DE LONDRES, OR, LONDON FASHION. (ENTRÉE.)

Raise the flesh entire from the upper side of the best end of a neck of veal, free it from the skin, and from the greater portion of the fat, slice it equally into cutlets little more than a quarter of an inch thick, brush them with egg, strew them with fine bread-crumbs, and fry them of a light brown. Toast, or fry apart as many small slices of bacon as there are cutlets, and let them be trimmed nearly to the same shape; place them alternately on their edges round the inside of a hot dish (so as to form a sort of chain), and pour into the middle some rich gravy made in the pan, and very slightly flavoured with eschalot; or substitute for this some good brown mushroom sauce. Savoury herbs, grated lemon-rind, nutmeg or mace, salt, and white pepper or cayenne, should be mixed with the bread-crumbs, in the proportions directed at page 213, for cutlets of calf's head; or they may be varied at pleasure. A cheek of bacon is best adapted to this dish.

SWEETBREADS SIMPLY DRESSED. (ENTRÉE.)

In whatever way sweetbreads are dressed, they should first be well soaked in lukewarm water, then thrown into boiling water to _blanch_ them, as it is called, and to render them firm. If lifted out after they have boiled from five to ten minutes according to their size, and laid immediately into fresh spring water to cool, their colour will be the better preserved. They may then be gently stewed for three quarters of an hour in veal gravy, which with the usual additions of cream, lemon, and egg-yolks, may be converted into a fricassee sauce for them when they are done; or they may be lifted from it, _glazed_, and served with good Spanish gravy; or, the glazing being omitted, they may be sauced with the sharp _Maître d'Hôtel_ sauce of page 117. They may also be simply floured, and roasted in a Dutch oven, being often basted with butter, and frequently turned. A full sized sweetbread, after having been blanched, will require quite three quarters of an hour to dress it.

Blanched 5 to 10 minutes. Stewed 3/4 hour or more.

SWEETBREAD CUTLETS. (ENTRÉE.)

Boil the sweetbreads for half an hour in water or veal broth, and when they are perfectly cold, cut them into slices of equal thickness, brush them with yolk of egg, and dip them into very fine bread-crumbs seasoned with salt, cayenne, grated lemon-rind, and mace; fry them in butter of a fine light brown, arrange them in a dish placing them high in the centre, and pour _under_ them a gravy made in the pan, thickened with mushroom powder and flavoured with lemon-juice; or, in lieu of this, sauce them with some rich brown gravy, to which a glass of sherry or Madeira has been added. When it can be done conveniently, take as many slices of a cold boiled tongue as there are sweetbread cutlets; pare the rind from them, trim them into good shape, and dress them with the sweetbreads, after they have been egged and seasoned in the same way; and place each cutlet upon a slice of tongue when they are dished. For variety, substitute _croutons_ of fried bread stamped out to the size of the cutlets with a round or fluted paste or cake cutter. The crumb of a stale loaf, very evenly sliced, is best for the purpose.

STEWED CALF'S FEET.

(_Cheap and Good._)

This is an excellent family dish, highly nutritious, and often very inexpensive, as the feet during the summer are usually sold at a low rate. Wash them with nicety, divide them at the joint, and split the claws; arrange them closely in a thick stewpan or saucepan, and pour in as much cold water as will cover them about half an inch: three pints will be sufficient for a couple of large feet. When broth or stock is at hand, it is good economy to substitute it for the water, as by this means a portion of strong and well-flavoured jellied gravy will be obtained for general use, the full quantity not being needed as sauce for the feet. The whole preparation will be much improved by laying a thick slice of the lean of an unboiled ham, knuckle of bacon, hung beef, or the end of a dried tongue, at the bottom of the pan, before the other ingredients are added; or, when none of these are at hand, by supplying the deficiency with a few bits of lean beef or veal: the feet being of themselves insipid, will be much more palatable with one or the other of these additions. Throw in from half to three quarters of a teaspoonful of salt when they begin to boil, and after the scum has been all

cleared off, add a few branches of parsley, a little celery, one small onion or more, stuck with half a dozen cloves, a carrot or two, a large blade of mace, and twenty corns of whole pepper; stew them softly until the flesh will part entirely from the bones; take it from them, strain part of the gravy, and skim off all the fat, flavour it with catsup or any other store sauce, and thicken it, when it boils, with arrow-root or flour and butter; put in the flesh of the feet, and serve the dish as soon as the whole is very hot. A glass of wine, a little lemon juice, and a few forcemeat balls, will convert this into a very superior stew; a handful of mushroom-buttons also simmered in it for half an hour before it is dished, will vary it agreeably.

Calf's feet (large), 2; water, 3 pints; salt, 1/2 to 1/3 teaspoonful; onions, 1 to 3; cloves, 6; peppercorns, 20; mace, large blade; little celery and parsley; carrots, 1 or 2: stewed softly, 2-1/2 to 3-1/4 hours. Mushroom catsup, 1 tablespoonful; flour, or arrow-root, 1 large teaspoonful; butter, 1 to 2 oz. Cayenne, to taste.

CALF'S LIVER STOVED, OR STEWED.

From three to four pounds of the best part of the liver will be sufficient for a dish of moderate size. First lard it quite through by the directions of page 181, with large lardoons, rolled in a seasoning of spice, and of savoury herbs very finely minced; then lay it into a stewpan or saucepan just fitted to its size, and pour in about half a pint of broth or gravy; heat it very gently, and throw in, when it begins to simmer, a sliced carrot, a small onion cut in two, a small bunch of parsley, and a blade of mace; stew the liver as softly as possible over a very slow fire from two hours and a half to three hours; thicken the gravy with a little brown roux (see page 107), or with a dessertspoonful of browned flour; add a couple of glasses of white wine, and a little spice if needed, and serve it very hot, after having taken out the herbs and vegetable.

The liver may be stewed without being larded; it may likewise be browned all over in a carefully made _roux_, before the gravy is poured to it: this must then be made to boil, and be added in small portions, the stewpan being well shaken round as each is thrown in. The wine can be altogether omitted; or a wineglassful of port mixed with a little lemon-juice, may take the place of sherry. After the liver has been wiped very dry, minced herbs may be strewed thickly over it before it is laid into the stewpan; and it may be served in its own gravy, or with a _sauce piquante_.

Liver, 3 to 4 lbs: 2 to 3 hours.

TO ROAST CALF'S LIVER.

Take the whole or part of a fine white sound liver, and either lard it as a fricandeau upon the surface, or with large strips of highly-seasoned bacon in the inside (see Larding, page 181); or should either of these modes be objected to, merely wrap it in a well buttered paper, and roast it from an hour to an hour and a quarter at a moderate distance from a clear fire, keeping it constantly basted. Remove the paper, and froth the liver well from ten to fifteen minutes before it is done. It should be served with a sauce of some piquancy, such as a _poivrade_, or brown eschalot, in addition to some good gravy. French cooks steep the liver over-night in vinegar, with a sliced onion and branches of savoury herbs laid over it: this whitens and renders it firm. As an economical mode, some small bits of the liver may be trimmed off, floured, and lightly fried with a sliced onion, and stewed down for gravy in three quarters of a pint of water which has been poured into the pan, with the addition of a few peppercorns, and a small bunch of herbs. A seasoning of salt must not be forgotten, and a little lemon pickle, or juice, would generally be considered an improvement.

1 to 1-1/4 hour.

BLANQUETTE OF VEAL OR LAMB, WITH MUSHROOMS.

(ENTRÉE.)

Slice very thin the white part of some cold veal, divide and trim it into scallops not larger than a shilling, and lay it into a clean saucepan or stewpan. Wipe with a bit of new flannel and a few grains of salt, from a quarter to half a pint of mushroom-buttons, and slice them into a little butter which just begins to simmer; stew them in it from twelve to fifteen minutes, without allowing them to take the slightest colour; then lift them out and lay them on the veal. Pour boiling to them a pint of _sauce tournée_ (see page 108); let the _blanquette_ remain near, but not close to the fire for awhile: bring it nearer, heat it slowly, and when it is on the point of boiling mix a spoonful or two of the sauce from it with the well beaten yolks of four fresh eggs; stir them to the remainder; add the strained juice of half a small lemon; shake the saucepan above the fire until the sauce is just set, and serve the _blanquette_ instantly.

Cold veal, 3/4 lb.; mushrooms, 1/4 to 1/2 pint: stewed in 1-1/2 oz. butter, 12 to 15 minutes. Sauce _tournée_, or thickened veal gravy, 1 pint; yolks of eggs, 4; lemon-juice, 1 tablespoonful.

Obs.—Any white meat may be served _en blanquette_. The mushrooms are not indispensable for it, but they are always a great improvement. White sauce substituted for the thickened veal gravy will at once convert this dish into an inexpensive English fricassee. Mace, salt, and cayenne, must be added to either preparation, should it require seasoning.

MINCED VEAL.

When there is neither gravy nor broth at hand, the bones and trimmings of the meat must be boiled down to furnish what is required for the mince. As cold meat is very light in weight, a pound of the white part of the veal will be sufficient for a dish, and for this quantity a pint of gravy will be needed. Break down the bones of the joint well, add the trimmings of the meat, a small bunch of savoury herbs, a slice or two of carrot or of celery, a blade of mace, a few white peppercorns, and a bit or two of lean ham, boiled, or unboiled if it can be had, as either will improve the flavour of the mince. Pour to these a pint and a half of water, and stew them gently for a couple of hours; then strain off the gravy, let it cool, and clear it entirely from the fat. Cut the white part of the veal small with a very sharp knife, after all the gristle and brown edges have been trimmed away. Some persons like a portion of fat minced with it, others object to the addition altogether. Thicken the gravy with a teaspoonful and a half of flour smoothly mixed with a small slice of butter, season the veal with a saltspoonful or more of salt, and half as much white pepper and grated nutmeg, or pounded mace; add the lightly-grated rind of half a small lemon; mix the whole well, put it into the gravy, and heat it thoroughly by the side of the fire without allowing it to boil; serve it with pale toasted sippets in and round the dish. A spoonful or two of cream is always an improvement to this mince.

MINCED VEAL AND OYSTERS.

The most elegant mode of preparing this dish is to mince about a pound of the whitest part of the inside of a cold roast fillet or loin of veal, to heat it without allowing it to boil, in a pint of rich white sauce, or _béchamel_, and to mix with it at the moment of serving, three dozens of small oysters ready bearded, and plumped in their own strained liquor, which is also to be added to the mince; the requisite quantity of salt, cayenne, and mace should be sprinkled over the veal before it is put into the sauce. Garnish the dash with pale fried sippets of bread, or with _fleurons_[77] of brioche, or of puff-paste. Nearly half a pint of mushrooms minced, and stewed white in a little butter, may be mixed with the veal instead of the oysters; or should they be very small they may be added to it whole: from ten to twelve minutes will be sufficient to make them tender. Balls of delicately fried oyster-forcemeat laid round the dish will give another good variety of it.

Footnote 77:

Fleurons, flowers, or flower-like figures, cut out with tin shapes.

Veal minced, 1 lb.; white sauce, 1 pint; oysters, 3 dozen, with their liquor; or mushrooms, 1/2 pint, stewed in butter 10 to 12 minutes.

VEAL-SYDNEY. (GOOD.)

Pour boiling on an ounce and a half of fine bread-crumbs nearly half a pint of good veal stock or gravy, and let them stand till cool; mix with them then, two ounces of beef-suet shred very small, half a pound of cold roast veal carefully trimmed from the brown edges, skin, and fat, and finely minced; the grated rind of half a lemon, nearly a teaspoonful of salt, a little cayenne, the third of a teaspoonful of mace or nutmeg, and four well-beaten eggs. Whisk up the whole well together, put it into a buttered dish, and bake it from three quarters of an hour to an hour. Cream may be used instead of gravy when more convenient, but this last will give the better flavour. A little clarified butter put into the dish before the other ingredients are poured in will be an improvement.

Bread-crumbs, 1-1/2 oz.; gravy or cream, nearly 1/2 pint; beef-suet, 2 oz.; cold veal, 1/2 lb.; rind of 1/2 lemon; salt, small teaspoonful; third as much mace and nutmeg; little cayenne; eggs, 4 large or 5 small: 3/4 to 1 hour.

FRICASSEED VEAL.

Divide into small, thick, handsome slices of equal size, about a couple of pounds of veal, quite free from fat, bone, and skin; dissolve a couple of ounces of butter in a wide stewpan, and just as it begins to boil lay in the veal, and shake it over the fire until it

is quite firm on both sides, but do not allow it to take the slightest colour. Stir in a tablespoonful of flour, and when it is well mixed with the cutlets, pour gradually to them, shaking the pan often, sufficient boiling veal gravy to almost cover them. Stew them gently from fifteen to sixteen minutes, or longer should they not be perfectly tender. Add a flavouring of mace, some salt, a quarter-pint of rich cream, a couple of egg-yolks, and a little lemon-juice, observing, when the last are added, the directions given for a _blanquette_ of veal, page 229. Strips of lemon-rind can be stewed in the gravy at pleasure. Two or three dozens of mushroom-buttons, added twenty minutes before it is served, will much improve this fricassée.

SMALL ENTRÉES OF SWEETBREADS, CALF'S BRAINS AND EARS, &c. &c.

For tables of which the service consists rather of a great variety of light dishes (_entrées_) than of substantial English fare, the ears, brains, sweetbreads, gristles or _tendrons_, and the tail of a calf, may be dressed in many different ways to supply them; but they require a really good style of cookery, and many adjuncts to render them available for the purpose, as they do not possess much decided natural flavour, and their insipidity would be apt to tire if it were not relieved by the mode of preparing them. We shall give some few especial receipts for them in the chapter on Foreign Cookery, should sufficient space remain open for us to admit them; and insert here only such slight general directions as may suffice for preparing some of them in a simple form; as they are not in reality of first-rate importance. All of them may be served with good curried, or highly-flavoured tomato-sauce, after having been stewed in strong broth or gravy. The brains and sweetbreads cut into small dice or scallops, and mixed with _béchamel_, or with common white sauce, may be used to fill small _vol-au-vents_, or patty cases. The ears are usually filled in part with forcemeat, or a preparation of the brains, and placed upright when dished; and the upper part is cut into narrow fringe-like strips. For "_Tendrons de Veau_," and "Breast of veal rolled and stewed," the reader is referred to Chapter XXXIV.

CHAPTER XII.

=Mutton.=

[Illustration]

No. 1. Leg. 2. Best End of Loin. 3. Chump End of Loin. 4. Neck, Best End. 5. Neck, Scrag End. 6. Shoulder. 7. Breast. A Saddle is the Two Loins. A Chine, the Two Necks.

Mutton is best suited for table in autumn, winter, and early spring. It is not considered quite so good when grass-lamb is in full season, nor during the sultry months of summer.

TO CHOOSE MUTTON.

THE best mutton is small-boned, plump, finely-grained, and short-legged; the lean of a dark, rather than of a bright hue, and the fat white and clear: when this is yellow, the meat is rank, and of bad quality. Mutton is not considered by experienced judges to be in perfection until it is nearly or quite five years old; but to avoid the additional expense of feeding the animal so long, it is commonly brought into the market at three years old. The leg and the loin are the superior joints; and the preference would probably be given more frequently to the latter, but for the superabundance of its fat, which renders it a not very economical dish. The haunch consists of the leg and the part of the loin adjoining it; the saddle, of the two loins together, or of the undivided _back_ of the sheep: these last are always roasted, and are served usually at good tables, or for company-dinners, instead of the smaller joints. The shoulder, dressed in the ordinary way, is not very highly esteemed, but when boned, rolled, and filled with forcemeat, it is of more presentable appearance, and to many tastes, far better eating; though some persons prefer it in its natural form, accompanied by stewed onions. It is occasionally boiled or stewed, and covered with rich onion sauce. The flesh of that part of the neck which is commonly called the "best end," or the _back ribs_, and which adjoins the loin, is the most succulent and tender portion of the sheep, and makes an excellent small roast, and is extremely good served as cutlets, after being divested of the superabundant fat. It is likewise very frequently boiled; but so cooked it makes but an unsightly and insipid dish, though an idea prevails in this country that it is a very wholesome one. Cutlets (or _chops_, as the butchers term them) are commonly taken from the loin, and are generally charged at a higher rate than _joints_ of mutton, in consequence, probably, of the constant demand for them. They may likewise be cut from the saddle, but will then be very large, and of no better quality than when the two loins which form the saddle are divided in the usual way, though a certain degree of fashion has of late been accorded to them.[78] The scrag, or that part of it

which joins the head, is seldom used for any other purpose than making broth, and should be taken off before the joint is dressed. Cutlets from the thick end of the loin are commonly preferred to any others, but they are frequently taken likewise from the best end of the neck (sometimes called the _back-ribs_) and from the middle of the leg. Mutton kidneys are dressed in various ways, and are excellent in many. The trotters and the head of a sheep may be converted into very good dishes, but they are scarcely worth the trouble which is required to render them palatable. The loin and the leg are occasionally cured and smoked like hams or bacon.

Footnote 78:

Many years since, these "_saddle-back_" cutlets were supplied to us by a country butcher, and though of very fine South Down mutton, had no particular importance attached to them, nor were they considered as remarkably new.

TO ROAST A HAUNCH OF MUTTON.[79]

Footnote 79:

We recommend Liebig's directions for roasting (page 171), to be applied here, and for the joints which follow.

This joint should be well kept, and when the larder-accommodations of a house not are good, the butcher should be requested to hang it the proper time. Roast it carefully at a large sound fire, and let it remain at a considerable distance for at least a couple of hours; then draw it nearer, but never sufficiently so to burn or injure the fat. Keep it constantly basted; flour it soon after it is laid to the fire, instead of frothing it, as this latter mode is not generally relished, though fashion is in its favour. In from three and a half to four hours, the haunch will be done, and it will require something less of time when not kept back at first, as we have advised. Serve it with a good _Espagnole_, or with plain mutton-gravy and currant-jelly. This joint, when the meat is of very fine quality, may be dressed and served exactly like venison.

3-1/2 to 4 hours. 5 hours or more by the _slow_ method.

ROAST SADDLE OF MUTTON.

This is an excellent joint, though not considered a very economical one. It is usual for the butcher to raise the skin from it before it is sent in, and to skewer it on again, that in the roasting the juices of the meat may be better preserved, and the fat prevented from taking too much colour, as this should be but delicately browned. In less than half an hour before the mutton is done, remove the skin, and flour the joint lightly after having basted it well. Our own great objection to frothed meat would lead us to recommend that the skin should be taken off half an hour earlier, and that the joint should be kept at sufficient distance from the fire to prevent the possibility of the fat being burned; and that something more of time should be allowed for the roasting. With constant basting, great care, and good management, the cook may always ensure the proper appearance of this, or of any other joint (except, perhaps, of a haunch of venison) without having recourse to papering or pasting, or even to replacing the skin; but when unremitted attention cannot be given to this one part of the dinner, it is advisable to take all precautions that can secure it from being spoiled.

2-1/2 to 2-3/4 hours. More if _very_ large.

TO ROAST A LEG OF MUTTON.

In a cool and airy larder a leg of mutton will hang many days with advantage, if the kernel be taken out, and the flap wiped very dry when it is first brought in; and it is never tender when freshly killed: in warm weather it should be well dredged with pepper to preserve it from the flies. If washed before it is put upon the spit, it should be wiped as dry as possible afterwards, and well floured soon after it is laid to the fire. When the excellence of the joint is more regarded than the expense of fuel, it should be roasted by what we have denominated the _slow method_; that is to say, it should be kept at a considerable distance from the fire, and remain at it four hours instead of two: it may be drawn nearer for the last twenty or thirty minutes to give it colour. The gravy will flow from it in great abundance when it is cut, and the meat will be very superior to that roasted in the usual way. When this plan is not pursued, the mutton should still be kept quite a foot from the fire until it is heated through, and never brought sufficiently near to scorch or to harden any part. It should be _constantly basted_ with its own fat, for if this be neglected, all other precautions will fail to ensure a good roast; and after it is dished a little fine salt should be sprinkled lightly on it, and a spoonful or two of boiling water ladled over. This is the most palatable mode of serving it, but it may be frothed when it is preferred so, though we would rather recommend that the flour should be dredged on in the first instance, as it then prevents the juices of the meat from escaping, and forms a savoury coating to it; while the raw taste which it so often retains with mere frothing is to many eaters especially

objectionable.

Leg of mutton, 7 to 8 lbs.: slow method 4 hours, common method 1-3/4 to 2 hours.

Obs.—Many common cooks injure their roasts exceedingly by pouring abundance of hot water over them, "_to make gravy_" as they call it. This should never be done. The use of any portion may, perhaps, be rationally objected to; but when the joint is not carefully cooked it is sometimes very dry without it. A few spoonsful of Liebeg's extract of meat will supply excellent gravy for this, or for any other dish of roasted meat.

BRAISED LEG OF MUTTON.

Take out the bone as far as the first joint by the directions of the following receipt; roll some large strips of bacon in a seasoning of mixed spice, and of savoury herbs minced extremely fine or dried and reduced to powder, and with these lard the inside of the boned portion of the joint; or fill the cavity with forcemeat highly seasoned with eschalot or garlic. Sew up the meat, and place it in a braising-pan or ham-kettle nearly of its size, with slices of bacon under and over it, two or three onions, four or five carrots, two bay leaves, a large bunch of savoury herbs, a few bones, or bits of undressed mutton or veal, and about three quarters of a pint of gravy. Stew the meat as softly as possible from four to five hours, and keep live embers on the pan (or, as this mode of cooking is not general in England, set the mutton, if it can be done conveniently, into a moderately-heated oven, after having luted the edges of the vessel in which it is arranged with a bit of coarse paste); lift it out, strain the gravy, reduce it quickly to glaze, and brush the meat with it; or merely strain, free it from fat, and pour it over the mutton. White beans (_haricots blancs_), boiled tender and well drained, or a mild ragout of garlic or eschalots, may be laid in the dish under it. The joint can be braised equally well without any part of it being boned.

3 to 5 hours.

LEG OF MUTTON BONED AND FORCED.

Select for this dish a joint of South Down or of any other delicate-sized mutton, which has been kept sufficiently long to render it very tender. Lay it on a clean cloth spread upon a table, and turn the underside upwards. With a sharp-edged boning-knife cut through the middle of the skin, from the knuckle to the first joint, and raise it from the flesh on the side along which the bone runs, until the knife is just above it, then cut through the flesh down to the bone; work the knife round it in every part till you reach the socket; next remove the flat bone from the large end of the joint, and pass the knife freely round the remaining one, as it is not needful to take it out clear of the meat; when you again reach the middle joint, loosen the skin round it with great care, and the two bones can then be drawn out without being divided. This being done, fill the cavities with the forcemeat, No. 1. (Chapter VIII.), adding to it a somewhat high seasoning of eschalot, garlic, or onion; or cut out with the bone, nearly a pound of the inside of the mutton, chop it fine with six ounces of delicate striped bacon, and mix with it thoroughly three quarters of an ounce of parsley, and half as much of thyme and winter savoury, all minced extremely small; a half teaspoonful of pepper (or a third as much of cayenne); the same of mace, salt, and nutmeg, and either the grated rind of a small lemon, or four eschalots finely shred. When the lower part of the leg is filled, sew the skin neatly together where it has been cut open, and tie the knuckle round tightly, to prevent the escape of the gravy. Replace the flat bone at the large end, and with a long needle and twine, draw the edges of the meat together over it. If it can be done conveniently, it is better to roast the mutton thus prepared in a cradle spit or upon a bottle-jack, with the knuckle downwards. Place it at first far from the fire, and keep it constantly basted. It will require nearly or quite three hours' roasting. Remove the twine before it is served, and send it very hot to table with some rich brown gravy.

A BOILED LEG OF MUTTON WITH TONGUE AND TURNIPS.

(_An excellent Receipt._)

Trim into handsome form a well-kept, but perfectly sweet leg of mutton, of middling weight; wash, but do not soak it; lay it into a vessel as nearly of its size as convenient, and pour in rather more than sufficient cold water[80] to cover it; set it over a good fire, and when it begins to boil take off the scum, and continue to do so until no more appears; throw in a tablespoonful of salt (after the first skimming), which will assist to bring it to the surface, and as soon as the liquor is clear, add two moderate-sized onions stuck with a dozen cloves, a large faggot of parsley, thyme, and winter savoury, and four or five large carrots, and half an hour afterwards as many turnips. Draw the pan to the side of the fire, and let the mutton be simmered _gently_ from two hours to two and a half, from the time of its first beginning to boil. Serve it with caper, brown cucumber, or oyster sauce. If stewed _softly_, as we have

directed, the mutton will be found excellent dressed thus; otherwise, it will but resemble the unpalatable and ragged-looking joints of fast-boiled meat, so constantly sent to table by common English cooks. Any undressed bones of veal, mutton, or beef, boiled with the joint will improve it much, and the liquor will then make excellent soup or _bouillon_. A small smoked ox-tongue boiled very tender will generally be much approved as an accompaniment to the mutton, though it is out of the usual course to serve them together: innovation on established usages is, however, sometimes to be recommended. The tongue should be garnished with well-prepared mashed turnips, moulded with a tablespoon into the form of a half-egg, and sent to table as hot as possible; or the turnips may be dished apart.

Footnote 80:

We have left this receipt unaltered, instead of applying to it Baron Liebeg's directions for his improved method of boiling meat, because his objections to the immersion of the joint in _cold_ water are partially obviated, by its being placed immediately over a sound fire, and heated quickly; and the mutton is very good thus dressed.

2 to 2-1/2 hours.

ROAST OR STEWED FILLET OF MUTTON.

Cut some inches from either end of a large and well-kept leg of mutton, and leave the fillet shaped like one of veal. Remove the bone, and fill the cavity with forcemeat (No. 1, Chapter VIII.), which may be flavoured with a little minced eschalot, when its flavour is liked: more forcemeat may be added by detaching the skin sufficiently on the flap side to admit it. When thus prepared, the fillet may be roasted, and served with currant-jelly and brown gravy, or with only melted butter poured over it; or it may be stewed gently for nearly or quite four hours, in a pint of gravy or broth, after having been floured and browned all over in a couple of ounces of butter: it must then be turned every hour that it may be equally done. Two or three small onions, a faggot of herbs, a couple of carrots sliced, four or five cloves, and twenty whole peppercorns can be added to it at will.

Roasted 2 hours, or stewed 4 hours.

Obs.—At a large fire, half an hour less of time will roast the mutton sufficiently for English taste in general.

TO ROAST A LOIN OF MUTTON.

The flesh of the loin of mutton is superior to that of the leg, when roasted; but to the frugal housekeeper this consideration is usually overbalanced by the great weight of fat attached to it; this, however, when economy is more considered than appearance, may be pared off and melted down for various kitchen uses. When thus reduced in size, the mutton will be soon roasted. If it is to be dressed in the usual way, the butcher should be desired to take off the skin; and care should be taken to preserve the fat from being ever so lightly burned: it should be managed, indeed, in the same manner as the saddle, in every respect, and carved also in the same way, either in its entire length or in oblique slices.

Without the fat, 1 to 1-1/2 hour; with 1-1/4 to 1-3/4 hour.

TO DRESS A LOIN OF MUTTON LIKE VENISON.

Skin and bone a loin of mutton, and lay it into a stewpan, or braising-pan, with a pint of water, a large onion stuck with a dozen cloves, half a pint of port wine and a spoonful of vinegar; add, when it boils, a small faggot of thyme and parsley, and some pepper and salt: let it stew three hours, and turn it often. Make some gravy of the bones, and add it at intervals to the mutton when required. This receipt comes to us so strongly recommended by persons who have partaken frequently of the dish, that we have not thought it needful to prove it ourselves.

3 hours.

ROAST NECK OF MUTTON.

This is a very favourite joint in many families, the flesh being more tender and succulent than that even of the loin; and when only a small roast is required, the best end of the neck of mutton, or the middle, if divested of a large portion of the fat and cut into good shape, will furnish one of appropriate size and of excellent quality. Let the ends be cut quite even and the bones short, so as to give a handsome squareness of form to the meat. The butcher, if directed to do so, will chop off the chine bone, and divide the long

bones sufficiently at the joints to prevent any difficulty in separating them at table. From four to five pounds weight of the neck will require from an hour to an hour and a quarter of roasting at a clear and brisk, but not _fierce_, fire. It should be placed at a distance until it is heated through, and then moved nearer, and kept _thoroughly basted_ until it is done. Tomatas baked or roasted may be sent to table with it; or a little plain gravy and red currant-jelly; or it may be served without either.

When the entire joint, with the exception of the scrag-end (which should always be taken off), is cooked, proportionate time must be allowed for it.

TO ROAST A SHOULDER OF MUTTON.

Flour it well, and baste it constantly with its own dripping; do not place it close enough to the fire for the fat to be in the slightest degree burned, or even too deeply browned. An hour and a half will roast it, if it be of moderate size. Stewed onions are often sent to table with it. A shoulder of mutton is sometimes boiled, and smothered with onion sauce.

1-1/2 hour.

THE CAVALIER'S BROIL.

Half roast or stew, or parboil, a small, or moderate-sized shoulder of mutton; lift it into a hot dish, score it on both sides down to the bone, season it well with fine salt and cayenne or pepper, and finish cooking it upon the gridiron over a brisk fire. Skim the fat from any gravy that may have flowed from it, and keep the dish which contains it quite hot to receive the joint again. Warm a cupful of pickled mushrooms, let a part of them be minced, and strew them over the broil when it is ready to be served; arrange the remainder round it, and send it instantly to table. The reader will scarcely need to be told that this is an excellent dish.

FORCED SHOULDER OF MUTTON.

Cut off all the flesh from the inside of the joint down to the blade-bone, and reserve it for a separate dish. It may be lightly browned with some turnips or carrots, or both, and made into a small harrico or stewed simply in its own gravy, or it will make in part, a pie or pudding. Bone the mutton (see page 219), flatten it on a table, lay over the inside some thin and neatly-trimmed slices of striped bacon, and spread over them some good veal forcemeat (No. 1, Chapter VIII.) to within an inch of the outer edge; roll the joint up tightly towards the knuckle (of which the bone may be left in or not, at pleasure), secure it well with tape or twine, and stew it gently in good gravy, from four hours to four and a half.

4 to 4-1/2 hours.

Obs.—In France it is usual to substitute _sausage-meat_ for the bacon and veal stuffing in this dish, but it does not appear to us to be well suited to it.

MUTTON CUTLETS STEWED IN THEIR OWN GRAVY.

(_Good._)

Trim the fat entirely from some cutlets taken from the loin; just dip them into cold water, dredge them moderately with pepper, and plentifully on both sides with flour; rinse a thick iron saucepan with spring water, and leave three or four tablespoonsful in it; arrange the cutlets in one flat layer, if it can be done conveniently, and place them over a very gentle fire; throw in a little salt when they begin to stew, and let them simmer as _softly as possible_, but without ceasing, from an hour and a quarter to an hour and a half. If dressed with great care, which they require, they will be equally tender, easy of digestion, and nutritious; and being at the same time free from everything which can disagree with the most delicate stomach, the receipt will be found a valuable one for invalids. The mutton should be of good quality, but the excellence of the dish mainly depends on its being _most gently stewed_; for if allowed to boil quickly all the gravy will be dried up, and the meat will be unfit for table. The cutlets must be turned when they are half done: two or three spoonsful of water or gravy may be added to them should they not yield sufficient moisture; or if closely arranged in a single layer at first, water may be poured in to half their depth. The advantage of this receipt is, that none of the nutriment of the meat is lost; for that which escapes from the cutlets remains in the gravy, which should all be served with them: any fat which may be perceived upon it should be carefully skimmed off. Cold broth used for it instead of water will render it extremely good.

1-1/4 to 1-3/4 hour.

TO BROIL MUTTON CUTLETS. (ENTRÉE.)

These may be taken from the loin, or the best end of the neck, but the former are generally preferred. Trim off a portion of the fat, or the whole of it, unless it be liked; pepper the cutlets, heat the gridiron, rub it with a bit of the mutton suet, broil them over a brisk fire, and turn them often until they are done; this, for the generality of eaters, will be in about eight minutes, if they are not more than half an inch thick, which they should not be. French cooks season them with pepper and salt, and brush them lightly with dissolved butter or oil, before they are laid to the fire, and we have found the cutlets so managed extremely good.

Lightly broiled, 7 to 8 minutes. Well done, 10 minutes.

Obs.—A cold Maître d'Hôtel sauce may be laid under the cutlets when they are dished; or they may be served quite dry, or with brown gravy; or with good melted butter seasoned with mushroom catsup, cayenne, and chili vinegar or lemon-juice.

CHINA CHILO

Mince a pound of an undressed loin or leg of mutton, with or without a portion of its fat; mix with it two or three young lettuces shred small, a pint of young peas, a teaspoonful of salt, half as much pepper, four tablespoonsful of water, from two to three ounces of good butter, and, if the flavour be liked, a few green onions minced. Keep the whole well stirred with a fork over a clear and gentle fire until it is quite hot, then place it closely covered by the side of the stove, or on a high trivet, that it may stew as softly as possible for a couple of hours. One or even two half-grown cucumbers, cut small by scoring the ends deeply as they are sliced, or a quarter of a pint of minced mushrooms may be added with good effect; or a dessertspoonful of currie-powder and a large chopped onion. A dish of boiled rice should be sent to table with it.

Mutton, 1 pint; green peas, 1 pint: young lettuces, 2; salt, 1 teaspoonful; pepper, 1/2 teaspoonful; water, 4 tablespoonsful; butter, 2 to 3 oz.: 2 hours. Varieties: cucumbers, 2; or mushrooms minced, 1/4 pint; or currie-powder, 1 dessertspoonful, and 1 large onion.

A GOOD FAMILY STEW OF MUTTON.

Put into a broad stewpan or saucepan, a flat layer of mutton chops, freed entirely from fat and from the greater portion of the bone, or in preference a cutlet or two from the leg, divided into bits of suitable size, then just dipped into cold water, seasoned with pepper, and lightly dredged with flour; on these put a layer of mild turnips sliced half an inch thick, and cut up into squ

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The book of hats and caps

M. Elliott

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THE BOOK

OF

HATS AND CAPS.

BY M. ELLIOTT,

(_Needlework Correspondent to The “Queen” Newspaper._)

Dedicated by permission to the Lady Marion Alford.

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[Illustration: REGISTERED

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TWO-FOLD.—Pale Blue, Pale Blue 2, Light Blue, Azuline, Royal, Navy, Grey, Buff, Flesh, Old Gold, Prune, Pink, Coral, Cardinal, Scarlet, Ruby, Cream, White and Black.

Put up in Half-ounce Balls. Boxed One Dozen Balls of a Shade.

The qualities and sorts mentioned in the following instructions are of the very best kind and make, and eminently suitable for all Knitting and Crochet purposes.

Besides these, there are other qualities and makes of Peacock Brand, as—

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WHOLESALE ONLY AT FAUDEL, PHILLIPS, & SONS', 36, 37, 38, 39, & 40, NEWGATE STREET, LONDON.

In presenting this book to the Public of useful Knitted and Crochet Articles, I wish to give a few suggestions with regard to the Wools used and the mode of washing them.

No Wool is so cheap as the best. It is false economy (I have tested it constantly) to work with inferior Wools. From a very long and tried experience I have the greatest confidence in fully recommending Peacock Qualities; they are full measure, and extra good. If washed according to the directions I give, and not washed oftener than necessary, I have no doubt of their wear. Little children's knitted garments should always be washed in the nursery, or at home. The following is an admirable method; but, where it can be done, all Knitting and Crochet should be "blocked" to dry. The "block" is a piece of evenly-planed hard wood—generally box-wood—cut the size and shape of the garment. In some cases the blocks are earthenware. Little feet, and models of children's legs and feet, can be procured in nearly all sizes. The work, when washed and wringed, but not wrung, must be drawn on the blocks and left to dry quickly in a warm place.

TO WASH WOOL.

All fine Shetland, or other finely-combed and spun Wools, should be washed in a lather of bran—_no_ soap, unless very dirty. A gallon of boiling water should be poured over 1 lb. of bran, and the two stirred well together in a boiling state for five or six minutes; leave it in a pancheon or basin all night; in the morning pour off the water, make it lukewarm, wash your work in it, then rinse in lukewarm clean soft water and block till dry. Where you have not a block, cover a board with a clean cloth and pin the work out to dry. If the work is much soiled, take a little transparent soap (it is the most free from all injurious matters), mix into a lather in a little warm water, and gently wash the work in the lather (on no account rub the work with soap), rinse in cold water, and block.

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_No. 1._

[Illustration: Tam o’Shanter cap]

TAM O’SHANTER CAP.

Knitted, for a Man.

You require 2 ozs. Navy Blue Eider Wool, ½ oz. Scarlet Single Berlin for the Tuft, 9 needles, No. 15 for a very tight knitter, No. 16 for a loose knitter. The cap knitted by these directions measured 12 stitches to the inch, laid perfectly flat, with no stretching whatever.

Cast 4 stitches on to one needle. Knit these off on to 4 separate needles, using a 5th, and work in rounds.

1st row—Knit plain.

2nd row—Knit 2 stitches on each of the 4 needles. You work these by knitting 2 in each stitch: knit the stitch, and before taking it from the left needle put the right needle between the two threads on the left needle, take up the back part and knit a stitch on it. All the increasings in the work are made in this manner.

3rd row—Knit plain.

4th row—Increase in the first stitch on each needle.

5th row—Knit plain. Repeat these two rows twice more.

10th row—Increase in every 3rd stitch.

11th, 12th and 13th rows—Knit plain. Repeat these 4 rows 3 more times.

26th row—Increase in every 4th stitch.

27th, 28th, 29th and 30th rows, plain. Repeat these 5 last rows 4 times.

51st row—Increase in every 5th stitch.

52nd and 4 next rows—Knit plain. Repeat from the 51st row 5 more times.

86th row—Increase every 6th stitch. In this round mark the beginning of the round with some white thread, as it is essential to keep the rows distinct. You will have to take more needles as they fill. 7 rounds plain.

94th round—Increase every 7th stitch.

95th and 7 next rounds plain.

103rd round—Increase every 8th stitch.

104th and next 8 rounds plain.

113th round—Increase every 9th stitch. Knit 10 rounds plain.

124th round—Increase every 10th stitch. 10 rounds plain.

134th round—Increase every 11th stitch. 20 rounds plain.

164th round—Decrease by knitting 2 together every 11th and 12th stitches. 10 rounds plain.

175th round—Knit together every 10th and 11th stitches. 9 rounds plain.

185th round—Knit together every 9th and 10th stitches. 9 rounds plain.

193rd round—Knit together every 8th and 9th stitches. 8 rounds plain.

201st round—Knit together every 7th and 8th stitches. 7 rounds plain.

208th round—Knit together every 6th and 7th stitches. 6 rows plain.

You now rib in alternate stitches of knit 1, purl 1, knitting each stitch from the back of the loop, 30 rows, and cast off.

The work must now be flattened, and shaped. Cut a round of stiff cardboard slightly larger than the work, put the work on the board and damp it, leave it on the board until it is quite dry. You line it with thin silk, and add the tuft.

The Tuft is made by winding the scarlet wool over card. Take a piece of card, 1½ in. wide—it must be smooth and strong—double over it a piece of fine wire the length of the card. Over the wire and the card wind the wool until the whole is wound, take the ends of the wire and twist the wool firmly and strongly together with it, slip the wool off the card; this makes a firm, compact tuft. You cut the top open, cut it level with sharp scissors, and sew into the middle of the hat.

_No. 2._

TAM O'SHANTER in Crochet.

Work with two contrasting colours of the Peacock A. A. Fingering, one skein of each, and a fine bone crochet hook, No. 12. Make a chain of 8, with one colour only, unite.

2nd row—Work in double crochet.

3rd row—Work 2 double crochet in every stitch.

4th row—Work each stitch in alternate colours, passing the wool at the back from one to the other, and increase in every 3rd stitch.

5th row—Plain.

6th row—Increase every 3rd stitch.

7th and 8th rows—Plain.

9th row—Increase every 3rd stitch.

10th and 3 next rows—No increasings. Repeat these 5 rows 5 more times.

34th row—Increase every 6th stitch. 4 rows plain. Repeat these 5 rows until your work measures 16 inches across, work 10 more plain rounds, and from that round begin to decrease every 6th stitch. This is done by taking up the 1st on the needle, then the 2nd, and working the two as one. Four rounds plain; repeat these 5 rounds until your work from the last of the 10 plain rounds measures 4½ inches. You then take up the stitches on 5 knitting needles, and knit 20 rounds, with one colour only, of 1 purl, 1 plain, and cast off.

The Cap should be lined, and a tuft made in the same manner as directed in the receipt for a Knitted Cap.

_No. 3._

[Illustration: Jack Tar cap]

JACK TAR, for a Man.

In imitation of Plush.

In some of our shops this shape is wrongly sold as the Tam O'Shanter; that shape is much larger, and the _under_ part much deeper than the Jack Tar.

This Cap has a very soft appearance, and is light and warm. For a fancy dress use light pink, blue, or cream; for general winter wear, maroon or dark grey. You will require 5 oz. of Peacock Fingering and a No. 12 hook: about the same quantity of Peacock Lady Betty, and more if Fleecy is used. If the work is _combed_ after it is finished, the Fleecy should be used, as it wastes the wool.

Make a chain of 40 stitches.

1st row—Double crochet.

2nd row—Put the hook in the 1st stitch, wind the wool over the hook and round the 1st finger of the left hand twice, draw the loops on the needle through the double crochet loop, and finish as usual. Work the whole row in this manner.

3rd row—Turn and work in single crochet.

These two rows are worked throughout; repeat them twice more. They will be called _one_ row in the remainder of the directions.

6th row—Work 8 stitches, turn, work back.

7th row—Work 8, and 4 more on the last long row, turn, work back.

8th row—Work 12, and 4 more, turn, work back. Work in this manner until all are raised, then work 3 more whole rows, working the 40 stitches. Repeat from the 6th row until the work lies flat on the table and meets easily. You will have to repeat it 9 more times according to some workers, perhaps more with a tight worker. When the top is finished and joined together, you work round the outside edge of the work 6 rounds of loop crochet, work round and round, and work 1 stitch on the stitch of the preceding row, always taking up the two edges of the stitch.

You now decrease for the under rim; this is not very wide, the whole depth not being more than 1 inch. If the hat is being made as a special fit, take the measure of the head, then measure the work, and decrease gradually to the exact size; 6 rows of decreasings only are required. For an ordinary hat, work for 6 rounds every 5th and 6th stitches as one. After these rounds, you work 12 rounds of plain double crochet for the head. The name of the wearer or a ship should be crocheted into the band.

The letters should be drawn out on a piece of point paper; this is divided into little squares 1-16th of an inch in size. Then you take a coloured wool; each square represents a stitch, the letters are worked in red or gold, in double crochet, by simply passing the wool used as the ground at the back of that used for the letters. It makes a better effect to work the letters by putting the needle into the stitch, pull the wool through, the wool on the needle, put the needle into the same stitch again, and draw through the wool on the needle and through all the loops on the needle. This stitch raises the work.

You must next cut the loops of wool open and trim them neatly with a sharp pair of scissors, and you have an exact imitation of fur.

The crochet work of the hat is now finished. Quilt a lining and sew in the head. Cut a piece of lining muslin, 3 doubles, for the brim (or a piece of leather), sew inside the 12 rows of crochet for the head, and add strings at the back.

A tassel of silk is made in the same way as the tuft, and placed in the middle of the crown.

_No. 4._

[Illustration: Dundee Bonnets]

DUNDEE BONNET.

Knitted in red and black Victoria yarn, or any other mixture; black Head-piece in crochet; a crochet-hook, No. 14.; six needles, No. 14.

Make a chain with the crochet-hook, working rather tightly, that will measure 22 inches. On this work a row of single crochet, thus, * the needle in the next stitch, draw the wool through and through the loop on the hook; repeat from *, at the end of the chain join to the first double crochet. On this foundation work very tightly, 12 rows of crochet. Work each row with the same stitch.

1st row of Head-piece—The wool on the needle, insert in the next stitch; draw the wool through, and then through the three stitches on the needle. When the 12 rows are finished, take up all the stitches on five knitting needles, an equal number on each; knit with the sixth. The 1st needle is the first half of the back; the 2nd, the side; the 3rd, the front; the 4th needle, the second side; the 5th, the last half of the back. Knit plain to the middle of the 4th needle, turn, purl the stitches to the middle of the 2nd needle, turn, slip the first, * knit 1, purl 1; repeat from * to the middle of the 4th needle, and increase in every 8th stitch; knit 4 stitches less on the 4th needle than you did before, * turn, purl the purled stitch of last row, knit the knitted, and leave 4 less at the end of this half-round. Repeat from *, increasing every 7th stitch in every 3rd row, and leaving 3 stitches instead of 4, as in the first repetition, then 2

stitches each repetition, until you have one quarter of the stitches left on the 3rd needle. You must now work all these stitches, and, as you take up each set of two, work an extra one on the side of the last, between it and the first of the two next; knit the whole round, increasing on the remainder of the 4th, 5th, 1st and 2nd needles, every 6th stitch. Work the increasings by knitting 2 in one stitch, as directed in the pattern, No. 1.

You must now knit in rounds, and increase every alternate round in the 6th stitch until the knitting at the back measures 1½ inches above the band. The front must be 5½ inches deep; it will require some more shaped rows, therefore, before you work the last 6 rounds of the back. Work on the 2nd, 3rd and 4th needles as many more half-rows, repeating the directions, until you have the right depth.

You now work the 6 rounds to finish the Head-piece, increasing every 6th stitch in _each alternate round_.

You next work 18 rounds with no decreasings; then decrease for the crown.

The knitting, according to the work from which this is written, measured 36 inches in circumference. Make a decreasing every 16th and 17th stitch by knitting those two stitches together; the 2nd and 3rd rounds no decreasings. Knit in this manner until there are only 10 stitches on the needle, cast these off with a row of double crochet, make a rosette, and place in the centre; add ribbons behind. Line the head with silk, and the band with thin leather or double linen.

_No. 5._

[Illustration: Bicycling Or Patrol Cap]

BICYCLING OR PATROL CAP.

Crocheted with Andalusian wool, and a fine bone crochet hook; a knot of fine mohair cord, or very fine black bobbin cord; the former is the best for use. The whole of the crochet is worked over this cord, which gives a raised appearance, and makes the shape better.

Make a chain of 4, unite, draw the cord through the chain, loop it securely over the cord and chain; work 8 double crochet. The cord must, throughout the work, be held in its place by the finger and thumb of the left hand, keeping it at the edge of the row, underneath and behind the needle.

2nd round—In the 8 double crochet work 16 treble. Take up all the stitches through _both_ loops, or your work will not have the ribbed appearance it should have.

3rd round—Work 2 treble in every stitch.

4th and successive rounds—Work round and round, increasing to keep the work flat, until you have 15 rounds. You now commence the band round the hat. In the first round you must slightly tighten together the cord, as well as in succeeding rounds, to keep it the right shape; work 9 rounds for this head-band, and finish with 2 of double crochet. You then line with black linen, and sew in a piece of leather. Work a small round of crochet to cover a button for the centre, and make a crochet rosette to go round it.

The Rosette.

Make a chain of 8, unite.

In this work 1 chain, 1 double crochet, 8 times.

2nd round—1 double crochet in the first chain, *2 treble on the double crochet, 1 double crochet in the next chain; repeat from *.

3rd round—1 double crochet on the double crochet, * 5 treble on the 2 treble, 1 double crochet on the next double crochet, repeat from *. Take the cord and work it round the next row.

4th round—* 1 double crochet on the double crochet, 2 treble on the 1st treble, 1 long on the 2nd, 2 double long on the 3rd, 1 long and 1 treble on the 4th, 1 treble on the 5th; repeat from *.

6th round—1 single on each stitch of last row. This is laid on the middle of the hat and the button placed in the centre.

_No. 6._

TARBUCH

In black netting silk and gold thread.

The Tarbuch is taken from one worked in Egypt, and is the correct shape. It is worked with very fine purse silk, twelve skeins; Japanese or Chinese gold thread, the finest size, wind this in balls; a fine crochet hook. The pattern consists of a star in the centre of the crown: this star has 10 divisions, a border of vine leaves round the edge, and powdered ground.

Commence the crown with black silk, with a chain of 4, unite; in this work 10 double crochet.

2nd round—In every stitch of last round work 1 black and 1 gold. In working with two colours you should knot the two threads together in beginning, and throughout the work hold both evenly over the same finger of the left hand, then, as you proceed, keep the thread _not_ in use in regular rotation over and under the thread in use; by this means you work them in. Care must be taken _never_ to completely finish a stitch with the one colour; if it _is_ done you have _two_ stitches of the colour and throw the pattern wrong. In this 2nd round put the needle into the stitch, draw through the _black_ silk, take up the _gold_ and finish the stitch; take up the next stitch with gold, finish it with black. You have now two distinct stitches.

3rd round—1 black on the black, 2 gold on the 1 in last round.

4th round—1 black on the black, 3 gold on the 2 in the last round.

5th round—1 black on the black, 4 gold on the 3 underneath.

6th round—1 black on the black, 5 gold on the 4 underneath.

7th round—1 black on the black, 6 gold on the 5 underneath.

8th round—1 black on the black, 7 gold over the 6.

9th round—1 black on the black, 8 gold over the 7.

10th round—1 black on the black, 9 gold over the 8.

11th round—1 black on the black, 10 gold over the 9.

12th round—1 black on the black, 11 gold over the 10.

13th round—1 black on the black, 12 gold over the 11.

14th round—1 black on the black, 13 gold over the 12.

15th round—1 black on the black, 14 gold over the 13.

16th round—1 black on the black, 15 gold over the 14.

17th round—2 black on the 1st black, * 14 gold over 14 gold, 1 black on the 15th, 2 black on the next black; repeat from *.

18th round—5 black over the 3 black, 13 gold over 13 gold.

19th round—Care must be taken to make the gold begin exactly on the same stitch in each division, as the right-hand side of each must be even, one less worked each row on the left side. 3 black, 1 gold, 3 black over the 3 black and the last gold; 12 gold over the 12 gold.

20th round—Over the 13th gold and 7 black work 9 black, 11 gold over 11.

21st round—10 gold over 10, on the last gold and the black work 11 black.

22nd round—9 gold over 9, 2 black, 1 gold, 7 black, 1 gold, 2 black, over the 11 and last.

23rd round—8 gold over 8, 15 black over the 13 black and 1 gold.

24th round—7 gold over 7, 17 black over the 15 and last gold.

25th round—6 gold over 6, 9 black, 1 gold, 9 black over the black.

26th round—5 gold over 5, 21 black over the black.

27th round—4 gold over 4, 23 black over 21 underneath.

28th round—3 gold over 3, 8 black, 1 gold, 7 black, 1 gold, 8 black, over the black.

29th round—2 gold over 2, 27 black.

30th round—1 gold over 1, 30 black.

31st round—On the point of the star (the one gold stitch) work 2 with black; on the next black work 7 black, 1 gold, 7 black, 1 gold, 7 black, 1 gold, 7 black; then repeat with 2 on the next gold.

32nd round—Between each point increase 3 stitches, and work entirely with black.

33rd round—Black, and no increasings.

34th round—You work 1 gold exactly between the 1st gold stitch in the 31st round and the point, then 7 black, 1 gold, repeating all round.

35th and 36th rounds—Black; repeat from 34th round 5 more times. In the last plain row work an extra stitch every 23rd stitch.

52nd round—* 8 black, 1 gold, 7 black, 1 gold, 7 black, 1 gold, 7 black, 1 gold; repeat from *.

53rd and 54th rounds—Repeat these 3 rounds twice more; increase until you have 360 stitches, which will bring you to the part for the border. Work a row of black double crochet, and begin

The Border.

1st round—2 black, 3 gold, * 12 black, 3 gold, repeat from *; end the round with 10 black.

2nd round—6 gold, 8 black, * 7 gold, 8 black, repeat from *; end the round with 1 gold.

3rd round—4 black, 3 gold, * 4 black, 4 gold, 4 black, 3 gold, repeat from *, and end the round with 4 gold.

4th round—* 7 gold, 3 black, 3 gold, 2 black, repeat from *.

5th round—2 gold, * 4 black, 1 gold, 3 black, 2 gold, 1 black, 4 gold, repeat from *, and end the round with 2 gold.

6th round—1 gold, * 7 black, 3 gold, 1 black, 4 gold, repeat from *; end the round with 3 gold.

7th round—* 8 black, 2 gold, 1 black, 4 gold, repeat from *.

8th round—* 9 black, 4 gold, repeat from *, and end the round with 2 black.

9th round—* 5 gold, 2 black, 2 gold, 1 black, 2 gold, 3 black, repeat from *.

10th round—1 gold, * 3 black, 3 gold, 6 black, 3 gold, repeat from *; end the row with 2 gold.

11th round—* 6 black, 3 gold, 2 black, 3 gold, 7 black, repeat from *, and end the round with 1 black.

12th round—* 2 gold, 1 black, 2 gold, 3 black, 4 gold, 2 black, 3 gold, 1 black, repeat from *; end round with 1 gold.

13th round—3 black, 4 gold, * 11 black, 4 gold, repeat from *, and end with 8 black.

14th round—1 black, * 2 gold, 1 black, 4 gold, 8 black, repeat from *, and end with 7 black.

15th round—1 black, 3 gold, * 1 black, 4 gold, 7 black, 3 gold, repeat from *; end the round with 6 black.

16th round—3 black, * 2 gold, 2 black, 3 gold, 4 black, 1 gold, 3 black, repeat from *, and end the round with 1 gold.

17th round—3 black, 4 gold, * 2 black, 6 gold, 3 black, 4 gold, repeat from *; end with 1 gold.

18th round—* 4 black, 5 gold, 3 black, 3 gold, repeat from *.

19th round—7 black, * 7 gold, 8 black, repeat from *.

20th round—10 black, * 4 gold, 11 black, repeat from *, and end the round with 1 black.

21st, 22nd and 23rd rounds—Black.

24th round—* 7 black, 1 gold, repeat from *.

25th round—* 5 black, 3 gold, repeat from *.

26th and 27th rounds—Gold only, and fasten off.

This completes the Cap. It should, properly speaking, be put upon a block; this may be made of cardboard. Line the Cap through with a blue satin lining, gathering it in at the top and sew over neatly with a large button covered with satin. This must not be sewn in until the tassel is passed through.

The Tassel.

Wind the netting silk round a piece of cardboard 5 inches long, wind a sufficient quantity to make it look handsome. Under the silk pass a doubled length, and tie it all together very tightly, slip it off the card, and wind two thicknesses of silk firmly over the tied end for the depth of three-quarters of an inch, leave an end about half a yard long, thread a strong needle with this end, pass it through the tassel, under the silk wound over, and bring the needle out at the top; make a firm chain of about 2 inches long with this silk.

You next crochet a covering for the top of the tassel. This is worked in double crochet. Begin with 5 chain, work 7 double crochet on it, on the 7 double crochet work 10, on the 10 work 14, and increase until it will fit tightly over the silk you have wound over; work the depth to cover the winding, sew it down strongly. Pass the chain through the foundation chain of the cap, and sew very securely.

_No. 7._

[Illustration: Fisherman’s Cap]

FISHERMAN’S CAP, for a Man.

One oz. of dark red, one oz. of gold wool.

These Caps should be knitted in stripes to suit the Jersey, jacket, or shirt of the wearer. They are knitted in Merino wool, or 2-fold Ice silk, on No. 17 needles. On a Lamb’s knitting machine use the finest red silk; knit the Cap the full length in stripes; then, on each side and in the middle, decrease until you come to a point; sew this together, and the hat is made.

To knit the Cap with the wool or silk named, cast on on 4 needles 260 stitches with red wool, knit 16 rounds; change, take the gold, knit 16 rounds. Knit 16 stripes in this manner, 8 of red, 8 of gold, then begin to decrease for the top.

Black stripe—Knit 2, knit 2 together, knit 57, knit 2 together, knit 4, knit 2 together, knit 57, knit 2 together, knit 4, knit 2 together, knit 57, knit 2 together, knit 4, knit 2 together, knit 57, knit 2 together, knit 2.

Knit 3 rounds plain.

5th round—Knit like the first row in the black stripe, but with 55 stitches between, instead of 57. Work in this manner, with 3 plain rounds between each round of decreasing, until you have 41 stitches between each set of decreasings, then decrease every 3rd round until you have only 27 on the needle between the decreasings; after that, decrease every alternate round until the decreased stitches come close together; you then * knit 2, knit 2 together, all round; repeat from *. In the next round knit 1, * knit 3 together, knit 2, repeat from *; then decrease by knitting 2 together every stitch until you have a point. Make a tassel of the two colors, and sew on to the point. Hem up the foundation round inside the work, folding the knitting evenly in the middle of the third black stripe.

* * * * *

This Cap can, of course, be knitted in any material; the finer the wool, the more suitable. The size must be determined by measuring the head; knit a small piece of knitting of 20 stitches square with the materials you intend to use, and measure this with a tape measure. A simple multiplication of the number of stitches you have in an inch will enable you at once to cast on the required number of stitches, then work as directed. A very handsome Cap is made by using a combination of colors. Commence with black, ¼-inch, 3 rounds of red, 1 of gold, 2 of blue, 1 of gold, 2 of red, 3 of gold, 2 of red, 1 of gold, 5 of blue, 1 of gold, 2 of red, 3 of gold, 2 of red, 1 of gold, 2 of blue, 1 of gold, 3 of red, 20 of black, then commence the red again for one or two more stripes, and work the remainder of the Cap in one color, or continue it in stripes.

_No. 8._

[Illustration: Football Cap]

CAP, TURBAN-SHAPE, FOR FOOTBALL, Etc.

Crocheted with Japanese Silk, using black and gold, or any of the colours required for clubs. You require a ball of gold Japanese silk, one of black, a steel crochet needle, No. 12.

With the black make a chain of 3, unite, work round and round, increasing to keep flat, until you have 32 stitches.

Take the gold silk, work 2 rounds of double crochet; turn.

3rd round—In the 1st stitch work * 2 double crochet, 1 in the 2nd, take up the 2nd double crochet in the 1st of these 3 rounds, work 4 treble in it, join the 1st and 4th of these long stitches together by a single; repeat from *. Work 2 stitches in every stitch after the treble stitches.

4th and 5th rounds—Black, double crochet, increasing to keep the work flat.

6th and 7th rounds—Gold silk, double crochet, increasing as necessary.

8th round—Like the 3rd round. Work in this manner until you have 7 rounds of raised work, which will make the cap the right shape; it should be 6½ to 7 inches in diameter. Then continue the same with no decreasings for the band round the head; you require 4 rows of patterns for this. Finish the work with 2 rounds of black silk. Line the cap, add a piece of leather round the edge, and put a button, covered with double crochet worked in gold silk, in the centre.

For a Smoking Cap this shape, add a silk tassel, to hang down over the side.

_No. 9._

FOOTBALL CAP.

Crocheted in Japanese Silk or Eider Wool; Crochet hook, No. 12; 3 balls of silk, or 1½ oz. of wool.

Make a chain of 3, unite, in this work 6 double crochet.

2nd round—Work 12 double crochet.

3rd round—* Insert the needle in the next stitch, draw the thread through the thread round the needle, draw through the same loop again, the thread on the needle, draw through all the loops on the needle; repeat from * for each stitch. Work the round, and make 2 stitches in every 3rd stitch of the round underneath.

4th round—Work the same stitch as last round, and in each successive round, but work _between_ the stitches of the previous round. The work must be kept rather tight. Increase every 5th stitch.

5th round—No increasings.

Work in this manner, increasing gradually, until the work is nearly 7 inches across. This will allow the size to be just under 21 inches; about 22½ is a usual size in hats. The brim of the hat is increased very gradually indeed. Work 4 rounds with no increasings; in the next, divide the work into quarters; work an extra stitch in beginning each quarter; and do the same every 3rd round, which will give the brim the desired slope. When you have worked the top, work round and round, with no increasings, for 6

rounds; then take the contrasting colour and work 1½ inches of it; fasten off. Work another small round of the same stitch in this colour, cover a large button or curtain ring with it, and place at the top of the cap. Line the crown and sides with black silk, and sew a piece of leather, 3 inches deep, round the rim.

Transcriber’s Notes

pg 18 Changed an unknown symbol to an asterisk at beginning of line: * knit 1, purl 1; repeat from * to the middle of the 4th needle

pg 23 Changed: knot the two threads together in begining to: knot the two threads together in beginning

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Family fare

Unknown

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Transcriber’s Note Italic text displayed as: _italic_ Bold text displayed as: =bold=

FAMILY FARE food management and recipes

U.S. DEPARTMENT OF AGRICULTURE · HOME AND GARDEN BULLETIN NO. 1

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FAMILY FARE

food management and recipes

[Illustration Styled chicken and food scale]

Whether you are just learning the skills of food management and good cooking or are an experienced hand in the kitchen, this booklet—prepared by USDA food and nutrition scientists—can serve you well.

It combines good eating and good nutrition. It packs the results of years of food and nutrition research into a ready handbook for everyday use. It tells how to get the nutrients you need from a variety of foods—then translates this knowledge into taste-tested recipes and well-balanced meals.

Feeding your family well takes less time and work than it used to. Today’s foods can have built-in convenience. Meals can be more varied because more food choices are available.

* * * * *

In this publication you’ll find—

• A daily food guide—a simple, workable presentation of the kinds and amounts of foods to have each day.

• Tips on meal planning.

• Helpful information on buying, storing, measuring, and using foods.

• A selection of recipes—main dishes, vegetables, salads, soups, sauces, breads, sandwiches, desserts—plus variations of some of these recipes.

• Menu suggestions.

• A list of cooking terms.

NUTRITION....

Food At Work For You

Nutrition is the food you eat and how the body uses it.

People differ in how much they want to know about nutrition, but everyone needs to know a few facts about food and health as a basis for selecting the foods to eat.

You need food to get energy for work and play, to move, to breathe, to keep the heart beating—just to be alive. Children and youths need energy from food for growth.

Food also provides a variety of substances—nutrients—that are essential for the building, the upkeep, and the repair of body tissues, and for the efficient functioning of the body.

Everyone needs the same nutrients throughout life but in different amounts. Proportionately greater amounts are required for the growth of a body than just for its upkeep. Boys and men need more energy and nutrients than girls and women. Large people need more than small people. Active people require more food energy than inactive ones. People recovering from illness need more than healthy people.

You and your family can get all the nutrients you need from foods, but no one food contains all the nutrients in the amounts required for growth and health. Only a variety of different kinds of foods will supply all you need.

A guide to eat by

Nutrition scientists have translated knowledge of the nutrient needs of people and the nutritive values of foods into an easy-to-use guide for food selection.

This Daily Food Guide, on pages 4 and 5, sorts foods into four groups on the basis of their similarity in nutrient content. Each of the broad food groups has a special contribution to make toward an adequate diet.

Here are some of the reasons different food groups are emphasized in the guide and the names of some of the nutrients these foods provide.

Meat, poultry, fish, and eggs from the _meat group_ and their alternates—dry beans, dry peas, and nuts—are valued for their protein. This is needed for the growth and repair of body tissues—muscle, organs, blood, skin, and hair. These foods also contribute iron and the B-vitamins—thiamine, riboflavin, and niacin.

Vegetables and fruits from the _vegetable-fruit group_ are valuable sources of vitamins and minerals. In the guide, this group is counted on to supply most of the vitamin C and a large share of the vitamin A value in the diet. Choices are directed toward the citrus fruits and some other foods that are among the better sources of vitamin C; and toward the dark-green and deep-yellow ones for vitamin A value.

Vitamin C is needed for healthy gums and body tissues. Vitamin A is important for growth, normal vision, and a healthy condition of the skin and other body surfaces.

Foods from the _milk group_ are relied on to meet most of the calcium needs for the day. Milk is the leading source of the mineral calcium, which is needed for bones and teeth.

Milk also provides protein, riboflavin, vitamin A, and many other nutrients. Cheese and ice cream also supply these nutrients, but in different proportions.

The _bread-cereal group_, with its whole-grain and enriched bread and other cereal products, furnishes important amounts of protein, iron, several of the B-vitamins, and food energy.

Fats, oils, sugars, and sweets are not emphasized in the guide because they are common in every diet. Some of the fats and oils provide certain of the vitamins, and some furnish essential fatty acids, but the chief nutritional contribution of these foods is energy value.

How to use the guide

Homemakers who follow the guide will find it flexible enough to use in choosing foods for families.

Food choices within the groups are wide enough to allow for a variety of everyday foods. Meals can be planned to include family favorites, foods in season, and foods to fit the family budget.

The size of servings can be suited to the needs of family members—small servings for children and for those wanting to lose weight; extra large servings (or seconds) for very active adults, teenagers, and those wanting to gain weight. Pregnant and nursing women also need more food.

Foods from the Daily Food Guide fit easily into a three-meals-a-day pattern of eating. Foods from each group often appear in each meal—but this isn't essential. The important thing is that the suggested number of servings from each food group be included sometime during the day.

Many people want and need more food than the minimum servings suggested from the four food groups. To round out meals and satisfy appetites, you can include additional foods from the four groups as well as other foods not listed in these groups.

A Daily Food Guide

MEAT GROUP

Foods Included

Beef; veal; lamb; pork; variety meats, such as liver, heart, kidney.

Poultry and eggs.

Fish and shellfish.

As alternates—dry beans, dry peas, lentils, nuts, peanuts, peanut butter.

Amounts Recommended

Choose 2 or more servings every day.

Count as a serving: 2 to 3 ounces of lean cooked meat, poultry, or fish—all without bone; 2 eggs; 1 cup cooked dry beans, dry peas, or lentils; 4 tablespoons peanut butter.

VEGETABLE-FRUIT GROUP

Foods Included

All vegetables and fruits. This guide emphasizes those that are valuable as sources of vitamin C and vitamin A.

Sources of Vitamin C

Good sources.—Grapefruit or grapefruit juice; orange or orange juice; cantaloup; guava; mango; papaya; raw strawberries; broccoli; brussels sprouts; green pepper; sweet red pepper.

Fair sources.—Honeydew melon; lemon; tangerine or tangerine juice; watermelon; asparagus tips; raw cabbage; collards; garden cress; kale; kohlrabi; mustard greens; potatoes and sweetpotatoes cooked in the jacket; spinach; tomatoes or tomato juice; turnip greens.

Sources of Vitamin A

Dark-green and deep-yellow vegetables and a few fruits, namely: Apricots, broccoli, cantaloup, carrots, chard, collards, cress, kale, mango, persimmon, pumpkin, spinach, sweetpotatoes, turnip greens and other dark-green leaves, winter squash.

Amounts Recommended

Choose 4 or more servings every day, including:

1 serving of a good source of vitamin C or 2 servings of a fair source.

1 serving, at least every other day, of a good source of vitamin A. If the food chosen for vitamin C is also a good source of vitamin A, the additional serving of a vitamin A food may be omitted.

The remaining 1 to 3 or more servings may be of any vegetable or fruit, including those that are valuable for vitamin C and for vitamin A.

Count as 1 serving: ½ cup of vegetable or fruit; or a portion as ordinarily served, such as 1 medium apple, banana, orange, or potato, half a medium grapefruit or cantaloup, or the juice of 1 lemon.

MILK GROUP

Foods Included

Milk—fluid whole, evaporated, skim, dry, buttermilk.

Cheese—cottage; cream; Cheddar-type, natural or process.

Ice cream.

[Illustration: Dairy products]

Amounts Recommended

Some milk every day for everyone.

Recommended amounts are given below in terms of 8-ounce cups of whole fluid milk:

Children under 9 2 to 3 Children 9 to 12 3 or more Teen-agers 4 or more Adults 2 or more Pregnant women 3 or more Nursing mothers 4 or more

Part or all of the milk may be fluid skim milk, buttermilk, evaporated milk, or dry milk.

Cheese and ice cream may replace part of the milk. The amount of either it will take to replace a given amount of milk is figured on the basis of calcium content. Common portions of cheese and of ice cream and their milk equivalents in calcium are:

1-inch cube Cheddar-type cheese = ½ cup milk ½ cup cottage cheese = ■ cup milk 2 tablespoons cream cheese = 1 tablespoon milk ½ cup ice cream = ¼ cup milk

BREAD-CEREAL GROUP

Foods Included

All breads and cereals that are whole grain, enriched, or restored; _check labels to be sure_.

Specifically, this group includes: Breads; cooked cereals; ready-to-eat cereals; cornmeal; crackers; flour; grits; macaroni and spaghetti; noodles; rice; rolled oats; and quick breads and other baked goods if made with whole-grain or enriched flour. Bulgur and parboiled rice and wheat also may be included in this group.

[Illustration: Bread products]

Amounts Recommended

Choose 4 servings or more daily. Or, if no cereals are chosen, have an extra serving of breads or baked goods, which will make at least 5 servings from this group daily.

Count as 1 serving: 1 slice of bread; 1 ounce ready-to-eat cereal; ½ to ¾ cup cooked cereal, cornmeal, grits, macaroni, noodles, rice, or spaghetti.

OTHER FOODS

To round out meals and meet energy needs, almost everyone will use some foods not specified in the four food groups. Such foods include: unenriched, refined breads, cereals, flours; sugars; butter, margarine, other fats. These often are ingredients in a recipe or added to other foods during preparation or at the table.

Try to include some vegetable oil among the fats used.

Maintaining desirable weight

It is best to maintain desirable weight for one's height at all ages, even during childhood. Here are two principles that you can use—

• Reduce food intake as you become less active. Exercise and activity use up energy—or calories. If you cut down activity but not food, you are providing more energy than the body needs. The excess is stored as fat.

• Reduce food intake as you—as an adult—get older. As adults grow older, less energy is needed to keep the body functioning.

To reduce food intake without shortchanging the body of essential nutrients, follow the pattern of choices suggested by the Daily Food Guide. Weight watchers need the same types of food for health as everyone else. Crash diets and food fads are not the answer and may be dangerous to health.

Cut down on food, but don't cut out any important kinds of foods.

Snacks are counted as a part of the day's total food. Sensible snacking can help meet nutritional needs, but indiscriminate eating between meals usually leads to more calories than are wanted, less of some nutrients than are needed.

Specific information on controlling weight is given in Home and Garden Bulletin 74, "Food and Your Weight." It includes basic weight-control facts, suggestions for reducing or gaining weight, meals and menus, and calorie values of common foods.

Tips on meal planning

Keep these points in mind when you plan meals for your family:

• Include a variety of foods each day and from day to day. Introduce a new food from time to time.

• Vary flavors and textures. Contrast strong flavor with mild, sweet with sour. Combine crisp textures with smooth.

• Try to have some meat, poultry, fish, eggs, milk or cheese at each meal.

• Make a collection of nutritious recipes that the family enjoys and serve them often.

• Brighten food with color—a slice of red tomato, a sprig of dark greens, or other garnish.

• Combine different sizes and shapes of food in a meal, when possible.

Servings and Pounds

If you are a thrifty food shopper, you learn to buy the kinds and amounts of food that your family will use—with a minimum of waste. To avoid waste and to make the most of your food dollar, you also need to know how many servings you get from a market unit, such as 1 pound of fresh carrots or a 10-ounce package of frozen peaches.

Information in this section can help you decide how much to buy to feed your family.

The amount of meat, poultry, and fish to buy varies with the amount of bone, fat, and breading.

Meat, poultry, and fish

Servings per pound[1] =MEAT= Much bone or gristle 1 or 2 Medium amounts of bone 2 or 3 Little or no bone 3 or 4 =POULTRY (READY-TO-COOK)= Chicken 2 or 3 Turkey 2 or 3 Duck and goose 2 =FISH= Whole 1 or 2 Dressed or pan-dressed 2 or 3 Portions or steaks 3 Fillets 3 or 4

[1] Three ounces of cooked lean meat, poultry, or fish per serving.

Vegetables and fruits

For this table, a serving of vegetable is ½ cup cooked vegetable unless otherwise noted. A serving of fruit is ½ cup fruit; 1 medium apple, banana, peach, or pear; or 2 apricots or plums. A serving of cooked fresh or dried fruit is ½ cup fruit and liquid.

Servings per pound[2] =FRESH VEGETABLES= Asparagus 3 or 4 Beans, lima[2] 2 Beans, snap 5 or 6 Beets, diced[3] 3 or 4 Broccoli 3 or 4 Brussels sprouts 4 or 5 Cabbage: Raw, shredded 9 or 10 Cooked 4 or 5 Carrots: Raw, diced or shredded[3] 5 or 6 Cooked[3] 4 Cauliflower 3 Celery: Raw, chopped or diced 5 or 6 Cooked 4 Kale[4] 5 or 6 Okra 4 or 5 Onions, cooked 3 or 4 Parsnips[3] 4 Peas[5] 2 Potatoes 4 Spinach[6] 4 Squash, summer 3 or 4 Squash, winter 2 or 3 Sweetpotatoes 3 or 4 Tomatoes, raw, diced or sliced 4

[2] As purchased.

[3] Bought in pod.

[4] Bought without tops.

[5] Bought untrimmed.

[6] Bought prepackaged.

Servings per package (9 or 10 oz.) =FROZEN VEGETABLES= Asparagus 2 or 3 Beans, lima 3 or 4 Beans, snap 3 or 4 Broccoli 3 Brussels sprouts 3 Cauliflower 3 Corn, whole kernel 3 Kale 2 or 3 Peas 3 Spinach 2 or 3

Servings per can (1 lb.) =CANNED VEGETABLES= Most vegetables 3 or 4 Greens, such as kale or spinach 2 or 3

Servings per pound =DRY VEGETABLES= Dry beans 11 Dry peas, lentils 10 or 11

Servings per market unit[7] =FRESH FRUIT= Apples } Bananas } Peaches } 3 or 4 per pound Pears } Plums }

Apricots } Cherries, sweet } 5 or 6 per pound Grapes, seedless }

Blueberries } Raspberries } 4 or 5 per pint Strawberries 8 or 9 per quart

[7] As purchased.

Servings per package (10 or 12 oz.) =FROZEN FRUIT= Blueberries 3 or 4 Peaches 2 or 3 Raspberries 2 or 3 Strawberries 2 or 3

Servings per can (1 lb.) =CANNED FRUIT= Served with liquid 4 Drained 2 or 3

Servings per package (8 oz.) =DRIED FRUIT= Apples 8 Apricots 6 Mixed fruits 6 Peaches 7 Pears 4 Prunes 4 or 5

Smart Buying

Meat

Your best guides for selecting meat are the U.S. Department of Agriculture grades. Federally graded meats carry a purple grade stamp—a shield enclosing the letters “USDA” and the grade name. These stamps divide the wide range of meat quality into several groups.

Grade stamps appear on most retail beef, veal, calf, lamb, and mutton cuts. Pork is not usually graded. Some meat packers, wholesalers, and retailers use their own brand names to designate the quality levels of their products.

USDA Prime, the top grade, is used largely by hotels and restaurants. USDA Choice and USDA Good are the grades most commonly found in retail markets. USDA Standard and Commercial grades are not often sold at retail.

[Illustration:

38 U. S. INSP'D & P'S'D

U. S. INSPECTED AND PASSED BY DEPARTMENT OF AGRICULTURE EST. 38

USDA meat inspection marks.]

Another purple stamp that may appear on fresh retail meat cuts is the circular mark of Federal meat inspection (below, left). This shows that meat is inspected and passed for wholesomeness, and that it is processed under strict sanitary conditions. A round mark of Federal meat inspection (below, right) also appears on processed meat products to show they are made from wholesome meat, are processed under sanitary conditions, and are truthfully labeled. All fresh or processed meat products that are shipped from one State to another must bear a mark of Federal inspection.

Not all meat is federally inspected. Some States and cities have their own regulations for locally produced meats. However, the Wholesome Meat Act of 1967 will ultimately assure consumers that all meat is inspected by either the Federal Government or an adequate State system.

Meat and your money

At the meat counter, consider the amount of cooked lean meat you will get for the money you pay.

The prices for a pound of beef chuck roast, pork rib roast, ground beef, and beef liver may be about the same at your store. In many instances, a pound of these roasts will provide only about half as much cooked lean meat as a pound of ground beef or beef liver. The other half of the pound of roast is bone, excess fat, and drippings.

So it would take twice as many pounds—and twice as much money—to feed your family the roasts as it would the ground beef or liver, even though the price per pound is the same.

Poultry

In retail markets, ready-to-cook poultry is available chilled or frozen, whole or cut up. Processed poultry products are also on the market in canned, frozen, dehydrated, and other convenient forms.

[Illustration: USDA poultry inspection and grademarks.]

Look for both the round U.S. Department of Agriculture inspection mark and the shield-shaped grademark on the poultry you buy.

The round USDA inspection mark (above, left) means that poultry and poultry products have been officially inspected for wholesomeness, are truthfully labeled, and are not adulterated. USDA inspection is required in plants that produce poultry products for sale across State lines or in foreign trade.

The shield-shaped grademark (above, right) shows that the poultry has been officially graded for quality. Poultry must be USDA-inspected before it can be federally graded. The U.S. grades for poultry are based on meatiness, freedom from defects, and general appearance. The best grade of poultry is marked "USDA Grade A."

Chicken, turkey, duck, and goose are common forms of poultry. Guinea is available in some markets. The label may suggest suitable cooking methods and indicate the age of the poultry—for chicken: "broiler or fryer," "roaster," "stewing chicken;" for turkey: "fryer-roaster," "young hen," "young tom," "mature turkey."

Types of poultry

Broilers, fryers, roasters, capons, and Rock Cornish game hens are young chickens with tender meat. Stewing chickens, hens, and fowl are mature chickens with less tender meat. Turkeys labeled fryer-roaster or young turkey are young birds with tender meat. Most ducks are marketed young as ducklings—broilers, fryers, and roasters. Most geese and guineas are marketed as young geese and young guineas.

Ready-to-cook chickens are sold chilled or frozen—whole or cut into parts. Most ready-to-cook turkeys are marketed frozen whole, in a wide range of sizes; some are available chilled. Frozen turkey halves, quarters, or parts are sometimes available. Ducks, geese, and guineas—like turkeys—are generally marketed frozen whole. Ducklings are also available as cut-up parts.

Frozen poultry, stuffed and ready for the oven, is available in many markets. Boneless poultry roasts and rolls—so convenient—are also on the market.

Fish

Today there are about 240 commercial species of fish and shellfish marketed in the United States. They may be fresh, frozen, or canned.

Fresh fish are generally available by the pound in these forms—whole, dressed, and in steaks, fillets, and chunks. Most fish dealers will clean, dress, or fillet your fish for you. They can also tell you what fish are in season and what fish are a good buy.

Frozen fish are usually packed during the season when they are plentiful and are held in freezer storage until distributed. This means that you can buy most fish throughout the year. Frozen fish come whole, dressed, and in steaks, fillets, chunks, portions, and sticks.

Canned fish and specialty items containing fish are ready to serve or use as bought. Canned tuna, salmon, mackerel, and Maine sardines are widely available.

Market forms

Familiarize yourself with these market forms of fish:

Whole.—Fish marketed just as they come from the water. Ask your dealer to scale, eviscerate, and remove head, tail, and fins.

Dressed or pan-dressed.—Fish with scales and entrails removed, and—usually—head, tail, and fins removed. Small fish are called pan-dressed and are ready to cook as purchased. Large dressed fish may be cooked as purchased, but often are filleted or cut into steaks or chunks.

Steaks.—Cross-section slices from large dressed fish cut ■ to 1 inch thick. Steaks can be cooked as purchased.

Fillets.—Sides of the fish cut lengthwise away from the backbone. They may be skinned or the skin may be left on. Fillets are ready to cook as purchased.

Chunks.—Cross sections of large dressed fish. A cross section of the backbone is the only bone in a chunk. They are ready to cook as purchased.

Raw breaded fish portions.—Portions cut from frozen fish blocks, coated with a batter, breaded, packaged, and frozen. Raw breaded fish portions weigh more than 1½ ounces. They are ready to cook as purchased.

Fried fish portions.—Portions cut from frozen fish blocks, coated with a batter, breaded, partially cooked, packaged, and frozen. Fried fish portions weigh more than 1½ ounces. They are ready to heat and serve as purchased.

Fried fish sticks.—Sticks cut from frozen fish blocks, coated with a batter, breaded, partially cooked, packaged, and frozen. Fried fish sticks weigh up to 1½ ounces. They are ready to heat and serve as purchased.

Inspection and grading

The U.S. Department of the Interior provides an official inspection service that enables you to identify high-quality seafoods. Such products may be identified by the official USDI grade or inspection shields that appear on the label. Fishery products that display these shields have been processed under continuous in-plant inspection and have met definite quality, processing, and packaging requirements.

Eggs

Buy graded eggs in cartons at a store that keeps them in refrigerated cases. Federally graded eggs are identified with a shield-shaped grademark that indicates the quality at the time of grading. If they have been properly handled since grading, there

should be little loss in quality.

Quality.—U.S. Grade AA (or Fresh Fancy) and Grade A eggs are excellent for all purposes, but are especially good for poaching and frying where the appearance of the finished product is important. Grade B eggs are satisfactory for use in cooked dishes.

The grade of the egg does not affect its food value; lower grades are as high in nutrients as top grades. Buy either white or brown eggs. The color of the shell does not affect the nutritive value or quality of the egg.

Size.—Eggs are also classified by size according to weight per dozen. Size is independent of quality; large eggs may be of high or low quality and high-quality eggs may be of any size. Common market sizes of eggs and the minimum weight per dozen:

U.S. Extra Large—27 ounces. U.S. Large—24 ounces. U.S. Medium—21 ounces. U.S. Small—18 ounces.

The substitution of one size egg for another often makes little difference in recipe results. However, in some recipes—for example in sponge and angelfood cakes—the proportion of egg to other ingredients is very important. For these recipes, it may be necessary to increase the number of eggs if you are using a smaller size.

Fresh fruits and vegetables

Fresh fruits and vegetables are usually best in quality and lowest in cost when in season.

Whatever fruit or vegetable you are buying, look first for freshness. Pointers on selecting some fruits and vegetables follow on page 12.

Fruits

Apples.—Good color usually indicates full flavor.

Bananas.—Bananas should be firm, fresh in appearance, and unscarred. Yellow or brown-flecked ones are ready for immediate use. Select slightly green-colored bananas for use within a few days.

Berries.—Select plump, solid berries with good color. Avoid wet or leaky berries. Blackberries and raspberries with clinging caps may be underripe. Strawberries without caps may be too ripe.

Grapes.—Grapes should be plump, fresh in appearance, and firmly attached to the stems. Red or black varieties should be well colored for the variety. Most white or green varieties should have a slightly amber tone.

Melons (except watermelons).—Ripe cantaloups have a yellowish surface color; honeydews, a creamy color; crenshaws, a golden-yellow color mottled with green; casabas, a yellow color; and persian melons, a dull gray-green color. Ripe melons of these types usually have a fruity aroma and a slight softening at the blossom end. A ripe cantaloup has no stem; other melons may have stems attached.

Oranges, grapefruit, and lemons.—Choose those heavy for their size. Smooth, thin skins usually indicate more juice. Most skin markings do not affect quality. Oranges with a slight greenish tinge may be just as ripe as fully colored ones. Light or greenish-yellow lemons are more tart than deep-yellow ones.

Peaches.—Best quality peaches are fairly firm, not bruised, with yellow or red color over the entire surface.

Pears.—Some pears, especially winter varieties, are marketed when slightly underripe and need to be ripened at home—at room temperature. Pears are ripe and ready to eat when they yield slightly to moderate pressure.

Pineapples.—Pineapple varieties vary greatly in color. Ripe pineapples have a fragrant, fruity aroma. Usually, the heavier the fruit for its size, the better the quality. Avoid pineapples that have decayed or moldy spots.

Watermelons.—Ripe watermelons have a somewhat dull surface and a creamy color underneath. The interior should be fully red and firm, and should have few immature seeds.

Vegetables

Asparagus.—Stalks should be tender and firm; tips should be close and compact. Choose the stalks with little white—they are more tender. Use asparagus promptly—it toughens rapidly.

Beans, snap.—Choose slender beans with no large bumps (bumps indicate large seeds). Avoid beans with dry-looking pods.

Broccoli.—Look for small flower buds on compactly arranged heads with good green color. Avoid yellowing, soft, or spreading heads.

Brussels sprouts.—The heads should be firm with good green color. Yellowing outer leaves and softness indicate aging. Smudgy, dirty spots may indicate insect damage or decay.

Cabbage.—Choose heads that are firm and heavy. Outer leaves should be fresh, green, and free from worm-holes.

Cauliflower.—Choose heads that are compact, firm, and white or creamy white. Avoid discolored heads and those with soft spots.

Celery.—Best-quality celery is fresh and crisp. It is clean and has leaves that appear fresh; stems do not have black or brown discoloration. Avoid pithy, woody, or very stringy celery.

Corn.—Good-quality fresh corn has husks that are fresh and green. The ears are well filled with plump, firm, milky kernels. Immature ears of corn have small, undeveloped, watery kernels. Overmature ears have very firm, large, starchy kernels, often indented.

Cucumbers.—Choose firm, slender cucumbers for best quality. Avoid yellowed cucumbers and those with withered or shrivelled ends.

Lettuce (head).—Select heads that are green, fresh, crisp, and fairly firm to firm. Head lettuce should be free from rusty appearance and excessive outer leaves.

Onions (dry).—Size and color do not affect flavor or quality of dry onions. Clean, hard, well-shaped onions with dry skins are usually of good quality. Moisture at the neck may be a sign of decay. Mild-flavored onions, which are often large, may be elongated or flat. Stronger-flavored onions are usually medium size and globe shaped.

Peas and lima beans.—Select pods that are well filled but not bulging. Avoid dried, spotted, yellowed, or flabby pods.

Potatoes.—Best-quality potatoes are firm, smooth, and well shaped. They are free from cuts, blemishes, and decay. To judge quality more easily, look for potatoes that are reasonably clean. Avoid potatoes with wasteful deep eyes. Potatoes with green skins may be bitter. If you plan to buy a large quantity of potatoes, buy a few first to see if they are the kind you want. Early-crop potatoes, harvested in spring and summer, tend to be less mealy when cooked than those harvested later.

Root vegetables.—Choose smooth, firm vegetables. Very large carrots may have woody cores; oversized radishes may be pithy; oversized turnips, beets, and parsnips may be woody. The size and condition of the tops on root vegetables do not necessarily indicate the eating quality.

Sweetpotatoes.—Choose sweetpotatoes that are clean, smooth, well shaped, and firm. Damp or soft spots may indicate decay. There are two types of sweetpotatoes. The moist type has soft, moist, orange-colored flesh and bronze or rosy skin. The dry type has firm, dry, somewhat mealy, yellow-colored flesh and yellow or light-brown skin.

Tomatoes.—Choose tomatoes that are plump, firm, and uniformly pink, red, or yellow in color. They should be free from growth cracks, scars, and bruises. The best flavored tomatoes are ripened on the vine.

For more information, see Home and Garden Bulletins 141, “How to Buy Fresh Fruits,” and 143, “How to Buy Fresh Vegetables.”

Canned and frozen foods

Canned.—You may want to choose the highest quality for salads, or for serving “as is.” But second quality may do for combination dishes such as stews, casserole dishes, soups, and fruit puddings, where uniform size, shape, or color is not important.

Frozen.—Buy only packages that are frozen solid. Avoid partially thawed packages that feel soft or are stained. Thawing and refreezing lower quality.

Wise Storing

Meat, poultry, and fish

All meat should be promptly refrigerated.

The transparent wrap on prepackaged meat, poultry, or fish is designed for refrigerator storage at home for 1 or 2 days.

Meat or poultry wrapped in meat paper when brought from the store—or prepackaged roasts and steaks that may be stored in the refrigerator for 3 to 5 days—should be unwrapped, placed on a platter or tray, and loosely covered before refrigerating. Wrap and store fish separately from other foods. Poultry giblets should also be wrapped and stored separately.

Keep cooked meat, poultry, and fish, and the gravy or broth made from them, in covered containers in the refrigerator. Use within 1 or 2 days.

Cured and smoked meats.—ham, frankfurters, bacon, sausage—can be stored in their original containers in the refrigerator. Mild-cured hams are similar to fresh meats in keeping quality. Use whole hams within a week, half hams and slices within 3 to 5 days. For best flavor, use bacon, franks, and smoked sausages within a week.

Eggs

To help maintain quality, store eggs in the refrigerator promptly after purchase—large end up.

For best flavor and cooking quality, use eggs within 1 week if possible. Eggs held in the refrigerator for a long time may develop off-flavors and lose some thickening and leavening power.

Cover leftover yolks with cold water and refrigerate in a tightly covered container. Refrigerate leftover egg whites, too, in a tightly covered container. Use leftover yolks or whites within 1 or 2 days.

Fresh fruits and vegetables

Fresh fruits should be ripe when stored in the refrigerator. Some unripe fruits will ripen if left for a time at room temperature—preferably in a cool room between 60° and 70° F.

Keep bananas at room temperature. They will turn dull brown if refrigerated. Sort berries and cherries; then refrigerate, unwashed. Use promptly. Refrigerate ripe pineapples.

Sweet corn keeps best if refrigerated uncovered in husks; use it promptly. Removing tops from carrots, beets, and radishes reduces wilting. Storing potatoes in a cool, dark place prevents greening.

STORAGE GUIDE FOR FRUITS AND VEGETABLES.

Hold at room temperature until ripe; then refrigerate, uncovered:

Apples Apricots Avocados Berries Cherries Grapes Melons, except watermelons Nectarines Peaches Pears Plums Tomatoes

Store in cool room or refrigerate, uncovered:

Grapefruit Lemons Limes Oranges

Store in cool room, away from bright light:

Onions, mature Potatoes Rutabagas Squash, winter Sweetpotatoes

Refrigerate, covered:

Asparagus Beans, snap or wax Beets Broccoli Cabbage Carrots Cauliflower Celery Corn, husked Cucumbers Greens Onions, green Parsnips Peas, shelled Peppers, green Radishes Squash, summer Turnips

Refrigerate, uncovered:

Beans, lima, in pods Corn, in husks Peas, in pods Pineapples Watermelons

Fats and oils

Refrigerate lard, butter, margarine, drippings, and opened containers of cooking and salad oils. You can store most firm vegetable shortenings (those that have been hydrogenated), covered, at room temperature. Refrigerate opened jars of salad dressing; do not freeze.

Canned, frozen, and dried foods

Canned foods.—Store in a dry place at room temperature (not above 70° F.).

Frozen foods.—Can be stored in freezing unit of refrigerator up to 1 week. For longer storage, keep in a freezer at 0° F.

Dried foods.—Store _dried fruits_ in tightly closed containers at room temperature (not above 70° F.). In warm, humid weather, refrigerate.

Store _nonfat dry milk_ in a closed container at a temperature of 75° F., or lower. Because of its higher milkfat content, _dry whole milk_ does not keep as well as nonfat dry milk. Keep dry whole milk in a tightly closed container in the refrigerator. Refrigerate _reconstituted dry milk_ as you would fresh fluid milk.

Ingredients and Measurements

About ingredients

Ingredients that may be used in place of other ingredients are listed on the next page.

Recipes in this bulletin were tested with the ingredients listed. Sometimes a choice of ingredients is given in the recipe or under Variations of the recipe.

“Flour” refers to _all-purpose flour, unsifted_. In a few recipes, where “cake flour” is specified it is also unsifted. Recipes in this bulletin are not intended for use with either instantized or self-rising flour.

“Baking powder” refers to _double-acting baking powder_ that leavens during mixing and again during baking. Quick-acting baking powder (containing cream of tartar) is single-acting; it can be used most satisfactorily in foods that are mixed and baked immediately. (See One Ingredient For Another, p. 17, for amounts.)

“Fat or oil” refers to any type—butter, margarine, shortening, lard, or any kind of vegetable oil. In recipes specifying a particular type of fat—“butter or margarine,” for example—you’ll have best results with the fat suggested. Recipes in this bulletin are not intended for use with whipped fats.

Measuring foods

All measurements given in this bulletin are level.

Frequently used food measurements are given below.

1 tablespoon = 3 teaspoons 1 fluid ounce = 2 tablespoons ¼ cup = 4 tablespoons ■ cup = 5■ tablespoons ½ cup = 8 tablespoons ■ cup = 10■ tablespoons ¾ cup = 12 tablespoons 1 cup = 16 tablespoons or 8 fluid ounces 1 pint = 2 cups 1 quart = 2 pints or 4 cups

Part of cup.—Use tablespoons or small measures-½, ■, ¼ cup—for greater accuracy.

Brown sugar.—Pack firmly into cup or spoon and level off top with straight, thin edge of spatula or knife.

Solid fats.—Pack fat firmly into cup or smaller measure and level off top with straight, thin edge of spatula or knife.

To measure less than 1 cup, you can also use the water method: Partly fill a cup with cold water, leaving enough space for the amount of fat needed. (To measure ¼ cup of fat, for example, fill cup with water to ¾ mark.) Spoon fat into cup, push under water until water level reaches 1-cup mark. Drain thoroughly before using fat.

For solid fat in sticks or pounds, cut off amount needed. A 1-pound form measures about 2 cups; a ¼-pound stick of butter or margarine measures ½ cup.

Flour.—Spoon flour lightly into measuring cup until measure is overflowing. Do not shake or tap cup. Level off top with straight, thin edge of spatula or knife.

Fine meal, fine crumbs.—Stir lightly with fork or spoon. Measure like flour.

Baking powder, cornstarch, cream of tartar, spices.—Dip spoon into container and bring it up heaping full. Level off top with straight, thin edge of spatula or knife.

Dry milk.—Pour dry milk from spout or opening in package, or spoon lightly, into measuring cup until measure is overflowing. Do not shake. Level off top with straight, thin edge of spatula or knife.

ONE INGREDIENT FOR ANOTHER

=For these= =You may use these=

1 whole egg, for baking or thickening • 2 egg yolks.

1 cup butter or • ■ cup vegetable or animal shortening margarine for plus ½ teaspoon salt. baking

1 ounce unsweetened chocolate • 3 tablespoons cocoa plus 1 tablespoon fat.

1 teaspoon double-acting {• 2 teaspoons quick-acting baking powder. baking {• ¼ teaspoon baking soda plus ½ cup sour powder { milk or buttermilk instead of ½ cup { sweet milk.

1 cup buttermilk or {• 1 cup fluid whole milk plus 1 sour milk, for { tablespoon vinegar or lemon juice. baking {• 1 cup fluid whole milk plus 1¾ { teaspoons cream of tartar.

1 cup fluid whole milk {• ½ cup evaporated milk plus ½ cup water. {• 1 cup reconstituted nonfat dry milk {• plus 2½ teaspoons butter or margarine.

1 cup fluid skim milk • 1 cup reconstituted nonfat dry milk.

1 tablespoon flour, {• ½ tablespoon cornstarch. for thickening {• 2 teaspoons quick-cooking tapioca.

1 cup cake flour, for baking • ■ cup all-purpose flour.

NOTE: Seven-eighths cup equals 1 level cup minus 2 tablespoons.

Main Dishes

Foods that abound in protein—meat, poultry, fish, eggs, and cheese—make satisfying main dishes. Thrifty main dishes often combine these protein-rich foods with vegetables and cereals—beef stew with vegetables or dumplings, chicken with rice, fish with stuffing, cheese with macaroni.

Dry beans and peas are also economical choices for main dishes.

If the main dish is not high in protein, you can supply additional protein with other foods in the meal. If, for example, a pound of meat is to serve eight persons, you might combine it with vegetables or cereal in a casserole or stew, have milk to drink, and serve cheese-topped apple pie for dessert.

Meat

Meat cooked at low to moderate temperatures is more tender, juicy, and flavorful than meat cooked at high temperatures. There is more meat to serve because there is less shrinkage at low temperatures.

Beef may be cooked rare, medium, or well done. Lamb is enjoyed either medium or well done, but veal and pork are usually cooked well done.

Broiling, pan-frying, and roasting are recommended for tender meats only. Less tender cuts are more satisfactory if braised, pot-roasted, or simmered. For suggested methods for cooking, see guide on [page 19].

Frozen meat need not be thawed before cooking, but extra cooking time will be required if it is not thawed first.

Roasting ... beef, veal, lamb, pork

Place roast, fat side up, on a rack in a shallow pan. Do not add water; do not cover. Season either before or after cooking.

Check the timetable (p. 20) for approximate roasting times. The quality of the meat, its size and shape, and its temperature at the start of cooking will affect the roasting time. Times given here are for meats at refrigerator temperature. Frozen roasts may take 1½ to 2 times as long to cook as unfrozen roasts of the same weight and shape.

If you are using a meat thermometer, insert it so the tip is at the center of the thickest part of the roast, and not touching bone or fat.

Broiling ... beef, lamb, cured ham

Slash fat around edge of meat to prevent curling. Place meat on cold broiler grid.

Broiling temperature can be regulated by the distance meat is placed from heat source and whether the door is open or closed during broiling. Because broilers vary widely, follow the manufacturer’s directions. If you like meat well done, place it farther from the heat source than for medium or rare meat—to avoid burning the outside before the center is cooked. Place thicker cuts farther from the heat source than thin ones, for the same reason.

MEAT COOKING GUIDE

BEEF VEAL LAMB PORK

ROASTING

Chuck or shoulder Loin Leg Fresh and Rib Leg Loin cured ham Round Shoulder Rib Fresh and Rump Shoulder cured shoulder Sirloin Loin Sirloin tip Spareribs Tenderloin

BROILING

Patties (ground) Liver Chops Bacon Thick steaks: Liver Canadian bacon Chuck Patties (ground) Chops Club Cured ham Porterhouse slices Rib Top round Sirloin T-bone

PAN-BROILING, PAN-FRYING

Liver Cube steaks Chops Bacon Patties (ground) Liver Liver Canadian bacon Thin steaks: Patties (ground) Patties (ground) Cured ham slices Club Cutlets or round Liver Cube steaks steak Thin chops Porterhouse Loin and rib chops Thin steaks Rib Round Sirloin T-bone

BRAISING, POT-ROASTING

Chuck or shoulder Cutlets Breast Chops Flank Loin and rib chops Neck slices Ham slices Liver Roasts: Shanks Liver Round Round Shortribs Shanks Rump Rump Shoulder cuts Spareribs Shortribs Shoulder Steaks Sirloin tip Tenderloin

SIMMERING, STEWING

Brisket Breast Breast Cured ham Corned beef Riblets Neck slices Cured shoulder Heel of round Shanks Shanks Hocks Neck Shanks Shanks Spareribs Shortribs

TIMETABLE FOR ROASTING MEATS

———————————————————+———————————+———————————+———————————+———————————— | | Approximate | Internal |Ready-to-cook|roasting time |temperature Kind and cut of meat| weight | at 325°F. | of meat | | | when done ———————————————————+———————————+———————————+———————————+———————————— BEEF | | | Standing ribs: | _Pounds_ | _Hours_ | °_F._ Rare | 6 to 8 | 2½ to 3 | 140 Medium | 6 to 8 | 3 to 3½ | 160 Well done | 6 to 8 | 3■ to 5 | 170 Rolled rump: | | | Rare | 5 | 2¼ | 140 Medium | 5 | 3 | 160 Well done | 5 | 3¼ | 170 Sirloin tip: | | | Rare | 3 | 1½ | 140 Medium | 3 | 2 | 160 Well done | 3 | 2¼ | 170 VEAL | | | Leg | 5 to 8 | 2½ to 3½ | 170 Loin | 5 | 3 | 170 Shoulder | 6 | 3½ | 170 LAMB | | | Leg (whole) | 6 to 7 | 3¼ to 4 | 180 Shoulder | 3 to 6 | 2¼ to 3¼ | 180 Rolled shoulder | 3 to 5 | 2½ to 3 | 180 PORK, FRESH | | | Loin | 3 to 5 | 2 to 4 | 170 Shoulder | 5 to 8 | 3½ to 5 | 185 Ham, whole | 10 to 14 | 5½ to 6 | 185 Ham, half | 6 | 4 | 185 Spareribs | 3 | 2 | 185 PORK, CURED | | | Cook-before-eating: | | | Ham, whole | 12 to 16 | 3½ to 4¼ | 160 Ham, half | 6 | 2½ | 160 Picnic shoulder | 6 | 3■ | 170 Fully cooked:[8] | | | Ham, whole | 12 to 16 | 3 to 3¾ | 130 Ham, half | 6 | 1½ to 2 | 130

[8] Can also be served without heating, if desired.

Broil until top side of meat is browned, about half of total cooking time. Season, turn, and brown other side. Use timetable (next page) as a guide to total broiling time. To tell if meat is done, cut into it along bone and observe color.

Use a low temperature for broiling frozen meat, so the surface does not char before the interior thaws and cooks. Allow 1½ to 2 times as long as specified in the timetable on page 21.

Pan broiling ... beef, lamb, pork

Choose thin steaks, chops, or ham slices (1 inch thick or less). Or shape meat patties less than an inch thick.

Slash fat around edge of meat to prevent it from curling. Grease pan lightly with fat or rub pan with fat edge of meat.

Cook meat slowly over moderate heat, turning occasionally as necessary. Pour off excess fat as it accumulates. Total cooking time will be 10 to 20 minutes, depending on the degree of doneness desired. Pork chops may take a little longer.

Remove meat from pan, season, and serve.

Braising ... beef, veal, lamb, pork

Brown meat slowly on all sides in enough added fat to keep meat from sticking. Use a heavy pan. Meats may be floured or not, as desired, before browning. Floured meats brown better than unfloured meats. Meats that have a considerable amount of fat and that are not floured can be browned without added fat.

Season the meat. If necessary to prevent overbrowning, add a small amount of liquid (about ½ cup for a roast). Many cuts of meat can be braised without added liquid. Steam from meat juices trapped in a covered pan provides enough moisture. Cover pan tightly.

Cook slowly over low heat or in a 350° F. oven until tender, adding more liquid if needed. Use the timetable (p. 22) as a guide to braising time.

TIMETABLE FOR BROILING MEATS

———————————————————————————+———————————+———————————+———————————— |Approximate |Degree of | Approximate Kind and cut of meat | thickness | doneness |total cooking | | | time[9] ———————————————————————————+———————————+———————————+———————————— | _Inches_ | | _Minutes_ Beef steaks | 1 |Rare | 10 to 15 (Club, porterhouse, rib, | 1 |Medium | 15 to 20 sirloin, T-bone, tenderloin) | 1 |Well done | 20 to 30 | 1½ |Rare | 15 to 20 | 1½ |Medium | 20 to 25 | 1½ |Well done | 25 to 40 | 2 |Rare | 25 to 35 | 2 |Medium | 35 to 45 | 2 |Well done | 45 to 55 | | | Hamburgers | ¾ |Rare | 8 | ¾ |Medium | 12 | ¾ |Well done | 14 | | | Lamb chops | 1 |Medium | 12 (Loin, rib, shoulder) | 1 |Well done | 14 | 1½ |Medium | 18 | 1½ |Well done | 22 | | | Cured ham slices | ¾ |Well done | 13 to 14 (Cook-before-eating) | 1 |Well done | 18 to 20 ———————————————————————————+———————————+———————————+————————————

[9] Meat at refrigerator temperature at start of broiling.

TIMETABLE FOR BRAISING MEATS

———————————————————————————————————+———————————————————+———————————— | Approximate | Approximate Kind and cut of meat | ready-to-cook |total cooking | weight or thickness | time ———————————————————————————————————+———————————————————+———————————— BEEF | | | _Hours_ Pot roast, such as chuck or round | 3 to 5 pounds | 3 to 4 Steak, such as chuck or round | 1 to 1½ inches | 2 to 2½ Short ribs | 2 to 2½ pounds | 2 to 2½ | | VEAL | | | Chops | ½ to ¾ inch | ¾ Shoulder, rolled | 3 to 5 pounds | 2 to 2½ | | LAMB | | | Chops | ½ to ¾ inch | ½ to ¾ Shanks | 1 pound each | 1½ to 2 Shoulder, rolled | 3 to 5 pounds | 2 to 2½ | | PORK | | | Chops | ½ to 1 inch | ¾ to 1 Spareribs | 2 to 3 pounds | 1½ to 2½ ———————————————————————————————————+———————————————————+————————————

Quick beef pie

6 servings

1½ pounds ground beef 1 medium-size onion, chopped ½ teaspoon salt 1 can (10½ ounces) condensed tomato soup 1 can (1 pound) cut green beans, drained ¼ teaspoon pepper 1½ cups seasoned mashed potatoes ½ cup shredded Cheddar cheese

Crumble beef into large frypan. Add onion and salt, and cook until browned. Drain off excess fat.

Add soup, green beans, and pepper; simmer 5 minutes. Pour into greased 2-quart casserole.

Drop potatoes in mounds onto hot meat mixture. Sprinkle with cheese. Bake at 350° F. (moderate oven) 20 minutes.

Menu suggestion

Serve with buttered carrots, stuffed prune salad, and brownies.

Beef stroganoff

6 servings

■ cup flour 1 teaspoon salt ¼ teaspoon pepper 1 pound sirloin tip steak, cut in very thin strips ½ cup finely chopped onion ¼ cup fat or oil 1 can (10½ ounces) condensed cream of mushroom soup 1 can (8 ounces) sliced mushrooms, drained 1 cup sour cream Cooked rice Paprika Parsley

Combine flour, salt, and pepper. Coat meat strips with flour mixture. Brown meat in hot fat in a large frypan. Add onion and cook until clear. Drain off excess fat.

Add soup and mushrooms. Simmer, covered, 10 to 15 minutes. Blend in sour cream and remove from heat. Serve over rice. Sprinkle with paprika and garnish with parsley.

Menu suggestion

Serve with green beans, cucumber and tomato salad, and have sliced peaches and poundcake for dessert.

Luncheon special

6 servings

2 cups medium white sauce (p. 57) 2 cups shredded Cheddar cheese 1 package (10 ounces) frozen cut green beans, cooked and drained 1 can (12 ounces) luncheon meat, cut in thin strips 1 tablespoon chopped pimiento White pepper, as desired Toast triangles

To hot white sauce, add remaining ingredients except toast. Cook over low heat 10 minutes, or just until cheese melts and mixture is hot. Serve on toast triangles.

Menu suggestion

Serve with glazed carrots, fruit salad, and chocolate pudding.

Curried meat

6 servings

2 beef bouillon cubes 1■ cups hot water 1½ cups sliced celery 2 tablespoons chopped onion 3 tablespoons fat or oil 1 tablespoon cornstarch 1 teaspoon curry powder ½ teaspoon salt 3 cups chopped, cooked lamb, pork, or veal

Dissolve bouillon cubes in hot water.

Lightly brown celery and onion in hot fat in a large frypan. Blend in cornstarch and seasonings. Slowly stir in bouillon. Add meat. Cook mixture over moderate heat 15 to 20 minutes, stirring as needed to prevent sticking. Serve on rice.

Menu suggestion

Serve with italian green beans, citrus fruit salad, and spiced prune cake.

Sausage and potatoes au gratin

6 servings

1 can (10½ ounces) condensed cream of mushroom soup ½ cup milk ½ cup finely chopped onion ¼ cup chopped green pepper 1 tablespoon chopped pimiento ½ teaspoon salt ¼ teaspoon pepper 4 cups thinly sliced potatoes 1 package (8 ounces) precooked small smoked sausages, cut in bite-size pieces 1 tablespoon butter or margarine ½ cup shredded Cheddar cheese

Combine soup, milk, onion, green pepper, pimiento, salt, and pepper; blend well.

Place half the potatoes in a greased 2-quart casserole. Add half the sausage. Cover with half the soup mixture. Repeat layers. Dot with fat. Cover and bake at 350° F. (moderate oven) about 1¼ hours.

Remove cover. Sprinkle with cheese and bake, uncovered, 15 minutes more, or until potatoes are tender.

Menu suggestion

Serve with brussels sprouts, fruit, and gingerbread.

Ham patties

6 servings

2 cups ground cooked ham 1 cup mashed potatoes 1 tablespoon chopped onion ¼ teaspoon dry mustard ¼ teaspoon salt 1 tablespoon milk 1 egg, beaten ½ cup fine dry breadcrumbs 3 tablespoons fat or oil

Combine ground ham, mashed potatoes, onion, mustard, and ¼ teaspoon salt. Chill about 1 hour. Shape into 12 patties.

Blend milk into beaten egg. Dip patties in egg mixture and then in crumbs.

Fry patties in hot fat until golden brown. Serve with egg sauce (p. 57).

Menu suggestion

Serve with asparagus, molded fruit salad, cheese biscuits, and peanut butter cookies.

Braised liver and onions

6 servings

1½ pounds sliced beef liver ½ cup flour 2 tablespoons fat or oil 1½ teaspoons salt ¼ teaspoon pepper 1 large onion, sliced ¼ cup water

Remove skin and large veins from liver. Coat meat with flour. Heat fat in large frypan over moderate heat and brown liver on one side.

Turn liver, sprinkle with seasonings and cover with onions. Add water and cover pan tightly. Cook over low heat 20 to 30 minutes, or until liver is tender.

Menu suggestion

Serve with stewed okra and tomatoes, spinach salad, and apple crisp.

Spaghetti with meat sauce

6 servings

1 pound ground beef 1 medium-size onion, finely chopped 1 clove garlic, peeled ½ teaspoon oregano 1 teaspoon salt ¼ teaspoon pepper 1 can (6 ounces) tomato paste ¾ cup water 1 can (15 ounces) spanish-style tomato sauce 1 bay leaf 1 tablespoon sugar 4 cups cooked spaghetti ½ cup grated Parmesan or Romano cheese

Crumble ground beef into 4-quart saucepan. Add onion, garlic, oregano, salt, and pepper. Heat to brown meat.

Add tomato paste, water, tomato sauce, and bay leaf. Bring to a boil. Then simmer, uncovered, over low heat 45 minutes. Remove garlic. Add sugar and simmer 15 minutes longer.

Place hot spaghetti on a platter. Cover with meat sauce. Sprinkle with cheese.

Menu suggestion

Serve with tossed green salad and upside-down cake.

Meat loaf

6 servings

1½ pounds ground beef 3 slices soft white bread, torn into very small pieces 1 cup tomato juice or milk ½ cup finely chopped onion 1 egg, beaten 1 teaspoon salt ¼ teaspoon pepper

Mix ingredients thoroughly. Press into a 9- by 5- by 3-inch loafpan or shape into loaf.

Bake uncovered at 350° F. (moderate oven) about 1½ hours. Remove from oven and drain off excess fat.

Menu suggestion

Serve with green bean-mushroom casserole, baked potatoes, celery sticks and olives, and orange sherbet.

Stuffed green peppers

6 servings

3 large green peppers 2 teaspoons salt Boiling water 1 pound ground beef 1½ cups cooked rice 2 tablespoons finely chopped celery 2 tablespoons finely chopped onion ¼ cup chili sauce 2 teaspoons salt ¼ teaspoon pepper 1 egg 2 tablespoons shredded Cheddar cheese

Halve peppers lengthwise; remove stems, seeds, and membranes. Add 2 teaspoons salt to enough boiling water to cover peppers; boil peppers 5 minutes. Drain.

Combine other ingredients except cheese; mix well. Fill pepper halves with this mixture and place in ½ inch of hot water in a baking pan.

Bake uncovered at 350° F. (moderate oven) 45 to 55 minutes. Sprinkle cheese over peppers and bake 5 minutes longer, or just until cheese melts.

Menu suggestion

Serve with corn pudding and coleslaw, and have your favorite ice cream for dessert.

Saucy luncheon meat

6 servings

2 packages (3 ounces each) cream cheese 2 tablespoons milk 1 pound bologna or other luncheon meat, finely diced ¼ cup finely chopped onion 2 tablespoons sliced ripe olives 2 teaspoons prepared mustard ¾ cup canned condensed cream of mushroom soup Biscuits, cooked rice, or noodles

Blend cream cheese with milk in top of double boiler. Add meat, onion, olives, mustard, and soup; mix thoroughly. Heat over simmering water 15 to 20 minutes, stirring occasionally. Serve over biscuits, rice, or noodles.

Menu suggestion

Serve with kale, carrot and pineapple salad, and chocolate chip cookies.

Beef stew

6 servings

■ cup flour 1½ teaspoons salt ■ teaspoon pepper 1½ pounds boneless stew beef, cut in 1-inch cubes 2 tablespoons fat or oil 3 cups water 3 medium-size onions, sliced 4 medium-size potatoes, cut in 1-inch cubes 5 medium-size carrots, quartered 1½ cups frozen peas ¼ cup water

Combine flour, salt, and pepper; coat meat with seasoned flour. Save remaining flour. Brown meat in hot fat in a 4-quart saucepan.

Add water and cover tightly. Simmer until meat is tender, about 1½ hours.

Add onions, potatoes, and carrots. Cover and simmer 15 minutes.

Add peas. Cover and simmer until all vegetables are tender.

Blend ¼ cup water with remaining flour. Add to stew, stirring gently; cook until thickened.

Variation

Irish stew.—Use lean lamb instead of beef. Add 1 turnip, diced, with potatoes and carrots.

Menu suggestion

Serve with tossed green salad and hot biscuits. Have fruit sherbet and cookies for dessert.

Poultry

Serve poultry often—it’s versatile, flavorful, and economical. You can buy chicken and turkey in convenient sizes—chilled or frozen—any day of the year. And for variety, try duck and goose.

Preparing poultry

Ready-to-cook poultry needs little preparation before cooking. Inspect for pinfeathers. Wash and drain poultry.

Keep _frozen poultry_ frozen until time to thaw or cook. Frozen poultry usually is thawed before cooking, but poultry parts or whole poultry frozen without giblets can be cooked without thawing. Cooking time will be longer than for unfrozen poultry. Do not thaw commercially frozen stuffed poultry before cooking.

To thaw poultry in the refrigerator, place frozen poultry on a tray or shallow pan to catch the thawing drip; if unwrapped, cover lightly. Remove giblets from cavity when bird is pliable.

If it is not practical to thaw poultry in the refrigerator, immerse poultry in a watertight wrapper in cold water. Change water often to hasten thawing. Or you can partially thaw poultry in the refrigerator and partially in cold water. It takes 1 to 8 hours to thaw poultry in cold water, or 1 to 3 days in a refrigerator.

Cook poultry promptly after thawing. Stuff poultry just before roasting.

Cooking guides

Most poultry sold whole can be roasted. Stewing chickens and mature turkeys, however, are more tender if braised or stewed. They are good for stews, or to provide cooked meat for casseroles, sandwiches, and salads.

Broiler or fryer chickens can be roasted, ovenbaked, barbecued, or cooked on a rotisserie as well as broiled or fried. Fryer-roaster turkeys weighing 4 or 5 pounds can be roasted whole, or can be cut into parts and fried or broiled.

Rock Cornish game hens can be cooked like broiler or fryer chickens. Small ducks are suitable for broiling or frying; larger ones, for roasting or rotisserie cooking. Geese roast very well.

Roast poultry uncovered for best color and to reduce splitting and shrinkage. Poultry can be roasted with or without stuffing; unstuffed birds take slightly less time to cook. Cook poultry until tender and juicy; do not overcook.

Roasting

Prepare the poultry as directed above. Stuff the body and neck cavities lightly; allow about ½ cup of stuffing per pound of ready-to-cook poultry. See stuffing recipe (p. 28). Or if desired, leave poultry unstuffed.

Fold loose neck skin toward back; fasten with a skewer. Turn wingtips back of heavy wingbone to rest against neck skin. Tuck ends of legs under band of skin at tail or fasten legs together close to body.

To roast poultry, place breast side up on a rack in a shallow pan. Do not cover pan and do not add water.

See roasting guide (p. 28) for approximate times for roasting poultry.

A meat thermometer is the best guide to doneness of turkeys. Insert the thermometer into the center of the inner thigh muscle. Make sure it does not touch the bone.

Salt the giblets and neck, seal them in aluminum foil, and roast along with the poultry. Or simmer them in salted water until tender.

You can baste poultry with pan drippings or a little fat if you like.

If poultry browns early in the roasting period, cover the breast and drumsticks lightly with aluminum foil or with a thin cloth moistened with fat. After poultry is partly roasted, cut band of skin that holds legs together.

Use any one or more of the following ways to tell if poultry is done:

• A meat thermometer inserted in the center of the inner thigh muscle of a turkey reaches 180° to 185° F. If turkey is stuffed, also check stuffing temperature by inserting a thermometer into the body cavity for 5 minutes. Temperature should reach 165° F.

• Drumstick feels soft when you press meaty part with protected fingers.

• Drumstick moves up and down easily and leg joint gives readily.

CAUTION: Do not partly roast poultry on one day and complete roasting the following day.

ROASTING GUIDE

———————————————————+———————————+———————————+———————————— | | Approximate | Internal |Ready-to-cook | roasting time| temperature Kind of poultry | weight[10] |at 325° F. for| of poultry | | stuffed | when done | | poultry[11] | ———————————————————+———————————+———————————+———————————— | _Pounds_ | _Hours_ | °F. | | | Chickens |1½ to 2½ |1 to 2 | (Broilers, fryers,| | | or roasters) |2½ to 4½ |2 to 3½ | | | | Ducks |4 to 6 |2 to 3 | | | | Geese |6 to 8 |3 to 3½ | |8 to 12 |3½ to 4½ | | | | Turkeys |6 to 8 |3 to 3½ | } 180 to 185 |8 to 12 |3½ to 4½ | } in center |12 to 16 |4½ to 5½ | } of inner |16 to 20 |5½ to 6½ | } thigh |20 to 24 |6½ to 7 | } muscle. ———————————————————+———————————+———————————+————————————

[10] Weight of giblets and neck included.

[11] Unstuffed poultry may take slightly less time than stuffed poultry. Cooking time is based on chilled poultry or poultry that has just been thawed—temperature not above 40° F. Frozen unstuffed poultry will take longer. Do not use this roasting guide for frozen commercially stuffed poultry; follow package directions.

Stuffing

About 1 quart

3 tablespoons butter, margarine, or poultry fat ¾ cup chopped celery 3 tablespoons chopped parsley 2 tablespoons chopped onion 1 quart soft breadcrumbs ½ teaspoon savory seasoning ½ teaspoon salt Pepper, as desired

Melt fat in heavy pan; add celery, parsley, and onion, and cook a few minutes.

Combine all ingredients. Mix lightly but well.

Use to stuff poultry, or bake in a separate pan during the last hour of cooking.

NOTE: Allow about ½ cup stuffing per pound of ready-to-cook poultry. This stuffing may be used for baked fish, if desired.

Variation

Nut stuffing.—Omit parsley and savory seasoning and add ½ cup of chopped nutmeats—roasted almonds, pecans, filberts, or cooked chestnuts.

Braised boneless turkey roast

Place boneless turkey roast on a rack in a pan; insert a meat thermometer in the center of the roast; cover pan tightly. Braise in an oven at 400° F. (hot) until thermometer registers about 170° F. Or, follow cooking directions on package.

NOTE: A 3-pound boneless turkey roast requires about 1½ hours cooking time. If desired, uncover roast last 20 minutes to brown.

Broiled chicken

Plump young chicken, about 1½ to 2¼ pounds ready to cook Melted fat or oil Salt and pepper, as desired

Prepare chicken for cooking according to directions on page 26.

Split chicken down the back and, if desired, cut into halves through the breastbone. Break joints and cut off wingtips.

Brush chicken on both sides with melted fat and sprinkle with salt and pepper.

Preheat the broiler and grease broiler rack lightly. Place chicken on the rack, skin side down. Place broiler pan at the distance from heat recommended by the range manufacturer.

Broil chicken 20 to 30 minutes on one side or until browned; turn, brush with fat or oil, and broil until done, 15 to 25 minutes longer.

Menu suggestion

Serve with broccoli, creamed potatoes, and lemon chiffon pie.

Stewed chicken

Use a plump stewing chicken, 3 to 4 pounds ready to cook. Or, you can stew a broiler-fryer chicken, although the flavor will be somewhat milder.

Prepare chicken for cooking according to the directions on page 26. Leave whole or cut in serving-size pieces.

Place the chicken in a deep pan. Add enough water to half cover a whole chicken or to cover pieces. Season as desired.

Cover pan and cook over low heat until the chicken is tender—2 to 3 hours for a stewing chicken, 45 minutes to 1 hour for a broiler-fryer.

Cook giblets with the chicken or separately.

Serve stewed chicken in gravy made by thickening the broth, or use in any recipe that calls for cooked chicken.

Fried chicken

Plump young chicken, 1½ to 3 pounds ready to cook Salt, pepper, flour Fat or oil

Prepare chicken for cooking according to the directions on page 26. Cut in serving pieces.

Season chicken with salt and pepper and roll in flour.

In a heavy frypan, heat ¼ to ¾ cup fat or oil—just enough to cover bottom of pan. Use moderate heat.

Brown chicken pieces on one side; turn and brown on other side.

Continue to cook slowly, uncovered, until tender. Or, if more convenient, cook in oven at 350° F. (moderate) until tender. Cooking time will be from 30 to 45 minutes.

Variation

Oven-fried chicken.—Prepare the chicken according to directions on page 26. Cut in serving pieces. Preheat oven to 400° F. (hot). Shake or roll chicken pieces in seasoned flour and place in a baking pan containing hot fat (■ inch deep or less). Turn pieces to coat both sides with fat. Cook chicken skin side down for 30 minutes; turn; and cook 20 to 30 minutes longer, or until tender.

Menu suggestion

Serve with mashed potatoes, carrots, and green salad. For dessert have cherry pie.

Chicken a la king

6 servings

1 cup frozen green peas 2 tablespoons finely chopped onion ¼ cup chopped green pepper ■ cup boiling water ■ cup flour 1 cup cold milk 2 cups chicken broth 2 teaspoons salt Pepper, as desired ½ teaspoon poultry seasoning 2 cups diced cooked chicken or turkey 1 can (4 ounces) mushroom stems and pieces, drained and chopped 1 tablespoon chopped pimiento Cooked rice, toast, or biscuits

Cook peas, onion, and green pepper in boiling water in a covered pan 5 minutes. Drain; save the liquid.

Blend flour with milk. Combine vegetable cooking liquid, broth, and seasonings; slowly stir in flour mixture. Bring to a boil, stirring constantly; cook 1 minute.

Add chicken, cooked vegetables, mushrooms, and pimiento. Heat thoroughly and serve on rice, toast, or biscuits.

NOTE: Two chicken bouillon cubes and 2 cups of hot water may be used to make broth. Decrease salt to 1 teaspoon.

Menu suggestion

Serve with green beans, molded pineapple and carrot salad, and apple crisp.

Turkey-noodle bake

6 servings

4-ounce package noodles (about 2 cups uncooked) ¼ cup flour 2 cups mushroom liquid and water 2 chicken bouillon cubes ¼ teaspoon salt Pepper, as desired ½ teaspoon poultry seasoning 1 tablespoon chopped pimiento 4-ounce can mushroom stems and pieces, drained, chopped 2 cups cooked turkey, cubed ¾ cup shredded sharp process cheese ■ cup fine dry breadcrumbs 1 tablespoon butter or margarine

Cook noodles as directed on package; drain.

In a saucepan, blend flour with a little of the liquid to make a paste. Gradually stir in remaining liquid. Add bouillon cubes and seasonings.

Bring to a boil, stirring constantly. Reduce heat to simmer; cook 1 minute longer, stirring as needed.

Add pimiento and mushrooms to sauce.

In a 2-quart casserole place half the noodles and half the turkey in layers. Cover with half the sauce. Repeat layers.

Top with cheese; sprinkle with breadcrumbs; dot with fat.

Bake, uncovered, at 350° F. (moderate oven) 30 to 40 minutes or until bubbly and browned.

Variation

Chicken-noodle bake.—Use chicken instead of turkey, and chicken broth instead of water and bouillon cubes.

Menu suggestion

Serve with buttered beets, coleslaw, and have ice cream for dessert.

Chicken pie

6 servings, 9- or 10-inch pie

Filling

3 tablespoons chicken fat, butter, or margarine ¼ cup flour 1¼ cups chicken broth 1 cup milk 1½ teaspoons salt ■ teaspoon pepper ¼ teaspoon poultry seasoning, if desired 2 cups cooked chicken, diced 1■ cups cooked peas and carrots

Pastry for top crust

1 cup flour ¾ teaspoon baking powder ½ teaspoon salt ■ cup shortening 2½ to 3 tablespoons water

Melt fat for the filling in a saucepan; blend in flour. Add broth, milk, and seasonings. Cook, stirring constantly, until thickened.

Add chicken and vegetables; heat thoroughly.

For the pastry, mix flour, with baking powder and salt.

Mix in fat until mixture is crumbly. Add a little water at a time, blending lightly.

Dough should be just moist enough to cling together when pressed into a ball.

Roll dough on a lightly floured surface; shape to fit top of 9- or 10-inch piepan. Make a few small slits near center.

Pour filling into piepan; top with pastry. Turn under pastry edges and press firmly to pan.

Bake at 400° F. (hot oven) 30 minutes, or until browned.

Variation

Turkey pie.—Use turkey broth and cooked turkey in place of chicken broth and cooked chicken.

Menu suggestion

Serve with sliced tomatoes and celery strips and have spicy fruit for dessert.

Braised chicken with vegetables

6 servings

½ cup flour 1 teaspoon salt ¼ teaspoon pepper 3-pound ready-to-cook broiler-fryer chicken, cut up 3 tablespoons fat or oil ¾ cup hot water ½ teaspoon salt 1½ cups sliced carrots 3 cups sliced celery ¾ cup finely chopped onion ¾ cup chopped green pepper

Combine flour, 1 teaspoon salt, and pepper; coat chicken pieces with mixture. Brown chicken in hot fat in large frypan. Drain excess fat from pan. Add water and ½ teaspoon salt. Cover tightly and simmer 45 minutes to 1 hour, or until chicken is almost tender.

Add vegetables and cook 20 to 30 minutes longer, or until vegetables are tender.

Menu suggestion

Serve with rice, lettuce and tomato salad, and fruit for dessert.

Homemade noodles with chicken

6 servings

1 cup flour 1 egg or ¼ cup egg yolks (3 or 4 yolks), slightly beaten 1 tablespoon half-and-half or table cream 1½ teaspoons salt ¾ teaspoon poultry seasoning Pepper, as desired 5 cups chicken broth 3 cups cubed cooked chicken (p. 29) Paprika Parsley

Combine first three ingredients thoroughly and form into a ball. Do not knead. Divide into two parts. Roll each part on lightly floured surface until paper thin. Allow dough to dry 5 to 10 minutes.

With a thin sharp knife, cut dough into strips of desired width and length.

Add seasonings to broth; bring to a boil. Add noodles and boil 9 to 12 minutes, or until tender. Add chicken and continue cooking only until chicken is hot. Sprinkle with paprika and garnish with parsley.

NOTE: One chicken bouillon cube and 1 cup of water may be used for each cup of broth; decrease salt to taste.

Timesaver

Use 1½ cups uncooked packaged noodles instead of making noodles.

Menu suggestion

Serve with broccoli, tossed vegetable salad, and brownies.

Fish

Fish may be cooked by any of the basic methods with excellent results. Fish should not be overcooked; cook only until it flakes easily when tested with a fork. This will leave the fish moist and tender and will bring out its flavor.

Pan-fried fish fillets or steaks

6 servings

2 pounds fish fillets or steaks, fresh or frozen ¼ cup milk 1 egg, beaten 1 teaspoon salt Pepper, as desired 1½ cups fine dry bread, cereal, or cracker crumbs Fat or oil

Thaw frozen fish. Cut fish into 6 portions.

Combine milk, egg, salt, and pepper. Dip fish in milk mixture and roll in crumbs.

Place fish in a single layer in hot fat in a 10-inch frypan. Fry over moderate heat 4 to 5 minutes, or until brown. Turn carefully. Fry 4 to 5 minutes longer, or until fish are brown and flake easily when tested with a fork. Drain on absorbent paper.

Variation

Deep-fat fried fish fillets or steaks.—Prepare fish as for pan-fried fish. Fill fry kettle one-third full of fat; heat to 350° F.

Place fish in a single layer in a fry basket. Fry 3 to 5 minutes, or until fish are brown and flake easily when tested with a fork. Drain on absorbent paper.

TIMETABLE FOR COOKING FISH

———————————————————+———————————————————+———————————————+———————————————— Cooking method | Approximate | Cooking | Approximate and market form | ready-to-cook | temperature | cooking time |weight or thickness| | in minutes ———————————————————+———————————————————+———————————————+———————————————— BAKING | | | | | Dressed | 3 pounds | 350° F. | 45 to 60 Pan-dressed | 3 pounds | 350° F. | 25 to 30 Fillets or steaks | 2 pounds | 350° F. | 20 to 25 Portions | 2 pounds | 400° F. | 15 to 20 Sticks | 2¼ pounds | 400° F. | 15 to 20 | | | BROILING | | | | | | Pan-dressed | 3 pounds | | 10 to 16[1] Fillets or steaks | ½ to 1 inch | | 10 to 15 Portions | ■ to ½ inch | | 10 to 15 Sticks | ■ to ½ inch | | 10 to 15 | | | CHARCOAL BROILING | | | | | | Pan-dressed | 3 pounds | Moderate | 10 to 16[1] Fillets or steaks | ½ to 1 inch | Moderate | 10 to 16[1] Portions | ■ to ½ inch | Moderate | 8 to 10[1] Sticks | ■ to ½ inch | Moderate | 8 to 10[1] | | | DEEP-FAT FRYING | | | | | | Pan-dressed | 3 pounds | 350° F. | 3 to 5 Fillets or steaks | ½ to 1 inch | 350° F. | 3 to 5 Portions | ■ to ½ inch | 350° F. | 3 to 5 Sticks | ■ to ½ inch | 350° F. | 3 to 5 | | | OVEN-FRYING | | | | | | Pan-dressed | 3 pounds | 500° F. | 15 to 20 Fillets or steaks | ½ to 1 inch | 500° F. | 10 to 15 | | | PAN-FRYING | | | | | | Pan-dressed | 3 pounds | Moderate | 8 to 10[1] Fillets or steaks | ½ to 1 inch | Moderate | 8 to 10[1] Portions | ■ to ½ inch | Moderate | 8 to 10[1] Sticks | ■ to ½ inch | Moderate | 8 to 10[12] | | | POACHING | | | | | | Fillets or steaks | 2 pounds | Simmer | 5 to 10 | | | STEAMING | | | | | | Fillets or steaks | 2 pounds | Boil | 5 to 10 ———————————————————+———————————————————+———————————————+————————————————

[12] Turn once.

Menu suggestion

Serve with tartar sauce, baked potatoes, snap beans, tossed green salad, and upside-down cake.

Salmon loaf

6 servings

1 can (1 pound) salmon ½ cup milk 3 cups soft breadcrumbs ¼ cup butter or margarine, melted ■ cup salmon liquid 3 egg yolks, beaten 2 tablespoons finely chopped green pepper 2 tablespoons finely chopped onion 1 tablespoon lemon juice ■ teaspoon pepper 3 egg whites, stiffly beaten

Drain salmon; save the liquid. Flake salmon.

Heat milk. Add breadcrumbs and butter or margarine and let stand 5 minutes. Add salmon liquid and beat until smooth. Add egg yolks, green pepper, onion, lemon juice, pepper, and salmon; mix well. Fold in egg whites. Pour into a well-greased 1½-quart loafpan.

Bake at 350° F. (moderate oven) 40 to 50 minutes, or until firm in center. Remove from oven and let stand 5 minutes. Loosen from sides of pan with a spatula and invert on a serving platter. Serve plain or with a sauce.

Menu suggestion

Serve with onion or pea sauce, scalloped potatoes, lettuce salad, and apple crisp.

Broiled pan-dressed fish

6 servings

3 pounds pan-dressed fish, fresh or frozen ¼ cup melted fat or oil ¼ cup lemon juice 1½ teaspoons salt ¾ teaspoon paprika Pepper, as desired

Thaw frozen fish. Clean, wash, and dry fish.

Combine fat and seasonings. Place fish on well-greased broiler pan. Brush fish inside and out with seasoned fat.

Broil about 4 inches from heat 5 to 8 minutes. Turn fish carefully and brush on remaining fat. Broil 5 to 8 minutes longer, or until fish flake easily when tested with a fork.

Menu suggestion

Serve with fried potatoes, spinach, grapefruit salad, and gingerbread.

Baked fish fillets or steaks

6 servings

2 pounds fish fillets or steaks, fresh or frozen 2 tablespoons melted fat or oil 2 tablespoons lemon juice 1 teaspoon salt ½ teaspoon paprika Pepper, as desired

Thaw frozen fish. Cut into 6 portions.

Place fish in a single layer, skin side down, in a well-greased baking dish. Combine remaining ingredients and pour over fish.

Bake at 350° F. (moderate oven) 20 to 25 minutes, or until fish flake easily when tested with a fork.

Menu suggestion

Serve with french-fried potatoes, cabbage, molded vegetable salad, and lemon chiffon pie.

Oven-fried fish fillets or steaks

6 servings

2 pounds fish fillets or steaks, fresh or frozen ½ cup milk 1 teaspoon salt 1½ cups cereal crumbs or toasted fine dry bread crumbs ¼ cup melted fat or oil

Thaw frozen fish. Cut into 6 portions.

Combine milk and salt. Dip fish in milk and roll in crumbs. Place fish in a single layer, skin side down, on a well-greased baking pan. Pour fat over fish.

Bake at 500° F. (extremely hot oven) 10 to 15 minutes, or until fish are brown and flake easily when tested with a fork.

Menu suggestion

Serve with broccoli, potatoes with cheese sauce, lettuce salad, and peach crisp.

Baked stuffed fish

6 servings

1 dressed fish (3 pounds), fresh or frozen Salt and pepper, as desired 3 cups stuffing (p. 28) 2 tablespoons melted fat or oil

Thaw frozen fish. Clean, wash, and dry fish.

Sprinkle inside with salt and pepper. Place fish on a well-greased 18- by 13-inch bake-and-serve platter. Stuff fish loosely. Brush fish with fat.

Bake at 350° F. (moderate oven) 45 to 60 minutes, or until the fish flakes easily when tested with a fork.

NOTE: Fish may be baked without stuffing.

Menu suggestion

Serve with broiled tomatoes, peas and celery, coleslaw, and fruit pie.

Topsy turvy tuna pie

6 servings

1 can (6½ or 7 ounces) tuna 2 tablespoons chopped onion 1 tablespoon tuna oil 1 can (10½ ounces) condensed cream of mushroom soup 2 eggs, beaten ½ cup soft breadcrumbs 6 thin slices lemon or orange 1 package (12 ounces) cornbread or corn muffin mix

Drain tuna; save oil. Flake tuna.

Cook onion in oil until tender. Add soup, eggs, breadcrumbs, and tuna; mix well. Arrange lemon or orange slices on the bottom of a well-greased 10-inch piepan. Pour tuna mixture over fruit slices.

Prepare cornbread mix as directed on package. Spread batter over tuna mixture.

Bake at 400° F. (hot oven) 25 to 30 minutes, or until brown. Remove from oven and let stand 5 minutes. Loosen from sides of pan with a spatula and invert on a serving plate.

Menu suggestion

Serve with stewed okra and tomatoes, celery sticks, brownies, and fruit.

Sardine puff

6 servings

2 cans (3¾ or 4 ounces each) Maine sardines 8 slices white bread 1½ tablespoons butter or margarine ¼ cup chopped green pepper ¾ cup shredded sharp natural Cheddar cheese 3 eggs ½ teaspoon salt ¼ teaspoon dry mustard Pepper, as desired 2 cups milk Paprika

Drain sardines and cut into thirds.

Remove crusts from bread, spread with butter or margarine, and cut bread into ½-inch cubes. Place half the bread cubes in a well-greased 12- by 8- by 2-inch baking dish. Cover with sardines, green pepper, and half the cheese. Top with remaining bread cubes and cheese.

Beat eggs, salt, mustard, and pepper. Add milk and mix well. Pour over bread and sprinkle with paprika.

Bake at 350° F. (moderate oven) 45 to 50 minutes, or until firm in the center. Remove from oven and let stand 5 minutes before serving.

Menu suggestion

Serve with green peas, a relish plate, and orange bavarian cream.

Eggs, cheese, dry beans

Main dishes made with eggs, cheese, or dry beans are economical choices for family meals.

Cooking eggs

For best eating quality, eggs should be cooked with low to moderate heat, for just the right amount of time. If cooking temperature is too high or the egg is cooked too long, the white becomes tough and the yolk mealy.

Caution on Use of Cracked or Soiled Eggs

Cracked or soiled eggs may contain bacteria that can produce food poisoning. For your protection, use cracked or soiled eggs only when they are thoroughly cooked or when the foods in which they are an ingredient are thoroughly cooked.

In this publication, a warning note is given with each recipe in which cracked or soiled eggs should not be used.

Scrambled eggs

Break eggs into a bowl. Add milk as follows: For creamy scrambled eggs, add 1 tablespoon milk for each ego; for dry scrambled eggs, add ½ tablespoon milk for each egg. For a product with uniform yellow color, beat mixture enough to blend yolks and whites thoroughly. If you prefer scrambled eggs with flecks of yellow and white, beat only slightly. Season with salt and pepper.

Pour the mixture into a heated frypan in which a little fat has been melted. Cook slowly, stirring occasionally to let the uncooked portion flow to the bottom. Cook until the mixture is set, but still moist.

Or, if preferred, use a double boiler. Melt a little fat in the top part, pour in the egg mixture, place over simmering water in the bottom of the boiler, and cook as above.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

Variation

Before cooking the mixture, add herbs, chopped onion, shredded cheese, or small pieces of cooked bacon or ham.

Eggs cooked in shell

Put eggs in a pan; cover them completely with cold water.

For soft-cooked eggs, heat water slowly to simmering. Cover pan and remove from heat. Let stand 3 to 5 minutes; allow the longer time for a larger number of eggs or for a firmer consistency.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

For hard-cooked eggs, bring water to simmering and simmer 20 to 25 minutes. Do not let the water boil. Serve the eggs hot or plunge them at once into cold running water and leave until cold.

NOTE: The green discoloration that sometimes appears between the white and the yolk of a hard-cooked egg results from a chemical reaction, which is harmless. To help prevent this discoloration, cook eggs at low temperature, avoid overcooking, and cool promptly.

Fried eggs

Heat a small amount of fat in a frypan. Bacon or ham drippings may be used for flavor. Break eggs, one at a time, into a saucer, and slip them into the fat. Sprinkle with salt and pepper. Cook over low heat, basting with the fat, until whites are firm.

Or, if you prefer eggs with less fat, use this “fry-poach” method. Melt a little fat in a frypan over low heat—just enough to grease the bottom. Add eggs one at a time, pour in 2 or 3 tablespoons of water, cover pan tightly, and steam until eggs are done. Season before serving.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

French toast

6 servings

4 eggs, beaten ■ cup milk ¼ teaspoon salt 12 slices white bread 2 tablespoons fat or oil

Combine eggs, milk, and salt. Dip each side of bread in egg mixture.

Brown on both sides in fat on a hot griddle—3 to 4 minutes on each side. Serve immediately.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

Variation

Add ½ teaspoon cinnamon or nutmeg to egg mixture before dipping bread.

Plain or french omelet

6 servings

6 eggs ¾ teaspoon salt Pepper, as desired 6 tablespoons milk 3 tablespoons butter or margarine

Beat eggs until yolks and whites are well mixed.

Add salt, pepper, and milk.

Melt the fat in a large frypan and pour in the egg mixture.

Cook over moderate heat. As the omelet cooks, lift edges toward center and tip pan so that the uncooked mixture flows under the cooked portion. Continue cooking until bottom is light brown.

Fold one half of the omelet over the other half and serve at once.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

Variations

Spread tart jelly or browned mushrooms on half the omelet just before folding.

Sprinkle top of the omelet with shredded cheese, your favorite herbs, or bits of crisp bacon or ham.

Poached eggs

Break eggs into a saucer or custard cup, one at a time, then slip them into gently boiling, salted water—enough water to cover the eggs in a shallow pan.

Reheat water to simmering, take pan from heat, cover. Let stand 5 minutes, or until eggs are of desired firmness. Remove eggs from water and sprinkle with salt and pepper.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

Poached eggs supreme

6 servings

1 can (10½ ounces) condensed Cheddar cheese soup 2 tablespoons chopped green pepper ¼ cup process sharp Cheddar cheese spread 6 slices toast 6 eggs

Combine soup and green pepper; heat. Spread cheese on toast. Poach eggs until firm (p. 38). Place eggs on toast and cover with hot soup mixture. Serve immediately.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

Menu suggestion

Serve with green beans, fruit salad, and oatmeal cookies.

Deviled eggs

6 servings

6 eggs ¼ cup mayonnaise 1 teaspoon prepared mustard ½ teaspoon vinegar ¼ teaspoon salt White pepper, as desired Paprika

Hard-cook eggs as directed on page 37. Cool eggs under cold running water 5 to 10 minutes. Peel shells from eggs. Cut eggs in half lengthwise. Mash yolks with remaining ingredients except paprika until mixture is smooth. Fill whites with this mixture; sprinkle with paprika.

Variation

Ham-deviled eggs.—Omit salt. Add 1 can (2¼ ounces) deviled ham to yolk mixture.

Baked eggs in hash nests

6 servings

1 can (1 pound, 8 ounces) corned beef hash 6 eggs 2 tablespoons fine dry breadcrumbs, if desired Salt and pepper, as desired 1 tablespoon butter or margarine

Spread hash evenly in a 10½- by 7- by 2-inch baking pan. Form six depressions by pressing the bottom of a ½-cup measure into the hash.

Break an egg into each depression. Sprinkle each egg with breadcrumbs, if desired. Sprinkle with salt and pepper; dot with fat.

Bake at 325° F. (slow oven) 20 to 25 minutes, or until eggs are as firm as desired.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

Menu suggestion

Serve with mixed vegetables, lettuce wedges, and brownies.

Cooking cheese

Cheese, like eggs, should be cooked at low temperatures and never overcooked.

Melt cheese over simmering water, or add it to a hot mixture. Add cheese to a sauce after the sauce is cooked and heat only long enough to melt the cheese. Add cheese to an omelet just before folding.

Bake casseroles containing cheese at low to moderate temperatures. To keep cheese toppings from toughening or hardening, cover the cheese with crumbs or add cheese just a few minutes before the casserole comes out of the oven.

Cheese blends more readily with other ingredients and melts more quickly if you shred or dice it first.

Spanish rice with cheese

6 servings

3 slices bacon 1 small onion, finely chopped ¼ cup chopped green pepper ¼ cup chopped celery 1 cup water ½ teaspoon salt ¾ cup packaged precooked rice 2 cups cooked or canned tomatoes 1 teaspoon sugar ¼ teaspoon worcestershire sauce 1 cup shredded Cheddar cheese

Fry bacon in a heavy 2-quart saucepan. Drain bacon on paper. In 1 tablespoon bacon drippings, lightly brown onion, green pepper, and celery.

Add water and salt; bring to a boil. Stir in rice, tomatoes, sugar, and worcestershire sauce. Simmer until rice is just tender, stirring occasionally.

Crumble bacon and stir into rice mixture. Sprinkle cheese over top. Cover and continue cooking over very low heat until cheese is melted, about 5 minutes.

Menu suggestion

Serve with kale, fruit salad, and ice cream.

Pizza

2 pizzas, 14 inches in diameter

1 yeast roll recipe (p. 59) 4 cups shredded cheese (Mozzarella, Muenster, Colby, or process Swiss or Cheddar) 2 cans (8 ounces each) Spanish-style tomato sauce ½ teaspoon oregano ½ cup grated Parmesan cheese

Preheat oven with oven regulator set at broil; leave oven door closed.

Prepare roll dough as directed in recipe, but do not allow to rise. Divide dough into two equal portions; form each into a ball. On a floured surface, roll out each ball of dough into a 14-inch circle. Place on lightly greased pizza pans or baking sheets, turning up edges of dough slightly to form rim.

Sprinkle each pizza with 2 cups shredded cheese. Combine tomato sauce and oregano; spread half the mixture over each pizza. Sprinkle half the Parmesan cheese over each pizza.

Place pizzas in preheated oven and turn oven regulator to 525° F. (extremely hot). Bake 20 to 25 minutes, or until crust is crisp.

NOTE: Any of toppings below may be added before Parmesan cheese. Amounts are for 1 pizza:

1 can (8 ounces) sliced mushrooms, drained ¾ pound ground beef, browned and drained ¼ pound pepperoni, thinly sliced ¾ pound fresh pork sausage, browned and drained

Menu suggestion

Serve with mixed vegetable salad and fruit for dessert.

Macaroni with cheese sauce

6 servings

¼ cup butter or margarine ¼ cup flour ½ teaspoon salt 2 cups milk ½ teaspoon mustard 1½ cups cut-up processed Cheddar cheese 3 cups cooked macaroni

Melt fat and mix in flour and salt. Add milk slowly, stirring constantly, until sauce starts to boil. Lower heat and cook 3 minutes, or until thick.

Add mustard and cheese. Stir over low heat until cheese softens.

Mix in cooked macaroni and heat through.

Menu suggestion

Serve with broiled tomatoes, asparagus, lettuce, and apple crisp.

Baked cheese fondue

6 servings

12 slices white bread ¾ pound process Cheddar cheese, thinly sliced 3 eggs, beaten 3 cups milk ½ teaspoon salt ¼ teaspoon pepper Sage, as desired 1 tablespoon butter or margarine

Grease an 8- by 12- by 2-inch baking dish. Trim crusts from bread. Lay 6 slices in dish; cover with cheese. Top with remaining bread. Combine eggs and milk. Add seasonings and pour over bread. Dot with fat.

Bake at 350° F. (moderate oven) 45 minutes to 1 hour, or until set.

Variation

Place a layer of ¾ cup ground cooked ham on top of cheese before topping with bread.

Menu suggestion

Serve with peas, coleslaw, and apple pie.

Cooking dry beans

Dry beans need soaking before cooking. Use 2½ cups water for 1 cup of blackeye beans (blackeye peas, cowpeas), Great Northern beans, and lima beans. Use 3 cups water for 1 cup of kidney beans, pea (navy) beans, and pinto beans.

To soak them quickly, boil beans 2 minutes, remove from heat, and let stand 1 hour. Or if you prefer, boil beans 2 minutes and let them stand overnight.

Cook the beans in the soaking water. Add 1 teaspoon salt for 1 cup of beans; boil gently for the time given below. One cup of uncooked beans yields about 2½ cups cooked beans.

Approximate cooking time Kind of beans (hours)

Blackeye (blackeye peas, ½ cowpeas). Great Northern 1 to 1½ Kidney 2 Lima 1 Pea (navy) 1½ to 2 Pinto 2

Dry beans will cook more quickly if you add baking soda to the water before soaking. If tap water is of medium hardness, adding ■ teaspoon soda to the water for each cup of dry beans reduces cooking time about one-fourth. Measure soda exactly; too much soda affects flavor and nutritive value of beans.

To reduce foaming when cooking dry beans, add 1 tablespoon meat drippings or other fat to the cooking water for each cup of beans.

Cooked dry beans may be seasoned and eaten without further cooking, or they may be baked, or combined with other foods.

If acid ingredients like tomatoes, catsup, or vinegar are included in the recipe, add them after the beans are tender. Acids prevent softening of the beans.

Boston baked beans

6 servings

2 cups dry navy beans 6 cups (1½ quarts) water ¼ pound salt pork, cut in chunks or slices 1½ teaspoons salt ¼ cup brown sugar, packed 1 teaspoon dry mustard 2 teaspoons chopped onion ½ cup dark molasses

Boil beans in water 2 minutes. Soak 1 hour, or overnight if preferred.

Add salt pork and salt to beans and simmer until beans are tender, about 1½ hours. Drain; save ½ cup liquid. Place beans in a 3-quart casserole.

Combine bean cooking liquid, brown sugar, mustard, onion, and molasses. Pour over beans. Bake uncovered at 350° F. (moderate oven) 1 hour, or until beans are lightly browned on top and of desired consistency.

Menu suggestion

Serve with frankfurters or cold cuts, coleslaw, and baked apples.

Vegetables

Knowing how to prepare vegetables to retain their nutritive value and appetite appeal is a test of any good cook. To help you improve your skill with vegetables, here are some cooking tips—

• Boil vegetables in as little water as possible; losses in vitamins and minerals will be less, the less water you use. Serve the cooking liquids with your vegetables, or make them into sauces, gravies, or soups.

• Cook vegetables until just tender, and serve them immediately; they will taste better and retain more nutrients.

• Trim leafy vegetables like lettuce and cabbage sparingly. Use the dark outer leaves—they are especially rich in nutrients. Remove woody midribs from kale leaves—there is little nutritive loss and the kale cooks more uniformly.

Fresh vegetables

Preparing for cooking

Wash vegetables thoroughly. Use plenty of water for leafy greens; wash several times, lifting vegetables from the water.

Remove bruised, wilted, or tough parts; trim sparingly.

Soak fresh brussels sprouts and broccoli in cold salt water (2 teaspoons salt for each quart of water) 30 to 60 minutes to remove any insects.

Cooking times

In using the Boiling Guide for Fresh Vegetables on the following page, remember that vegetables may require shorter or longer cooking time than given, the exact time depending on quality and variety of vegetable. The altitude at which you live will also affect cooking times; you can shorten the time by cutting, slicing, dicing, or coarsely shredding vegetables.

Boiling fresh vegetables

Bring salted water to a boil. One-half to 1 cup water usually is enough for 6 servings of young, tender vegetables. Older root vegetables that need longer cooking may require water to cover. Spinach and other greens need only the water clinging to their leaves from washing if cooked over low heat in a pan with a tight-fitting lid. Tomatoes can be cooked in their own juice.

Add vegetable. Cover, and quickly bring water back to a boil. Reduce heat and cook gently until vegetable is just tender. Start timing after water returns to boiling.

Frozen and canned vegetables

Frozen.—Cook frozen vegetables according to package directions. For uniform cooking, thaw leafy vegetables just enough to separate the leaves before you put them in boiling water. Partly thaw corn on the cob before cooking it. If necessary, separate pieces of frozen vegetables with a fork during cooking.

Canned.—Commercially canned vegetables need reheating only. If liquid is not served with the vegetable, save it for other uses. (See Ways to Use Leftovers, p. 75.)

Unless you are absolutely sure home-canned vegetables have been processed correctly, bring them to a rolling boil. Then cover and boil for at least 10 minutes. Boil spinach and corn 20 minutes. If food looks spoiled, foams, or has an off-odor during heating, destroy it.

Serving boiled vegetables

Hot, seasoned.—Any vegetable or a combination of two or more.

Before cooking, add a pinch of an herb, such as marjoram or thyme. Or after cooking, season with butter, margarine, or drippings—or with salad oil and lemon juice, horseradish, or garlic. Or sprinkle cooked vegetables with herb vinegar or crumbled bacon.

Mashed.—Potatoes, sweetpotatoes, turnips, rutabagas, kohlrabi, carrots, winter squash.

Drain and mash cooked vegetable. Add hot milk or cream to moisten if needed. Season with salt, pepper, and butter or margarine. Beat until fluffy.

Creamed.—Peas, carrots, celery, cabbage, asparagus, broccoli, potatoes, snap beans, onions, lima beans, cauliflower, spinach.

For 6 servings, combine 3 cups drained cooked vegetable with 1½ cups medium white sauce (p. 57); heat. You may prefer thin white sauce with potatoes or lima beans.

For quick creamed vegetables, pour 1 can (10½ ounces) undiluted condensed soup—Cheddar cheese or cream of celery or mushroom—over 3 cups drained cooked vegetable; heat.

BOILING GUIDE FOR FRESH VEGETABLES

Boiling time Vegetable (minutes)

Asparagus: Whole 10 to 20 Tips 5 to 15 Beans: Lima 25 to 30 Snap, 1-inch pieces 12 to 16 Beets: Young, whole 30 to 45 Older, whole 45 to 90 Sliced or diced 15 to 25 Beet greens, young 5 to 15 Broccoli, heavy stalks, split 10 to 15 Brussels sprouts 15 to 20 Cabbage: Shredded 3 to 10 Quartered 10 to 15 Carrots: Young, whole 15 to 20 Older, whole 20 to 30 Sliced or diced 10 to 20

Cauliflower: Separated 8 to 15 Whole 15 to 25 Celery, cut up 15 to 18 Chard 10 to 20 Collards 10 to 20 Corn, on cob 5 to 15 Kale 10 to 15 Okra 10 to 15 Onions 15 to 30 Parsnips: Whole 20 to 40 Quartered 8 to 15 Peas 12 to 16 Potatoes: Whole, medium size 25 to 40 Quartered 20 to 25 Diced 10 to 15 Rutabagas, pared, cut up 20 to 30 Spinach 3 to 10 Squash: Summer, sliced 8 to 15 Winter, cut up 15 to 20 Sweetpotatoes, whole 35 to 55 Tomatoes, cut up 7 to 15 Turnips: Cut up 10 to 20 Whole 20 to 30 Turnip greens 10 to 30

Chilled, in salads.—Chill cooked vegetables and marinate them in sweet french or italian dressing. See recipes on page 53.

With a sauce.—Suggestions for vegetable and sauce combinations follow. Sauce recipes begin on page 57.

• Asparagus—mock hollandaise sauce, lemon-butter sauce, egg sauce.

• Green beans—quick mushroom or celery sauce.

• Broccoli—sour cream sauce, lemon-butter sauce, mock hollandaise sauce.

• Cauliflower—lemon-butter sauce, cheese sauce.

• Peas—onion sauce, quick mushroom or celery sauce.

• Potatoes—sour cream sauce, cheese sauce.

• Spinach—lemon-butter sauce, mock hollandaise sauce, egg sauce.

• Sweetpotatoes—honey-orange sauce.

Panned vegetables

Panning is a good way to cook cabbage, carrots, or corn.

For 6 servings, use 1½ quarts finely shredded cabbage or 1 quart cut corn or thinly sliced carrots.

Heat 1½ to 2 tablespoons butter, margarine, meat drippings, or oil in a heavy pan over moderate heat. Add vegetable and sprinkle with ½ teaspoon salt. Add 3 tablespoons water (6 tablespoons for corn) and cover pan tightly to hold in steam.

Cook over low heat until vegetable is tender; stir occasionally to prevent sticking. Cabbage will require 6 to 8 minutes, carrots about 10 minutes, and corn 15 to 18 minutes.

Variation

Add finely chopped onion or onion juice before cooking. Or add bits of crumbled crisp bacon or diced ham to cooked vegetable.

Spinach souffle

6 servings

1 package (10 ounces) frozen chopped spinach 1 tablespoon finely chopped onion ¼ cup fat or oil ■ cup flour 1½ cups milk 1½ teaspoons salt ¼ teaspoon pepper 4 eggs, separated ½ teaspoon cream of tartar

Cook spinach as directed on package, but omit salt. Drain.

Lightly brown onion in fat in a heavy 1-quart saucepan. Blend in flour. Slowly stir in milk. Bring to a boil, stirring constantly. Reduce heat and cook 1 minute more, stirring constantly. Add salt, pepper, and spinach.

Beat egg yolks slightly; stir in a little of hot mixture. Then stir egg yolks into remaining hot mixture and cook 1 minute more. Cool slightly.

Add cream of tartar to egg whites and beat until stiff but not dry. Fold in spinach mixture. Pour into a greased 2-quart casserole. Set casserole in a pan of hot water.

Bake at 350° F. (moderate oven) about 1¼ hours. Souffle is done when a knife inserted in the center comes out clean.

Broiled tomatoes

6 servings

3 large or 6 small ripe tomatoes Salt and pepper, as desired 2 teaspoons butter or margarine 2 tablespoons fine dry breadcrumbs

Wash tomatoes; cut off stem ends. Cut large tomatoes in 1-inch slices; cut small tomatoes in half crosswise.

Place cut side up on broiler rack. Sprinkle with salt and pepper. Dot each slice with fat and sprinkle with breadcrumbs.

Broil until tomatoes are soft and crumbs lightly browned, 5 to 7 minutes.

Sweetpotatoes in orange shells

6 servings

3 oranges 1 can (1 pound) sweetpotatoes, undrained 2 tablespoons butter or margarine, melted 3 tablespoons brown sugar, packed ½ teaspoon salt ¼ cup flaked coconut 6 miniature marshmallows

Squeeze oranges; save juice.

Remove membranes from orange shells.

Mash sweetpotatoes. Blend in 3 tablespoons orange juice, fat, brown sugar, and salt. Stir in coconut.

Spoon sweetpotato mixture into the orange shells. Place in a shallow baking pan.

Bake at 350° F. (moderate oven) for 20 to 30 minutes, or until lightly browned on top.

Top with marshmallows and bake about 5 minutes longer to melt and brown marshmallows.

Hungarian cabbage

6 servings

2 slices bacon 2 quarts coarsely shredded cabbage (about 1 pound) ¾ teaspoon salt Pepper, as desired 2 tablespoons vinegar 2 tablespoons water

Fry bacon until crisp; remove from pan. Add remaining ingredients to fat in pan.

Cover tightly and cook over low heat, stirring occasionally, for 20 to 25 minutes. Cabbage should be tender but crisp.

Crumble bacon over top before serving.

Stewed okra and tomatoes

6 servings

1 small onion, chopped 2 tablespoons fat or oil 1 package (10 ounces) frozen okra 1 can (1 pound) tomatoes ½ teaspoon salt ¼ teaspoon pepper

Cook onion in fat in saucepan over moderate heat until lightly browned.

Add remaining ingredients and cook until okra is tender and mixture thickens, 10 to 15 minutes. Stir occasionally to prevent sticking.

Quick cauliflower au gratin

6 servings

2 packages (10 ounces each) frozen cauliflower 1 can (10½ ounces) condensed Cheddar cheese soup 2 tablespoons fine dry breadcrumbs 1 teaspoon melted butter or margarine

Cook frozen cauliflower according to package directions.

Drain cauliflower and place in a greased 1-quart casserole. Pour undiluted soup over cauliflower. Mix crumbs with fat and sprinkle over top. Bake at 350° F. (moderate oven) 20 to 30 minutes, or until sauce bubbles and crumbs are brown.

NOTE: Two pounds of fresh cauliflower, separated into small flowerets and cooked until tender, can be used instead of frozen cauliflower.

Variation

Quick spinach au gratin.—Use 2 packages (10 ounces each) frozen chopped spinach. Crumble 6 slices crisp fried bacon over mixture before topping with crumb mixture.

Lima bean creole

6 servings

2 packages (10 ounces each) frozen lima beans 6 slices bacon ¼ cup finely chopped onion 2 tablespoons chopped green pepper ½ teaspoon salt Pepper, as desired 2 cups cooked or canned tomatoes

Cook beans as directed on package; drain.

Fry bacon; drain on absorbent paper. In 2 tablespoons bacon drippings, brown onion and green pepper. Crumble bacon. Add browned onion and green pepper, bacon, seasonings, and tomatoes to beans. Cover and simmer gently 15 minutes.

Variations

Green bean creole.—Use 2 packages (10 ounces each) frozen cut green beans instead of lima beans.

Eggplant creole.—Use 1 medium-size eggplant, pared and cubed, instead of beans. Do not cook eggplant before combining with other ingredients. Increase salt to 1 teaspoon. Cook 15 to 20 minutes, until eggplant is tender.

Scalloped zucchini squash

6 servings

6 cups thinly sliced zucchini squash 1 cup boiling water ¾ cup medium white sauce (p. 57) 2 eggs, beaten 1 teaspoon salt ½ teaspoon worcestershire sauce 1 teaspoon finely chopped onion ¼ cup fine dry breadcrumbs 1 tablespoon butter or margarine, melted

Cook squash in boiling water until tender, about 5 minutes. Drain.

Make white sauce.

Stir a little hot white sauce into beaten eggs; then gradually stir eggs into remaining sauce. Stir in salt, worcestershire sauce, onion, and cooked squash.

Put in a greased 1-quart casserole. Mix breadcrumbs with fat; sprinkle over squash mixture. Bake at 325° F. (slow oven) about 35 minutes.

Ham-seasoned green beans

6 servings

1½ pounds green beans, broken into short pieces 2 small onions, quartered ½ stalk celery, sliced About 2 ounces cooked ham, cut into bite-sized pieces 2 teaspoons salt Pepper, as desired ½ cup water 1 tablespoon butter or margarine

Place beans in a 2-quart saucepan. Add remaining ingredients. Simmer until beans are tender, 12 to 20 minutes.

NOTE: Instead of fresh green beans, use 2 packages (10 ounces each) frozen cut green beans.

Harvard beets

6 servings

3 tablespoons cornstarch ■ cup sugar ¾ teaspoon salt 1½ cups beet liquid (or beet liquid plus water) 2 tablespoons vinegar 1½ tablespoons butter or margarine 3 cups sliced cooked or canned beets

Mix cornstarch, sugar, and salt. Blend in beet liquid, vinegar, and fat. Cook over moderate heat, stirring constantly, until thickened.

Add beets to sauce. Let stand 10 minutes, if desired, to blend flavors. Heat to serving temperature.

Eggplant casserole

6 servings

2 cups pared, cubed eggplant 2 tablespoons finely chopped onion ¼ cup water 2 eggs, slightly beaten 2 slices soft bread, torn in very small pieces ½ cup milk 1 teaspoon salt Pepper, as desired 1¼ cups shredded sharp Cheddar cheese

Cook eggplant and onion in unsalted water until eggplant is tender, about 7 minutes; drain. Combine all ingredients except ¼ cup cheese; mix well. Pour into a greased 1-quart casserole. Bake uncovered at 350° F. (moderate oven) 25 minutes. Sprinkle with remaining cheese and bake 5 minutes longer.

Glazed carrots

6 servings

2 tablespoons butter or margarine ¼ cup brown sugar, packed 1 tablespoon water 3 cups cooked carrots, cut in strips

Blend fat, sugar, and water in a heavy fry pan over low heat. Add carrots. Cook over low heat 5 to 10 minutes, turning carrots to coat all sides with sirup. Keep heat low to prevent scorching.

Potato patties

6 patties

2 cups seasoned mashed potatoes 1 egg or 2 egg yolks, slightly beaten 1 tablespoon finely chopped onion 1 tablespoon chopped green pepper 2 tablespoons fat or oil

Combine all ingredients except fat; mix well. Shape into six patties. Brown well in hot fat, about 4 minutes on each side.

NOTE: Leftover mashed potatoes or instant mashed potatoes, prepared according to package directions, may be used in this recipe.

Stuffed baked potatoes

6 servings

6 medium-size baking potatoes 1 package (3 ounces) cream cheese, at room temperature ■ cup milk 1 teaspoon salt ■ cup butter or margarine Paprika

Rub potatoes with a little fat if soft skins are desired. Bake at 425° F. (hot oven) 50 to 60 minutes, or until potato is soft when pressed. Slash tops lengthwise and crosswise. Fold back flaps, scoop out inside, and mash thoroughly.

Soften cream cheese and blend in milk, salt, and fat until smooth and creamy. Add cream cheese mixture gradually to hot potato, blending thoroughly.

Stuff skins with potato mixture. Sprinkle with paprika. Return to oven a few minutes to brown tops.

Green bean-mushroom casserole

6 servings

2 packages (10 ounces each) frozen cut green beans ¼ cup finely chopped onion ¼ cup water 1 teaspoon salt 1 can (10½ ounces) condensed cream of mushroom soup 1 can (4 ounces) mushroom stems and pieces, drained, chopped ½ cup canned french-fried

onion rings

Cook beans and chopped onion in water with salt until beans are tender, 12 to 15 minutes. Drain.

Stir in undiluted soup and mushrooms. Pour into greased 1½-quart casserole. Top with onion rings. Cover and bake at 350° F. (moderate oven) 30 minutes, or until mixture is heated through and top is brown.

Onions in mushroom sauce

6 servings

1½ pounds small yellow onions 1 cup water 1 teaspoon salt 1 can (10½ ounces) condensed cream of mushroom soup Parsley

Peel and quarter onions. Leave very small onions whole. Simmer onions in salted water 15 to 20 minutes, or until just tender. Drain.

Add undiluted soup and simmer 10 to 15 minutes longer. Garnish with parsley before serving.

Salads and Salad Dressings

What better way to serve a variety of fruits, vegetables, even meats—than in a colorful salad? As an appetizer, a side dish, a dessert, or the main course of your meal, a salad brings lots of goodness to your table. Salads can be light or hearty, depending on the ingredients you choose.

Summertime salads often feature a medley of fresh fruits. Tossed green salads are year-round favorites. Salads made from eggs and potatoes, from seafoods, and from meats and cheeses also deserve a place in your meal planning.

Tips on salad making

Selecting top-quality fruits and vegetables is a good start toward a good salad. Fresh food has eye and taste appeal.

Give salad foods the best care to avoid damage and to keep them fresh. If you prepare salad ingredients ahead of time, store them, without dressing, in the refrigerator.

If you plan to use unpeeled fruits or vegetables in a salad, choose those with smooth, tender, colorful skins.

See page 12 for other pointers on selecting fresh fruits and vegetables. You'll find suggestions for storing them on page 14.

For appetite appeal

Chill ingredients before you mix your salad.

For tossed green salads, tear greens into fairly large pieces. This will give your salad more body.

Always thoroughly drain the greens you use in salads.

Vary your salad greens. Try chicory, escarole, endive, kale, spinach, dandelion greens, romaine, watercress, and chinese cabbage.

Some salad fruits are likely to turn dark on standing; dip these in a little citrus juice.

Drain canned fruits and vegetables before you add them to a salad.

Tips on dressings

Main-dish salads made with meat, fish, poultry, eggs, beans, cheese, or potatoes usually call for a mayonnaise-type dressing, but some are good with french or italian dressing (p. 53).

On vegetable salads and vegetable-fruit combinations, try french, italian, thousand island, or Roquefort or blue cheese dressing (p. 53). Fruit salads taste best with sweet dressings—sweet french, orange-honey, or celery seed dressing ([p. 53]).

Prevent sogginess and wilting by using just enough salad dressing to moisten ingredients. Add dressing to raw vegetable salads at the last minute unless your recipe calls for marinated vegetables.

Salad go-togethers

Some salad combinations are traditional—lettuce and sliced tomatoes, canned peaches and cottage cheese. You can make a variety of salads by sometimes contrasting flavors and textures, sometimes complementing them.

Ingredients that go well together in salads are suggested below.

Fruit salad combinations

6 servings

• Pare and section 2 grapefruit and 3 oranges. For each salad arrange grapefruit and orange sections on a lettuce leaf; garnish with a maraschino cherry half.

• Lightly mix 1½ cups each of cantaloup, honeydew, and watermelon balls or cubes. Serve on crisp salad greens. Allow about ■ cup fruit per serving.

• Drain 1 can (13½ ounces) pineapple tidbits; combine with 3 oranges, pared and sectioned, and 1 banana, sliced. Place on crisp salad greens and sprinkle with ¼ cup chopped walnuts. Allow about ½ cup fruit per serving.

• Lightly mix 2 cups cantaloup cubes; ½ cup fresh blueberries; and 1 large banana, sliced. Serve on crisp salad greens; allow about ½ cup fruit per salad.

• Combine 4 peaches, peeled and sliced; ½ cup halved seedless grapes; ½ cup halved, seeded Tokay grapes; and 1 large banana, sliced. Serve on crisp salad greens; allow about ■ cup fruit per serving.

Vegetable salad combinations

6 servings

• Lightly toss together ½ pound young spinach leaves, torn in bite-size pieces; 2 green onions, thinly sliced; and 4 crisp bacon strips, crumbled. Garnish with 2 hard-cooked eggs, chopped.

• Lightly toss together 2 carrots, thinly sliced; ½ head raw cauliflower, thinly sliced; ½ head lettuce, torn in bite-size pieces; ¼ cup chopped green pepper; and 2 tomatoes, cut in wedges.

• Cook, drain, and chill 1 package (10 ounces) frozen mixed vegetables; lightly toss together with ½ head lettuce, torn in bite-size pieces.

Marinated vegetable salads

6 servings

Asparagus spear salad.—Hard cook 2 eggs; chill. Drain 1 can (1 pound) asparagus spears and marinate overnight in ½ cup sweet french dressing (p. 53). For each salad arrange asparagus spears on a lettuce leaf, top with a strip of canned pimiento, and sprinkle with chopped hard-cooked egg.

Cucumber and onion salad.—Score 2 cucumbers with a fork; pare first, if desired. Slice thinly. Slice ½ medium onion and separate it into rings. Marinate cucumber and onion slices 3 to 4 hours in ½ cup sweet french dressing (p. 53). Serve garnished with tomato wedges.

Green bean salad.—Drain 1 can (1 pound) cut green beans and 1 can (8 ounces) cut wax beans. Thinly slice 1 small onion and separate into rings. Toss beans and onion rings with ½ cup chopped sweet red or green pepper. Marinate overnight in ½ cup sweet french dressing (p. 53).

Three-bean salad.—Drain 8-ounce cans of green beans, wax beans, and kidney beans; continue as directed for green bean salad.

Creamy fruit salad

6 servings

1 package (3 ounces) cream cheese 1 tablespoon sirup from canned mandarin oranges 1 can (11 ounces) mandarin orange sections, drained 1 can (13½ ounces) pineapple tidbits, drained 1 cup miniature marshmallows ■ cup halved, drained maraschino cherries Lettuce

Beat cream cheese with liquid from mandarin oranges until creamy. Add oranges, pineapple, and marshmallows; combine gently but thoroughly. Lightly fold in cherries. Chill. Serve in lettuce cups.

Variation

Frozen fruit salad.—Blend ¼ cup mayonnaise with cream cheese and liquid before adding the fruits. Whip 1 envelope of dessert topping mix as directed on package label. Fold whipped topping and cherries into the fruit mixture. Pour into a 1½-quart mold and freeze overnight. Dip in warm water to unmold.

Molded pineapple-carrot salad

6 servings

1 package (3 ounces) lemon-flavored gelatin 1 cup shredded raw carrots 1 can (10½ ounces) crushed pineapple, drained ¼ cup raisins Lettuce Mayonnaise

Prepare gelatin according to package directions, using pineapple sirup as part of the liquid. Chill until mixture is slightly thickened.

Fold in carrots, pineapple, and raisins; pour into a 1-quart mold. Chill until firm. Serve on lettuce; top with mayonnaise if desired.

Souffle meat salad

6 servings

1 package (3 ounces) lemon-flavored gelatin 1 cup boiling water ½ cup cold water ½ cup salad dressing 2 tablespoons vinegar ¼ teaspoon salt Pepper, as desired ½ cup chopped celery 1 tablespoon chopped parsley 1 tablespoon grated onion 2 cups chopped cooked meat Salad greens

Dissolve gelatin in boiling water. Add cold water, salad dressing, vinegar, salt, and pepper. Beat until smooth. Chill until slightly thickened.

Whip until fluffy. Fold in celery, parsley, onion, and meat. Pour into a 1-quart mold. Chill until firm.

Unmold on salad greens.

Variations

Souffle poultry salad.—Use 2 cups chopped cooked poultry as the meat.

Souffle fish salad.—Use 2 cups flaked canned or cooked fish as the meat.

Menu suggestion

Serve with broiled tomatoes, asparagus, and have apple pie with cheese for dessert.

Stuffed prune salad

6 servings

½ cup creamed cottage cheese 1 to 2 tablespoons milk, if needed 1 to 2 teaspoons grated orange rind, as desired ¼ cup chopped peanuts ¼ teaspoon salt (if peanuts are unsalted) 18 chilled, pitted, cooked prunes Salad greens

If cottage cheese is dry, soften it with milk. Mix in orange rind, 3 tablespoons peanuts, and salt; stuff into prunes.

Arrange prunes on salad greens and sprinkle with rest of peanuts.

Luncheon chef salad bowl

6 main-dish salads

2 medium heads lettuce 8 radishes, thinly sliced 4 green onions, with tops, thinly sliced 3 large ripe tomatoes, cut into 8 wedges each 3 cups cooked ham (about 1 pound), cut into 1-inch cubes 2 cups coarsely shredded Swiss cheese Croutons (p. 56) Salad dressing

Wash and drain lettuce. Reserve outer lettuce leaves; tear remaining lettuce into bite-size pieces. Combine torn lettuce, radishes, and green onions; toss lightly.

Line 6 individual salad bowls with lettuce leaves. For each salad, use 2 cups lettuce mixture and top with 4 tomato wedges, ½ cup ham cubes, and ■ cup shredded cheese. Top with croutons. Serve with dressing of your choice.

Menu suggestion

Serve with garlic bread and have quick cherry cobbler for dessert.

Coleslaw

6 servings

1½ teaspoons salt ½ teaspoon dry mustard White pepper, as desired ¼ cup sugar 2 tablespoons lemon juice 1 tablespoon tarragon vinegar ¼ cup table cream 3 cups coarsely shredded cabbage ¼ cup finely chopped green pepper 1 tablespoon chopped pimiento ½ cup finely chopped celery 2 tablespoons finely chopped onion

Thoroughly mix all ingredients except vegetables.

Combine vegetables; mix well. Gently stir in the dressing. Chill before serving.

Potato salad

6 servings

½ cup mayonnaise 1 teaspoon dry mustard 2½ teaspoons salt 2 tablespoons finely chopped onion 2 tablespoons chopped green pepper ¾ cup finely chopped celery ¼ cup sweet pickle relish 1 tablespoon chopped pimiento 6 medium-size boiled potatoes, diced 3 hard-cooked eggs, chopped

Combine ingredients except potatoes and eggs; mix thoroughly. Pour this mixture over potatoes and mix gently. Add chopped eggs. Chill several hours before serving.

Variation

Pea salad.—Use 1 package (10 ounces) frozen peas, cooked and drained, or 1 can (1 pound) peas, drained, in place of potatoes. Reduce salt to 1 teaspoon. Add 1 cup process Cheddar cheese cubes.

Basic french dressing

About 1 cup

■ cup salad oil 1 tablespoon tarragon vinegar 2 tablespoons lemon juice 1½ teaspoons salt ½ teaspoon paprika ½ teaspoon dry mustard White pepper, as desired

Thoroughly mix all ingredients. Chill. Shake well just before serving.

Variations

Sweet french dressing.—Increase vinegar to 2 tablespoons and add ¼ cup sugar.

Italian dressing.—Use ¼ teaspoon white pepper. Add ¼ cup finely chopped onion, 1 teaspoon finely chopped garlic, 2 tablespoons sugar, ½ cup catsup, and ½ teaspoon oregano. Refrigerate, covered, overnight to blend flavors. Strain to remove onion and garlic before serving. About 1½ cups.

Roquefort (blue) cheese dressing

About 1 cup

1 cup mayonnaise 1 package (4 ounces) Roquefort or blue cheese, crumbled 2 tablespoons half-and-half or table cream ½ teaspoon tabasco sauce

Mix all ingredients.

Refrigerate until used.

Orange-honey french dressing

About 1¼ cups

¼ cup orange juice frozen concentrate 1 tablespoon vinegar ¼ cup honey ½ teaspoon dry mustard ½ teaspoon salt ■ cup salad oil

Thoroughly mix all ingredients except salad oil.

Add the oil slowly while beating constantly with rotary or electric beater.

Refrigerate until used.

Celery seed dressing

About 1 cup

■ cup sugar 2 tablespoons lemon juice 1 tablespoon tarragon vinegar 1½ teaspoons salt ½ teaspoon paprika ½ teaspoon dry mustard 1 teaspoon celery seed ■ cup salad oil

Thoroughly mix all ingredients except salad oil.

Add the oil slowly while beating constantly with rotary or electric beater.

Refrigerate until used.

Thousand island dressing

About 2 cups

1 cup mayonnaise ¼ cup sweet pickle relish 2 tablespoons chili sauce 1 tablespoon chopped green pepper 1 tablespoon finely chopped onion 1 hard-cooked egg, finely chopped

Mix all ingredients except the egg. Gently mix in the chopped egg.

Refrigerate until used.

Soups

Steaming hot, hearty soups and chowders make delicious dishes for luncheon or supper. When they contain substantial amounts of fish, meat, milk, dry beans or peas, they are filling enough to be the main part of your meal. Or you can serve soup with a salad or a sandwich.

Turkey-vegetable soup

6 servings

1 small onion, chopped 2 tablespoons butter or margarine 2 cups water 2 chicken bouillon cubes 2 cups cooked turkey, diced ½ cup celery tops and pieces 1½ cups diced potatoes 1 cup diced carrots 2½ cups milk 2 tablespoons flour 1 teaspoon salt ■ teaspoon pepper

Cook onion in fat until tender. Add water, bouillon cubes, turkey, and vegetables.

Boil gently, covered, until vegetables are tender.

Stir a little of the milk into the flour until mixture is smooth; add remaining milk, salt, and pepper. Add milk mixture to soup.

Simmer, stirring occasionally to prevent sticking, until soup is slightly thickened.

Variation

Chicken-vegetable soup.—Use chicken instead of turkey, and chicken broth instead of water and bouillon cubes.

Menu suggestion

Serve with a cucumber salad, toast, and cherry pie.

Hearty vegetable soup

6 servings

1 cup cooked beef, cut in small pieces 6 cups beef broth 2 cups fresh or canned tomatoes 1 cup diced potatoes ¾ cup diced carrots ½ cup sliced onion 3 cups other uncooked vegetables (green peas, chopped cabbage, diced celery, cut green beans, chopped green pepper, sliced okra, diced turnips, cut corn) 1½ teaspoons salt ■ teaspoon pepper

Combine beef and broth in a large saucepan. Add remaining ingredients.

Cook, covered, about 35 minutes, or until vegetables are tender.

NOTES: In place of beef broth use 6 beef bouillon cubes and 6 cups water. (Liquid from canned or cooked vegetables may replace some of the water.)

Canned or leftover vegetables may be used instead of uncooked vegetables. Add to soup during last few minutes of cooking.

Menu suggestion

Serve with toasted cheese sandwiches and have fruit gelatin for dessert.

Bean soup

6 servings

1½ cups dry beans 7 cups water Ham pieces or ham bone 1 small onion, chopped 2 celery stalks, chopped 1 teaspoon salt ¼ teaspoon pepper

Boil beans in the water for 2 minutes; remove from heat. Let soak in cooking water 1 hour, or overnight if preferred.

Add remaining ingredients. Simmer, covered, until beans are soft, about 2 to 3 hours.

Remove ham bone and partially mash beans before serving soup.

Menu suggestion

Serve with coleslaw, cornbread, and apple pie with cheese.

New England fish chowder

6 servings

1 pound fish fillets or steaks, fresh or frozen 2 tablespoons chopped bacon or salt pork ½ cup chopped onion 2½ cups diced potatoes 1½ cups boiling water 1 teaspoon salt Pepper, as desired 2 cups milk 1 tablespoon butter Chopped parsley

Thaw frozen fish. Remove skin and bones. Cut fish into 1-inch pieces.

Fry bacon or salt pork in a 3-quart saucepan until crisp. Add onion and cook until tender. Add potatoes, water, salt, pepper, and fish. Cover; simmer 15 to 20 minutes, or until potatoes are tender.

Add milk and butter. Heat. Garnish with parsley.

Menu suggestion

Serve with crackers, fruit salad, and chocolate cake.

Manhattan fish chowder

6 servings

1 pound fish fillets or steaks, fresh or frozen ¼ cup chopped bacon or salt pork ½ cup chopped onion 2 cups boiling water 1 can (1 pound) tomatoes 1 cup diced potatoes ½ cup diced carrots ½ cup chopped celery ¼ cup catsup 1 tablespoon worcestershire sauce 1 teaspoon salt ¼ teaspoon pepper ¼ teaspoon thyme Chopped parsley

Thaw frozen fish. Remove skin and bones. Cut fish into 1-inch pieces.

Fry bacon or salt pork in a 3-quart saucepan until crisp. Add onion and cook until tender. Add water, vegetables, catsup, and seasonings except parsley. Cover and simmer 40 to 45 minutes, or until vegetables are tender.

Add fish. Cover and simmer about 10 minutes longer, or until fish flake easily when tested with a fork. Garnish with parsley.

Menu suggestion

Serve with marinated green bean salad, peaches, and oatmeal cookies.

Croutons

6 servings

3 slices bread 2 tablespoons softened butter or margarine ¼ teaspoon garlic salt Paprika

Trim crusts from bread. Blend butter or margarine with garlic salt; spread on both sides of bread. Cut bread into cubes; place them on baking sheet and sprinkle with paprika.

Bake at 300° F. (slow oven) until crisp and golden brown, about 20 to 30 minutes.

Serve on soups or salads or as a soup accompaniment.

Variation

Cheese croutons.—Mix bread cubes lightly with ½ cup grated Parmesan cheese before placing on baking sheet.

Creamy potato soup

6 servings

5 cups raw diced potatoes ¼ cup finely chopped onion 1½ cups water 3 cups potato cooking liquid and milk 2 tablespoons butter or margarine 2 teaspoons salt Pepper, as desired Paprika or chopped parsley

Cook potatoes and onion in water in a covered saucepan until potatoes are tender, about 15 minutes. Drain and mash potatoes; save cooking liquid.

Measure liquid; add enough milk to make 3 cups.

Slowly stir liquid into potatoes; add fat and seasonings.

Simmer a few minutes to blend flavors. Garnish with paprika or parsley.

Menu suggestion

Serve with tossed vegetable salad, cheese muffins, and fresh fruit.

Cream of broccoli soup

6 servings

1 package (10 ounces) frozen chopped broccoli 1 tablespoon finely chopped onion ¼ cup flour 3 cups vegetable cooking liquid and milk 1 tablespoon butter or margarine 1½ teaspoons salt Pepper, as desired 1 hard-cooked egg, sliced, if desired

Cook broccoli according to package directions, but omit salt and add onion. Drain; save cooking liquid.

Mix flour with part of milk mixture until smooth. Add remaining liquid to broccoli. Stir in flour mixture, fat, and seasonings.

Cook over moderate heat, stirring occasionally, until soup is slightly thickened and flavors are blended. Garnish with slices of hard-cooked egg, if desired. Serve with croutons (see recipe on this page).

Menu suggestion

Serve with meat sandwiches and baked apples.

Sauces and Gravies

Sauces and gravies are not difficult if you begin with these basic recipes. As you become more expert, you can develop your own variations.

White sauce

1 cup

Thin _Medium_ _Thick_ Fat (tablespoons) 1 1 or 2 2 or 3 Flour (tablespoons) 1 2 3 or 4 Salt (teaspoon) ¼ ¼ ¼ Milk (cup) 1 1 1

Melt butter, margarine, or other fat in heavy saucepan. Blend in flour until smooth. Add salt. Add milk slowly, stirring rapidly to prevent lumping. Bring mixture to a boil, stirring constantly. Reduce heat and cook 1 minute, stirring constantly. Remove from heat.

Thin white sauce is used in cream soup, gravy, and in creamed and scalloped vegetables, eggs, fish, and meat.

Medium white sauce is also used in gravy and in creamed and scalloped vegetables, eggs, fish, and meat.

Thick white sauce is used in hollandaise sauce and as a binder for croquettes and souffles.

Variations

Cheese sauce.—Add 1 cup of finely grated cheese to 1 cup hot white sauce, either thin or medium. Stir until cheese is melted, taking care not to overcook.

Egg sauce.—To 1 cup of hot medium white sauce add: 3 chopped, hard-cooked eggs; 1 tablespoon lemon juice; a few drops of yellow food coloring, if desired. Stir.

Onion sauce.—Use proportions for medium white sauce. Brown ½ cup of finely chopped onion in fat before adding flour; then continue as directed above. Add white pepper, as desired.

Gravy

For a thin gravy use 1 tablespoon each of flour and fat or drippings to each cup of liquid; for a medium gravy use 2 tablespoons of flour and 1 or 2 tablespoons of fat or drippings, as desired. If drippings are scant, add a bouillon cube or a little meat extract to the liquid.

METHOD 1.—_Use with fat or with drippings containing only fat and browned crusty bits._ Measure fat or drippings. Stir flour into fat; brown over low heat. Add liquid slowly, stirring constantly. Cook until thickened, stirring occasionally. Season to taste.

METHOD 2.—_Use with fat or drippings containing a considerable amount of liquid._ Measure drippings; if necessary add water to make desired amount of liquid. Heat. Combine flour with an equal amount of cold water by stirring or shaking until smooth. Stir slowly into hot liquid. Cook until thickened, stirring occasionally. Season to taste.

Tartar sauce

About ¾ cup

½ cup mayonnaise or salad dressing 1 tablespoon chopped olives 1 tablespoon chopped onion 1 tablespoon chopped parsley 1 tablespoon chopped sweet pickle

Combine all ingredients and mix well. Chill. Serve with fish.

Honey-orange sauce

About 1 cup

■ cup honey 1 tablespoon cornstarch 1 teaspoon grated orange rind ½ cup orange juice ¼ cup water 2 tablespoons butter or margarine

Combine honey, cornstarch, and orange rind in a heavy saucepan. Stir in orange juice and water. Bring to a boil; add fat and blend well. Cool slightly. (Sauce thickens as it cools.)

Can be spooned over warm gingerbread or other desserts.

Sour cream sauce

About 1 cup

1 cup sour cream 1 tablespoon chopped fresh or frozen chives or green onion tops ¼ teaspoon salt 3 drops worcestershire sauce White pepper, as desired

Combine all ingredients thoroughly at least 2 hours before serving. Refrigerate. Serve at room temperature or slightly chilled.

Can be served with broccoli or baked potatoes.

Quick vegetable sauce

About 2 cups

1 can (10½ ounces) condensed cream of vegetable, celery, or mushroom soup ½ cup half-and-half or table cream

Combine ingredients and heat.

Serve over vegetables, meats, or fish.

Mock hollandaise sauce

About 1 cup

1 cup thick white sauce, made with 3 tablespoons flour and 3 tablespoons fat (p. 57) 2 egg yolks, slightly beaten 2 tablespoons lemon juice

Make 1 cup of thick white sauce. Add a little hot white sauce to beaten egg yolks; then stir egg mixture into remaining white sauce. Cook 1 minute over low heat.

Stir in lemon juice. Serve immediately.

Can be served with asparagus, broccoli, or spinach.

NOTE: _Use yolks from clean, sound-shelled eggs in this recipe._

Lemon-butter sauce

About ■ cup

¼ cup melted butter or margarine ¾ teaspoon salt ¾ teaspoon paprika 1 tablespoon lemon juice 2 teaspoons prepared horseradish

Mix all ingredients well.

Serve hot over vegetables or fish.

Breads and Sandwiches

Hot breads

Bake a batch of homemade bread or yeast rolls, and watch tired appetites perk up. Surprise your family with hot biscuits or muffins.

For a leisurely Sunday breakfast, make waffles or pancakes.

Before using the recipes for breads, see the section on ingredients and measurements (p. 16).

Yeast rolls

18 to 24 rolls

1 package active dry yeast or 1 cake compressed yeast ¼ cup warm water (about 110° F.) ¾ cup hot milk ¼ cup shortening or oil ¼ cup sugar 1¼ teaspoons salt 1 egg About 4 cups flour

Dissolve yeast in water. Mix milk, fat, sugar, and salt in a large mixing bowl. Cool to lukewarm.

Stir in egg and yeast. Add 2 cups flour and beat until smooth. Gradually stir in more flour until dough leaves sides of bowl.

Turn dough out onto lightly floured surface and knead until dough is smooth and elastic.

Place in a lightly greased bowl and turn over once to grease upper side of dough. Cover and let rise in a warm place (80° to 85° F.) until almost double in bulk, 1 to 1¼ hours. Dough should rise until a light touch leaves a slight depression. Press the dough down into the bowl to remove air bubbles.

To make plain rolls, divide dough into small pieces and roll into balls about 1½ inches in diameter. Place in a shallow greased pan with sides touching—or 1 inch apart if you prefer crusty sides.

Cover loosely and let rise in a warm place until double in bulk, 45 minutes to 1 hour.

Bake at 400° F. (hot oven) 15 to 20 minutes.

Brush rolls with melted butter or margarine after removing them from the oven.

Variations

Crescent rolls.—Divide dough into three portions. On a lightly floured surface, roll out each portion into a circle about 10 inches in diameter. Brush with melted butter or margarine. Cut each circle into 6 wedges; roll wedges up tightly, beginning at wide end. Place on greased baking sheet with points down; curve ends to form crescents. Let rise and bake.

Cinnamon-nut rolls.—Roll dough out on lightly floured surface into a rectangle about ¼-inch thick. Brush with melted butter or margarine. Sprinkle with a mixture of ½ cup sugar and 2 teaspoons cinnamon. Press ½ cup chopped nuts into dough. Roll as for jelly roll; seal edge. Cut into ¾-inch slices. Place close together, cut side down, in a greased shallow baking pan. Let rise and bake.

Cloverleaf rolls.—Divide dough into very small pieces and roll into balls about ¾ inch in diameter. Dip each ball in melted butter or margarine and place three balls together in a greased muffin tin. Let rise and bake.

Biscuits

12 biscuits

2 cups flour 1 tablespoon baking powder 1 teaspoon salt ■ cup shortening About ¾ cup milk

Mix dry ingredients thoroughly. Mix in fat only until mixture is crumbly.

Add most of the milk and stir to mix. Add more milk as needed to make a dough that is soft but not too sticky to knead. Knead dough gently on a lightly floured surface 10 to 12 times. Form into a ball.

Pat or roll dough to ½- to ¾-inch thickness. Cut with a floured biscuit cutter or cut into squares with a knife. Place on an ungreased baking sheet—1 inch apart for crusty biscuits; together for softer biscuits.

Bake at 450° F. (very hot oven) 12 to 15 minutes, or until golden brown.

Variations

Cheese biscuits.—Combine ¾ cup shredded sharp or extra sharp cheese with dry ingredients before adding fat.

Sweet biscuits or shortcake.—Combine 1 tablespoon sugar with dry ingredients. Use ¼ cup butter or margarine for fat. Reduce milk to ■ cup. Bake at 425° F. (hot oven) 10 to 15 minutes.

Popovers

12 popovers

3 eggs 1 cup milk 2 tablespoons melted fat or oil 1 cup flour ½ teaspoon salt

Grease muffin tins and place them in an oven that is preheating at 450° F. (very hot).

Beat eggs well in a large mixing bowl. Add milk and fat. Mix flour and salt; add to liquid mixture. Beat until smooth.

Fill hot muffin tins half full of batter. Bake at 450° F. 15 minutes; reduce heat to 375° F. (moderate oven) and bake 10 minutes longer. Do not open oven door during baking.

Immediately after baking, insert a paring knife through the top of each popover to allow steam to escape.

Cornbread

6 servings

1 cup yellow cornmeal 1 cup flour 4 teaspoons baking powder ¼ or ■ cup sugar, as desired ½ teaspoon salt 1 cup milk 1 egg, beaten ¼ cup melted shortening or oil

Mix dry ingredients thoroughly. Combine milk and egg; stir in fat. Add liquid to dry ingredients; stir only enough to mix.

Pour batter into a greased 8- by 8- by 2-inch baking pan. Bake at 400° F. (hot oven) about 25 minutes, or until lightly browned.

Variation

Corn muffins.—Fill greased muffin tins half full of batter. Bake at 400° F. (hot oven) about 20 minutes. Makes 12 muffins.

Spoonbread

6 servings

3 cups milk 1 cup cornmeal 1½ teaspoons salt 2 tablespoons butter or margarine 4 egg yolks, beaten 4 egg whites

Combine milk, cornmeal, and salt. Cook over low heat, stirring constantly, until thickened, about 15 minutes. Mix in fat. Cool to lukewarm. Stir in egg yolks.

Beat egg whites until stiff, but not dry. Fold into mixture; pour into greased 1½-quart casserole.

Bake at 400° F. (hot oven) for 35 to 40 minutes or until set. Serve immediately.

Muffins

12 muffins

1 egg 1 cup milk ■ cup oil or melted shortening 2 cups flour 1 tablespoon baking powder 1 teaspoon salt ■ cup sugar

Beat egg until yolk and white are well blended. Blend in milk and fat.

Mix dry ingredients thoroughly. Add liquid and stir until dry ingredients are barely moistened. Do not overmix. Batter should be lumpy.

Fill greased muffin tins half full of batter. Bake at 400° F. (hot oven) 20 to 25 minutes.

Variations

Blueberry muffins.—Increase sugar to ½ cup. Lightly blend in ¾ cup fresh or drained canned blueberries when combining liquid and dry ingredients. Do not crush berries.

Bran muffins.—Reduce flour to 1¼ cups. Mix 2 cups bran flakes or raisin bran cereal with dry ingredients before adding liquid.

Oatmeal-raisin muffins.—Reduce flour to 1¼ cups. Mix 1 cup quick-cooking rolled oats and ½ cup raisins with dry ingredients before adding liquid.

Nut bread

1 loaf

■ cup sugar ¼ cup shortening 2 eggs 2 cups flour 3 teaspoons baking powder ½ teaspoon salt 1 cup orange juice or milk ½ teaspoon vanilla ■ cup chopped nuts

Beat sugar, shortening, and eggs until creamy.

Mix flour, baking powder, and salt thoroughly. Stir into egg mixture alternately with liquid and vanilla; stir nuts into last portion of flour mixture before blending it into batter.

Pour into greased 9- by 5- by 3-inch loafpan. Bake at 350° F. (moderate oven) 50 to 60 minutes, or until no batter clings to toothpick inserted in center of loaf. Remove from pan and cool on rack.

Quick coffee cake

6 servings

3 tablespoons softened butter or margarine ½ cup granulated sugar 1 egg 1 cup flour 1¼ teaspoons baking powder ¼ teaspoon salt ■ cup milk ¼ teaspoon vanilla ■ cup brown sugar, packed ½ teaspoon cinnamon 2 tablespoons butter or margarine

Mix 3 tablespoons fat with granulated sugar. Add egg and beat until creamy.

Mix flour, baking powder, and salt thoroughly; add to sugar mixture alternately with milk. Add vanilla. Spread batter evenly in a greased 8-inch square baking pan.

Mix brown sugar and cinnamon and sprinkle over batter. Dot with 2 tablespoons fat. Bake at 350° F. (moderate oven) 25 to 30 minutes.

Pancakes

About 12 pancakes, 4½ inches in diameter

2 cups flour 4 teaspoons baking powder 1 teaspoon salt 2 tablespoons sugar 1 egg, well beaten 1¾ cups milk ■ cup oil or melted fat

Heat griddle while mixing batter. When griddle is hot enough, drops of water sprinkled on it will bounce.

Mix dry ingredients thoroughly. Combine egg with milk and fat. Add to dry ingredients and stir only until combined. Batter will be lumpy.

For each pancake, pour about ¼ cup batter onto hot griddle. Cook until edges become slightly dry and bubbles form on top. Turn and brown the other side.

Variation

Waffles.—Increase eggs to 3. Pour batter into hot waffle iron and bake until steaming has almost stopped.

NOTE: For a lighter-textured waffle, beat egg whites separately until stiff but not dry. Fold into waffle batter.

Sandwiches

Sandwiches play many roles in family fare. You can make them fancy for teas and parties—light for snacks—or hearty for the main course at lunch or supper.

Spread sandwich fillings generously, all the way to the edge of the bread. Fillings should be moist, but not wet. Experiment with new fillings, and with different kinds of bread.

Bacon-cheese sandwiches

6 servings

6 slices bacon 6 slices bread 6 slices (1 ounce each) cheese

Cut bacon slices into halves crosswise; fry until most of fat has cooked out.

Preheat oven with broiler pan and rack in place.

Put a slice of cheese on each bread slice. Top with partly cooked bacon.

Place sandwiches under broiler to lightly brown bacon and melt cheese.

Barbecued beef sandwiches

6 servings

1½ pounds ground beef 1 cup chopped onion 1 cup chopped celery 1 can (8 ounces) spanish-style tomato sauce ¼ cup catsup 2 tablespoons brown sugar, packed 2 tablespoons vinegar 2 tablespoons barbecue sauce 1 tablespoon worcestershire sauce 1 tablespoon prepared mustard 2 teaspoons salt Pepper, as desired 6 hamburger buns

Crumble beef into saucepan and brown lightly. Drain off excess fat. Mix in onion and celery. Combine tomato sauce, catsup, brown sugar, vinegar, barbecue sauce, and seasonings. Pour over meat, cover pan, and simmer barbecue 1½ to 2 hours, or until flavors are well blended.

Spoon beef mixture over buns.

Fish-cheeseburgers

6 servings

6 frozen fried fish portions or 12 frozen fried fish sticks 6 buttered hamburger buns 6 tablespoons chili sauce 6 slices (1 ounce each) cheese

Place frozen fried fish portions or fish sticks in a single layer on a well-greased baking sheet. Bake at 400° F. (hot oven) 15 to 20 minutes, or until heated through.

Place 1 fish portion or 2 fish sticks on bottom half of each bun on a baking sheet. Top each sandwich with 1 tablespoon chili sauce, a slice of cheese, and other half of bun.

Bake at 350° F. (moderate oven) 8 to 10 minutes, or until cheese melts.

Meat salad sandwiches

6 servings

2 cups ground cooked meat ■ cup mayonnaise or salad dressing ■ cup pickle relish ½ teaspoon salt (omit when ham is used) Pepper, as desired 12 slices bread Softened butter or margarine

Combine meat, salad dressing, relish, and seasonings; mix well. Chill.

Spread bread with butter or margarine. Then spread 6 slices with meat mixture and top each with second slice of bread.

Variations

Grilled open-face sandwiches.—Use 6 slices bread. Toast bread on one side under broiler. Spread untoasted side of the bread with butter or margarine and meat mixture. Broil sandwiches until meat browns slightly. Serve piping hot.

Poultry salad sandwiches.—Use 2 cups of ground cooked poultry as the meat.

Desserts

Dessert adds a touch that gives a good dinner its final, satisfying note.

Before using the dessert recipes in this bulletin, refer to the section on ingredients and measurements (p. 16).

Cake recipes in this publication generally need to be adapted for use in high-altitude areas. Write to your State Experiment Station or contact your county extension agent for information on baking cakes in your area.

For pies and cakes, use pans of the size specified.

To grease pans for cakes, coat lightly with unsalted fat or oil. Then sprinkle lightly with a little flour. Tip pan from side to side to coat evenly; then shake out excess flour.

In recipes that call for greased and floured cakepans, you may use a wax paper lining if you prefer. Cut wax paper to fit the bottom of the pan. Then grease the paper lightly.

Pastry

8- or 9-inch pastry shell

1 cup flour ½ teaspoon salt ■ cup shortening About 2 tablespoons cold water

Mix flour and salt thoroughly. Mix in fat only until mixture is crumbly.

Add a little water at a time, blending lightly. Dough should be just moist enough to cling together when pressed.

Shape dough into a ball. Roll out on a lightly floured surface or between two sheets of waxed paper. Fit carefully into piepan. Lift edges and smooth out air bubbles. For baked pastry shell, trim pastry, leaving about 1 inch around the edge. Fold edge under and shape into an upright rim.

Prick bottom and sides well with a fork. Bake at 450° F. (very hot oven) 12 to 15 minutes, or until golden brown.

Variation

Two-crust pie.—Double the recipe. Form dough into two balls, one slightly larger than the other. Roll out larger ball of dough and fit into piepan. Roll out remaining dough for top crust; make several slits in crust to let steam escape during baking. Put filling into pastry-lined pan. Top with second crust. Fold edges of crusts under and press together to seal. Bake as directed in pie recipe.

Apple pie

8-inch pie, 6 servings

Pastry for 2-crust 8-inch pie (above) 5 cups pared, sliced tart apples ■ cup sugar 1 tablespoon cornstarch ½ teaspoon cinnamon 1 or 2 tablespoons butter or margarine, if desired

Prepare unbaked pastry.

Mix dry ingredients lightly with apples in a bowl. Put filling into pastry-lined pan. Dot with fat, if desired. Top with second crust.

Bake at 400° F. (hot oven) for 40 to 60 minutes, or until filling bubbles and the crust is golden brown.

NOTE: If fruit is sweet, decrease amount of sugar; if unusually tart, increase sugar.

Variations

Blueberry pie.—Use 3 cups fresh blueberries instead of apples. Omit cinnamon and increase cornstarch to 3 tablespoons. Sprinkle fruit with 2 tablespoons lemon juice. Bake 50 to 60 minutes.

Cherry pie.—Instead of apples, use 1 can (1 pound) pitted red sour cherries, water pack. Do not drain. Omit cinnamon. Increase cornstarch to 2 tablespoons. Add ■ teaspoon almond extract and a few drops of red food coloring, if desired. Bake 40 to 45 minutes.

Peach pie.—Use 3 cups fresh sliced peaches instead of apples. Use only ¼ teaspoon cinnamon. Bake 40 to 50 minutes.

Vanilla cream pie

8-inch pie, 6 servings

1 8-inch pastry shell (p. 64) 3 tablespoons cornstarch ¼ cup sugar ½ teaspoon salt 2 cups milk 2 egg yolks, beaten 2 tablespoons butter or margarine 1 teaspoon vanilla ½ cup whipping cream 1 tablespoon confectioner’s sugar

Prepare, bake, and cool pastry shell.

Mix cornstarch, sugar, and salt in heavy saucepan. Gradually stir in milk.

Cook over moderate heat, stirring constantly, until thickened. Simmer 1 minute longer.

Stir a little of the hot mixture into egg yolks; then stir yolks into remaining hot mixture. Cook 1 minute longer, stirring constantly. Stir in fat and vanilla.

Set saucepan in cold water to cool. Stir frequently. Change water occasionally.

Pour filling into pastry shell. Chill thoroughly.

Before serving, whip cream until stiff and beat in confectioner’s sugar. Spread over pie.

NOTES: _Use only clean, sound-shelled eggs in this recipe._

Use whipped dessert topping instead of whipped cream, if desired.

Variations

Coconut cream pie.—Stir ½ to 1 cup shredded coconut, as desired, into the hot filling with fat and vanilla.

Banana cream pie.—Slice 2 bananas into pie shell before adding filling.

Chocolate cream pie.—Increase sugar to ¾ cup. Cut 1½ ounces bitter chocolate into cream filling after adding milk.

Graham cracker crust

8- or 9-inch pie

■ cup butter or margarine 2 tablespoons sugar 1¼ cups graham cracker crumbs

Stir fat and sugar together in a saucepan over low heat until fat is melted. Blend in cracker crumbs. Press evenly into piepan. Chill.

Pecan pie

9-inch pie, 8 servings

1 unbaked 9-inch pastry shell (p. 64) 1 cup pecan halves 3 eggs, beaten ½ cup sugar 1 cup dark corn sirup ¼ teaspoon salt 1 teaspoon vanilla ¼ cup melted butter or margarine

Prepare unbaked pastry shell. Spread nuts in bottom of pastry shell.

Combine remaining ingredients and pour over nuts. Bake at 375° F. (moderate oven) 30 to 40 minutes, or until the filling appears set when the pie is gently moved.

Pumpkin pie

8-inch pie, 6 servings

1 unbaked 8-inch pastry shell (p. 64) 1 cup canned pumpkin ½ teaspoon cinnamon ¼ teaspoon ginger ¼ teaspoon nutmeg ■ teaspoon cloves 1 cup milk, half-and-half, or evaporated milk ½ cup sugar 1 egg, slightly beaten ½ teaspoon salt

Prepare unbaked pastry shell.

Blend pumpkin and spices thoroughly. Stir in remaining ingredients; mix well. Pour into pastry shell.

Bake at 400° F. (hot oven) about 1 hour. Pie is done when a table knife inserted in center comes out clean. Filling may be soft but will set on cooling.

Quick meringue-topped pie

8-inch pie, 6 servings

1 baked 8-inch pastry shell (p. 64) 1 package (3 to 4 ounces) pudding and pie filling mix, any flavor 2 egg whites ¼ teaspoon salt ¼ cup sugar

Prepare pastry shell.

Make pie filling according to package directions. Cool filling slightly; then pour into baked pastry shell.

Beat egg whites until foamy. Add salt and beat until soft peaks form. Add sugar gradually, beating constantly, and continue beating until stiff peaks form.

Pile meringue on pie while filling is still warm. Bake at 350° F. (moderate oven) 15 to 20 minutes, or until lightly browned.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

Lemon chiffon pie

8-inch pie, 6 servings

1 8-inch graham cracker crust (p. 65) or baked pastry shell (p. 64) 1 tablespoon unflavored gelatin ¼ cup cold water 3 egg yolks ½ cup lemon juice ½ teaspoon grated lemon rind ¾ cup sugar 3 egg whites ¼ teaspoon salt

Prepare graham cracker crust or pastry shell.

Soften gelatin in cold water. Beat egg yolks slightly. Add juice, rind, and half the sugar. Cook over low heat, stirring constantly, until mixture begins to thicken, 10 to 15 minutes.

Add gelatin; stir until dissolved. Chill until mixture begins to thicken.

Beat egg whites until foamy. Add salt and beat until soft peaks form. Slowly add remaining sugar, beating constantly until stiff. Fold into chilled mixture.

Pour into crust and chill until firm.

NOTE: _Use only clean, sound-shelled eggs in this recipe._

Variation

Lime chiffon pie.—Use ½ cup lime juice and ½ teaspoon grated lime rind in place of lemon. Add a few drops of green food coloring to dissolved gelatin before chilling.

Fruit delight pie

9-inch pie, 8 servings

1 9-inch graham cracker crust (p. 65) 1 envelope whipped dessert topping mix 1 package (8 ounces) cream cheese, at room temperature ¼ cup confectioner's sugar ¼ teaspoon vanilla ½ cup chopped pecans 1 cup canned blueberry, peach, or cherry pie filling

Make graham cracker crust.

Prepare whipped dessert topping according to package directions. Beat in cream cheese, sugar, and vanilla until smooth. Stir in nuts.

Pour into pie shell. Top with pie filling. Chill at least 3 hours before serving.

Spiced prune cake

Two 8- or 9-inch layers

1 package spice cake mix (for 2-layer cake) 1¼ cups drained, pitted, and chopped cooked prunes

Prepare cake batter according to package directions. Thoroughly mix prunes into cake batter. Pour batter into two greased and floured 8- or 9-inch layer cakepans.

Bake according to package directions but increase baking time by 10 minutes. Cool cake a few minutes before removing from the pans. When cool, frost with creamy white frosting (p. 69).

Velvety white cake

Two 8-inch layers

2 cups cake flour 1¼ cups sugar 1 tablespoon baking powder 1 teaspoon salt ½ cup softened butter or margarine or shortening 1 cup milk 4 egg whites, unbeaten 1 teaspoon vanilla ¼ teaspoon almond extract, if desired

Mix dry ingredients well. Add fat and half of the milk; beat until creamy. Add remaining milk, egg whites, and flavoring; beat until creamy.

Pour into two 8-inch greased and floured layer cakepans. Bake at 375° F. (moderate oven) 25 to 30 minutes, or until the cake surface springs back when touched lightly. Cool cake for a few minutes before removing from the pans. When cool, frost as desired.

Gingerbread

6 to 9 servings

½ cup shortening ½ cup brown sugar, packed 1 egg ½ cup molasses 1½ cups flour ½ teaspoon salt ¾ teaspoon baking soda ½ teaspoon ginger ½ teaspoon cinnamon ½ cup boiling water

Beat shortening and sugar until creamy. Add egg and molasses; beat well.

Mix dry ingredients thoroughly. Add to molasses mixture alternately with boiling water. Beat after each addition.

Pour batter into a greased 8- by 8- by 2-inch baking pan. Bake at 350° F. (moderate oven) 35 to 40 minutes. Serve warm.

Upside-down cake

6 servings

2 tablespoons butter or margarine ½ cup brown sugar, packed 6 drained canned peach halves 6 drained maraschino cherries, halved 12 pecan halves 1 recipe quick coffee cake batter (p. 62)

Melt fat in a 9-inch layer cakepan over low heat. Sprinkle brown sugar over fat. Arrange fruit and nuts in sugar mixture.

Prepare coffee cake batter and pour over fruit; spread evenly. Bake at 350° F. (moderate oven) 30 to 40 minutes.

Loosen cake from sides of pan and invert on serving plate. Allow to cool 5 minutes before removing pan.

Variations

Use 12 canned apricot halves or 6 canned pineapple slices or 1 cup of drained canned crushed pineapple for the fruit.

Timesaver

Instead of quick coffee cake batter, use a 1-layer package of cake mix, prepared by package directions.

Cherry cobbler

6 servings

½ recipe sweet biscuit dough (p. 60) ■ cup sugar 2 tablespoons cornstarch 1 can (1 pound) pitted red sour cherries, water pack ■ teaspoon almond extract Few drops red food coloring 1 tablespoon butter or margarine

Make biscuit dough but do not roll out.

Blend sugar and cornstarch in a 1-quart saucepan. Gradually stir in cherries. Cook over moderate heat until thickened and clear, stirring constantly. Remove from heat. Add flavoring, food coloring, and fat. Pour into a 1½-quart casserole.

Drop biscuit dough by spoonfuls onto hot cherry mixture. Bake at 425° F. (hot oven) 15 to 20 minutes, or until filling bubbles and topping is lightly browned.

Timesaver

Quick cherry cobbler.—Use 1 can (1 pound 5 ounces) cherry pie filling. Heat to boiling and stir in 1 tablespoon butter or margarine. For biscuit topping, combine 1 cup packaged biscuit mix and 1 tablespoon sugar. Add ■ cup milk and 1 tablespoon melted butter or margarine; stir until moistened. Drop by spoonfuls onto hot cherry filling and bake as directed.

Chocolate cake

Two 8-inch layers

1¾ cups cake flour 1■ cups sugar 1 teaspoon salt 1 teaspoon baking soda ½ cup softened butter or margarine 1 cup milk 1 teaspoon vanilla 2 eggs 2 or 3 ounces (2 or 3 squares) unsweetened chocolate, melted

Mix dry ingredients well. Add fat and half of the milk; beat until creamy. Mix in remaining milk, vanilla, and eggs. Add chocolate; beat until creamy.

Pour into two 8-inch greased and floured layer cake pans. Bake at 350° F. (moderate oven) 30 to 35 minutes, or until the cake surface springs back when touched lightly. Cool cake a few minutes before removing from the pans. When cool, frost with creamy chocolate frosting (this page).

NOTE: For a loaf cake, use a greased and floured 9- by 12-inch cakepan. Bake about 40 minutes.

Creamy white frosting

For 8-inch layer cake or 9- by 12-inch loaf cake

About 2½ cups confectioner’s sugar ■ cup softened butter or margarine 3 tablespoons milk 1 teaspoon vanilla

Beat about 2 cups of the sugar with all other ingredients until frosting is creamy and smooth. Beat in enough of the remaining sugar for a frosting that will spread evenly. Spread on cooled cake.

Variation

Creamy chocolate frosting.—Mix in 1 or 2 ounces (1 or 2 squares) of melted chocolate. Or increase milk to ¼ cup and use ■ cup cocoa. Beat until creamy and smooth.

Caramel-nut frosting

For 8-inch layer cake or 9- by 12-inch loaf cake

½ cup butter or margarine 1 cup brown sugar, packed ¼ cup milk 2 cups confectioner's sugar ■ cup finely chopped pecans or walnuts ½ teaspoon vanilla Nut halves, as desired

Combine, fat, brown sugar, and milk. Cook over medium heat, stirring constantly, only until mixture boils and sugar is dissolved. Cool slightly.

Beat confectioner's sugar into cooked mixture until frosting reaches spreading consistency. Add chopped nuts and vanilla; mix well.

Spread on cooled cake. Garnish with nut halves.

Orange bavarian cream

6 servings

1 tablespoon unflavored gelatin ¼ cup cold water ¾ cup orange juice 2 tablespoons lemon juice ½ teaspoon grated orange rind ■ cup sugar ¼ teaspoon salt 1 cup whipping cream 1 cup fresh orange sections, cut in pieces

Soften gelatin in water. Combine fruit juices, orange rind, sugar, and salt; heat to simmering. Dissolve gelatin in hot mixture. Chill until mixture begins to thicken.

Whip cream only until stiff. Fold whipped cream and orange sections into gelatin mixture. Pour into a 1-quart mold and chill until firm.

Oatmeal cookies

3 to 4 dozen cookies

1 cup flour 1¼ teaspoons baking powder ½ teaspoon baking soda ½ teaspoon salt ½ cup shortening 1 cup brown sugar, packed 1 egg ¾ teaspoon vanilla 1½ cups quick-cooking rolled oats

Mix flour, baking powder, soda, and salt. Beat shortening and sugar until creamy. Beat in egg and vanilla. Blend in flour mixture. Stir in rolled oats. Chill.

Shape dough into balls about 1 inch in diameter. Place about 2 inches apart on an ungreased baking sheet. Bake at 350° F. (moderate oven) 10 to 15 minutes.

Remove from baking sheet while warm.

Variations

Raisin-oatmeal cookies.—Add ½ cup raisins with the oats.

Coconut- or nut-oatmeal cookies.—Add ½ cup flaked coconut or ½ cup chopped nuts with the oats.

Orange-oatmeal cookies.—Add 2 tablespoons orange juice and 1 teaspoon grated orange rind to shortening and sugar mixture. Add ½ cup raisins and ½ cup chopped nuts with the oats. Chill dough thoroughly; drop from teaspoon onto baking sheet.

Peanut butter cookies

4 to 5 dozen cookies

1 cup shortening 1 cup peanut butter 1 cup granulated sugar 1 cup brown sugar, packed 2 eggs 1 teaspoon vanilla 2½ cups flour ½ teaspoon salt ¾ teaspoon baking soda ½ teaspoon baking powder

Beat shortening and peanut butter until creamy. Gradually add sugars, beating thoroughly after each addition. Beat in eggs and vanilla.

Mix remaining ingredients and blend into peanut butter mixture. Shape dough into balls about 1 inch in diameter. Place about 2 inches apart on an ungreased baking sheet. Flatten each cookie. Criss-cross top of each cookie with a fork, if desired.

Bake at 375° F. (moderate oven) 10 to 15 minutes.

Remove from baking sheet while warm.

Variation

Top-hat cookies.—Roll balls of dough in granulated sugar before placing on baking sheet. Do not flatten. Bake 10 minutes; then remove from oven and press a milk chocolate candy kiss into center of each cookie. Return to oven and bake 2 to 5 minutes longer, or until cookies are done.

Molasses snaps

3 to 4 dozen cookies

¾ cup shortening 1 cup brown sugar, packed 2 eggs ¼ cup molasses 2¼ cups flour 2 teaspoons baking soda ½ teaspoon salt ½ teaspoon cloves 1 teaspoon cinnamon 1 teaspoon ginger ½ cup chopped nuts, if desired ½ cup raisins, if desired

Beat shortening and sugar until creamy. Beat in eggs and molasses.

Mix dry ingredients and stir in raisins and nuts, if used. Stir flour mixture into molasses mixture.

Drop dough from a teaspoon onto a lightly greased baking sheet; space cookies about 2 inches apart. Bake at 375° F. (moderate oven) 10 to 12 minutes, or until set but not hard.

Remove from baking sheet while warm.

Chocolate sparkles

5 to 6 dozen cookies

1 cup softened butter or margarine 1¼ cups sugar 2 eggs 2 ounces (2 squares) unsweetened chocolate, melted ½ teaspoon vanilla 2■ cups flour 2 teaspoons cream of tartar 1 teaspoon baking soda ½ teaspoon salt ¼ cup sugar

Beat fat and 1¼ cups sugar until creamy. Beat in eggs; add melted chocolate and vanilla.

Mix flour, cream of tartar, soda, and salt. Stir into chocolate mixture; blend well. Chill dough.

Shape dough into balls about 1 inch in diameter. Roll balls in ¼ cup sugar and place about 2 inches apart on an ungreased baking sheet. Bake at 400° F. (hot oven) 8 to 10 minutes.

Remove from baking sheet while warm.

Variations

Cinnamon-sugar cookies.—Omit chocolate. Roll balls of dough in a mixture of ¼ cup sugar and 1 tablespoon cinnamon; bake as directed.

Chocolate chip cookies.—In place of 1½ cups granulated sugar, use ½ cup granulated sugar and 1 cup brown sugar. Beat sugars with butter or margarine. Omit the chocolate. Stir ■ cup chopped nuts and 1 package (12 ounces) chocolate chips into the dough. Drop dough from a teaspoon onto an ungreased baking sheet and bake as directed.

Apple crisp

6 servings

2 tablespoons granulated sugar ¼ teaspoon cinnamon 4 cups pared, sliced tart apples ¼ cup water ½ cup flour ■ teaspoon salt ¼ teaspoon cinnamon ¼ teaspoon nutmeg ■ cup brown sugar, packed 3 tablespoons softened butter or margarine

Mix granulated sugar with ¼ teaspoon cinnamon; sprinkle over apples and mix lightly. Spread apples in a greased 8- by 8- by 2-inch baking pan. Sprinkle with the water.

Blend flour, salt, cinnamon, nutmeg, and brown sugar. Mix in fat to make a crumbly mixture. Spread over apples. Bake uncovered at 350° F. (moderate oven) 40 minutes or until lightly browned and apples are tender.

Baked apples

6 servings

6 large baking apples 6 tablespoons sugar 2 tablespoons butter or margarine Cinnamon, as desired ½ cup water

Wash and core apples. Pare apples one-third of the way down or slit the skin around the apple about half-way down.

Place apples in a baking dish. Put sugar and butter or margarine in the center of each apple. Sprinkle with cinnamon. Pour the water around apples to prevent sticking.

Bake uncovered at 400° F. (hot oven) until tender, 45 minutes to 1 hour.

Variation

Cranberry-baked apples.—Omit the sugar, fat, and cinnamon. Combine ¾ cup chopped raw cranberries, ½ cup sugar, and 3 tablespoons chopped nuts. Stuff apples with this mixture before baking.

Brownies

16 brownies

2 ounces (2 squares) unsweetened chocolate ■ cup shortening or oil 1 cup sugar 2 eggs, slightly beaten 1 teaspoon vanilla ■ cup flour ½ teaspoon baking powder ½ teaspoon salt ½ cup chopped nuts

Melt chocolate and fat together over low heat. Cool slightly. Mix sugar with eggs.

Stir chocolate mixture into eggs gradually. Add vanilla.

Mix dry ingredients, stir in nuts, and add to chocolate mixture.

Spread batter in a greased 8-inch square baking pan. Bake at 350° F. (moderate oven) 25 to 30 minutes or until crust is shiny and brownies begin to shrink from pan. Cool in pan. Cut into 2-inch squares.

Variation

Chewy brownies.—Follow directions above, but omit baking powder.

Baked custard

6 servings

4 eggs, slightly beaten ■ cup sugar ¼ teaspoon salt 3 cups hot milk 1 teaspoon vanilla Nutmeg, as desired

Combine eggs, sugar, and salt. Stir in the milk gradually. Add vanilla.

Pour into custard cups. Sprinkle with nutmeg. Set cups in a pan of hot water.

Bake at 325° F. (slow oven) 30 to 40 minutes, or until the tip of a knife inserted in the center comes out clean.

Raisin-nut bread pudding

6 servings

2 cups milk 1 tablespoon butter or margarine ¼ cup brown sugar, packed 1 teaspoon cinnamon ½ teaspoon nutmeg ½ teaspoon vanilla 2 egg yolks, slightly beaten 4 slices bread, cut in 1-inch cubes ½ cup raisins ½ cup slivered almonds 2 egg whites ¼ teaspoon salt

Heat milk. Stir in fat, sugar, cinnamon, nutmeg, and vanilla.

Stir a little of the milk mixture into egg yolks; then stir yolks into rest of milk mixture. Add bread cubes, raisins, and half the nuts.

Beat egg whites until foamy. Add salt and beat until stiff but not dry. Fold egg whites into pudding mixture. Pour into greased 1-quart casserole. Sprinkle top with rest of nuts. Place casserole in pan of hot water.

Bake at 325° F. (slow oven) 1¼ to 1½ hours, or until the tip of a knife inserted in the center comes out clean.

Quick ice cream desserts

Pecan balls.—Toast pecans by spreading 1½ cups in a shallow pan, and baking at 300° F. (slow oven) 15 to 20 minutes, or until lightly browned. Cool and chop. Shape 1 quart ice cream into 6 balls. Roll balls in pecans. Place on a tray covered with wax paper and return to freezer until firm. Just before serving, top balls with hot fudge sauce. Makes 6 servings.

Snowballs.—Shape 1 quart ice cream into 6 balls. Roll balls in ½ cup flaked coconut. Return balls to freezer as directed above. Makes 6 servings.

Ice cream sandwiches.—Slice 1 quart ice cream into 6 slices. Place each slice between 2 graham crackers (plain, cinnamon-flavored, or chocolate-coated). Serve immediately or return to freezer until time to serve. Makes 6 sandwiches.

Buttered nut sundae.—Add ½ cup chopped pecans or walnuts to 2 tablespoons melted butter or margarine in a frypan. Toast nuts over low heat for 15 to 20 minutes, stirring as needed, until they are lightly browned. Stir in ¼ cup brown sugar (packed) and ¼ cup water; simmer 2 minutes. Pour warm sauce over ice cream. Makes about ¾ cup or enough for 6 sundaes.

Ways to Use Leftovers

Don’t throw good leftover food away. Use your cooking skill—and your imagination—to make leftovers tasty.

Some leftovers make good second meals merely by reheating. Others are better prepared in a new way—with seasonings, sauces, crisp toppings. Try leftover fruit in muffins, vegetables in omelets. Substitute 2 leftover egg yolks for 1 whole egg in baked custard. And soups often become richer, more delicious when leftovers are added.

Listed below are some of the ways in which leftovers may be used.

Egg yolks, in—

Baked custard Cakes, cookies Homemade noodles Mock hollandaise sauce Scrambled eggs

Egg whites, in—

Cakes Meringue Souffles

Hard-cooked egg or yolk, in—

Casseroles Egg sauce Garnish Salads Sandwiches Thousand island dressing

Buttermilk, in—

Cakes, cookies Quick breads

Sour cream, in—

Beef stroganoff Cakes, cookies Salad dressings Sauce for vegetables

Cooked meats, poultry, fish, in—

Casseroles Creamed foods Curries Hash Patties Potpies Salads Sandwiches

Meat or poultry drippings and broth, in—

Gravies Sauces Soups Stews

Cooked potatoes, in—

Fried or creamed potatoes Meat or potato patties Meat-pie topping Potatoes in cheese sauce Salads Soups, stews, or chowders

Cooked snap beans, lima beans, corn, peas, carrots, in—

Casseroles Creamed dishes Meat, poultry, or fish pies Salads Sauces Scalloped vegetables Soups Stews Vegetables in cheese sauce

Cooked leafy vegetables, chopped, in—

Creamed or scalloped vegetables Omelets Souffles Soups

Vegetable cooking liquids, in—

Gravies Sauces Soups Stews

Cooked or canned fruits, in—

Fruit cups Fruit sauces Gelatin desserts Prune cake Quick breads Salads Shortcake Upside-down cake Yeast breads

Fruit cooking liquids or fruit sirups, in—

Fruit cups Fruit sauces Fruit drinks Gelatin mixtures Tapioca puddings

Cooked wheat, oat, or corn cereals, in—

Fried cereal Meat loaf or patties Souffles Sweet puddings

Cooked rice, noodles, macaroni, spaghetti, in—

Baked macaroni and cheese Casseroles Macaroni salad Meat or cheese loaf Spanish rice

Bread, in—

Bread pudding Croutons Dry crumbs for breading meat, poultry, or fish Fondues French toast Meat loaf, salmon loaf Sardine puff Stuffings

Cookies or unfrosted cake, in—

Crumb crust for pies Ice cream sandwiches Refrigerator cake (cake strips or cookies layered with pudding or whipped cream and chilled) Toasted cake slices, served with fruit or ice cream

Cooking Terms

=Bake= To cook in an oven or oven-type appliance in a covered or uncovered container.

=Barbecue= To roast slowly on a spit or rack, usually basting with a highly seasoned sauce. Also, foods cooked in or served with barbecue sauce.

=Baste= To pour melted fat, drippings, or other liquid over food to moisten it during cooking.

=Boil= To cook in water or other liquid at boiling temperature (212° F. at sea level). Bubbles rise continually and break on the surface.

=Braise= To cook meat or poultry slowly in steam from meat juices or added liquid trapped and held in a covered pan. Meat may be browned in a small amount of fat before braising.

=Broil= To cook uncovered on a rack placed directly under heat or over an open fire. _Pan broil._—To cook in uncovered pan over direct heat, pouring fat off as it accumulates.

=Caramelize= To heat sugar or food containing sugar until a brown color and characteristic flavor develop.

=Fold= To combine two mixtures (or two ingredients such as beaten egg white and sugar) by gently cutting down through mixture, turning over, and repeating until well mixed.

=Fry= To cook in fat without water, uncovered. _Pan-fry or saute._—To cook in frypan in a small amount of fat. _Deep-fry or french-fry._—To cook in a deep kettle, in enough fat to cover or float food.

=Grill= Same as broil.

=Knead= To press, stretch, and fold dough or other mixture to make it elastic or smooth. Bread dough becomes elastic; fondant becomes smooth and satiny.

=Marinate= To let foods stand in a liquid (usually mixture of oil with vinegar or lemon juice) to add flavor or to make more tender.

=Parboil= To boil until partly cooked.

=Poach= To simmer gently in liquid so food retains its shape.

=Pot-roast= To cook large cuts of meat by braising.

=Reconstitute= To restore concentrated food—such as frozen orange juice or dry milk—to its original state, usually by adding water.

=Rehydrate= To soak or cook dried foods to restore the water lost in drying.

=Roast= To cook in heated air—usually in an oven—without water, uncovered.

=Simmer= To cook in liquid just below the boiling point, at temperatures of 185° to 210° F. Bubbles form slowly and break below the surface.

=Steam= To cook food in steam, with or without pressure. Food is steamed in a covered container on a rack or in a perforated pan over boiling water.

=Stew= To cook in liquid, just below the boiling point.

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FAMILY FARE is a result of USDA research. Here, the Agricultural Research Service brings together information on nutrition, food management, and food preparation.

Guidelines for nutritious meal planning and for food management came from the Consumer and Food Economics Research Division of ARS. Basic cooking methods and recipes were developed and taste-tested in the ARS Food Quality and Use Laboratory of the Human Nutrition Research Division. Fish recipes and information on buying fish were contributed by home economists in the Bureau of Commercial Fisheries, Department of the Interior.

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The virtues of common water

John Smith

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Transcriber’s notes:

Apart from the corrections listed below, the text of this e-book has been preserved as in the original. Italic text is denoted by _underscores_.

universa → universal Digeston → Digestion liqours → liquors hydochondriac → hypochondriac childdren → children loosenese → looseness watet → water appply → apply rhey → they absoltue → absolute or → of yest → yeast distilation → distillation mettalic → metallic Leediensis → Leodiensis sudirifics → sudorifics primative → primitive closs → close it → is decripedness → decrepidness

THE VIRTUES OF COMMON WATER:

OR,

THE ADVANTAGES THEREOF, IN PREVENTING AND CURING MANY DISTEMPERS.

GATHERED _From the writings of several eminent Physicians, and also from more than forty years experience_.

By JOHN SMITH, C. M.

To which is added, SOME RULES FOR PRESERVING HEALTH BY DIET.

That’s the best physic, which doth cure our ills Without the charge of ’pothecaries bills.

THE TENTH EDITION, WITH ADDITIONS.

[Illustration]

COMMUNICATED BY _Mr RALPH THORESBY, F. R. S. and Others_.

[Illustration]

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1799.

THE

VIRTUES

OF

COMMON WATER.

[Illustration]

For the benefit of mankind in general, I have taken pains to give the world an account of what I have found written in the works of the most eminent physicians, concerning the good that mankind may receive from the use of Common Water; and of the

informations I have had concerning the benefits thereof from others by word of mouth; and of what I have discovered by my own experience, from frequent trials, during a time that hath intervened from that of thirty to seventy-four years of age: which is sufficient to confirm the stupendious effects thereof; especially in the many particulars that shall be mentioned as my own discovery with respect to this excellent remedy, which will perform cures with very little trouble, and without any charge, and is also to be had wherever there are any habitations, which can hardly be said of any other: So that in some sense water may be truly stiled, _an universal remedy_, since the diseases it either prevents or cures may have this remedy applied to all persons, and in all places where men inhabit.

[Sidenote: _Excellency of Water._]

The first commendation of Common Water I shall mention, is that of Dr Manwaring, in his _Method and means of enjoying health_; wherein he saith, that water is a wholesome drink, or rather the most wholesome--being appointed for man in his best state; which doth strongly argue that drink to be the most suitable for human nature--answering all the intentions of common drinks; for it cools, moistens, and quencheth thirsts; 'tis clear, thin, and fit to convey the nourishment through the smallest vessels of the body--and it is a drink that is a rule to itself, and requires little caution in the use of it, since none will be tempted to drink of it more than needs: And that, in the primitive ages of the world, water-drinkers, he says, were the longest livers by some hundreds of years--not so often sick and complaining as we are.

[Sidenote: _Digestion to help._]

Dr Keill, treating of the stomach, in his _Abridgment of the anatomy of human bodies_, saith, that water seems the fittest to promote the digestion of food; all spirituous liquors having a property by which they hurt, rather than help digestion; the sad effects of which they are sensible of, he saith, who by a long use thereof have lost their appetites, hardly ever to be restored without drinking water, which seldom faileth of procuring a good appetite and a strong digestion. With which Dr. Baynard agrees, affirming, "That water liquifies and concocts our food better than any fermented liquor whatever." _Hist. of cold bathing_, p. 440.

[Sidenote: _Diseases to prevent._]

Dr. Prat, in his _treatise of mineral waters_, shews it to be his judgment, that, if people would accustom themselves to drink water, they would be more free from many diseases; such as tremblings, palsies, apoplexies, giddiness, pains in the head, gout, stone, dropsy, rheumatism, piles, and such like: which diseases are most common among them that drink strong drinks, and which water generally would prevent. Moreover, he saith, that water plentifully drank, strengthens the stomach, causeth an appetite, preserves the sight, maketh the senses lively, and cleanseth all the passages of the body, especially those of the kidneys and bladder.

[Sidenote: _Health to procure by Water._]

'Tis also said by Dr. Duncan, in his _treatise of hot liquors_, that, when men contented themselves with water, they had more health and strength; and that at this day those who drink nothing but water are more healthy, and live longer, than those who drink strong liquors, which raise the heat of the stomach to excess, whereas water keeps it in a due temper. And he adds in another part of the book, that by hot liquor the blood is inflamed; and such whose blood is inflamed, live not so long as those who are of a cooler temper; a hot blood being commonly the cause of fluxes, rheums, ill digestion, pains in the limbs, head-ach, dimness of sight, and especially of hysteric vapours. He also imputes the cause of ulcers to a hot blood, and declares, that if men kept their blood cool and sweet, by a moderate and cooling diet, they would never be troubled with ulcers, or other breakings-out. Which coolness of the blood will be well attained to by drinking a large draught of water in the morning, which also will carry off the bilious and salt recrements by urine. And, if water is drank also after dinner, it will cool a hot stomach, and prevent the rising of those fermentations which cause wind and belching after meat. So that if persons who are liable to these disorders will leave off strong liquors and a hot diet, and drink water, they will procure better health to themselves than they had before.

[Sidenote: _Some of the good properties of Water._]

Sir John Floyer also, in his _treatise of cold baths_, p. 109, edit. 5, affirms, that water-drinkers are temperate in their actions, prudent and ingenious; they live safe from those diseases which affect the head, such as apoplexies, palsies, pain, blindness, deafness, gout, convulsions, trembling, madness: And the drinking of water cures the hiccough, fætor of the mouth, and of the whole body; it resists putrefaction, and cools burning heats and thirsts, and after dinner it helps digestion.--And if the virtues of cold water were seriously considered, all persons would value it as a great medicine, in preventing the stone, asthma, and hysteric fits; and to the use of this, children ought to be bred up from their cradles. And, in page 434, he saith, That as water is in chief the

universal drink of the world--so it is the best, and most salubrious. And, in page 434. That he hath known where a regular drinking of spring-water hath done considerable cures by washing off the acrid, scorbutic salts from the blood, and strengthening the coats and fibres of the stomach and bowels, and hath brought on a good appetite, and a strong digestion. And I add, that it will infallibly do it in all curable cases.

[Sidenote: _Cold Water strengthening._]

Having read over an old book written by Sir Thomas Elliot, intituled, _The castle of health_, he there declared from his own experience, that in the county of Cornwall, tho' it was a very cold quarter, the poorer sort, which in his time did never, or but very seldom, drink any other drinks but water, were strong of body, and lived to a very great age. To which relation that of Sir Henry Blunt's is very agreeable, who affirmed, in his book of travels into the Levant, (where under the Turkish government the use of wine was forbid, and where the common drink is water) that he then had a better stomach to his food, and digested it more kindly than he ever did before or since.

[Sidenote: _Digestion considered._]

And in the _treatise of the vanity of philosophy_, written by Dr. Gideon Harvey, it is affirmed, that it is not heat that causeth a good digestion, but a proper ferment, or liquor provided by nature, to dissolve the food into a substance like unto pap made with fine flour; which dissolvent, he saith, is much depraved by hot spirituous liquors; and therefore he commends water above all other drinks to promote digestion.

[Sidenote: _Gout and Hypochondriac Melancholy._]

Water-drinking is also said by Dr. Allen to be good to prevent two deplorable distempers, the gout and the hypochondriac melancholy; For, says he, the gout is generally caused by too great drinking of fermented liquors, and is never said to have assaulted any drinker of water; and he saith also, that melancholy hypochondriac is kept off longest by drinking water instead of strong drink. To which let me add, that I once knew a gouty gentleman, who, to avoid his drinking companions in London, retired to New Brentford, where I then lived; in which town, by a very temperate diet of one meal a day, and drinking only water, he lived two whole years free from pain: But being visited by one who came that way, and invited to drink but one bottle of Claret between them, he fell next day into a terrible fit of the gout, which held above a month after; of which being recovered, he by the same course continued well till I left the place, which was about a year and an half after.

[Sidenote: _Gravel._]

The good properties of water are further manifested in preventing the breeding of gravel in the kidneys; for Zechias, in _Consult._ 17. as quoted by Salmon, affirms, that nothing so much abates the heat of the kidneys, and frees them from those recrements which cause pain in the back, one great sign of gravel, as water does; but he adviseth to drink it warm. By the use of which, he saith, the unnatural heat in time will be so extinguished, that no more of that matter causing gravel will be produced in the body. Which assertion by experience I have found to be true; for observing much gravel to be voided by me, also abundance of matter floating in the urine like bran; with a great number of recrements like cuttings of hair, some above an inch long, which substances were found in all the water that I made in above twelve months; for which I could get no remedy: I was advised to drink water, which in about half a year did entirely free me from those symptoms, which some out of ignorance imputed to witchcraft, so that from that time to this I never have been troubled with it.

[Sidenote: _Stone in the Bladder._]

Water also is commended as efficacious to prevent the breeding of the stone in the bladder; for it hath been observed, that in some who have been cut for the stone, that new stones have been engendered, so that some young persons have been cut several times. Now, to prevent this, the drinking water hath been advised with success; for by this that intemperate heat in the body was abated, which did occasion the distemper. Some have advised to drink it warm, and others cold, particularly Van Heyden, a physician of Ghent in Flanders, in his book intituled, _Help for the rich and poor_; which, he saith, in p. 40, is sufficiently insinuated by Piso and Alexander, who assure us, that the taking a draught of cold water in the morning hath done so much good, that several, after the voiding of a stone, never had any more stones grew in them.

[Sidenote: _Stone to dissolve._]

Which experiment may give light to the discovery of a way to cure the stone without cutting: For if the growing of new stones can be prevented by drinking water, let it be hot or cold, it may prevent a stone from growing bigger when begun; and if the adding matter to increase a stone new begun, can be prevented, nature in time may waste that which is begun, especially if some drops of sweet spirit of nitre be added to all the water drank, which will powerfully help to cool, and is known to be an admirable mover or provoker of urine, and will waste a stone, and make it crumble like fuller's earth, if applied to a stone taken from the body. Or the water may be sweetened with honey, which is now much in use among the gentry, as I am informed by an ingenious apothecary; who told me, that, among them at present, pump-water and honey are in great repute to give ease in gravel: And there is so near an affinity between gravel and the stone, that what is proper for one, will doubtless be suitable for the other, and will prevent the growth of both.

[Sidenote: _Beneficial in child-bearing._]

Water is also stiled in Senertus' works, _The balsam of children_, the drinking of it by the mother being one of those things whereby children will be strengthened in the womb, and will prevent those injuries that are done them by womens drinking strong liquors; which Samson's mother was not allowed to do, for she was commanded not to drink wine or strong drink, Judg. xiii. 4. But I will not say, if all women should do this, their children shall be as strong as Samson was; yet this I will say, if they would do this, they would find their children more free from distempers and frowardness, and so much more easy to nurse and bring up, and be less liable to an immature death; the want of which abstinence from strong drinks, is the cause why so many rich people find it hard to bring up children, in comparison to what is done by the poor: For these last are born of mothers who not only are prevented from being gluttons by their want of dainties, which are deceitful meat, Prov. xxiii. 3. but they seldom taste wine or strong drink; whereas the rich not only feed high, but also drink strong drinks, which in most constitutions do overheat and corrupt the humours of the body, and that blood by which their children are nourished during their pregnancy: which injury to unborn infants would be prevented, if the mother would be temperate in diet, and drink water, especially at meals, by which the blood of the mother would be kept cool and clean; which must needs communicate a healthful substance to the child within her, and prevent all those distempers which infants bring with them into the world.

[Sidenote: _Increases milk in women._]

And here it may be proper to add, what by divers experiments it hath been found to be true, that the drinking water by nurses, while they give suck to children, will wonderfully increase milk in those that want it, as every one will find, who can be persuaded to make use thereof. I have advised many to use it, who have found that, by drinking a large draught of water at bed-time, they have been supplied with milk sufficient for that night; when before they wanted it, and could not be supplied by any other means: And besides, they who have found their children restless, by reason of too much heat in their milk, do find them much more quiet after their milk is cooled by water-drinking.

[Sidenote: _Stays hunger, and prevents starving._]

By drinking water also the want of food for a time may be suffered without starving: For I have been informed by a credible friend, who was an officer at sea, that being sent down to Stafford to see some men conveyed on shipboard, that had been pressed by act of Parliament for the sea-service; he found in the prison where they were kept a lusty fellow, who had declared he would starve himself rather than go to sea; and, taking particular notice thereof, he found upon due enquiry, that for twenty days he had refused to eat any manner of food, only he drank each day about three pints or two quarts of water, hoping thereby to get himself discharged: But when he found his pretensions to be in vain, and that in or about two days they should all march for London, he condescended to eat some food, beginning with a little; and in the march he was observed to travel as well as the best man. I find also an account in Dr. Car's letters, of a certain crack-brained person, who at Leyden, when the doctor resided in that university, pretended he could fast as long as Christ did; and it was found he held out the time of forty days without eating any food, only he drank water and smoked tobacco. And I once had a sad complaint from a poor old woman of the greatness of her want, affirming, that oftentimes she had not eaten any food for two or three days; upon which I asked her, if she did not then suffer much uneasiness in her stomach? she said she did; but found a way at last to asswage her hunger by drinking water, which satisfied her appetite.

[Sidenote: _Strengthens weak children._]

Water is also of great use to strengthen weak children; For we are informed by Dr Joseph Brown, in his _treatise of cures performed by cold baths_, that the Welsh women do preserve their children from the rickets, by washing them night and morning in

cold water, till they are three quarters of a year old, p. 79. And 'tis said by Sir John Floyer, in his _treatise on cold baths_, that a lady in Scotland, who had lost several children thro' weakness, did, by the advice of a Highland beggar woman, preserve those she had afterwards, by washing them daily in cold water. And I myself advised a neighbour, whose child began to be ricketty, to treat the child in the same manner; but she, instead of washing, dipped it over head and ears every morning, it being then in the summer-time: The event of which was, the child became strong, and had a good countenance, tho' before it was very pale and wan: Which shews how great the power of water is, when used outwardly, to invigorate the spirits, and strengthen nature.

[Sidenote: _Swellings from bruises._]

It is also a known custom, to prevent the swellings that follow bruises in the faces of children, by immediately applying thereunto a linen cloth four or six times double, dipped in cold water, and new dipped as it begins to grow warm; for the cold repels or prevents the flowing of humours to the part, which otherwise would cause great swelling, and after turn blackish: And if upon neglecting to do so, a swelling should succeed, it may be discussed by fomenting night and morning, for an hour at a time, with water as hot as can be endured; for that will give vent to the humours to transpire through the skin, or dissolve them, so as to make them capable of returning back.

[Sidenote: _All sickness at the stomach to cure._]

Moreover, by means of water all sickness at the stomach may be cured, which is done thus: Take four quarts of water, make it as hot over the fire as you can drink it: of which water let a quart be taken down at several draughts; then wrap a rag round a small piece of stick, till it is about the bigness of a man's thumb; tie it fast with some thread; and with this, by endeavouring gently to put it a little way down your throat, provoke yourself to vomit up again most of the water: Then drink another quart, and vomit up that, and repeat the same the third and fourth time, if once or twice is not sufficient. You may also provoke vomiting by tickling your throat with your finger, or the feather-end of a goose quill; but the cloth round a skewer maketh one vomit with more ease, which is done with no trouble when the stomach is full. And by this way of vomiting, which will be all performed in an hour's time, that viscous and ropy phlegm in the stomach, which causeth the sickness, will be cast up, so that the party in that time will be free from all that inward disturbance, if you use the remedy at first; but, if the sickness hath continued for a time, it will require the same course once or twice more, which may be done in three or four hours, one after another, without any other inconvenience, besides that of being a little sore in the breast the next day, which will soon go off by the force of nature. Which remedy, by forty years experience, I look upon to be infallible in all sickness at the stomach, from what cause soever, and for all pains in the belly which seem to be above the navel; for these are all in the stomach, as by long experience I have found: Which pains are generally counted the cholic; but it is not so; for true cholics are always below the navel, in the gut colon. And by this means I have eased very great pains caused by eating mussels that were poisonous; and it is also a certain cure for all surfeits or disorders that follow after much eating. So that the lives of multitudes might be saved by this means, who, for want of expelling what offends, often die in misery: For, by thus cleansing the stomach at the first, the root of diseases proceeding from surfeiting, or unwholsome food, or any viscous humours from a bad digestion, are prevented; the stomach being the place in which all distempers at first begin. No man was more subject to sickness than myself before thirty years of age; but since I found out the way of vomiting with water, which is now above forty years, I never have been sick for two days together: For, when I find myself ill to any great degree, I betake myself to this way of vomiting, which in an hour's time restores me to ease, and perfectly removes my illness. And the same benefit all my family find in it, as do others also whom I can persuade to try the experiment, which is such, that no physician whatever can advise a better to the king himself, should he fall sick. For, in the first place, it is not a nauseous remedy, it does not make the patient sick, as the best of all other vomits do; and then it is a vomit which is at our own command, since we can leave off when we please: And it infallibly works a cure to all sick stomachs, from whatever cause.

[Sidenote: _Digestion to cause._]

Some few indeed pretend they are not able to vomit by this means: Now, if they cannot vomit, let them take a pint of water when they find themselves ill from eating, and do so every three or four hours, eating no more till they are hungry; and they will find the water digest and carry off what was offensive. The ingenious Dr. Cheyne, in his _Treatise of the gout_, affirms, that warm water drank freely in a morning fasting, and at meals, (and I say cold water is as good) hath a sovereign remedy for restoring left appetites, and strengthening weak digestions, when other more pompous medicines have failed. And he adviseth gouty persons, after excess either in meat or drink, to swill down as much fair water, as their stomach will bear, before they go to bed, whereby they will reap these advantages, either the contents of the stomach will be thrown up, or both meat and drink will be much diluted, and the labour and expence of spirits in digestion much saved, p. 44. ed. 4: And indeed I have found by long experience, that

nothing causeth so good a digestion as fair water; but this requires time to free us from the uneasiness that an ill digestion causeth, whereas vomiting is an immediate remedy, and frees a man from it upon the spot.

[Sidenote: _Other benefits of vomiting with water._]

We are told by Sir John Floyer, in his _Treatise of bath and mineral springs_, that vomiting with water is very useful in the gout, sciatica, wind, shortness of breath, hypochondriac melancholy, and falling-sickness; which distempers are generally derived from evil matter contained in the stomach, as is likewise giddiness in the head, and apoplexies, with which myself once seemed to be threatened: For, after eating a plentiful dinner, I was seized with giddiness, and the sight of my eyes became so depraved, that things seemed double, which was accompanied with a strange consternation of spirit; and having read, that apoplexies generally seize after eating, I immediately called for water, and, net daring to stay till it was warmed, I drank it cold, and by the help of my finger provoked vomiting: Upon which I did immediately overcome the evils I was threatened with, the symptoms before-mentioned being the same as did precede the fit of an apoplexy in another person, as himself afterwards told me, who died of it the third fit, about a year after.

[Sidenote: _Shortness of breath._]

As for people who are troubled with shortness of breath, it is certain from experience, that vomiting with warm water three or four times, will afford certain relief. And the same may be prevented by drinking nothing but water afterwards, either cold or warmed with a toast. For, upon doing this, the difficulty of breathing will apparently abate; which water, if you please, may be boiled with honey. And I knew one, who by this means, as he was advised by me, lived comfortably in this city two or three winters, but, having undertaken business which did occasion drinking strong drinks, was the next winter carried off by the distemper: Wine, ale, or brandy, being as bad as poison to people troubled with shortness of breath. So that nothing but water ought to be drank in that distemper.

[Sidenote: _Vomiting to cure._]

Some people are taken with violent vomiting, and the excess thereof in some hath been so great as to endanger their lives, yea, cause death: In which case water will be very helpful; for, if a pint of it warmed be drank after every vomit, it will prevent that violent straining, wherein lieth the danger of all vomiting, because to strain violently, when but little will come up, endangers the breaking of some inward vessel. And, besides this, the offending matter will be sooner loosened from the internal part of the stomach, and cast out, upon which the vomiting will sooner cease: For after this manner the famous Sydenham, a most honest writer, did overcome the cholera morbus, or vomiting and looseness, so common in his time, and was found by the weekly bill to kill more than now die of convulsions; for his way was to boil a chicken in four gallons of water, which made a broth not such differing from water, of which he ordered large draughts to be given, and some of it to be taken by clyster, till the whole quantity was spent, if the vomiting did not stop before; which did so take off the sharpness of the matter offending, and wash it out, that the party in a little time became well. And the same was the practice of Sigismundus Grafius, who commends pure water in a vomiting or looseness to be drank in large quantities; for thereby, he saith, the corrosive and sharp humours will be so weakened, that they will no more offend: And he saith, it may be drank cold if the patient be strong, otherwise let it be warmed.

[Sidenote: _Fluxes._]

And in common fluxes without vomiting, a quart or more of warm water drank, will so weaken the sharpness whereby the distemper is caused, that is will soon be overcome, and the gripings eased. And in the bloody flux, which is the most dangerous of all fluxes, the ingenious Cornelius Celsus adviseth a large drinking of cold water as the best of remedies: But then no other substance must be taken till the disease is cured. And Lusitanus, another great physician, affirms, _Cent. 1. Obser. 46._ that he knew one, who, being in the summer-time afflicted with the bloody flux, drank a large quantity of cold water, and thereby recovered. This large quantity of water, in these fluxes, doth so correct the sharpness of the humour offending, that it can have no power to cause pain, or corrode the vessels, and cause bloody digestions or stools.

[Sidenote: _Consumptions._]

Water also is a drink that conduceth above all things to cure consumptive people; for the digestion being weakened, is the cause of producing a hot fretting nourishment, which is injurious to the tender substance of the lungs, and which constringes and stops up the lymphatic vessels thro' which the nourishment is to pass to all the parts, so that by degrees the body for want of due supplies consumes: Which obstructions, and that acrimony which causeth them, will be opened and sweetened by the plentiful use of water,

if taken before the lungs become ulcerous. Which cure of consumptions by water is recommended in the writings of Dr. Couch, who, in his _Praxis Catholica_, tells us, that he knew a man cured very soon of a consumption by drinking pure water. And it is said by another, that some have been cured of consumptions by drinking no other drink but water, avoiding all malt liquors, and sharp wines: For wine or any other strong liquor is pernicious in this distemper, whose original is affirmed by Dr Coward to be always in the stomach, from some intemperance in meat or drink.

[Sidenote: _Flushes in the face._]

Some there are who are much troubled with flushing heat in the face, and others with a heat in the back; in both which cases, water used as common drink is the best remedy, with a spare cooling diet: And it is also excellent for such as have red blotches in their face, which proceed from a hot fretting blood, which by water-drinking, and a moderate diet, will be kept under: For as Dr. Duncan, before quoted, doth affirm, those who keep their blood cool and clean, are never troubled with breakings-out, like many others, who may be known to be drinkers of hot drinks, and to use a hot full diet, by their faces being full of blotches.

[Sidenote: _Cholic._]

Water is also commended by the learned for the cholic; large drinking of water hath been found to be an excellent remedy. And it is said by Fortis, that when he practised at Venice, he often gave cold water in the cholic, with good success. With whom an English physician, Dr. Wainwright, in his _Mechanical account of the six non-naturals_, concurs; for he saith, that water-drinkers are never troubled with the cholic, and that many thereby have been cured, when all other remedies failed: But in this case a quart at least is required.

[Sidenote: _Small Pox._]

And, in the Small Pox, water hath also been proved to be an excellent drink. Salmon, in his _Synopsis Medicinæ_, saith, that in this distemper you may safely give the sick fair water, of which, says he, they may drink liberally to quench thirst; the want of which plenty of drink, hath been the death of many a patient. Which opinion of his was right, as by experience I have found in two of my own children, when sick of this distemper; to whom, after I had given a gentle vomit of emetic tartar, I gave no other drink but water, and they both recovered safely, and were not in the least light-headed, as two others before were in the same distemper, when treated otherwise. And I remember that one Dr. Betts, being consulted in a case where the eruption did not come out kindly, ordered two quarts of cold water to be drank as soon as could be, upon which they came out according to expectation, and the party did well.

[Sidenote: _Burning fevers._]

It is also certain, that, in what we call burning fevers, water is found to be a safe and effectual remedy. It is said by Dr. Primrose, in his _Popular Errors_, that many great physicians have commended the drinking cold water in diseases, and they attribute to it the chief place in fevers, where the sick must drink largely; for thus taken it will quench all heat, p. 374. And Galen is said, by an English author, to reprove Crasistratus for denying cold water in burning fevers; and says, that this is a remedy for any fever, provided it be drank in great abundance. With which opinion I find Dr. Oliver to agree, who, in his _Essay on Fevers_, says, that in fevers we must drink oftner than thirst calls for it, and such draughts as are plentiful; and the drink he prescribes is either cold water or barley-water. Dr. Wainwright affirms also, that water is proper in fevers, and that the ancients gave as much of it as the patient could drink. And by another it is said, that if you give the patient nothing but water for three days, that in the third day the fever will be cured generally; but, if it is not, give for food a little barley-broth, and the fever will not exceed the seventh day. And by another we are informed, how one in a fever, that was past hope, being forbidden to drink water, which he greatly desired, did find means, in the absence of his nurse, to get a large potfull, which he drank off, and lay down again, being well cooled; after which he fell into a sweat, and so was cured. Dr. Cook of Warwick, in his book of _Observations on English bodies_, prescribes for the cure of fevers, first a vomit, and afterwards as much cold water as the patient can drink; and he saith, that, if he sweat upon it, the sweat must be continued as long as can be. And it is said by another, that it is an excellent remedy in fevers to drink a quart of hot water, and sweat upon it, being covered warm. Dr. Quinton, in his book of _Observations_, writes, that to one in a malignant fever, whose pulse was so low it could scarcely be felt, there were three quarts of water given, at several draughts, to make him vomit; but it did not operate that way, yet the event was this: It refreshed him much, raised his pulse, brought him into a breathing sweat, and passed off by urine; which lowness of the pulse I have often found to be raised in other cases, by drinking water plentifully. And I know a woman, who, tho' she in a fever had the advice of two doctors, yet became distracted; I bid the nurse give her a pint of cold water, which she drank up, and in three or four minutes came to her right senses; and desiring to drink more, she recovered. And I

have observed, that when in fevers the patient can relish no other drink, yet water is always drank with pleasure, as it also will always be after the eating of sweet things, that spoil the relish of other drinks; which is one excellence peculiar to water, and shews it to be most agreeable to the nature of mankind, tho' now so much slighted. And, besides this, it is a drink that will not turn sour in the stomach, as all fermented drinks will do, to the increase of distempers already begun there, by acidity or sourness.

[Sidenote: _Gout._]

And as for the gout, which Dr. Harris saith, in his _Anti Empiric_, is gotten either by high feeding or drinking much wine, or other strong drink; it may be cured, as that author affirms, by a very spare diet, and drinking water: According to what is said also by Sir Theodore Mayhern, who, in his _Medicinal Counsels_, adviseth to leave off all strong drinks in this disease, and drink only water. And Van Heyden saith also, in his _Treatise of help for the rich and poor_, that there is not any greater remedy for the gout than drinking water, not only by young, but old men; many of whom, he saith, have drank cold water for many weeks, which hath succeeded so well, though they were far gone in years, that they found great ease thereby, without that offence to the stomach, or hindrance of digestion, which some did not seem to fear. And he also commends the large drinking of water in the sciatica or hip-gout, he having often cured that distemper, by this means, in less time than could reasonably be expected. And the same I have found to be effectual in a pain in the shoulder, which had continued very bad for three months: For, being taken with a fever, I drank in one day about four quarts of water; which tho' it did not make me sweat, because I lay not in my bed, yet it cured me so that I slept well that night; and, in the morning when I rose, the pain in my shoulder was not felt, neither did it ever return. And the same success I have had in the pains of other parts; whereby, I judge, that, in all pains whatever, the drinking of water is proper, as well as in the gout: And accordingly I find cold water advised to be drank largely for the cure of the head-ach from hard drinking; that pain proceeding from the same cause the gout does, namely, from heat, as all pains do, that are not from bruises.

[Sidenote: _Inflammatory distempers & wind._]

It is said also by Dr. Wainwright, that in the itch, scurvy, leprosy, and all hot inflammatory distempers, such as pleurisies, rheumatisms, and St. Anthony's fire, water is a proper remedy; but he adviseth to drink it hot in some cases, as doubtless it ought to be done in pleurisies. He also saith, that water is proper in head-achs, catarrhs, vapours, falling-sickness, dulness of sight, melancholy, shortness of breath, scurvy in the mouth, and windiness in the stomach: And for this wind in the stomach, I, by long experience, have found it the best remedy, who in the former part of my life, through a disorderly diet, and drinking strong drink like others, was never free from windy belchings, and sometimes very sickish qualms after meals; from which at length I was delivered, by drinking only water at meals; so that for above forty years I have been seldom troubled: And, if I find myself troubled, a pint or more of cold water, in less than half an hour will set me free, by drinking of it.

[Sidenote: _Hard drinking._]

And that water is the best remedy for the mischiefs that come by hard drinking, experience teacheth; there being nothing that so effectually frees from these nauseating and reaching qualms the next morning, as the drinking a pint or more of fair water; which effectually allays the inflammation of the bowels, occasioned by strong or hot drink, which spoils the strength of the stomach, and of all other parts; nothing being a greater enemy to the vigour of the nerves and sinews, since by much drinking, men make themselves unable to stand or go; which effect would never follow, if liquors that abound with spirits were strengthening; nor would the fibres of the stomach be so weakened after drinking strong drinks, as to make men sick; which sickness will soonest be recovered by the drinking cold water, this being also the best remedy, if taken largely, for that heat of urine often occasioned by hard drinking.

[Sidenote: _Colds and bad digestion._]

In colds, water is the best of all drinks to prevent floods of rheum from the nose and mouth, as my long experience testifies, and therefore will prevent coughs; for a cough will seldom succeed a cold, if water is used from the first as common drink: And if, through neglect, a cough should become troublesome, the use of water, avoiding all wine and strong drink, will contribute much to the cure. Some order the water to be drank warm, but others say, that the drinking it cold vastly excells the using it hot in a cough. It is said by Van Heydon, that some may think it strange to advise water in such diseases, which most account to proceed from crudity or indigestion; but he says, that, in any disease where the case is dangerous, the use of water is the only friend to nature; cold being a preventer rather than a cause of crudity; since by all experience it is proved to be a promoter of good digestion. And at this time I know a woman, seventy-eight years of age, who for ten years past hath had a great cough, and spit much tough phlegm, that this present winter 1722, hath been persuaded to leave off both strong and small fermented liquor, and drink only water at

meals, and sometimes a dish or two of tea; and hath found herself much less subject to cough than before, and scarce coughs at all in bed, tho' subject before to cough very much in the night: She also drinks at bed-time half a pint of cold water, and the same quantity first in the morning, and finds more comfort by it at so great an age, than wine hath at any time afforded, Moreover, drinking of water is a certain cure for the heart-burning; as some affirm.

[Sidenote: _Heart burn._]

[Sidenote: _Strong drinks hurtful to children._]

It is generally the opinion of most physicians, that wine and strong drinks are not proper for children; and that the smaller and cooler their drink is, the better it will be with them; and that nothing conduceth more to the health of children than drinking water, which will prevent the foundation of those diseases that are caused in many by strong drink, and shew themselves in their more advanced age, wherein many also suffer much by the mother's ill custom of making them gluttons, by constantly cramming their stomachs with food, many being thereby destroyed among the children of the rich, before they come to the years of maturity; when the children of poor country people, who fare hard, stand their ground till full grown: For fewer children die in the country than in great cities, where luxury in diet doth more abound; which is one reason why so few house-keepers in London were born in it, the great supply of inhabitants being from the country, children being brought up more hardy there than in London, where great numbers are killed by over-eating or pleasing their palates. Which mischief would be in a great measure prevented by their being accustomed to eat less, and drink water; this by experience being found to make young children free from that frowardness, which is commonly caused by a sharp, and hot, or feverish blood, which engendereth wind, and causeth pain and gripes: for there is no pain but is the consequence of heat, or inward as well as outward inflammations.

[Sidenote: _Fair water equal to that at Tunbridge._]

To what hath been said may be added this consideration, that, when the best physicians are baffled by some distempers, they advise their patients to use the water of some mineral spring, tacitly acknowledging thereby, that all their prescription may be excelled by water. They pretend indeed to ascribe its effects to some minerals with which the waters are tinctured: But Dr. Baynard, in p. 438, of Sir John Floyer's _Cold bathing_, tells of a certain person who used to frequent Tunbridge, by which he found much benefit; but, being hindered from going thither one season, drank the same quantity of water taken from the pump of a spring in his own yard, which did him as much service: whereupon he wrote thus upon his pump:

Steel is a cheat; 'Tis Water does the feat.

And, indeed, if we consider how many diseases and pains proceed from a sizey, thick blood, which cannot pass as it ought to do through the finest pipes that convey the blood to the parts, pure water, without minerals, drank to the quantity of a quart or three pints in a morning, will attenuate or thin the blood sufficiently: Nothing, as Boerhaave affirms, being a greater diluter of thick blood, than warm water drank in great quantity. Which to thin the blood may be best, tho' to strengthen the stomach it is best drank cold, having the same effect inwardly, in some cases, as cold bathing hath outwardly; its use this way being also great.

[Sidenote: _Burns and Scalds._]

For water I have found, by long experience, to be of excellent use in burns and scalds; for in all burns and scalds, that are slight, if the part is plunged immediately into cold water, the colder the better, the pain will instantly be taken off; and it will fetch out the fire, if continued so long as will be required to do it by any other remedy. And if the burn be so considerable, that other remedies must be applied, none of which will take off the smart of themselves in less than two or three hours; yet if you apply cold water presently, after other applications are made to the part, the pain will immediately cease, till the remedy becomes effectual: So that the ease water will give in such cases, makes it of good use. Which remedy, as it hath not been discovered till now, appears to transcend all other remedies in this case; because, in a moment, the greatest smart will eased, if the water is cold, and will be felt no more, if the part afflicted be kept immersed in it till the fire is extinguished, either by the water, or the medicine applied. Besides, it is a remedy every-where ready at hand, which cannot be said of any other; which generally requires so much time to get it ready, that much pain will be endured, if blisters do not arise, which do much increase the trouble. If the part burnt, or scalded, cannot be dipped in water, you may apply water to it, with double linen cloths dipped therein, and new dipped as they grow warm; by which means I have cured burns and scalds in the face without blistering, when applied immediately before blisters did arise.

[Sidenote: _Ulcers from burnings._]

I once knew a large ulcer in the foot, made by the running of melted brass into the shoe, that was kept in hand by a surgeon nine weeks, without any probability of healing, because of the great inflammation that attended it; but the party, being a lover of angling, was persuaded to go with some others to Hackney-river: Some of them went bare-legged into the water, to come at a certain hole where much fish was sometimes found. The sport was so good, that the lame man having pulled off his stockings and plaisters, went in also, where he staid above two hours, and coming out again, the ulcer, which appeared very red and angry when he went in, looked pale; he put on his dressings, and came home, and in less than a fortnight his ulcers healed up; which doubtless was occasioned by the abating of the inflammation by the coldness of the water. And I have had an account also from an acquaintance, that was a surgeon to a merchant ship, that their gunner, at a time when the captain treated some friends on board, going to charge a gun that just before had been fired off, the cartridge he was ramming down took fire, whereby he was blown into the water, and had some of his fingers torn off, and it was about an hour before a boat could be got to take him up: But they found that the coldness of the water had almost stopt the bleeding, and the cure was effected so speedily, that other surgeons wondered at it; which he imputed to the water, which kept back the humours, by its coldness, from flowing to the part at the first: So that there was no impediment, from inflammation, to hinder healing; for the chief impediment to healing, is inflammation in wounds or ulcers. Moreover, to bathe with cold water, is affirmed by Dr. Lower to be a sovereign remedy for any hot swelling, if continued a due time at the first beginning; and it is affirmed also to be a good cure for the cramp.

[Sidenote: _Hot swellings._]

[Sidenote: _Sprains and hot swellings._]

And as for strains and sprains in the joints, cold water affords the best and most speedy remedy, as Van Heydon affirms; who saith, that, by bathing in cold water, all harm so received may by this remedy be cured more safely and more speedily than by any other, without loss of time, cost or trouble; for no more is to be done, as I have often found, than, as soon as can be, to put the part into a vessel of cold water for about two hours, which will prevent all swelling and pain, by repelling or keeping back the humours that otherwise would flow to the part. And if it should be the shoulder, or any other part, which is so hurt, that cannot well be immersed in water after this manner; water may be applied, by dipping towels folded up into it, and laying them to the part, as is done, in effect, to the wrenched joints of horses, about which, if you wind oftentimes a thick rope made of hay, and then cast upon it divers times a pail of cold water, the wrench will be cured; which experiment is now commonly practised by those concerned about horses.

[Sidenote: _Sprains in horses._]

[Sidenote: _Weakness of the joints._]

Bathing in cold water hath also been found to be a good remedy to strengthen weakness in the joints, as Sir John Floyer, in his treatise of _Cold Bathing_, hath shewed; and which by experience I found to be true on a certain woman, who complained of great weakness and pain in her ancles: I advised her to dip the part in cold water every morning for a quarter of an hour, and do the same at night; and in about twenty days she became as strong in that part as she was in the other. And Sir John tells us of a boy who could not stand, his limbs were so weak, that, by bathing in cold water, perfectly recovered his strength in a little time.

[Sidenote: _Pain in the head._]

Great pain in the head hath been also cured by this means; for we are told by Van Heydon, that Sir Toby Matthews had for twenty years been troubled with great pain in one side of his head, and a great defluxion of rheum from his nose: but he at last was cured, by applying cold water to the part every day for about a quarter of an hour: Upon reading of which, I tried the experiment upon myself, who for a long time had been troubled with the running of much clear water from my nose, with great spitting of thin rheum; for I let a water-cock run upon the mould of my head every morning, by which, in about six weeks time, I was eased of my trouble. And since that, I had a credible information of a certain servant maid, who was afflicted greatly with a rheumatism, and an intolerable pain in the head, who being put into St. Thomas's Hospital, her nurse was ordered by the doctor to apply to her head towels four times double, dipt in cold water, changing them as they became warm, which she was to continue doing four or five hours; in which time she was freed from that pain in the head, and was afterwards cured of the rheumatism by other means.

[Sidenote: _Want of sleep in fevers._]

The want of sleep in fevers, may be cured likewise by the application of cold water: For to a near relation in a fever, who could not sleep for three days and three nights, I ordered a towel to be several times folded up, then to be dipped in water, and a little wrung

out, and so laid upon her forehead, and to be new dipped as it grew hot; which in about two hours time so cooled her head, that she fell into a sleep, and continued in it five hours: And I ordered the same to be done the next night, with the same success. Dr. Cockburn, in his treatise of _Sea-diseases_, orders, for the want of sleep in fevers, to dip a towel four times doubled in oxycrat, which is six parts water and one part vinegar, to be bound about the head and temples; which, he saith, will cause sleep with wonderful success. But cold water only will have the same effect, as I often have proved.

[Sidenote: _Swoonings._]

And that the use of cold water, in swooning, is of great effect, common experience teacheth: For, if a dish or cup of cold water is thrown strongly upon the face, the person in an instant will recover, tho' for a time he seemeth dead, and perhaps might not have recovered in some cases, if cold water had not been so applied; such faintings being sometimes deadly, which proceed from poisonous vapours ascending up to the brain from a foul stomach: For such effects there are, as I have found by experience, who in my young days did swoon away twice; at both which times I was sensible of a collection of wind in my stomach, from whence I plainly felt a fume or vapour ascend to the head, that in an instant deprived me of all sense: But being both times in the company of a person who had seen the thing tried, he dashed some cold water against my face, which I remember made me start, as if I had been suddenly awaked. And I am apt to think, that some die in such a fit, when none are near to help them; and especially when so taken in their sleep, which I believe none need fear, who live temperately, or that eat no suppers; none who have refrained from suppers; having been ever found to die in their sleep.

[Sidenote: _Bleedings at the nose._]

Dangerous bleedings at the nose have also been cured with cold water largely drank, syringing cold water up their nostrils, and applying towels round their necks dipt in cold water, changing them as they grow warm; for it is said by a good writer, that this will so cool the heat of the blood, and by the coldness of the water syringed, up the nose, so contract the mouths of the veins which bleed, that it will put a stop to the bleeding. Such bleedings have also been stopt by dashing cold water often in the face, as a French writer hath affirmed, whose name was Flammand; and the same also is asserted by Cook, in his _Marrow of Surgery_.

[Sidenote: _Small cuts._]

Cold water is an absolute cure for all small cuts, in the fingers, or other parts; for if you close the cut up with the thumb of your other hand, keeping it so closed for a quarter or half an hour, this will infallibly stop the bleeding: After which, if you double up a linen-rag five or six times, dip it in cold water, and apply it to the part, binding it on; this, by preventing inflammation and a flux of humours, will give nature time soon to heal it without any other application, as is seen in the common practice of surgeons when they let a man blood; for all the application they make to the vein so cut, is a pledget of linen dipped in cold water, and bound on with a fillet: For all wounds, without loss of substance, will heal of themselves, if inflammation be prevented, and the lips of the wound are kept close together.

[Sidenote: _Bitings of a mad dog._]

We are also informed by Van Heydon, that in his time some were of an opinion, that a person bit by a mad dog might be preserved from that symptom, called, the fear of water, which generally follows, and proves so mortal, by applying cold water to the place bitten: And this, he says, they conceive to be no unlikely thing, if there is any credit to be given to what Cornelius Celsus writes, who saith, that the only remedy in this case is, to throw the party who hath the fear of water upon him, into a pond or river, and, when plunged over head and ears, to keep him in the water till filled with it, whether he will or no; and by this means both his thirst and dread of water will be cured. For, if this immersion be of use when the person is so far gone, why should it not be of greater force in preserving from it, if speedily applied, and repeated? Now, tho' this is mentioned by him as a probable opinion, yet experience in our days shews, that the plunging the patient into the salt water, either of the river of Thames about Gravesend, or in the salt springs in Cheshire, is the best means to prevent any evil succeeding the bite of a mad dog; they must indeed be dipped so often, as to be almost drowned before the danger is over: But it is a question whether the saltness of the water contributes any thing to this cure, since Boerhaave, the present professor at Leyden, affirms, that when men bitten by a mad dog are arrived to the fear of water, called an hydrophobia, they may be cured by blinding the patient's eyes, and throwing of him into a pond of water often, till he seems not to be afraid of it, or but very little, and then force him to drink large quantities.

[Sidenote: _Falling-sickness._]

And we are told by Dr. Edward Browne, that a person troubled with the falling-sickness, by happening to fall into a cold spring, (I suppose it was in the time of his fit) was freed from his distemper all his life after: And he saith, there is no need of preparing the body for it in this, as in some other cases. But the patient, when plunged into a cold bath, ought to continue in the bath each time about three or four minutes; for, in plunging over head and ears at his first entrance into a cold bath, the brain will be so sensibly affected, as to be relieved from the distemper, which is a kind of convulsion proceeding from an inflammation, or some other cause; but we want more experiments to confirm this notion: which notion may be worth noticing, that the thing may be tried in others, to see if it will succeed as it did in this person. For it is said by the ingenious Dr. Pitcairn, a Scotsman, sometime professor at Leyden, that there is no such thing as the art of curing, but only the practice; remedies were found out by chance, p. 264, of his works. For when remedies thus happen to be discovered, and prove often to be effectual, the remembering that remedy, to apply it in a like case of practice, brings reputation to the prescriber; but, if it fails, some other experiment must be tried, which, were physic an art, need not be done, because the rules of art are certain, and men depend upon them as such.

[Sidenote: _Madness & melancholy._]

It is also said by the same Dr. Browne, that madness and melancholy, with all their retinue, may find better effects from the use of bathing in cold water, than from other violent methods, with which people so afflicted are now treated; for, says he, that which will make a drunken man sober in a minute, will certainly go a great way towards the cure of a madman in a month. Now it is most certain, to my own knowledge, that, if a drunken man be plunged over head and ears in cold water, he will come out of it perfectly sober: And some I have known, that in such cases have been recovered by barely washing their heads in cold water. Which fore-mentioned opinion of Dr. Browne is confirmed by the practice of Dr. Blair, who, in a letter to Dr. Baynard, declares, that he cured a man raving mad, who being bound in a cart, stript off his clothes, and blindfolded, that the surprise might be the greater; he on a sudden had a great fall of water let down upon him from the height of twenty foot, under which he continued so long as his strength would permit: And, after his return home, he fell into a sleep, and slept twenty-nine hours, and awaked in as quiet a state of mind as ever, and so had continued to the time of writing that letter, which was twelve months. Distraction also in fevers, of which there are divers instances in the history of _Cold Baths_, has been cured by being plunged in cold water. _See p. 226._

Which relation seems to make that a more probable truth, which was related in a letter from Sir John Floyer, to Dr. Browne, and printed by that doctor; that in Normandy they immerse fools, or dip them in cold water to cure them: A hot brain being the cause, perhaps, of several disorders in the understanding, and is in great part found to be true in the ridiculous behaviour of some drunken men, which, when their heads are become cool, abhor what they before did or said. Now, if such dipping would cure fools among us, great numbers might be made more happy than they are by being so dipped, before they have beggared themselves by imprudence.

[Sidenote: _King's-evil._]

Dr. Browne, in his discourse of _Cold Baths_, affirms, that to bathe in cold water hath been found to be the quickest, safest, and pleasantest cure for the king-evil; and he tells us, in p. 85, of a Yorkshire gentleman, who was grievously afflicted with this distemper, having great ulcers in the glands of his neck, which were so much inflamed, as to bring him very low; but, being advised by Dr. Baynard to bathe in the cold bath, he in a month's time was perfectly cured, his ulcers being healed up, contrary to the opinion of the most learned physicians.

[Sidenote: _Jaundice, swelling, inflamed eyes, and pains in the joints._]

We also find mention, in the description of the Scottish Islands, of an odd remedy commonly made use of there for the cure of the Jaundice; which is this: They strip the party naked, lay him upon the ground on his belly, and pour unawares upon his back a pail of cold water. And also pains in the joints, as Dr. Curtis tells us, will be cured, by holding the part under the stream of a pump or cock; and fomenting with cold water, is commended as good to assuage hot swellings. And I know a person who had often been subject to blood-shot or inflamed eyes, who afterwards, upon the beginning of the same distemper, took, by advice, a ball of linen rags, dipped them in cold water, and applied them to the part, cooling them by new-dipping as oft as they grew hot: Which application was continued three hours, in which time the humour was so repelled, as to be troublesome no more; for the party, to my knowledge, hath had no sign of that distemper since, tho' the same had been very troublesome many times before: And the same others have tried with the like success.

[Sidenote: _Defluxions on the eyes._]

It is also advised by Dr. Gideon Harvey to wash the eyes well twice a day in cold water, as the best remedy to prevent defluxions on them, and preserve the eye-sight, which it greatly comforts. And this I have found true for many years, my eyes being often apt to be dim and stiff, so that I could scarce open my eye-lids; which, upon washing for a minute with fair water, hath been felt no more for a good while after. Besides which benefit to the eyes, authors say, it is also good to preserve the memory, if the whole forehead be washed twice a day; and it is also a certain cure for itching in the eyes. And indeed, washing with water will free mankind from a troublesome itching in any other part of the body, let it be never so private; as Cook, in his _Observations on English bodies_, doth expresly declare from experience. And Wedelius affirms, that violent itching in a man's cod was so cured by him; and, if the other sex would make use of it, a single life would be less uneasy than it seems to be to some.

[Sidenote: _Callosity & sore feet._]

Some people are troubled with a callosity, or hardness of the bottom of their feet, which is so troublesome, as to be a hindrance to their easy walking; for which a cure is prescribed by Dr. Cook, that is, to soak them well in warm water, till the hardness is softened, and then scrape it off with the edge of a knife: And if the feet burn with any unnatural heat, and are tender, it was advised by Mr. Rumsey, in his _Organon Salutis_, to bathe them daily in cold water. Others affirm, that to bathe tender feet often in hot water will cool them, by giving vent to that which is offensive; and it is useful in a cough.

[Sidenote: _Scurvy._]

The plentiful drinking of water is commended in the scurvy, whether hot or cold, by Dr. Pitcairn, to dissolve the scorbutic salts, and carry them out by urine; but this is a distemper that Dr. Cheyne affirms is difficult to cure, that nothing but a total abstinence from flesh, fish, and strong liquor, will overcome the scurvy, p. 127, whether they are acids or alkalies. But tho' weakness and faintness commonly attends on this distemper, yet myself, who have been formerly extremely troubled with the scurvy, which often made me faint and weak, and my pulse so low as scarcely to be felt, found at last that the pulse would infallibly rise upon drinking a pint or more of cold water, and in a little time I should again become brisk and strong: for I have often observed, that, upon a disorder of the stomach, the strength of the bodily members soon would fail, and as easily be recovered when the disorder of the stomach was removed; which requires temperance and cooling diet, when distempered, especially in drink.

[Sidenote: _Asthma & consumption._]

To what hath been already said, I will add an account, taken from a credible person, of a man in the parish of Shoreditch, who was desperately ill of an asthma, or shortness of breath, and deep consumption, for which he had tried many remedies to no purpose. At length he was advised by a physician, being poor, to drink no drink but water, and eat no other food but water-gruel, without salt or sugar; which course of diet he continued for three months, finding himself at first to be somewhat better, and at the three months end he was perfectly cured; but, for security's sake, he continued in that diet a month longer, and grew fat and strong upon it. But his diet he had no mind to till he was thoroughly hungry, and then he did eat it with pleasure; in which perhaps consisted the best part of his cure, it being an advantage to health never to eat till hunger calls for food.

[Sidenote: _Cough cured._]

And I remember a young woman, a burnisher of silver, who had a desperate cough, for which she had taken many things of an apothecary to no purpose; at length the journeyman told her, his master said, he could do no more:

But, said the fellow, I would advise you every morning to wash behind your ears, and upon your temples, and on the mould of your head, with cold water: which she told me she did, and was perfectly cured of her cough by that means. And for a hoarseness that comes upon a cold, the dipping of a handkerchief five times double in very hot water, and holding it to the mouth and nose, new-dipping it as it becomes cold, is commended by Dr. Alexander Read as a good remedy.

[Sidenote: _Hoarseness._]

[Sidenote: _Difficulty in making water._]

There are divers other cases wherein the use of water hath done much good. An ancient practiser in physic told me, that in many difficulties of making water, he had advised the party to put his yard into water as hot as he could endure it, which in a minute did cause him to make water; and that women have had the same benefit by sitting over hot water. And he often had advised them who were costive, and went to stool with great difficulty, to sit over a pot with hot water in it; which soon was attended with an easy dejection of stool, the body drawing up the vapour, which provoked expulsion of the excrements without much straining.

[Sidenote: _Costiveness._]

[Sidenote: _Children unquiet._]

And it hath been observed, that froward children have been made much more quiet, by washing their lower parts every morning with water, to wash off the salts of their urine, which usually stick in the pores of the skin, and are fretful and uneasy; and nothing cures their soreness about those parts like it. Nor is there any thing more effectual to cure men who are gauled by riding, than to wash themselves well when they go to bed with cold water; and washing the bare breast every morning with cold water, will make those hardy who before were apt at every turn to take cold. To which I will add what Sir Theodore Mayhern affirms in his _Medicinal Counsels_, that in most diseases

[Sidenote: _Head diseases._]

[Sidenote: _Pains in the ear._]

of the head, there is nothing better than to bathe it with cold water. Which, in a desperate pain of the ear upon taking cold, I have found to be true; for the pain did vanish upon applying to it about 30 minutes a towel doubled up often, and wet often in cold water; and tho' it returned again, yet ease was soon obtained the same way, and the cure perfected in four times doing: Which cure of a pain gotten with cold, by a cold application, will not seem so strange, when we consider, that, in the northern countries, mortifications from cold are nowise to be cured but by applying cold snow; as travellers into Denmark and Sweden do affirm.

[Sidenote: _Curtis's opinion of water._]

In short, water, when rightly made use of, appears, from the accounts before-mentioned, very effectual to prevent and cure many diseases; but more especially the inward use thereof: For to use the words of the ingenious Dr. Curtis, in his _Essay for the preservation and recovery of Health_; the habitual use of water for common drink, preserves the native ferment of the stomach in due order, keeps the blood temperate, and helps to spin out the thread of life to the longest extent of nature; it makes the rest at night more quiet and refreshing, the reason and understanding more clear, the passions less disorderly; and, in case of eating too much, a large draught of cold water vastly exceeds any other cordial to cause digestion: water being not so cold and lifeless, he saith, as many imagine. Besides which commendation of it by this doctor, it is certainly a drink that will not ferment in the stomach, nor turn sour, as wine and strong malt-drinks will, to the hindering of a good digestion, which all acidity in the stomach certainly doth, when it abounds there; and is best corrected by weakening or making it less sour, by drinking good store of water, as the experience of above forty years practice hath assured myself, and many others. For tho' water is accounted a contemptible drink, yet by beginning to make use of it about thirty years of age, before which I was often out of order, and continuing the use of it ever since, drinking very little wine or strong drink, I have attained to the age of seventy-four years, when thousands in the meantime, who delighted only in drinking strong beer, wine, and brandy, have not lived half so long: which makes good that saying in the Scriptures, that _Wine is a mocker, and strong drink is raging, and he who is deceived thereby is not wise_, Prov. xx. 1., since it noway contributes to long life; for it is certain, that thousands in the world live as long who drink no strong drink, as any drinkers of it do. Some indeed, from an extraordinary strength of nature, have been hard drinkers, and yet die old; but for one who does this, perhaps an hundred are destroyed by it before they come to half the time of life: and generally we shall find, that very strong and healthy constitutions, at the long-run, are ruined by riot and excess, there being no certain safety in any way of living, but that of temperance and moderation. Nature in some may, a long time, withstand the abuses offered to it, but at last it will yield to its enemies; and those who live the longest in an intemperate course, might, from the strength of their constitution, have lived much longer, had they ate less, and used themselves to drink more water; which drink, as it is most friendly, and longest will preserve the life of a strong constitution, so it is absolutely necessary for those that are weak and sickly, and are naturally subject to the gout, the stone, shortness of breath, wind, ill digestion, and such like.

[Sidenote: _Useful in Vomiting._]

But the chief use of water, in preserving of health, is by using of it as a vomit, as before was shewn, which is an infallible and the most speedy remedy that was ever found out for any stomach sickness, or pain there; for to vomit with warm water, will effectually remove it in one hour, and be a means to prevent great fits of sickness, and preserve the lives of many thousands to old age, by cleansing the stomach from that tough, slimy, or corrupt matter that offends, and is the cause of all mortal diseases, especially of an apoplexy, which, tho' counted a disease of the head, yet hath its original from a foul stomach, which nothing doth so effectually cleanse as vomits; according to Dr. Curtis, who saith, that vomiting with warm water, or carduus-tea, is very beneficial to bring up

that which fluctuates in the stomach, and that tough, ropy phlegm, which sticks fast to the wrinkles and folds of that bowel, and which purges do often pass over, and cannot remove. Which way of vomiting with warm water, is ten times more easy and pleasant than that which is effected by the use of nauseous tea made of carduus, which physicians sometimes advise; and it is also such as can do no harm by violence, as other vomits made from antimony sometimes do, for want of drinking after each vomit a pint or more of water-gruel, or warm water, when you vomit with water.

And here it may not be amiss to relate what I some years ago discovered, in order to mens freeing themselves from sickness that may happen after eating; for being invited to dine at a certain table, where there were several good dishes of meat, I was over-persuaded to eat more than I should, and in a little time after dinner found myself began to be sick. I went out, and in a private place attempted to vomit, by tickling my throat with my finger, but could not vomit as I designed; only by this means I raised up two or three mouthfuls of thick, tough phlegm, upon which I found myself better, and my sick qualm went off. I took the hint it gave me, and have done the same several times since, and find that the getting up the phlegm, which, like yeast upon beer, works up to the mouth of the stomach, a man may free himself from some kinds of sickness after eating. And I remember it is an advice given by one Vaughan, in a book long since printed, intituled, _Directions for Health_, for men who feed high, to put their finger in their throat when they rise in the morning, to make themselves puke, or void the phlegm which can be raised, as an excellent way to preserve health; and it is said also to be an absolute preservative from the gout, by a good writer.

[Sidenote: _The quantity of water needful._]

I will conclude with this note, that, in such distemper where water-drinking will be available for a cure, the same must not be drank sparingly, but plentifully; as (for instance) to ease the gripings in a looseness or flux: for, if but a pint of water should be drank, ease would hardly succeed; but, drinking in about an hours time a quart or three pints, the sharpness and evil quality of the humour offending, will be so far diluted or weakened, that immediate ease will follow. If the season be too cold to drink cold water, you may warm it a little upon the fire, or put a hot toast of bread into every pint. And the same is true in fevers, or in pains from gravel or the cholic: A small quantity will not be effectual in these cases; for in the cholic a quart is necessary, which ought to be carefully noted; and, in a fever, a little water will rather increase the burning, which large draughts, often drank, will soon take off. Rest, fasting, and drinking much water, after a vomit or two, is a course that never yet hath failed to cure fevers, by clearing the stomach of that sordid filthiness which causeth the distemper: for a happy issue will certainly follow such a course, if the fever is simple, and not complicated with such other distempers which will resist all remedies: For in many cases nothing can prevent mortality, as is evident by the death of the best physicians themselves, and by the death of many who consulted with them for a cure, since many die under the hands of the most able doctors, as well as quacks.

[Sidenote: _Grief and frights._]

I will add to what hath been said, one experiment more, that is very material: And that is, being very hypochondriacal, and of a melancholy temper, I have often been strangely dejected in mind when under grief for some misfortunes, which sometimes have been so great, as to threaten danger to life; in which fits of grief I always found the parts within my breast very uneasy, and sometimes continued long: But now I have found a good remedy; for, upon drinking a pint or more of cold water, I find ease in two or three minutes, so that no grief seems to afflict. Which experience I discover for the sake of others in the same circumstances, being certain, that the stomach sympathizeth with the mind, and this becomes the cause of that uneasy sensation perceived there, for which, cold water I have found to be the best remedy in myself, and I believe others may find the same benefit, who wilt make use thereof upon the like occasion. And it gives also relief to people under frights, which sometimes have been very fatal, even unto death.

[Sidenote: _Vapours._]

There is also another experiment that I have often seen of good effect; and that is, that if persons, subject to what is called vapours, or that are afflicted with fits, commonly called _the fits of the mother_, will but drink water when they find their fits approach, it will immediately yield relief. There is in this case a mealy julep, prescribed by Dr. Bates, which is, to take a spoonful of fine wheat-flour, an ounce of fine sugar, and a pint of water, brew them together, and drink it off: This is pleasanter than water alone; but water of itself will be as effectual, or rather better, as hath been often proved upon persons in those fits.

[Sidenote: _How to distinguish Water._]

Some perhaps may desire to know how to distinguish good from bad water. And the way to do this is, by the taste and scent; for being purely fresh, not salt, nor sweetish, nor ill-scented, it is good, provided it be pure and clear: Of which kind is the common water used in London, when well settled, or in fair weather. As for those who are curious, and will be at the charge, they may procure the best water for drink by distillation, either in an alembick, or in a cold still used in drawing any cold water from herbs; for no earthly or metallic substance, nor any kind of salt will rise in distillation: So that the water so distilled will be pure, and admirable to drink when cold, and will keep as long from stinking as any of the cold distilled water in the apothecaries shops; according to what Dr. Quincy hath affirmed about it in his _Dispensatory_.

Those who have not the conveniency of distillation, may boil it a little as they do for tea; for then, when kept a while after it is cold, it will become more fine, by suffering any mixture contained in it to settle to the bottom of the vessel, and that will render it still more pure: In short, all water that will make a good lather with soap, is wholesome to drink without boiling, but none else.

[Sidenote: _Pains in the stomach._]

Since the collecting together the fore-mentioned accounts, I have met with a book written by Dr. Boerhaave, the present professor of physic at Leyden in Holland, who affirms that drinking water, made very warm, is a good remedy to pacify griping pains in the stomach; and that it is proper to bathe wounds in the face with it, when they come to be just healed, so that the place be kept continually wet, which I conceive is best done by applying often linen cloths wet, and binding them on till they begin to be dry, for this will prevent scars: And he saith, that warm water is better to attenuate or thin the blood than cold.

[Sidenote: _Fevers._]

There is published lately a book of experiments made with water, by Dr. Hancock, a divine, called _Febrifugum Magnum_; wherein he saith, that drinking a pint or a quart of cold water in bed will raise a copious sweat, and cure all burning fevers, which at once taking hath done the business: It will raise a sweat without much more covering than ordinary. And he further affirms, that the same taken at the beginning of the cold fit of an ague, and sweating upon it, at two or three times taking, will cure that distemper. A large quantity of hot water, I know, hath been advised to take off the cold fit of agues, but the party was not ordered to sweat. Which discovery of the reverend doctor about fevers, is confirmed by the following accounts, which I received from a worthy gentleman, Mr. Ralph Thoresby, F. R. S.[1] to whom they were transmitted by Mr. Lucas, a pious and learned gentleman of Leeds in Yorkshire, who says, that

[1] Author of _Ducatus Leodiensis_, or Topography of Leeds, which the present learned Bishop of London, in his preface to the new edition of Cambden's Britannia, stiles, _An useful and accurate Treatise_.

'One Captain Rosier fell into a violent fever, which as soon as he perceived, he said he must have some cold water. The gentlewoman, at whose house he lodged, not thinking that proper, boiled the water (unknown to him) and put some spirits therein, and sent it up cold; but he smelt it before it came to his head, and refused to drink it, saying, he knew what he did, for he had several times tried it. Afterwards, some clear water being brought, he drank it, sweat profusely, and was well the next day.

'Another captain of a ship also took the same method, when he, or any of his men, fell into a fever; which had the desired success.'

Mr. Lucas adds, in another letter to the same gentleman, 'That his own wife fell very ill of a fever; she drank water, sweat very much, and thereby recovered.'

[Sidenote: _Colds._]

All which instances corroborate the new way of curing fevers, so lately discovered in this city by Dr. Hancock; who also saith, he has had long experience of curing common colds with cold water; and this is done by drinking a large draught of water at going to bed, another in the night, and another in the morning: which, he saith, will soon thicken and sweeten, and digest that thin sharp rheum that provokes coughing to no purpose; for the rheum, when thin, is hard to be brought up; but, when thickened, it will come up easily, and the cough will soon go off. Which agrees with what I before affirmed from my own long experience.

[Sidenote: _Good for the breath._]

He also affirms from his own experience, that using sometimes to take a walk of eight or ten miles in a morning, he found that water gave twice as good breath for that purpose as wine or ale; and, if it would do this for a man who had no asthma, he doubts not but it would do the same in a person troubled with one. And he also affirms water to be the best remedy for a surfeit; to the truth of which

I can testify by long experience.

[Sidenote: _Rheumatism._]

He also affirms, that drinking cold water hath been found good in rheumatisms, and that to one so afflicted he had advised to drink it as he lay in his bed, and it took off the fit; but if hot water attenuates the blood most, as Boerhaave affirms it is then best to drink of it warm daily to a good quantity: For, as Pitcairn observes, it is then the best dissolver of all kinds of salts in the body, which it will carry off in the urine, if drank plentifully; for by urine salts are evacuated, as is evident by the taste.

[Sidenote: _Gout in the stomach._]

And it is his opinion, from the long experience he hath had of the effect of water in keeping the stomach in order, and making it tight and strong to perform its operations, and digest all humours, that it will cure the gout in the stomach; and perhaps it may do it better than wine, which I have known to fail. And I do not wonder that the same liquor, which is the principal cause of the gout in other parts, should not be a help in that part, but rather kill, as it often is found to do, tho' the strongest wine is drank.

[Sidenote: _What sweating most natural._]

In short, he affirms, and that with great reason, that sweating in fevers, by drinking cold water, is more natural than to do it with hot sudorifics, which often do harm in the beginning of fevers, except good store of cooling moistning liquors are drank with them, they being more apt to inflame than cool and quench heat in the body; and for that reason sweating hath not been often advised by physicians, because they were ignorant of this way of sweating to cure fevers, by drinking cold water.

Which cure, he said, did succeed in one who was his relation, at the fifth day after his falling sick; to whom he gave a dose of water after he was in bed, and he sweated profusely for twenty-four hours, and thereby was cured. Half a pint, he saith, is enough for a grown child; a pint to a man or woman, tho' if they drink a quart, it will be better. And in scarlet fevers, small pox, or measles, tho' the water will not cause sweat, yet it will so quell and keep under the fever, that the eruptions will come out more kindly; which is a confirmation of what before was said about Dr. Bett's prescribing two quarts of water, when the small pox did not come out kindly; the water afforded matter to fill them up, according to what the author observes of a certain person, in the history of _Cold Bathing_, p. 347., that he could give an hundred instances where people of all ages have been lost, by being denied drink in the small pox,----for it hinders the filling of the pustules.

[Sidenote: _Plague._]

And Dr. Hancock sets down an account of the author of the _Free-thinker_, concerning a woman, who in the last great plague fell ill of that distemper, who got her husband to fetch her a pitcher of water from Lambs-conduit; she drank plentifully of it, but did not avoid the cold, and so did not sweat, however she was cured. And he gives us another relation of an Englishman, formerly resident at Morocco, that fell ill of the plague at that place, and, getting water to drink, fell into a violent sweat, and recovered: From whence the doctor concludes, that water is good in the plague; agreeable to what is related in Sir John Floyer's book of _Cold Baths_, wherein it is said, that but two died of the plague who lived over the water upon London bridge, p. 223, the coolness of the air being supposed to contribute to their health who inhabited on the water in that manner, their blood being cooler than others: It is said also, the watermen escaped better than others.

[Sidenote: right pointing finger icon]

I will here add to what the doctor hath said before, concerning the cure of fevers, that if the fever be accompanied in the beginning with any great illness at the stomach, nauseating or vomiting, it will be the surest and safest practice to clear the stomach first, by vomiting with warm water, as before directed; for I cannot believe it possible for the stomach to be cleared from foul humours by sweating. It may do, if no great sense of disorder is perceived there; but it will certainly be safest to cleanse the stomach first, which is the place where all diseases have their original; for then sweating with cold water afterwards may turn to good account. Indeed I have not made any trial of it since the doctor's book was published, but I have a very good opinion of his accounts therein given concerning the benefit of water, having had so much experience thereof in my own practice for above forty years; for so long it is since I first began to collect those accounts, and make those experiments, which are herein made public for the benefit of all. I will only add, that in a book, intituled, _Organum Salutis_, p. 50. written by Judge Rumsey, he saith, he never found any thing more useful for the health of man, than to drink first in the morning half a pint of cold water; and this will contribute much to the cure of blood-shotten eyes.

[Sidenote: _Pag._ 42, 43, 44.]

Since the last edition of this work, there hath been published _An Essay of Health and long Life_, by Dr. Cheyne, wherein this truth is asserted too, ‘That water was the primitive, original beverage--(and happy had it been for the race of mankind, if other mixt and artificial liquors had never been invented) and that water alone is sufficient and effectual for all the purposes of human wants in drink. Strong liquors were never designed for common use, tho’ now we see the better sort scarce ever dilute their food with any other liquor: And thereby we see their blood becomes inflamed into gout, stone, rheumatisms, raging fevers, and pleurisies; and their passions enraged into quarrels, murders, and blasphemies; their juices dried up; and their solids scorched and shriveled.’ This author, p. 46., exclaims against strong drinks, as the root of one half of all the human miseries; but finds they are unwilling to leave them off, pretending the danger of all sudden changes. But he alledgeth, ‘That he hath known good and constant effects from leaving off suddenly great quantities of wine, and flesh-meats too, by those accustomed to both; and never observed any ill consequences from it in any case whatsoever; but that broken constitutions have thereby lived longer, and grown better, by so doing.’

Some few, and but very few, have pretended, that by leaving off wine and strong drink, and using only water, they found their bodies weakened: But this perhaps may proceed only from the same fancy which made the lady believe her doctor could not cure her, because he did not keep a coach. There may be some constitutions that water doth not agree with, even as cheese will not agree with some: Nay, I once met with an ancient woman, who affirmed, she could not, and never did eat bread. And there are so few in comparison to them who have found benefit by the use of water, to those who have not, that no wise man will refrain on their account, till, upon trial, he really finds it will not agree with him.

One of the most ingenious watch-makers in London, very lately, from a long continued flux, was very much weakened, and entirely lost his appetite, so far that he could eat no food whatsoever: He had the advice of an able physician, his intimate acquaintance, who could not give him any relief: He, upon reading my book, came to ask me, whether I thought he might venture to drink water? I thereupon prevailed with him to drink half a pint of cold water going to bed, and half a pint in the morning: He, tho’ an immoderate drinker of wine before, was so far from being injured by it, that in a fortnight he began to eat, and in about a month recovered as good a date of health and countenance as he had before.

It hath been objected by some few, that drinking of water maketh them costive: which well considered, is an argument that it strengthens the bowels; for all fluxes proceed from weak bowels, and are an enemy to the strength of the bodily members, no persons being in health, as Dr. Baynard affirms, but those who evacuate figured excrements, which weak bowels never do; so that firm excrements tend most to strength, provided there be an evacuation one in a day, which is enough for them who through temperance live wisely, and do not destroy themselves by gluttony.

SOME RULES FOR Preserving Health by Diet, _Collected from Physical Authors._

[Sidenote: _Diet will cure diseases._]

In a little treatise, intituled, _Kitchen-physic_, written by Dr. Cook, the author declares, he can hardly be told of any disease which he cannot relieve or cure by a proper diet, p. 39. And in the same book we find his opinion to be this, that all tender sickly people, and all aged and decrepid persons, ought to eat often, and but a little at a time, because weak and wasted bodies are to be restored by little and little; and by moist and liquid food also, rather than by solid, because moist and liquid diet does nourish soonest, and digest easiest.

[Sidenote: _Feeding much, bad for weak people._]

Those, he saith, that eat much, and get little strength by eating, shew, that they have used themselves to too full a diet; and the more you cram such bodies, the less they thrive by it, but rather grow worse and worse: Because by much feeding you do but add to the bad humours wherewith the body is already filled, which should rather be wasted by purging, and using a spare diet.

[Sidenote: _A spare diet, what._]

And a spare diet he describes to be this, that we never eat at once till the appetite is fully satisfied, and never to eat till we have an appetite; and men never have a true appetite till they can eat any ordinary food: And he adviseth to keep constantly to a plain diet, for those, he says, enjoy most health, and live longest, that avoid curiosity and variety of meats and drinks, which only serve to entice to gluttony, and so work our ruin.

[Sidenote: _Sick, to recover soonest._]

Another saith, that the less food the sick person eats, the sooner he will recover; for it is a true saying, _the more you fill foul bodies, the more you hurt them_. The stomach being the place where diseases have their origin, when that part therefore is weak, and out of order, and cannot make a good digestion, if much is eaten, raw and crude humours must needs be bred, and bad humours cannot produce good blood.

[Sidenote: _The evil of full meals._]

All men find by experience, that, in the morning before they have eaten, they are light and pleasantly easy in their bodies; but, after they have indulged their appetites with plenty of food, they find themselves heavy and dull, and often sleepy: which sufficiently shews, that those full meals are prejudicial to the welfare of the body; for a moderate meal would have continued the ease and lightsomeness they before found in themselves, and would have refreshed any faintness that emptiness might occasion. And he certainly, who useth the most simple meats and drinks, avoideth the snare of provoking his appetite beyond the necessities of nature; whereas variety enticeth to a fresh desire of every dainty, till at last the stomach is gorged, and made uncapable of performing a good digestion; and this produceth those crudities which are the cause of all diseases, and of so many sudden deaths.

[Sidenote: _The evil of high feeding._]

It is generally observed, that the most unhealthy are found among those who feed high upon the most delicious dainties, and drink nothing but the strongest and most spirituous liquors; whereas others who want this delicate fare, are seldom sick, except they have such unsatiable appetites as to eat too much; which a man may do of the plainest diet, whose _belly is his god_, as an apostle expresses it. Phil. iii 19. But tho' men may glut themselves with coarse food, yet coarse food, and long life are very confident, as appears by John Bill, mentioned in the history of _Cold Baths_, p. 408. whose food was bread, cheese, and butter; and drink, whey, butter-milk, or water; and yet he lived 133 years, and was a strong, strait, upright man. And the food of John Bailes, whose age amounted to 128, was for the most part brown bread and cheese; and his drink, water, or small beer and milk, _Cold Bath_, p. 416. He had buried the whole town of Northampton twenty times over, except three or four, and said, _Strong drink killed them all_.

[Sidenote: _Small suppers best._]

Dr. Pratt adviseth to sup sparingly; for to sup sparingly, he saith, is most healthful, because of the experience of an infinite number of persons who have received the greatest benefit from light suppers. For the stomach being not overburdened, the sleep is more pleasant; and from sparing suppers the breeding of those humours it prevented, which cause defluxions, rheumatisms, gouts, dropsies, giddiness, and corruption in the mouth from the scurvy: And from light suppers a freedom from sickness and reaching in the morning is obtained, and concoction is made perfect, which prevents obstructions.

[Sidenote: _Fasting, its benefit._]

Another saith, it is well known, that many indispositions are cured by fasting, or a very spare diet; for what is taken into the stomach being no more than can be well digested, the chylous juice, so rightly prepared, is conveyed into the lacteal vessels, and from thence into the blood; so that, nature being duly supplied with well-concocted nourishment, the corrupted blood will free itself from that corruption in time, by throwing it out, through the pores of the skin, in perspiration, and supply itself with the purer juices; and, in this way, consumptions and scurvies, and other chronical distempers, will be overcome. Which way of curing diseases by fasting, swine do naturally betake themselves to, who, when sick, will eat nothing till they recover, as they always do after they injure themselves by over-eating; in which over-eating they are imitated by all who delight in gluttony, tho' not in using the same means of recovery, by fasting; so that hogs are wiser in that particular than such people.

[Sidenote: _A rule in eating._]

That men in health may prevent diseases, it was advised, that one meal should not be eaten, till the other, which was eaten before, was passed off clean out of the stomach; which never is done till the appetite of hunger is found to call for another supply: By means of which constant observation, the food will be converted to good chyle, and from good chyle, which is a milk-like substance, good blood will be bred, and from good blood generous spirits will be produced, on which a healthy constitution will ensue; but, on the contrary, when too great a quantity of food is taken for pleasure only, which the stomach cannot well digest, the chyle will be raw and corrupt, which will foul the blood, and render the body disordered and unhealthy.

[Sidenote: _Benefits of sobriety._]

Others say, that abstinence and sobriety free from most diseases, especially catarrhs, coughs, wheesings, giddiness, pain in the head and stomach, sudden death, lethargies, gout and sciatica, an ill digestion being the cause of all these; it also prevents pains in the splene, stone, and gravel, and a dry itch; it makes the body vigorous and nimble, maintains the five senses in a good state, preserveth the memory, quickens the wit; and quencheth all undue lust in mankind; and, in short, all misers, who eat and drink but little, do live long.

[Sidenote: _Rule for diet after fifty._]

Two meals a day is said to be sufficient for all persons after fifty years of age, and all weak people; and the omitting of suppers does always conduce much to the health of the weak and aged: since, if no supper be eaten, the stomach will soon free itself from all tough, slimy humours wherewith it is slabbered over on the inside, and thereby the appetite will be renewed, and digestion made more strong. Moreover, all that are troubled with sweating in the night, any ill taste in their mouths, belching and troublesome dreams, must avoid suppers; for in sleep the fibres of the stomach relax, and are not able to contract themselves so strongly, as when awake, to embrace the food, and by tituration reduce it into a pap fit to pass into the intestines, out of which the nourishment is sent to other parts.

[Sidenote: _Temperance prolongs life._]

It was said by Dr. Curtis, that tho' those who use a spare diet cannot well bear long labour; yet such people, when their exercise is suitable to their strength, do live longer than those of a robust constitution, that think large feeding adds strength; especially such as, being strong, use no exercise proportionable to it, to consume the superfluities which a full feeding doth occasion: So that the only way for those to live long, who have much wealth, and need not labour for a livelihood, is to live temperately; and this temperance doth consist in not letting the common custom of meals invite you to eat, except your appetite concur with those times. We must not indulge the cravings of a depraved appetite, as those do who eat to please their fancy, and not the necessities of nature; and, when we do eat, we must not think that the more plentifully we eat, we shall be the more strengthened; for it will not prove so: A little well digested will make the body stronger then the being glutted with superfluity, most of which will be turned into a corrupt juice, and must be cast out by physic, or else sickness will ensue. The easiest physic is that which the Germans call the _Hunger-cure_, if continued a due time.

[Sidenote: _Children, when ill managed._]

It is the opinion of learned men, that the early distemper of the bodies of children, called the rickets, proceeds from the faults of their mothers, in making them gluttons from their cradles, gorging them with food till they lothe it, out of a mistaken opinion, that this is the way to make them thrive and grow strong: which excess is not only the cause of this disease, but of the immature death of many; and in others it lays the foundation of many distempers, which afflict those afterwards who live to years of maturity. And as they gorge them with food, so they vainly think to cherish them with strong drink, than which nothing can be more pernicious to the health of children, whose diet should be little and often, and their drink cooling. As it also should be when men arrive at the time of becoming children again in old age, that is, in an helpless state, which should be prevented as much as can be, by a cooling, moistening diet, in opposition to the hot, dry, and withered state of age; for it is heat and dryness that are the cause of most old men's miseries, especially the wasting of the substance that fills the parts with moisture, and keeps the body plump and smooth; they who stile wine the old man's milk, being greatly mistaken, for milk cools and wine heats.

[Sidenote: _Rules for sickness._]

It was the opinion of Dr Pitt, who was formerly physician to St. Bartholomew's hospital, that fasting, rest, and drinking water, would cure most diseases. And there seemeth to be a great deal of reason in what he asserts: for fasting will give time to the stomach to unload itself of the cause of distempers, the cause of all diseases being begun in that bowel only: to which cleansing, the drinking of

water plentifully will much contribute; which also will keep the action of the stomach upon the hinges, by filling of it when empty, at which time there will be need of rest, for thereby the body will be less fit for business: Tho' the mere drinking of water, which affords nourishment sufficient for the growth and support of all vegetables, will, in some measure, supply the want of food; as hath been shewn in the example of two, who were supported a long time by nothing else. In short, the best way for a sick man to recover, is to eat little or no food till he finds an appetite, according to that saying,

Spare diet will the most diseases cure, If a due time the same you can endure.

And fasting from food may be continued long enough to be a remedy for many diseases, with the assistance of common water; by the drinking of which warm, in a due quantity, without a total fasting, two persons, I am informed, were recovered out of consumptions, with which they were extremely weakened, and that in about six weeks time; as another by drinking milk and whey, equal parts, made blood hot, without using any other diet, which is thought to be far more effectual than asses milk, whose virtue consists in being thinner than other milk.

[Sidenote: _Air, its benefit._]

But, besides a spare diet, cool dry air is also very helpful to preserve men in health, who are not sick; for it mixes with the blood, and without it the motion of the blood and spirits can never be preserved; as appears by diving vessels, in which men cannot live when the air therein is made hot by their own body and breath: And is proved also by an experiment of Dr. Croone's, who stifled a chicken till it seemed quite dead; and yet, by blowing cool air into the lungs with a small pair of bellows, it revived. Hence it appears, that the common custom of managing sick people is very pernicious, and so far from helping them to recover, that it is sufficient to make a healthy person sick: For were a person, who was not sick, confined for three or four weeks in a room made hot like a stove, and kept in his bed, with the curtains drawn, and all the windows close shut, and the room made unpleasant with the nauseous fumes of physic and a close-stool, which will almost make a healthy man sick when he enters into it; we can never think that this is the way to recover one that really is sick, and wants the fresh air and reviving scents to cherish his blood; a fresh, open, sweet air being one principal means to strengthen the body, make a good appetite and digestion, and render the spirits brisk and lively: which advantage should be allowed to all but childbed women, and those who are afflicted with the small pox: for the fresh air can be prejudicial to no other, whose bodies are clothed warm, either in bed, or sitting in a chair in their chamber.

[Sidenote: _A fever suddenly cured._]

Some years since, a neighbour became very feverish, and his wife persuaded him to go to bed; and hearing of it soon after, I gave him a visit where I found the windows close shut, the curtains of the bed drawn, and the room very hot, for it was in July: He was burning hot, and complained for want of breath. I drew open the curtains, covered him warm, and then opened the windows, and the wind blew into the room; upon which he soon told me, his shortness of breath had left him. I persuaded him to drink water, which he found did much refresh him; and, after I had taken my leave of him, he called for more water: and, while he had the cup in his hand, an apothecary came in, whom his wife had sent for, who, finding him about to drink the water, told him, if he did it, he was a dead man; but, instead of forbearing, he drank it up in his presence: upon which the other took his leave, and told him, he would say no more to him. However, before night, the person got up, went abroad, and was cured of his fever. Which is one instance, among many others that might be given, of the benefit of fresh air to a person who is kept warm in his bed; for thereby his body was cooled inwardly, and his breathing made more free, by the air which was drawn into his lungs to refresh and comfort the blood as it passed through them.

[Sidenote: _A cool and low diet._]

I shall only add, that by keeping the blood cool as well as clean, is to be understood, not only moderation in diet, but to feed most on cooling food made of wheat, barley, oat-meal, rice, and ripe apples, as also on milk, which, joined with oat-meal, is the chief food of those lusty and strong men, the Highlanders of Scotland, who abound in children, as Dr. Cheyne tells us in his _Treatise of the Gout_, p. 108. edit. 4. which demonstrates milk and oat-meal to be a most strengthening food, and such as keeps the blood in due order; so that therewith men may subsist, tho' they abstain from beef, pork and venison, and all other meats hard to digest, and drink water as the highlanders do: Of the efficacy of which cooling milk-diet the said Dr. Cheyne gives a notable instance in a doctor that lived at Croyden, p. 103. who had long been afflicted with the falling-evil; for, by slow observation, he found the lighter his meals were, the lighter were his fits. At last he also cast off all liquids but water, and found his fits weaker, and the intervals longer; and finding his disease mend, as its fewel was withdrawn, he took to vegetable food, and water only, which put an entire period to his fits without any relapse: But finding that food windy to him, he took to milk, of which he drank a pint for a breakfast, a quart at

dinner, and a pint for supper, without fish, flesh, bread, or any strong or spirituous liquor, or any drink but water, with which he lived afterwards for fourteen years, without the least interruption in his health, strength or vigour, but died afterwards of a pleurisy. Which is a confirmation of what Dr. Cook did affirm, of the possibility of curing diseases by a diet only, that is temperate and cooling; of which milk is a part, as are also the roots and seeds of vegetables, such as potatoes, turnips, wheat, rice, barley, oat-meal, and full ripe fruit.

In short, temperance or a spare diet, void of dainties, never was injurious to the strongest constitution; and, without it, such as are weak and sickly cannot long subsist; for the more such persons eat and drink, the more weak and disordered they will still find themselves to be: so that if the strong despise temperance, yet the comfort of weak, sickly and pining people, does depend entirely upon their constantly observing it; which, when they are accustomed to it, will be easy to do: So that they will deny all intemperate desires with as great pleasure, as they before delighted in what is falsely stiled good eating and drinking; for nothing of that is good, which is injurious to health. It is custom only that makes men hanker after gluttony and drunkenness, and a contrary custom will make men abhor it as much: And therefore it is a wonder the rich do not strive to attain to it; for

A fatal error 'tis in men of wealth, To feed so high as will destroy their health.

Temperance being that which will enable them to live most at ease, and enjoy their wealth the longest; this, and water-drinking, being the surest way to bring men to old age, tho' it hath not power to make those young who are aged, yet it will make the aged more free from decripedness, and die with most ease, if the deathbed hath been well prepared for by a good life.

FINIS.

PRICE EIGHTPENCE.

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ENFRANCHISEMENT OF WOMEN.

AN ESSAY BY

MRS. JOHN STUART MILL.

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FOR JULY, 1851.

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ENFRANCHISEMENT OF WOMEN:

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Most of our readers will probably learn from these pages, for the first time, that there has arisen in the United States, and in the most civilized and enlightened portion of them, an organized agitation on a new question,--new, not to thinkers, nor to any one by whom the principles of free and popular government are felt, as well as acknowledged, but new, and even unheard of, as a subject for public meetings and practical political action. This question is, the enfranchisement of women; their admission, in law, and in fact, to equality in all rights, political, civil and social, with the male citizens of the community.

It will add to the surprise with which many will receive this intelligence, that the agitation which has commenced is not a pleading by male writers and orators _for_ women, those who are professedly to be benefited remaining either indifferent or ostensibly hostile; it is a political movement, practical in its objects, carried on in a form which denotes an intention to persevere. And it is a movement not merely _for_ women, but _by_ them. Its first public manifestation appears to have been a convention of women, held in the State of New York, July, 1848. Of this meeting we have seen no report. On the 23d and 24th of October last, a succession of public meetings was held at Worcester, in Massachusetts, under the name of a "Women's Rights Convention," of which the president was a woman, and nearly all the chief speakers women; numerously reinforced, however, by men, among whom were some of the most distinguished leaders in the kindred cause of negro emancipation. A general and four special committees were nominated, for the purpose of carrying on the undertaking until the next annual meeting.

According to the report in the _New York Tribune_, above a thousand persons were present throughout, and, "if a larger place could have been had, many thousands more would have attended." The place was described as "crowded, from the beginning, with attentive and interested listeners." In regard to the quality of the speaking, the proceedings bear an advantageous comparison with those of any popular movement with which we are acquainted, either in this country or in America. Very rarely, in the oratory of public meetings, is the part of verbiage and declamation so small, that of calm good sense and reason so considerable. The result of the convention was, in every respect, encouraging to those by whom it was summoned; and it is probably destined to inaugurate one of the most important of the movements towards political and social reform, which are the best characteristic of the present age.

That the promoters of this new agitation take their stand on principles, and do not fear to declare these in their widest extent, without time-serving or compromise, will be seen from the resolutions adopted by the convention, part of which we transcribe:

Resolved, That every human being, of full age, and resident for a proper length of time on the soil of the nation, who is required to obey the law, is entitled to a voice in its enactment; that every such person, whose property or labor is taxed for the support of the government, is entitled to a direct share in such government. Therefore,

Resolved, That women are entitled to the right of suffrage, and to be considered eligible to office; and that every party, which claims to represent the humanity, the civilization, and the progress of the age, is bound to inscribe on its banners, equality before the law, without distinction of sex or color.

Resolved, That civil and political rights acknowledge no sex, and therefore the word "male" should be stricken from every state constitution.

Resolved, That, since the prospect of honorable and useful employment in after life is the best stimulus to the use of educational advantages, and since the best education is that we give ourselves, in the struggles, employments and discipline of life; therefore it is impossible that women should make full use of the instruction already accorded to them, or that their career should do justice to their faculties, until the avenues to the various civil and professional employments are thrown open to them.

Resolved, That every effort to educate women, without according to them their rights, and arousing their conscience by the weight of their responsibilities, is futile, and a waste of labor.

Resolved, That the laws of property, as affecting married persons, demand a thorough revisal, so that all rights be equal between them; that the wife have, during life, an equal control over the property gained by their mutual toil and sacrifices, and be heir to her husband precisely to that extent that he is heir to her, and entitled at her death to dispose by will of the same share of the joint property as he is.

The following is a brief summary of the principal demands:

1. _Education_ in primary and high schools, universities, medical, legal and theological institutions.

2. _Partnership_ in the labors and gains, risks and remunerations, of productive industry.

3. _A coëqual share_ in the formation and administration of laws,--municipal, state and national,--through legislative assemblies, courts, and executive offices.

It would be difficult to put so much true, just and reasonable meaning into a style so little calculated to recommend it as that of some of the resolutions. But whatever objection may be made to some of the expressions, none, in our opinion, can be made to the demands themselves. As a question of justice, the case seems to us too clear for dispute. As one of expediency, the more thoroughly it is examined, the stronger it will appear.

That women have as good a claim as men have, in point of personal right, to the suffrage, or to a place in the jury-box, it would be difficult for anyone to deny. It cannot certainly be denied by the United States of America, as a people or as a community. Their democratic institutions rest avowedly on the inherent right of every one to a voice in the government. Their Declaration of Independence, framed by the men who are still their great constitutional authorities,--that document which has been from the first, and is now, the acknowledged basis of their polity,--commences with this express statement:

"We hold these truths to be self-evident: that all men are created equal; that they are endowed by their Creator with certain inalienable rights; that among these are life, liberty, and the pursuit of happiness; that, to secure these rights, governments are instituted among men, deriving their just powers from the consent of the governed."

We do not imagine that any American democrat will evade the force of these expressions by the dishonest or ignorant subterfuge, that "men," in this memorable document, does not stand for human beings, but for one sex only; that "life, liberty and the pursuit of happiness," are "inalienable rights" of only one moiety of the human species; and that "the governed," whose consent is affirmed to be the only source of just power, are meant for that half of mankind only, who, in relation to the other, have hitherto assumed the character of _governors_. The contradiction between principle and practice cannot be explained away. A like dereliction of the fundamental maxims of their political creed has been committed by the Americans in the flagrant instance of the negroes; of this they are learning to recognize the turpitude. After a struggle which, by many of its incidents, deserves the name of heroic, the abolitionists are now so strong in numbers and influence, that they hold the balance of parties in the United States. It was fitting that the men whose names will remain associated with the extirpation from the democratic soil of America of the aristocracy of color, should be among the originators, for America and for the rest of the world, of the first collective protest against the aristocracy of sex; a distinction as accidental as that of color, and fully as irrelevant to all questions of government.

Not only to the democracy of America the claim of women to civil and political equality makes an irresistible appeal, but also to those radicals and chartists in the British islands, and democrats on the continent, who claim what is called universal suffrage as an inherent right, unjustly and oppressively withheld from them. For with what truth or rationality could the suffrage be termed universal, while half the human species remain excluded from it? To declare that a voice in the government is the right of all, and demand it only for a part,--the part, namely, to which the claimant himself belongs,--is to renounce even the appearance of principle. The chartist who denies the suffrage to women is a chartist only because he is not a lord; he is one of those levellers who would level only down to themselves.

Even those who do not look upon a voice in the government as a matter of personal right, nor profess principles which require that it should be extended to all, have usually traditional maxims of political justice, with which it is impossible to reconcile the exclusion of all women from the common rights of citizenship. It is an axiom of English freedom, that taxation and representation should be coëxtensive. Even under the laws which give the wife's property to the husband, there are many unmarried women who pay taxes. It is one of the fundamental doctrines of the British constitution, that all persons should be tried by their peers; yet women, whenever tried, are tried by male judges and a male jury. To foreigners, the law accords the privilege of claiming that half the jury should be composed of themselves; not so to women. Apart from maxims of detail, which represent local and national, rather than universal ideas, it is an acknowledged dictate of justice, to make no degrading distinctions without necessity. In all things, the presumption ought to be on the side of equality. A reason must be given why anything should be permitted to one person, and interdicted to another. But when that which is interdicted includes nearly everything which those to whom it is permitted most prize, and to be deprived of which they feel to be most insulting; when not only political liberty, but personal freedom of action, is the prerogative of a caste; when even, in the exercise of industry, almost all employments which task the higher faculties in an important field, which lead to distinction, riches, or even pecuniary independence, are fenced round as the exclusive domain of the predominant section, scarcely any doors being left open to the dependent class, except such as all who can enter elsewhere disdainfully pass by; the miserable expediencies which are advanced as excuses for so grossly partial a dispensation would not be sufficient, even if they were real, to render it other than a flagrant injustice. While, far from being expedient, we are firmly convinced that the division of mankind into two castes, one born to rule over the other, is, in this case, as in all cases, an unqualified mischief; a source of perversion and demoralization, both to the favored class and to those at whose expense they are favored; producing none of the good which it is the custom to ascribe to it, and forming a bar, almost insuperable, while it lasts, to any really vital improvement, either in the character or in the social condition of the human race.

These propositions it is now our purpose to maintain. But, before entering on them, we would endeavor to dispel the preliminary objections which, in the minds of persons to whom the subject is new, are apt to prevent a real and conscientious examination of it. The chief of these obstacles is that most formidable one--custom. Women never have had equal rights with men. The claim in their behalf, of the common rights of mankind, is looked upon as barred by universal practice. This strongest of prejudices, the prejudice against what is new and unknown, has, indeed, in an age of changes like the present, lost much of its force; if it had not, there would be little hope of prevailing against it. Over three fourths of the habitable world, even at this day, the answer, "It has always been so," closes all discussion. But it is the boast of modern Europeans, and of their American kindred, that they know and do many things which their forefathers neither knew nor did; and it is, perhaps, the most unquestionable point of superiority in the

present, above former ages, that habit is not now the tyrant it formerly was over opinions and modes of action, and that the worship of custom is a declining idolatry. An uncustomary thought, on a subject which touches the greater interests of life, still startles when first presented; but if it can be kept before the mind until the impression of strangeness wears off, it obtains a hearing, and as rational a consideration as the intellect of the hearer is accustomed to bestow on any other subject.

In the present case, the prejudice of custom is doubtless on the unjust side. Great thinkers, indeed, at different times, from Plato to Condorcet, besides some of the most eminent names of the present age, have made emphatic protests in favor of the equality of women. And there have been voluntary societies, religious or secular, of which the Society of Friends is the most known, by whom that principle was recognized. But there has been no political community or nation in which, by law, and usage, women have not been in a state of political and civil inferiority. In the ancient world, the same fact was alleged, with equal truth, in behalf of slavery. It might have been alleged in favor of the mitigated form of slavery, serfdom, all through the middle ages. It was urged against freedom of industry, freedom of conscience, freedom of the press; none of these liberties were thought compatible with a well-ordered state, until they had proved their possibility by actually existing as facts. That an institution or a practice is customary, is no presumption of its goodness, when any other sufficient cause can be assigned for its existence. There is no difficulty in understanding why the subjection of women has been a custom. No other explanation is needed than physical force.

That those who were physically weaker should have been made legally inferior, is quite conformable to the mode in which the world has been governed. Until very lately, the rule of physical strength was the general law of human affairs. Throughout history, the nations, races, classes, which found themselves the strongest, either in muscles, in riches, or in military discipline, have conquered and held in subjection the rest. If, even in the most improved nations, the law of the sword is at last discountenanced as unworthy, it is only since the calumniated eighteenth century. Wars of conquest have only ceased since democratic revolutions began. The world is very young, and has but just begun to cast off injustice. It is only now getting rid of negro slavery. It is only now getting rid of monarchical despotism. It is only now getting rid of hereditary feudal nobility. It is only now getting rid of disabilities on the ground of religion. It is only beginning to treat any _men_ as citizens, except the rich and a favored portion of the middle class. Can we wonder that it has not yet done as much for women? As society was constituted until the last few generations, inequality was its very basis; association grounded on equal rights scarcely existed; to be equals was to be enemies; two persons could hardly coöperate in anything, or meet in any amicable relation, without the law's appointing that one of them should be the superior of the other. Mankind have outgrown this state, and all things now tend to substitute, as the general principle of human relations, a just equality instead of the dominion of the strongest. But, of all relations, that between men and women being the nearest and most intimate, and connected with the greatest number of strong emotions, was sure to be the last to throw off the old rule and receive the new; for, in proportion to the strength of a feeling, is the tenacity with which it clings to the forms and circumstances with which it has even accidentally become associated.

When a prejudice which has any hold on the feelings finds itself reduced to the unpleasant necessity of assigning reasons, it thinks it has done enough when it has reässerted the very point in dispute, in phrases which appeal to the preëxisting feeling. Thus, many persons think they have sufficiently justified the restrictions on women's field of action when they have said that the pursuits from which women are excluded are _unfeminine_, and that the _proper sphere_ of women is not politics or publicity, but private and domestic life.

We deny the right of any portion of the species to decide for another portion, or any individual for another individual, what is and what is not their "proper sphere." The proper sphere for all human beings is the largest and highest which they are able to attain to. What this is, cannot be ascertained without complete liberty of choice. The speakers at the convention in America have, therefore, done wisely and right in refusing to entertain the question of the peculiar aptitudes either of women or of men, or the limits within which this or that occupation may be supposed to be more adapted to the one or to the other. They justly maintain that these questions can only be satisfactorily answered by perfect freedom. Let every occupation be open to all, without favor or discouragement to any, and employments will fall into the hands of those men or women who are found by experience to be most capable of worthily exercising them. There need be no fear that women will take out of the hands of men any occupation which men perform better than they. Each individual will prove his or her capacities, in the only way in which capacities can be proved, by trial; and the world will have the benefit of the best faculties of all its inhabitants. But to interfere beforehand by an arbitrary limit, and declare that whatever be the genius, talent, energy, or force of mind, of an individual of a certain sex or class, those faculties shall not be exerted, or shall be exerted only in some few of the many modes in which others are permitted to use theirs, is not only an injustice to the individual, and a detriment to society, which loses what it can ill spare, but is also the most effectual mode of providing that, in the sex or class so fettered, the qualities which are not permitted to be exercised shall not exist.

We shall follow the very proper example of the convention, in not entering into the question of the alleged differences in physical or mental qualities between the sexes; not because we have nothing to say, but because we have too much: to discuss this one point tolerably would need all the space we have to bestow on the entire subject[1]. But if those who assert that the "proper sphere" for women is the domestic mean by this that they have not shown themselves qualified for any other, the assertion evinces great ignorance of life and of history. Women have shown fitness for the highest social functions exactly in proportion as they have been admitted to them. By a curious anomaly, though ineligible to even the lowest offices of state, they are in some countries admitted to the highest of all, the regal; and if there is any one function for which they have shown a decided vocation, it is that of reigning. Not to go back to ancient history, we look in vain for abler or firmer rulers than Elizabeth; than Isabella of Castile; than Maria Theresa; than Catharine of Russia; than Blanche, mother of Louis IX. of France; than Jeanne d'Albret, mother of Henri Quatre. There are few kings on record who contended with more difficult circumstances, or overcame them more triumphantly, than these. Even in semi-barbarous Asia, princesses who have never been seen by men other than those of their own family, or ever spoken with them unless from behind a curtain, have, as regents, during the minority of their sons, exhibited many of the most brilliant examples of just and vigorous administration. In the middle ages, when the distance between the upper and lower ranks was greater than even between women and men, and the women of the privileged class, however subject to tyranny from men of the same class, were at a less distance below them than any one else was, and often in their absence represented them in their functions and authority, numbers of heroic chatelaines, like Jeanne de Montfort, or the great Countess of Derby, as late even as the time of Charles I., distinguished themselves, not only by their political, but their military capacity. In the centuries immediately before and after the Reformation, ladies of royal houses, as diplomatists, as governors of provinces, or as the confidential advisers of kings, equalled the first statesmen of their time; and the treaty of Cambray, which gave peace to Europe, was negotiated, in conferences where no other person was present, by the aunt of the Emperor Charles the Fifth, and the mother of Francis the First.

[1] An excellent passage on this part of the subject, from one of Sydney Smith's contributions to the _Edinburgh Review_, we will not refrain from quoting: "A great deal has been said of the original difference of capacity between men and women as if women were more quick and men more judicious; as if women were more remarkable for delicacy of association, and men for stronger powers of attention. All this, we confess, appears to us very fanciful. That there is a difference in the understandings of the men and the women we every day meet with, everybody, we suppose, must perceive; but there is none, surely, which may not be accounted for by the difference of circumstances in which they have been placed, without referring to any conjectural difference of original conformation of mind. As long as boys and girls run about in the dirt, and trundle hoops together, they are both precisely alike. If you catch up one half of these creatures, and train them to a particular set of actions and opinions, and the other half to a perfectly opposite set, of course their understandings will differ, as one or the other sort of occupations has called this or that talent into action. There is surely no occasion to go into any deeper or more abstruse reasoning, in order to explain so very simple a phenomenon."--_Sydney Smith's Works_, vol. i., p. 200.

Concerning the fitness, then, of women for politics, there can be no question: but the dispute is more likely to turn upon the fitness of politics for women. When the reasons alleged for excluding women from active life in all its higher departments are stripped of their garb of declamatory phrases, and reduced to the simple expression of a meaning, they seem to be mainly three: the incompatibility of active life with maternity, and with the cares of a household; secondly, its alleged hardening effect on the character; and, thirdly, the inexpediency of making an addition to the already excessive pressure of competition in every kind of professional or lucrative employment.

The first, the maternity argument, is usually laid most stress upon; although (it needs hardly be said) this reason, if it be one, can apply only to mothers. It is neither necessary nor just to make imperative on women that they shall be either mothers or nothing; or, that if they had been mothers once, they shall be nothing else during the whole remainder of their lives. Neither women nor men need any law to exclude them from an occupation, if they have undertaken another which is incompatible with it. No one proposes to exclude the male sex from parliament because a man may be a soldier or sailor in active service, or a merchant whose business requires all his time and energies. Nine tenths of the occupations of men exclude them _de facto_ from public life, as effectually as if they were excluded by law; but that is no reason for making laws to exclude even the nine tenths, much less the remaining tenth. The reason of the case is the same for women as for men. There is no need to make provision by law that a woman shall not carry on the active details of a household, or of the education of children, and at the same time practise a profession or be elected to parliament. Where incompatibility is real, it will take care of itself; but there is gross injustice in making the incompatibility a pretence for the exclusion of those in whose case it does not exist. And these, if they were free to choose, would be a very large proportion. The maternity argument deserts its supporters in the case of single women, a large and increasing class of the population--a fact which, it is not irrelevant to remark, by tending to diminish the excessive competition of numbers, is calculated to assist greatly the

prosperity of all. There is no inherent reason or necessity that all women should voluntarily choose to devote their lives to one animal function and its consequences. Numbers of women are wives and mothers only because there is no other career open to them, no other occupation for their feelings or their activities. Every improvement in their education and enlargement of their faculties, everything which renders them more qualified for any other mode of life, increases the number of those to whom it is an injury and an oppression to be denied the choice. To say that women must be excluded from active life because maternity disqualifies them for it, is in fact to say that every other career should be forbidden them, in order that maternity may be their only resource.

But, secondly, it is urged, that to give the same freedom of occupation to women as to men, would be an injurious addition to the crowd of competitors, by whom the avenues to almost all kinds of employment are choked up, and its remuneration depressed. This argument, it is to be observed, does not reach the political question. It gives no excuse for withholding from women the rights of citizenship. The suffrage, the jury-box, admission to the legislature and to office, it does not touch. It bears only on the industrial branch of the subject. Allowing it, then, in an economical point of view, its full force,--assuming that to lay open to women the employments now monopolized by men would tend, like the breaking down of other monopolies, to lower the rate of remuneration in those employments,--let us consider what is the amount of this evil consequence, and what the compensation for it. The worst ever asserted, much worse than is at all likely to be realized, is, that if women competed with men, a man and a woman could not together earn more than is now earned by the man alone. Let us make this supposition, the most unfavorable supposition possible: the joint income of the two would be the same as before, while the woman would be raised from the position of a servant to that of a partner. Even if every woman, as matters now stand, had a claim on some man for support, how infinitely preferable is it that part of the income should be of the woman's earning, even if the aggregate sum were but little increased by it, rather than that she should be compelled to stand aside in order that men may be the sole earners, and the sole dispensers of what is earned! Even under the present laws respecting the property of women,[2] a woman who contributes materially to the support of the family cannot be treated in the same contemptuously tyrannical manner as one who, however she may toil as a domestic drudge, is a dependent on the man for subsistence. As for the depression of wages by increase of competition, remedies will be found for it in time. Palliatives might be applied immediately; for instance, a more rigid exclusion of children from industrial employment, during the years in which they ought to be working only to strengthen their bodies and minds for after life. Children are necessarily dependent, and under the power of others; and their labor, being not for themselves, but for the gain of their parents, is a proper subject for legislative regulation. With respect to the future, we neither believe that improvident multiplication, and the consequent excessive difficulty of gaining a subsistence, will always continue, nor that the division of mankind into capitalists and hired laborers, and the regulation of the reward of laborers mainly by demand and supply, will be forever, or even much longer, the rule of the world. But so long as competition is the general law of human life, it is tyranny to shut out one half of the competitors. All who have attained the age of self-government have an equal claim to be permitted to sell whatever kind of useful labor they are capable of, for the price which it will bring.

[2] The truly horrible effects of the present state of the law among the lowest of the working population is exhibited in those cases of hideous mal-treatment of their wives by working men, with which every newspaper, every police report, teems. Wretches unfit to have the smallest authority over any living thing have a helpless woman for their household slave. These excesses could not exist if women both earned and had the right to possess a part of the income of the family.

The third objection to the admission of women to political or professional life, its alleged hardening tendency, belongs to an age now past, and is scarcely to be comprehended by people of the present time. There are still, however, persons who say that the world and its avocations render men selfish and unfeeling; that the struggles, rivalries and collisions of business and of politics, make them harsh and unamiable; that if half the species must unavoidably be given up to these things, it is the more necessary that the other half should be kept free from them; that to preserve women from the bad influences of the world is the only chance of preventing men from being wholly given up to them.

There would have been plausibility in this argument when the world was still in the age of violence; when life was full of physical conflict, and every man had to redress his injuries, or those of others, by the sword or by the strength of his arm. Women, like priests, by being exempted from such responsibilities, and from some part of the accompanying dangers, may have been enabled to exercise a beneficial influence. But in the present condition of human life, we do not know where those hardening influences are to be found, to which men are subject, and from which women are at present exempt. Individuals now-a-days are seldom called upon to fight hand to hand, even with peaceful weapons; personal enmities and rivalries count for little in worldly transactions; the general pressure of circumstances, not the adverse will of individuals, is the obstacle men now have to make head against. That

pressure, when excessive, breaks the spirit, and cramps and sours the feelings, but not less of women than of men, since they suffer certainly not less from its evils. There are still quarrels and dislikes, but the sources of them are changed. The feudal chief once found his bitterest enemy in his powerful neighbor, the minister or courtier in his rival for place; but opposition of interest in active life, as a cause of personal animosity, is out of date; the enmities of the present day arise not from great things, but small,--from what people say of one another, more than from what they do; and if there are hatred, malice, and all uncharitableness, they are to be found among women fully as much as among men. In the present state of civilization, the notion of guarding women from the hardening influences of the world could only be realized by secluding them from society altogether. The common duties of common life, as at present constituted, are incompatible with any other softness in women than weakness. Surely weak minds in weak bodies must ere long cease to be even supposed to be either attractive or amiable.

But, in truth, none of these arguments and considerations touch the foundations of the subject. The real question is, whether it is right and expedient that one half of the human race should pass through life in a state of forced subordination to the other half. If the best state of human society is that of being divided into two parts, one consisting of persons with a will and a substantive existence, the other of humble companions to these persons, attached each of them to one, for the purpose of bringing up _his_ children, and making _his_ home pleasant to him; if this is the place assigned to women, it is but kindness to educate them for this; to make them believe that the greatest good fortune which can befall them is to be chosen by some man for this purpose; and that every other career which the world deems happy or honorable is closed to them by the law, not of social institutions, but of nature and destiny.

When, however, we ask, why the existence of one half the species should be merely ancillary to that of the other,--why each woman should be a mere appendage to a man, allowed to have no interests of her own, that there may be nothing to compete in her mind with his interests and his pleasure,--the only reason which can be given is, that men like it. It is agreeable to them that men should live for their own sake, women for the sake of men; and the qualities and conduct in subjects which are agreeable to rulers they succeed for a long time in making the subjects themselves consider as their appropriate virtues. Helvetius has met with much obloquy for asserting that persons usually mean by virtues the qualities which are useful or convenient to themselves. How truly this is said of mankind in general, and how wonderfully the ideas of virtue, set afloat by the powerful, are caught and imbibed by those under their dominion, is exemplified by the manner in which the world were once persuaded that the supreme virtue of subjects was loyalty to kings, and are still persuaded that the paramount virtue of womanhood is loyalty to men. Under a nominal recognition of a moral code common to both, in practice self-will and self-assertion form the type of what are designated as manly virtues, while abnegation of self, patience, resignation, and submission to power, unless when resistance is commanded by other interests than their own, have been stamped by general consent as preëminently the duties and graces required of women. The meaning being, merely, that power makes itself the centre of moral obligation, and that a man likes to have his own will, but does not like that his domestic companion should have a will different from his.

We are far from pretending that in modern and civilized times no reciprocity of obligation is acknowledged on the part of the stronger. Such an assertion would be very wide of the truth. But even this reciprocity, which has disarmed tyranny, at least in the higher and middle classes, of its most revolting features, yet when combined with the original evil of the dependent condition of women, has introduced in its turn serious evils.

In the beginning, and among tribes which are still in a primitive condition, women were and are the slaves of men for the purposes of toil. All the hard bodily labor devolves on them. The Australian savage is idle, while women painfully dig up the roots on which he lives. An American Indian, when he has killed a deer, leaves it, and sends a woman to carry it home. In a state somewhat more advanced, as in Asia, women were and are the slaves of men for the purposes of sensuality. In Europe, there early succeeded a third and milder dominion, secured not by blows, nor by locks and bars, but by sedulous inculcation on the mind; feelings also of kindness, and ideas of duty, such as a superior owes to inferiors under his protection, became more and more involved in the relation. But it did not, for many ages, become a relation of companionship, even between unequals; the lives of the two persons were apart. The wife was part of the furniture of home, of the resting-place to which the man returned from business or pleasure. His occupations were, as they still are, among men; his pleasures and excitements also were, for the most part, among men--among his equals. He was a patriarch and a despot within four walls, and irresponsible power had its effect, greater or less according to his disposition, in rendering him domineering, exacting, self-worshipping, when not capriciously or brutally tyrannical. But if the moral part of his nature suffered, it was not necessarily so, in the same degree, with the intellectual or the active portion. He might have as much vigor of mind and energy of character as his nature enabled him, and as the circumstances of his times allowed. He might write the "Paradise Lost," or win the battle of Marengo. This was the condition of the Greeks and Romans, and of

the moderns until a recent date. Their relations with their domestic subordinates occupied a mere corner, though a cherished one, of their lives. Their education as men, the formation of their character and faculties, depended mainly on a different class of influences.

It is otherwise now. The progress of improvement has imposed on all possessors of power, and of domestic power among the rest, an increased and increasing sense of correlative obligation. No man now thinks that his wife has no claim upon his actions, but such as he may accord to her. All men, of any conscience, believe that their duty to their wives is one of the most binding of their obligations. Nor is it supposed to consist solely in protection, which, in the present state of civilization, women have almost ceased to need; it involves care for their happiness and consideration of their wishes, with a not unfrequent sacrifice of their own to them. The power of husbands has reached the stage which the power of kings had arrived at, when opinion did not yet question the rightfulness of arbitrary power, but in theory, and to a certain extent in practice, condemned the selfish use of it. This improvement in the moral sentiments of mankind, and increased sense of the consideration due by every man to those who have no one but himself to look to, has tended to make home more and more the centre of interest, and domestic circumstances and society a larger and larger part of life, and of its pursuits and pleasures. The tendency has been strengthened by the changes of tastes and manners which have so remarkably distinguished the last two or three generations. In days not far distant, men found their excitement and filled up their time in violent bodily exercises, noisy merriment, and intemperance. They have now, in all but the very poorest classes, lost their inclination for these things, and for the coarser pleasures generally; they have now scarcely any tastes but those which they have in common with women, and, for the first time in the world, men and women are really companions. A most beneficial change, if the companionship were between equals; but being between unequals, it produces, what good observers have noticed, though without perceiving its cause, a progressive deterioration among men in what had hitherto been considered the masculine excellences. Those who are so careful that women should not become men, do not see that men are becoming what they have decided that women should be--are falling into the feebleness which they have so long cultivated in their companions. Those who are associated in their lives tend to become assimilated in character. In the present closeness of association between the sexes, men cannot retain manliness unless women acquire it.

There is hardly any situation more unfavorable to the maintenance of elevation of character or force of intellect, than to live in the society, and seek by preference the sympathy, of inferiors in mental endowments. Why is it that we constantly see in life so much of intellectual and moral promise followed by such inadequate performance, but because the aspirant has compared himself only with those below himself, and has not sought improvement or stimulus from measuring himself with his equals or superiors? In the present state of social life, this is becoming the general condition of men. They care less and less for any sympathies, and are less and less under any personal influences, but those of the domestic roof. Not to be misunderstood, it is necessary that we should distinctly disclaim the belief that women are even now inferior in intellect to men. There are women who are the equals in intellect of any men who ever lived; and, comparing ordinary women with ordinary men, the varied though petty details which compose the occupation of women call forth probably as much of mental ability as the uniform routine of the pursuits which are the habitual occupation of a large majority of men. It is from nothing in the faculties themselves, but from the petty subjects and interests on which alone they are exercised, that the companionship of women, such as their present circumstances make them, so often exercises a dissolvent influence on high faculties and aspirations in men. If one of the two has no knowledge and no care about the great ideas and purposes which dignify life, or about any of its practical concerns save personal interests and personal vanities, her conscious, and still more her unconscious influence, will, except in rare cases, reduce to a secondary place in his mind, if not entirely extinguish, those interests which she cannot or does not share. Our argument here brings us into collision with what may be termed the moderate reformers of the education of women; a sort of persons who cross the path of improvement on all great questions; those who would maintain the old bad principles, mitigating their consequences. These say, that women should be, not slaves nor servants, but companions, and educated for that office (they do not say that men should be educated to be the companions of women). But since uncultivated women are not suitable companions for cultivated men, and a man who feels interest in things above and beyond the family circle wishes that his companion should sympathize with him in that interest, they therefore say, let women improve their understanding and taste, acquire general knowledge, cultivate poetry, art, even coquet with science, and some stretch their liberality so far as to say, inform themselves on politics; not as pursuits, but sufficiently to feel an interest in the subjects, and to be capable of holding a conversation on them with the husband, or at least of understanding and imbibing his wisdom. Very agreeable to him, no doubt, but unfortunately the reverse of improving. It is from having intellectual communion only with those to whom they can lay down the law, that so few men continue to advance in wisdom beyond the first stages. The most eminent men cease to improve if they associate only with disciples. When they have overtopped those who immediately surround them, if they wish for further growth, they must seek for others of their own stature to consort with. The

mental companionship which is improving is communion between active minds, not mere contact between an active mind and a passive. This inestimable advantage is even now enjoyed when a strong-minded man and a strong-minded woman are, by a rare chance, united; and would be had far oftener, if education took the same pains to form strong-minded women which it takes to prevent them from being formed. The modern, and what are regarded as the improved and enlightened modes of education of women, abjure, as far as words go, an education of mere show, and profess to aim at solid instruction, but mean by that expression superficial information on solid subjects. Except accomplishments, which are now generally regarded as to be taught well, if taught at all, nothing is taught to women thoroughly. Small portions only of what it is attempted to teach thoroughly to boys are the whole of what it is intended or desired to teach to women. What makes intelligent beings is the power of thought; the stimuli which call forth that power are the interest and dignity of thought itself, and a field for its practical application. Both motives are cut off from those who are told from infancy that thought, and all its greater applications, are other people's business, while theirs is to make themselves agreeable to other people. High mental powers in women will be but an exceptional accident, until every career is open to them, and until they, as well as men, are educated for themselves and for the world,--not one sex for the other.

In what we have said on the effect of the inferior position of women, combined with the present constitution of married life, we have thus far had in view only the most favorable cases, those in which there is some real approach to that union and blending of characters and of lives which the theory of the relation contemplates as its ideal standard. But if we look to the great majority of cases, the effect of women's legal inferiority on the character both of women and of men must be painted in far darker colors. We do not speak here of the grosser brutalities, nor of the man's power to seize on the woman's earnings, or compel her to live with him against her will. We do not address ourselves to any one who requires to have it proved that these things should be remedied. We suppose average cases, in which there is neither complete union nor complete disunion of feelings and of character; and we affirm that in such cases the influence of the dependence on the woman's side is demoralizing to the character of both.

The common opinion is, that, whatever may be the case with the intellectual, the moral influence of women over men is almost always salutary. It is, we are often told, the great counteractive of selfishness. However the case may be as to personal influence, the influence of the position tends eminently to promote selfishness. The most insignificant of men, the man who can obtain influence or consideration nowhere else, finds one place where he is chief and head. There is one person, often greatly his superior in understanding, who is obliged to consult him, and whom he is not obliged to consult. He is judge, magistrate, ruler, over their joint concerns; arbiter of all differences between them. The justice or conscience to which her appeal must be made is his justice and conscience; it is his to hold the balance and adjust the scales between his own claims or wishes and those of another. He is now the only tribunal, in civilized life, in which the same person is judge and party. A generous mind, in such a situation, makes the balance incline against its own side, and gives the other not less, but more than a fair equality; and thus the weaker side may be enabled to turn the very fact of dependence into an instrument of power, and, in default of justice, take an ungenerous advantage of generosity; rendering the unjust power, to those who make an unselfish use of it, a torment and a burthen. But how is it when average men are invested with this power, without reciprocity and without responsibility? Give such a man the idea that he is first in law and in opinion,--that to will is his part, and hers to submit; it is absurd to suppose that this idea merely glides over his mind, without sinking into it, or having any effect on his feelings and practice. The propensity to make himself the first object of consideration, and others at most the second, is not so rare as to be wanting where everything seems purposely arranged for permitting its indulgence. If there is any self-will in the man, he becomes either the conscious or unconscious despot of his household. The wife, indeed, often succeeds in gaining her objects, but it is by some of the many various forms of indirectness and management.

Thus the position is corrupting equally to both; in the one it produces the vices of power, in the other those of artifice. Women, in their present physical and moral state, having stronger impulses, would naturally be franker and more direct than men; yet all the old saws and traditions represent them as artful and dissembling. Why? Because their only way to their objects is by indirect paths. In all countries where women have strong wishes and active minds, this consequence is inevitable; and if it is less conspicuous in England than in some other places, it is because English women, saving occasional exceptions, have ceased to have either strong wishes or active minds.

We are not now speaking of cases in which there is anything deserving the name of strong affection on both sides. That, where it exists, is too powerful a principle not to modify greatly the bad influences of the situation; it seldom, however, destroys them entirely. Much oftener the bad influences are too strong for the affection, and destroy it. The highest order of durable and happy attachments would be a hundred times more frequent than they are, if the affection which the two sexes sought from one another were that genuine friendship which only exists between equals in privileges as in faculties. But with regard to what is commonly

called affection in married life,--the habitual and almost mechanical feeling of kindliness and pleasure in each other's society, which generally grows up between persons who constantly live together, unless there is actual dislike,--there is nothing in this to contradict or qualify the mischievous influence of the unequal relation. Such feelings often exist between a sultan and his favorites, between a master and his servants; they are merely examples of the pliability of human nature, which accommodates itself, in some degree, even to the worst circumstances, and the commonest nature always the most easily.

With respect to the influence personally exercised by women over men, it, no doubt, renders them less harsh and brutal; in ruder times, it was often the only softening influence to which they were accessible. But the assertion that the wife's influence renders the man less selfish contains, as things now are, fully as much error as truth. Selfishness towards the wife herself, and towards those in whom she is interested, the children, though favored by their dependence, the wife's influence no doubt tends to counteract. But the general effect on him of her character, so long as her interests are concentrated in the family, tends but to substitute for individual selfishness a family selfishness, wearing an amiable guise, and putting on the mask of duty. How rarely is the wife's influence on the side of public virtue! how rarely does it do otherwise than discourage any effort of principle by which the private interests or worldly vanities of the family can be expected to suffer! Public spirit, sense of duty towards the public good, is, of all virtues, as women are now educated and situated, the most rarely to be found among them; they have seldom even, what in men is often a partial substitute for public spirit, a sense of personal honor connected with any public duty. Many a man, whom no money or personal flattery would have bought, has bartered his political opinions against a title or invitations for his wife; and a still greater number are made mere hunters after the puerile vanities of society, because their wives value them. As for opinions, in Catholic countries, the wife's influence is another name for that of the priest; he gives her, in the hopes and emotions connected with a future life, a consolation for the sufferings and disappointments which are her ordinary lot in this. Elsewhere, her weight is thrown into the scale either of the most commonplace, or of the most outwardly prosperous opinions, either those by which censure will be escaped, or by which worldly advancement is likeliest to be procured. In England the wife's influence is usually on the illiberal and anti-popular side; this is generally the gaining side for personal interest and vanity; and what to her is the democracy or liberalism in which she has no part--which leaves her the Pariah it found her? The man himself, when he marries, usually declines into conservatism; begins to sympathize with the holders of power more than with the victims, and thinks it his part to be on the side of authority. As to mental progress, except those vulgarer attainments by which vanity or ambition are promoted, there is generally an end to it in a man who marries a woman mentally his inferior; unless, indeed, he is unhappy in marriage, or becomes indifferent. From a man of twenty-five or thirty, after he is married, an experienced observer seldom expects any further progress in mind or feelings. It is rare that the progress already made is maintained. Any spark of the _mens divinior_, which might otherwise have spread and become a flame, seldom survives for any length of time unextinguished. For a mind which learns to be satisfied with what it already is, which does not incessantly look forward to a degree of improvement not yet reached, becomes relaxed, self-indulgent, and loses the spring and tension which maintain it even at the point already attained. And there is no fact in human nature to which experience bears more invariable testimony than to this; that all social or sympathetic influences which do not raise up pull down; if they do not tend to stimulate and exalt the mind, they tend to vulgarize it.

For the interest, therefore, not only of women, but of men, and of human improvement, in the widest sense, the emancipation of women, which the modern world often boasts of having effected, and for which credit is sometimes given to civilization, and sometimes to Christianity, cannot stop where it is. If it were either necessary or just that one portion of mankind should remain mentally and spiritually only half developed, the development of the other portion ought to have been made, as far as possible, independent of their influence. Instead of this, they have become the most intimate, and, it may now be said, the only intimate associates of those to whom yet they are sedulously kept inferior; and have been raised just high enough to drag the others down to themselves.

We have left behind a host of vulgar objections, either as not worthy of an answer, or as answered by the general course of our remarks. A few words, however, must be said on one plea, which, in England, is made much use of, for giving an unselfish air to the upholding of selfish privileges, and which, with unobserving, unreflecting people, passes for much more than it is worth. Women, it is said, do not desire, do not seek, what is called their emancipation. On the contrary, they generally disown such claims when made in their behalf, and fall with _acharnement_ upon any one of themselves who identifies herself with their common cause.

Supposing the fact to be true in the fullest extent ever asserted, if it proves that European women ought to remain as they are, it proves exactly the same with respect to Asiatic women; for they, too, instead of murmuring at their seclusion, and at the restraint imposed upon them, pride themselves on it, and are astonished at the effrontery of women who receive visits from male

acquaintances, and are seen in the streets unveiled. Habits of submission make men, as well as women, servile-minded. The vast population of Asia do not desire or value--probably would not accept--political liberty, nor the savages of the forest civilization; which does not prove that either of those things is undesirable for them, or that they will not, at some future time, enjoy it. Custom hardens human beings to any kind of degradation, by deadening the part of their nature which would resist it. And the case of women is, in this respect, even, a peculiar one, for no other inferior caste that we have heard of have been taught to regard their degradation as their honor. The argument, however, implies a secret consciousness that the alleged preference of women for their dependent state is merely apparent, and arises from their being allowed no choice; for, if the preference be natural, there can be no necessity for enforcing it by law. To make laws compelling people to follow their inclination, has not hitherto been thought necessary by any legislator. The plea that women do not desire any change is the same that has been urged, times out of mind, against the proposal of abolishing any social evil,--"there is no complaint;" which is generally not true, and, when true, only so because there is not that hope of success, without which complaint seldom makes itself audible to unwilling ears. How does the objector know that women do not desire equality and freedom? He never knew a woman who did not, or would not, desire it for herself individually. It would be very simple to suppose that, if they do desire it, they will say so. Their position is like that of the tenants or laborers who vote against their own political interests to please their landlords or employers; with the unique addition that submission is inculcated on them from childhood, as the peculiar attraction and grace of their character. They are taught to think that, to repel actively even an admitted injustice, done to themselves, is somewhat unfeminine, and had better be left to some male friend or protector. To be accused of rebelling against anything which admits of being called an ordinance of society, they are taught to regard as an imputation of a serious offence, to say the least, against the proprieties of their sex. It requires unusual moral courage, as well as disinterestedness, in a woman, to express opinions favorable to women's enfranchisement, until, at least, there is some prospect of obtaining it. The comfort of her individual life, and her social consideration, usually depend on the good will of those who hold the undue power; and to possessors of power any complaint, however bitter, of the misuse of it, is a less flagrant act of insubordination than to protest against the power itself. The professions of women in this matter remind us of the state offenders of old, who, on the point of execution, used to protest their love and devotion to the sovereign by whose unjust mandate they suffered. Griselda herself might be matched from the speeches put by Shakspeare into the mouths of male victims of kingly caprice and tyranny; the Duke of Buckingham, for example, in "Henry the Eighth," and even Wolsey. The literary class of women, especially in England, are ostentatious in disclaiming the desire for equality of citizenship, and proclaiming their complete satisfaction with the place which society assigns to them; exercising in this, as in many other respects, a most noxious influence over the feelings and opinions of men, who unsuspectingly accept the servilities of toadyism as concessions to the force of truth, not considering that it is the personal interest of these women to profess whatever opinions they expect will be agreeable to men. It is not among men of talent, sprung from the people, and patronized and flattered by the aristocracy, that we look for the leaders of a democratic movement. Successful literary women are just as unlikely to prefer the cause of women to their own social consideration. They depend on men's opinion for their literary as well as for their feminine successes; and such is their bad opinion of men, that they believe that there is not more than one in ten thousand who does not dislike and fear strength, sincerity, or high spirit, in a woman. They are, therefore, anxious to earn pardon and toleration, for whatever of these qualities their writings may exhibit on other subjects, by a studied display of submission on this: that they may give no occasion for vulgar men to say--what nothing will prevent vulgar men from saying--that learning makes women unfeminine, and that literary ladies are likely to be bad wives.

WOMAN

SUFFRAGE ASSOCIATION

OF MISSOURI.

MRS. FRANCIS MINOR, _President_. MRS. BEVERLY ALLEN, _Vice-President_. MRS. WM. T. HAZARD, _Corresponding Secretary_. MRS. GEO. D. HALL, _Recording Secretary_. MRS. NATHAN STEVENS, _Treasurer_.

St. Louis, Missouri.

To the General Assembly of the State of Missouri:

GENTLEMEN:

The undersigned men and women of Missouri, believing that all citizens who are taxed for the support of the Government and subject to its laws, should have a voice in the making of those laws, and the selection of their rulers; that, as the possession of the ballot ennobles and elevates the character of man, so, in like manner, it would ennoble and elevate that of woman, by giving her a direct and personal interest in the affairs of Government; and, further, believing that the spirit of the age, as well as every consideration of justice and equity, require that the ballot should be extended to woman, do unite in praying that an amendment to the Constitution may be proposed, striking out the word "male," and extending to women the right of suffrage.

And, as in duty bound, your petitioners will ever pray.

Copies of Petition, and Information furnished upon addressing either of above named officers.

Formation of Auxiliary Associations in every county requested. Petitions when completely signed to be returned to the head office.

==========

Untitled

George M. Rolph

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SOMETHING ABOUT SUGAR

[Illustration: _Refined Sugar Showing Form of Crystals_]

SOMETHING ABOUT SUGAR

ITS HISTORY GROWTH, MANUFACTURE AND DISTRIBUTION

BY GEORGE M. ROLPH

[Illustration]

Sugar is nothing more nor less than concentrated sunshine

SAN FRANCISCO JOHN J. NEWBEGIN PUBLISHER 1917

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DEDICATION:

TO R. P. RITHET

FOREWORD

The purpose of this book is to tell in simple language “Something About Sugar.” It gives a brief history of the commodity and its production in different parts of the world, and seeks to show, for the information, especially, of the layman and the pupil in school, the various steps by which sugar from cane and beets is prepared for the consumer.

G. M. R.

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PART I

Growth, Manufacture and Distribution

WHAT SUGAR IS

Among the many varieties of sugar the most important are the sucroses and the glucoses. They form a natural group of substances, chiefly of vegetable origin. Chemically considered, all sugars are carbohydrates, that is to say, bodies composed of three elements: carbon, hydrogen and oxygen. Sucrose contains twelve atoms of carbon, twenty-two atoms of hydrogen and eleven atoms of oxygen.

Apart from sucrose, which is usually cane and beet sugar, the variety most generally met with is dextrose—one of the glucoses. It possesses less sweetness than sucrose and differs from the latter in chemical composition. As an example: dextrose is found in the raisin in small grains. It also occurs in other fruits and is the result of the inversion of sucrose.

Glucose enters largely into the manufacture of candy, being particularly necessary in the preparation of soft filling for creams, as a certain amount of it added to cane-sugar syrup prevents crystallization.

Sucrose is derived from sugar cane, maple sap, sorghum and the sugar beet. It is a solid, crystallizing in the form of monoclinic prisms, generally with hemihedral faces, which are colorless, transparent, have a sweet taste, a specific gravity of 1.6 and a melting point of about 320 degrees Fahrenheit. It is soluble in about one-half its weight in cold water, and in boiling water in almost all proportions. It is practically insoluble in alcohol, turpentine, ether, chloroform and similar fluids.

The crop of 1914-15 showed a world's production of 18,409,016 long tons of sugar, and in the chapters relating to the history of sugar will be found a statement setting forth the amount produced by each country. The total was derived about one-half from cane and one-half from beets, produced as follows:

CANE BEET Total in America 5,017,375 660,236 " Asia 4,268,618 " Australia and Polynesia 348,408 " Africa 523,788 " Europe 7,376[4] 7,583,215 ---------- --------- 10,165,565 8,243,451

Sugar cane, described in botany as _Saccharum officinarum_, is a giant-stemmed perennial grass that grows from eight to twenty-four feet long. When ripe it produces at the top of its stalk a large feathery plume of flowers of a gray inflorescence called the "tassel," which is from two to four feet in length.

There are many kinds of cane, all of which are regarded as varieties of one species, although some botanists have raised a few to the rank of distinct species. The cultivated types are distinguished by the color of the internodes, yellow, red, purple or striped, and by other general characteristics.

[Illustration: SUGAR CANE—SHOWING EYES OR BUDS]

The stem of the cane is solid, with joints at intervals of three to six inches. In diameter it ranges from one to two and a half inches, and is unbranched, bearing in its upper part numerous long, narrow grass-like leaves, arranged in two rows. The leaves spring from large sheaths around the joints, and have a more or less spreading blade from three to five feet in length and two inches or more in width. The pith, of open cellular structure, contains the sugary juice. The tops, which contain but little sugar, are not crushed, but are used for seed, as the plant germinates from the eyes, or buds, which grow on the stem around the joints. Practically no cultivated cane is propagated from its seed. The roots that remain in the ground after the cane is harvested throw up fresh canes or ratoons for many seasons, after which replanting is necessary. Hawaiian growers do not count on ratoons for more than a few crops, whereas in Cuba this process can be repeated for many years.

As a rule, sugar cane consists of about eighty-eight per cent of juice and twelve per cent of fiber, the juice content varying from time to time, both as regards quality and amount. The quantity of the juice pressed from the cane determines the efficiency of the extraction, while quality is the main factor when the result of subsequent manufacture is under analysis.

It is difficult to arrive at a fair average of the composition of the juice of the cane, as it varies in different countries, on different plantations in the same country, and at different periods in any one year. The following is an approximation:

Water 80.8 per cent Sugar 16.4 " Invert sugar 1.98 " Organic non-sugar .54 " Ash (mineral matter) .28 "

THE GROWING OF SUGAR CANE

Sugar cane grows almost exclusively in the tropical belt, extending from twenty-two degrees north to twenty-two degrees south latitude, where the three essentials for its successful culture, viz., fertile soil, hot sunshine and plenty of moisture, are present. It flourishes in the islands of the Pacific ocean, particularly in the Hawaiian group, in Cuba, Mexico, Central America, the islands of the East and West Indies, Australia, China, India, along the shores of the China sea and the Indian ocean, and in certain parts of Africa and South America. In the low latitudes of the temperate zone it is grown with only fair success.

Owing to peculiar climatic conditions, sugar cane has been raised in southern Spain for generations, notwithstanding the fact that the provinces in which the sugar cane is grown lie, roughly speaking, between thirty-six degrees and thirty-eight degrees north latitude. The Gulf Stream is no doubt largely responsible for this phenomenon. The quantity of sugar produced in Spain, however, is small, the crop of 1914-15 amounting to less than 8000 tons.

Sugar cane thrives best in a moist, warm climate, with moderate intervals of dry, hot weather, and plenty of water for irrigation. It requires marly soil, free from saline ingredients. As a rule, it is raised on the lowlands, where the temperature is highest and where it is easy to bring water for irrigation. In Hawaii it takes eighteen months to ripen, and “tasseling” occurs about thirty days before it is ready to be cut. In Louisiana and Texas, because of the short seasons, cane is harvested in from nine to ten months from the time of sprouting, and, consequently, before it has attained maturity. In Cuba it is cut in twelve months, whether it is ripe or not.

[Illustration: ROOTS OF SUGAR CANE]

[Illustration: JUNGLE-LIKE VEGETATION OF CANE FIELD]

As the scientific culture and manufacture of sugar is probably further advanced in the Hawaiian islands than in any other part of the world, a description of the industry as carried on there will serve to illustrate the intensive cultivation and scientific methods of the present day.

The Hawaiian islands are situated in the Pacific ocean, in latitude nineteen degrees to twenty-two degrees north and in longitude one hundred and fifty-four degrees to one hundred and sixty-one degrees west, and are free from the destructive hurricanes of the East and West Indies. They are of volcanic formation and, as a rule, their centers are mountainous, in some instances reaching an elevation of nearly fourteen thousand feet. During the ages, torrential rains carried volcanic ash from the mountains toward the sea, near which it was deposited, thus forming alluvial areas of vast richness around the circumference of the islands. Parts of some of the islands are fringed with coral reefs, barriers that retain the washings from the mountains. In these low-lying areas the soil is extraordinarily fertile, and it is on such ground that the most generous crops are raised.

The soft, warm trade winds that blow from the northeast become laden with moisture as they sweep over the ocean; when they strike the cold mountain peaks the moisture condenses immediately into copious rains. The precipitation in some places reaches the astounding total of three hundred inches per annum. The rain water is conserved and, when needed, is carried to the various plantations by immense irrigation ditches.

In this tropical region there is an abundance of sunshine, accompanied by humid heat, exactly the conditions needed. It required only man’s ingenuity to utilize what nature so lavishly provided.

The commercial cultivation of sugar cane in these islands began about 1850, when a few hundred tons of raw sugar were produced, but the methods of husbandry and manufacture were crude. Time and experience worked great changes, until in 1914-15 the crop of raw sugar totaled 646,448 tons of 2000 pounds each.

For many years past the sugar planters have maintained in Honolulu an experimental station that is the marvel of the agricultural world. The bulletins issued by it are recognized as authoritative, and are read with interest in every sugar-producing country.

The most important features of the work carried on at this station are:

1. SOIL ANALYSIS

Skilled chemists examine the soils of the various plantations and, when occasion demands, advise the planter what necessary element is lacking, as well as how to obtain and apply it. A few years ago this branch of the work was considered highly important. Recently, however, the agriculturists have been depending more upon well-defined systems of experimentation. Each plantation has on its own lands plots of ground on which different methods of culture are tried and on which various kinds of fertilizer are used. Experiments are also made to determine the exact amount of water needed for irrigation. Particular attention is paid to seed cane, and a number of types of it are planted in order to obtain seed that will produce stalks that grow rapidly, yield a large tonnage per acre, contain a maximum amount of sugar, and have a high resistant power against disease and insect pests. The success attending this practical experimental work is such that soil analysis is being relegated to second place.

2. ENTOMOLOGY

A staff of trained experts assiduously study the insect life and eagerly watch for harmful, troublesome pests, which in the past have wrought great damage. It is their duty to find the means of eliminating these pests, and this they usually accomplish through the skillful use of insect parasites.

3. PATHOLOGY

The pathologists attached to the station supplement the scientific labors of the chemists and the entomologists by prescribing for any disease that may attack the cane. Plant life is subject to as many ills as the human family, and the work of these specialists in restoring health to ailing cane is of the highest importance.

To fully illustrate the character and scope of their work, a particular instance for each department may be cited:

A certain planter found that the amount of sugar obtained from his cane was decreasing yearly, though he could see no good reason for it. The land looked right; he ploughed deeply, harrowed well, kept the weeds down, gave the cane plenty of water, could find no reason to complain of climatic conditions, but still did not get satisfactory results. Finally the head of the experimental station was consulted and an agricultural chemist was sent to the plantation. This chemist, after careful investigation, took samples of the soil from various parts of the land; these were analyzed and the source of the trouble was found to be the lack of potash. Just here it may be explained that when the same crop is taken from the land many years in succession, without adequate fertilization, some of the essential properties of the soil become exhausted. Speaking generally, these are lime, soda, potash, phosphates and nitrogen. In this particular instance, as has been said, the land had been gradually drained of its potash. The experimental station recommended the planter to scatter a certain fertilizer over his fields. This advice was followed and the next crop showed remarkable improvement, the yield of cane and sugar per acre being greater than ever before.

At one time the sugar industry of the Hawaiian islands was threatened with annihilation by a little insect called the “leaf-hopper.” The harm done by this pest was so enormous that one plantation having an average yearly crop of 19,000 tons was so severely affected that the yield dropped from 19,000 to 12,000, and then to 3000 tons in three successive crops. All the plantations on the islands suffered to a greater or lesser extent, and the entire sugar industry of Hawaii was jeopardized.

The hoppers punctured the stalks and leaves of the young cane, and in the holes thus formed laid their eggs by thousands. When the young hoppers hatched out, they fed on the juices in the stalk and in the leaves, thus destroying the leaves and depriving the cane of its protection and principal means of absorbing nourishment from the air.

As soon as the leaf-hopper by its ravages made itself known in the islands, the entomologists were consulted, and they were confronted with the task of studying the life and habits of the hopper for the purpose of finding, if possible, some other insects that would attack and exterminate it. It is well known to entomologists that every insect pest has natural enemies; the vital question in this case was—what were the natural enemies of the leaf-hopper and where were they to be found? Obviously, too, the problem was to discover insectivorous enemies that would not themselves attack the cane after they had destroyed the hopper.

After careful investigation it was concluded that the leaf-hopper had been introduced in Hawaii in new varieties of seed cane imported from Australia, and, as the hopper was not doing material damage on the plantations in Australia, the inference was that it must be controlled there by its natural enemy. The chief of the Department of Entomology was sent to London. There in the archives of the British Museum he found a full description of the leaf-hopper and that its native habitat was Queensland, Australia. On his return to Hawaii, entomologists were sent to Australia and the search for the enemy of the hopper began.

[Illustration: LEAF-HOPPER (GREATLY MAGNIFIED)]

[Illustration: SUGAR CANE]

For weeks the entomologists virtually lived in the cane fields, undergoing extreme privations, but at last their faithfulness was crowned with success. Several species of parasites that kept the Queensland leaf-hopper in check were discovered, and later on more were found in the islands of Fiji. These tiny creatures as a rule were invisible to the naked eye and could only be seen with the aid of a powerful magnifying glass. All of these insects were parasites either of the leaf-hopper or its eggs. Two of them were particularly efficacious. One, quicker in movement than the hopper, caught it unawares and attached itself to the hopper’s body much in the same way that a mosquito does to a human being. After catching it, the parasite would sting the hopper and lay an egg in its body. In a few days a young parasite was hatched from the egg, and so ravenous was this young insect that it devoured the hopper in a short time and then sought a fresh victim in which to lay its eggs.

The other insect was even more effective. It liked the hoppers’ eggs and for a long time found plenty in Hawaii to stay its appetite. As soon as the leaf-hopper laid its eggs in the cane, this particular insect would appear and lay its eggs in the eggs of the leaf-hopper. When the little enemies hatched out, they fed on the hoppers’ eggs and in turn laid their eggs in the eggs of the hopper. It came to pass that the hoppers, attacked by the parasite on the one hand and by the enemy on the other, rapidly dwindled in number until only a few remained, and these not enough to do material damage. As the hoppers and their eggs diminished, so

did the parasite and the enemy, for the latter could live on insect food only.

How the scientists collected these tiny animalcules, kept them alive, transported them thousands of miles across the ocean, bred them in Hawaii and saved the Hawaiian sugar industry, reads like a romance.

The study of entomology is extremely interesting and the every-day business man rarely understands its importance. The finding, breeding and distribution of parasites of insect pests vitally affects the world's food supply. The entomological name of the leaf-hopper family is _Hemiptera_, and Dr. Sharp, an authority on the subject, has said: "There is probably no order of insects that is so directly connected with the welfare of the human race as the hemiptera; indeed if anything were to exterminate the enemies of hemiptera, we ourselves should probably be starved in the course of a few months."

It has been estimated by competent authority that the damage done in the world each year by the hemiptera, in spite of all their parasites, is conservatively $600,000,000. Were it not for the parasites, it would only be a year or two at most before every green leaf and spear of grass would disappear from the face of the earth. The direct influence of the practical application of this science to the production of sugar is readily apparent.

Pathology is almost equally important. In former years when cane failed to grow strong and sturdy and did not yield much sugar, the planter usually attributed the difficulty either to lack of water, poor soil, cool weather, too much rain or insufficient cultivation of the field by his manager, when in fact the trouble was due to none of these causes. He would personally oversee the operations of the following year, but with no better results.

[Illustration: EXPERIMENT STATION]

[Illustration: PLANTATION SCENE IN HAWAII—LIGHT-COLORED FOLIAGE IS SUGAR CANE]

When the roots of the cane became matted, stuck together and turned black, when a thick gum exuded from the stalk and leaves, preventing the plant from drawing proper nourishment from the air, it was thought that these troubles arose from climatic or local conditions, while in reality the plant was sick and needed a doctor. Today, under the new régime, whenever the plant shows any symptoms of ill-health, the pathologists are called in to eradicate the disease by scientific treatment.

Insect pests and plant diseases are generally brought into a country through planters sending to other cane-raising countries for new varieties of cane for seeding purposes that they think may produce more sugar than their own. Great trouble and heavy loss have been occasioned in this way and, as a consequence, the United States government has established a strict quarantine, allowing plant life to be landed only after rigid examination and when it is clear that no danger exists.

Another example of the work of the entomologists may be of interest:

During the visit of a well-known Hawaiian to Mexico many years ago, his attention was attracted by a beautiful shrub that he thought would make a splendid hedge around his home. It grew about five feet in height and its foliage was of a rich green, with a brown, red and yellow flower. The slips he brought to Honolulu thrived wonderfully and cuttings of the plant were taken to the other islands for a like purpose. Wherever planted it grew amazingly fast. It quickly spread over the hillsides and became so dense that cattle could not penetrate the thickets formed by it. It made valueless large areas of land that formerly had been used for the pasturing of cattle and plantation stock, and reduced the grazing area at an alarming rate. Land that adjoined the plantations and that in the course of time became needed for plantation purposes was also over-run by it.

The curtailment of the grazing lands and the increased cost of clearing were so great that the entomologists were finally sent for and asked if they could not eradicate the trouble. After a careful investigation they went to Mexico, whence the lantana, as the shrub is called, had come. On their return journey they brought back with them a fly. The fly laid its eggs in the bud of the lantana, and when the young flies were hatched they fed upon the lantana seeds. The flies multiplied rapidly and soon made away with the seeds, thus preventing the shrub from spreading any further. When it was once cleared from the land or the plantation it did not reappear.

These illustrations demonstrate the fact that the culture of sugar cane involves a constant struggle between science and unrestrained nature.

As a rule, Hawaiian sugar plantations are located close to the seacoast, between it and the base of the mountains. The lands slope gently toward the sea, thus insuring good drainage and easy application of water for irrigation. Most of the cane is grown on land

less than five hundred feet above sea-level, although in a few rare instances it is cultivated at an elevation as great as three thousand feet. Parts of the leeward side of the islands, where it is extremely dry and hot, and where the cane thrives best, depend entirely on irrigation, the water being brought to the plantations by ditches or pumped from wells. On the windward side of the island of Hawaii, where the rainfall is abundant, irrigation is unnecessary except during very dry periods.

In cultivating, the ground is turned with steam ploughs to depths up to twenty-four inches. These ploughs are operated by powerful engines that work in pairs, one on each side of a field, usually from one thousand to fifteen hundred feet apart. One engine pulls a gang-plough across the field and the other draws it back. By this method the rich soil is thoroughly loosened and a wonderful vegetable growth results. Ordinarily in California the farmer ploughs only from four to six inches deep.

[Illustration: STEAM PLOUGH]

[Illustration: PLANTING CANE]

After the lands are ploughed and harrowed and all the weeds turned under, double mould-board ploughs are used to make the furrows in which the seed is planted. The furrows are not like those made for planting potatoes, but are about five feet apart and eighteen inches deep, each furrow and hill being symmetrical. They follow the contour of the land so that the irrigation water will fill the furrow and remain there until it is absorbed by the soil and penetrates to the cane roots. At regular intervals of about thirty-five feet, lateral ditches are cut, from which there is an entrance into every furrow. These lateral ditches deliver the water from the main ditches to the various parts of the fields. The land is now ready for the seed.

Meanwhile, the harvesting of the ripened cane in other fields is going on. As the laborers cut the cane, they top it, that is to say, they cut off about twelve inches of the upper part of the solid stalk. Sugar cane resembles bamboo, in that it is cylindrical in shape and divided every few inches into sections by rings or joints. In every joint there is a bud or eye, from which a shoot of cane will sprout, if properly planted in the ground and watered.

These tops, always cut from untasseled cane, contain very little sugar. They are carried to the newly prepared field and placed in rows in the furrows, end to end, lengthwise, the ends overlapping a trifle in order to guard against blank spaces in the growing cane. They are then covered, according to the season, with one to one and a half inches of earth, and the water is turned in until the furrow contains from three to four inches of water. Between six and ten days afterward, the little green cane shoots appear above the ground. From this time forward continuous irrigation and cultivation, together with proper fertilization, are required until the cane matures.

Planting usually begins in March and continues until September, sometimes later, and the cane ripens one year from the following December.

Growing cane should be watered every seven days, and the amount of water used for this purpose is enormous. For example: a plantation producing thirty-five thousand tons of sugar per annum needs twice as much water per day as the city of San Francisco.

The appearance of growing cane is much like that of Indian corn. The whole field area is covered with a dense, jungle-like vegetation of brilliant green. The leaves are long and narrow and hang in graceful curves. The cane grows so thick that it is almost impossible to crawl through it, and so seldom do the sun’s rays penetrate to the ground that rapid evaporation of the irrigation water cannot take place, hence the cane gets the full benefit of the moisture.

In certain varieties of cane, the great weight of the juice in the stalks causes them to bend, droop and take fantastic shapes. Sometimes they lie on the ground with the ends turned upward, and in fields where the stalks grow to a length of twenty-four feet, the average height of the tops above the ground is not over twelve feet. In other kinds the stalks stand straight up to a height of from eight to fourteen feet.

The production of cane per acre varies in different countries and in different parts of the same country, according to the character of the soil, climatic conditions, care and attention, use of fertilizer and amount of rainfall or irrigation. In Hawaii it ranges from twenty to eighty-five tons, and the amount of sugar obtained per acre runs from two and one-half tons to twelve tons, the average being about five tons.

Broadly speaking, lack of a normal amount of cane per acre, lack of sugar in the cane, or the prevalence of disease, is primarily due to an unsanitary or unsuitable condition of the soil. This can usually be corrected by proper cultural methods, such as adequate aeration of the soil, the turning under of the cane tops and leaves, application of lime and suitable combinations of fertilizing

ingredients. Fundamentally, cane requires a well-aerated, moist, alkaline soil and a fertilizer in which the nitrogen content is high and in excess of the potash and phosphoric acid. It is found that nitrate of soda, when applied alone or in combination with potash and phosphoric acid, produces a very strong growth. The proper sanitation of the soil tends to promote the beneficial bacterial action so essential to the growth of the cane.

[Illustration: IRRIGATION DITCH—SHOWING TUNNEL]

[Illustration: IRRIGATION DITCH]

In December and January the cane tassels or flowers, which indicates that it has about reached maturity and is ready for cutting. Thenceforward very little irrigating is done, as additional water applied at this time might retard ripening, which would mean a reduced amount of sugar stored up in the cane.

It is interesting to note that while the cane is growing and in an unripe state, there is no discernible sucrose or pure sugar in it. As the ripening process goes on, the content of the cane juice is changed by the action of the sun's rays, and the amount of sucrose as determined by polariscopic test shows when the time for harvesting is at hand. Nature's operation in thus changing glucose or invert sugar into sucrose or pure sugar cannot be accomplished by any human means.

The harvesting then begins and continues until the end of July or August. Usually the field is set on fire before cutting. On account of the great amount of moisture or juice in the cane, the stalks do not burn, but the leaves are thoroughly consumed. This operation eliminates a good deal of leaf material that is not only useless, but which, if sent to the mill, would increase the cost of crushing, besides absorbing a certain quantity of the juice expressed from the cane.

Formerly men stripped the leaves from the cane in the fields, but it was a difficult matter to accomplish such work, and the cost was heavy. An accident changed the method of doing this work. A field took fire and it was found that while all the leaves were consumed, little or no damage was done to the stalks provided they were cut promptly and sent to the mill to be crushed. The practice of burning has since become general, although the advisability of continuing it is now being given very careful study.

Burning eliminates the arduous labor of stripping, and no doubt does away with many harmful insects and fungi, but at the same time it destroys the enemies and parasites of these insects and this loss is severely felt. Another disadvantage of burning is that the nitrogen contained in the cane leaves is liberated and not returned to the soil as would be the case if the leaves were stripped and ploughed under. In the latter case the leaves rot rapidly, add humus to the soil, help aeration, and improve the sanitary condition, all of which tends to increase the yield of cane per acre. From recent experience it is not improbable that burning will be discontinued in the near future.

As soon as the field is ready, whether burned or not, the laborers go in to cut the cane. A long, heavy knife is used. The cutter grasps the stalk and drives the knife into it, severing it just at the ground. He then tops it, that is, he cuts off the upper part that contains no sugar, and, to aid in subsequent handling, the long stalks are cut into convenient lengths.

As the burning destroys the eyes or buds, certain fields are cut and topped for seed before the burning takes place.

There are two general methods of transporting the cane to the mills. One is by rail and the other by flumes. On the irrigated plantations where water is never overplentiful, railroad tracks and locomotives are invariably employed, while on the non-irrigated plantations, located in districts where there are copious annual rains, V-shaped flumes are extensively used. In some cases a combination of both systems is adopted to advantage. From the upper lands where it is difficult to construct railroads, the cane is flumed to a convenient point on the railroad system, at a lower elevation, and delivered into cars, while the water is conducted into ditches and used for irrigating the lower cane lands.

[Illustration: YOUNG SUGAR CANE]

[Illustration: RIPE SUGAR CANE—SHOWING TASSELS]

In the case of rail transportation, paths one hundred and fifty feet apart are cut through the fields so that temporary railroad tracks may be laid and cars run in and loaded on these tracks. The whole field is then cut in the same way and the work continued until the entire crop is harvested.

The loaders follow up the cutters. These men lay a strap on the ground and pile the stalks on the strap until they have a bundle of cane weighing from seventy-five to one hundred pounds. With a dexterity born of long practice, they sling a bundle upon their

shoulders and carry it up an inclined runway to a railroad car not over seventy-five feet away and dump it on the car. The cutting and loading are usually done by contract, at so much per ton, and it is remarkable how proficient the men become.

When flumes are used exclusively, much the same methods are adopted. Paths are cut through the fields and in these paths are placed the flumes which, like the temporary railroad tracks, are moved from time to time as necessity demands. The mill is located at the lowest point on the plantation and the flumes are placed so as to insure a good grade from the cane fields on the uplands to the mill below. The flumes are either carried on low trestles or run along the ground, but always at a height which enables the laborers to throw the cane into them conveniently.

Water is turned into the upper end of the flume and, rushing rapidly down, carries or floats the cane to the mill. Cane is flumed in this way for distances up to seven miles at low cost and with satisfactory results.

The cars when loaded in the fields are made up into trains and hauled by locomotives to the mill, which is generally located about the center of the plantation, or at a point where most of the cane can be delivered on a downward grade. Each car is carefully weighed on a track scale and the exact quantity of its load of cane is ascertained and recorded.

For years past the planters have been offering large rewards for the invention of a machine to cut and load the cane, but the old hand method is still employed, although some experimental loading machines are meeting with more or less success, but none are in common use.

The problems involved in cutting cane by machinery seem insurmountable, and, while many devices have been tried, not one has proved successful.

After the cane is cut the first time, ploughs are sent through the fields and a furrow is ploughed along each side of the stubs of the cane which are left in place. This ploughing opens up the ground, aerates the soil, and affords the irrigating or rain water a means of easy access to the cane roots. The water tenders follow up the ploughs and the furrows are filled with water, which is gradually absorbed by the old cane roots left in the ground. In time new sprouts spring up from buds on the old stalks of the cane and another growth begins. The second crop is called “first ratoons” and, when cultivated for a single year only, it is designated “short ratoons.” As a rule it does not yield as much sugar as plant cane, but the saving in seed, in the preparation of the fields and in other labor frequently makes up for the reduced amount of sugar. If allowed to grow for two years, as is generally the case, it is called “long ratoons” and produces proportionately more sugar. In the past a very large percentage of the Hawaiian crop was planted with fresh seed every year and but a small percentage ratooned. Nowadays, however, the tendency is to ratoon the crop as long as the yield justifies, which in many cases is from three to four times. In Cuba the cane when once planted is ratooned for many years.

There have been specific instances in Hawaii where ratoons that have been allowed to grow for two years (long ratoons) have shown a better yield than the first planting. According to the best information, this is due to the presence of poisonous matter in the ground, turned up for the first time at the first planting.

[Illustration: CUTTING CANE]

[Illustration: LOADING CANE]

The object of all the ploughing, weeding, cultivating, fertilizing and irrigating, is to produce a large number of strong, sturdy stalks of cane, yielding a maximum amount of sugar. The sugar is contained in solution in the sap or juice and the amount can be materially increased by due care and attention.

As some of the elements which form the plant are absorbed from the air through the leaves, favorable climatic conditions are essential to its full growth and development. Proper fertilizers must be added to the soil, and water applied regularly and in sufficient quantity.

Commercial fertilizers are used in Hawaii probably to a greater extent than in any other country in the world. It is quite common for plantations to use half a ton of fertilizer per acre per crop, and at times as much as two thousand pounds per acre. The yearly fertilizer cost per acre will probably average twenty-five dollars.

As it takes eighteen months for a crop to mature in Hawaii, it will readily be seen that the plantation area must be at least double that used for any one crop. While one crop is being harvested, another crop is in the ground growing. As soon as the cane is cut, the lands are immediately prepared for replanting or ratooning, as the case may be. During certain periods each year, usually in

June and July, a visitor on an Hawaiian plantation can see one crop growing, one being harvested and one being planted.

From the foregoing it will be seen that the harvesting begins in December and ends in July or August. The planting begins from March to June and usually ends in September, according to plantation conditions and whether or not the land is irrigated.

THE MANUFACTURE OF RAW SUGAR

The details of the manufacture of raw sugar from cane and of sugar from beet roots differ, but there are several processes common to both. The operations necessary for making raw cane sugar are as follows:

1. The extraction of the juice. 2. The purification of the juice. 3. The evaporation of the juice to syrup point. 4. The concentration and crystallization of the syrup. 5. The preparation of the crystals or grains for the market by separating them from the molasses.

Every mill has an extensive laboratory where skilled chemists are constantly engaged in sampling and analyzing cane, raw juices, syrups, sugars and molasses. In fact the chemical work is a most important feature in the raw-sugar house, beet-sugar factory or refinery. The superintendent should be an expert chemist, as the proper recovery of the sugar from the cane and beet juices is wholly dependent upon the technical control of manufacturing processes.

EXTRACTION

After passing the scales, the cars containing the cane are switched alongside the carrier which feeds the cane into the mills. Before the cane is unloaded, however, samples are taken from each car and sent to the laboratory, where they are carefully analyzed. The amount of sugar present is ascertained, as well as the quantity and quality of the juice in the cane. It is, however, impossible to get a fair average sample of the cane in this way, and therefore the efficiency of the mill work is determined on the basis of an analysis of the juice and the fiber after it has passed through the crushers.

[Illustration: TRAIN-LOAD OF CANE READY FOR THE MILL]

[Illustration: A MODERN MILL]

The carrier just referred to is a wide slat conveyor, running alongside the railroad tracks in the yards to a point directly over the first set of crushers. The cane is taken from the cars by a mechanical unloader, the arms of which reach out and with distended fingers pull the cane stalks off and land them on the slow-moving carrier, which takes them onward and upward to the crusher.

The crusher consists of two large rolls, with immense interlocking, corrugated teeth on the circumference of each. These rolls are set close together, and the cane passing through is broken into short pieces and matted to an even layer. The juice squeezed out by this preliminary crushing runs through a metal trough into a large receptacle known as the juice tank.

From the crusher the mat of cane passes to the mills proper. These mills consist of from nine to eighteen rolls, about thirty-four inches in diameter and seventy-eight inches long, arranged in groups of three, set in the form of an isosceles triangle, one above and two below, one set following the other in a direct line. The lower rolls are parted enough to allow the expressed juice to fall through them, while the half-crushed cane is carried over by means of an iron bar called the returner. The faces of the rolls are more or less roughened, or grooved, so as to draw the cane through and give a better crushing action. They are turned slowly by powerful engines, which transmit the power to each set of rolls through a system of gears. The rolls are forced together by hydraulic rams exerting a pressure of from four hundred to six hundred tons. It is this tremendous pressure that squeezes the sugar-bearing juice out of the cane.

From the crusher the matted cane passes through the first set of rolls, where a large percentage of the remaining juice is liberated. This is caught in a metal trough and, after passing over a fine screen to remove the small pieces of cane, runs to the juice tank. The cane passes through the second set of rolls, thence to the third set, and so on to the end of the mill. In front of the last set of rolls, hot water is sprayed on the cane to soften the fiber and dilute the remaining juice, thus aiding the final extraction. The adding of hot water is termed _maceration_. By the time the cane has passed through the last set of rolls, all the economically recoverable juice is out of it and delivered into the juice tank, with the exception of the juice and maceration water from the last set of rolls, which is always returned to the preceding set of rolls for maceration purposes. The juice or maceration water coming from the last set of rolls contains very little sugar, and the object is to secure greater concentration by using it for double maceration instead of adding that much additional water which would have to be evaporated later on in the process.

In well-designed, modern mills, with cane carrying not over twelve per cent of fiber, more than ninety-eight per cent of the sugar in the cane is extracted, the remainder being left in the fiber. This is almost perfection today. What it will be tomorrow no one can say.

The fibrous, woody part of the cane, or bagasse as it is called, is comparatively dry as it leaves the last rolls. It is conveyed from the mills to the boiler house on a wide slat conveyor, and fed directly into the furnaces under the boilers that generate the steam for power and boiling purposes. A modern raw-sugar mill requires practically no other fuel than that obtained as a by-product from the crushing of the cane.

The boiler plant is usually of large capacity, as a great deal of steam is required to drive the engines that run the crusher, the rolls, the electric lighting system, the pumps and other machinery. Besides, a large amount is needed to evaporate the water in the juice and to boil and dry the sugar. The ashes from the furnaces are returned to the fields as fertilizer, so that very little is lost.

[Illustration: CANE CARRIER AND MECHANICAL UNLOADER]

[Illustration: ANOTHER TYPE OF CANE UNLOADER]

PURIFICATION

The juice as it comes from the mills contains impurities such as dirt from the fields, small pieces of cane stalks and other foreign matter, besides salts, gum, wax and albumen. It is necessary to remove as many of these substances as possible, and this is where the chemist's work begins.

So long as the juice is confined in the living cells of the cane it does not quickly ferment, but when liberated it rapidly undergoes such change. Therefore no time is lost in arresting this action. The juice is pumped to the top floor of the mill and there a solution of milk of lime is added in sufficient proportions to neutralize the acidity. The mixture is then heated in closed tanks under pressure to 215 degrees Fahrenheit. The heat causes the lime to combine rapidly with the gums and salts in the juice, and the albumen to coagulate.

The hot juice is then run into large settling tanks, where the insoluble solids and the albumen sink to the bottom, carrying with them vegetable and other matter suspended in the juice. Certain foreign substances of light specific gravity float to the surface in the form of scum.

After settling for a time the clear juice is drawn off and the scum, mud and cloudy liquor left in the tank. As a vast amount of liquor must be handled every hour, it is not practicable to have tank capacity great enough to admit of the liquor standing a sufficient length of time for every particle of foreign matter to settle, so as an adjunct to the settling tank, filters are used. These are cylindrical iron tanks, packed tightly with ordinary wood fiber, known as excelsior. The juice is conducted to these filters, and as it percolates through the excelsior, practically all of the remaining foreign matter is caught and retained in the fiber. The clear juice is then run to the receiving tanks for the evaporators and the mud and scum that remain are drawn off into mud tanks, where more lime is added and the mass stirred up. Finally it is delivered to the filter presses, where the mud and other impurities are taken out and the clear liquor containing sugar is sent to the evaporators.

Another method for cleaning, called "precipitation in motion," is to carefully lime the juice and then heat it in closed vessels and under sufficient pressure to carry it through a pipe to large insulated settling tanks.

These settling tanks, usually of sheet steel, are made in the form of truncated cones with conical bottoms, the small diameter of the tank being at the top. Suspended in the center is a vertical cylinder somewhat less in diameter than the upper part of the tank. This cylinder extends downward about eight feet to a point opposite the largest diameter, which makes the area between the circumference of the suspended cylinder and the tank at that point very much greater than the area of the cylinder itself. This difference in area is necessary to retard the flow of the juice and allow the sediment, mud and insoluble solids to be deposited at the bottom of the tank.

The juice is delivered by a pipe into the top of the cylinder which projects a few inches above the edge of the surrounding settling tank. It passes slowly down the central passageway, turns at the bottom, where its speed is materially slackened, and goes out through a pipe line connected to the side of the tank just below the upper edge.

There are several other methods in general use, but in all of them the principle of settling, upon which the separation or cleaning depends, is the difference in specific gravity between the juice and the dirt. A high and even temperature should be maintained by

preventing radiation, as lowering the temperature would increase the specific gravity and viscosity of the juice without increasing that of the dirt in equal proportion.

[Illustration: TWELVE-ROLLER MILL]

[Illustration: MODERN CRUSHING PLANT—TWO FIFTEEN-ROLLER MILLS AND CRUSHERS. CAPACITY, ONE HUNDRED AND FIVE TONS PER HOUR]

There are many different types of filter presses, but those at present in general use are long, oblong machines, set horizontally on the floors, with layers of corrugated iron plates, covered with canvas sheets, between which are hollow frames so arranged that the juice will pass from the hollow frames through the canvas to the corrugations in the plates.

In passing through the presses under pressure the sediment, scum and other impurities are caught on the canvas sheets and the clear juice passes through the canvas, down the corrugations and out through small holes in the plates controlled by valves on the outside of the presses, from whence it runs to the evaporator tanks. The sugar in the mud caught in the hollow frames is washed out of the mud with water and is sent to the evaporator, while the mud itself is finally returned to the field, to be used as a fertilizer.

The clarified juice from the settling tanks, filters or presses, is light brown in color, but is thin and watery, and must now be reduced to syrup point. All the suspended impurities have been removed, but some impurities in solution and the original coloring matter still remain. Some of these foreign substances are subsequently eliminated during the process of crystallization in the vacuum pans described later on.

The object to be attained in a raw-sugar house is the production of a sugar containing ninety-six per cent of sucrose, and there is little or nothing to be gained by carrying the process of manufacture beyond the stage that insures such result.

The final extraction of all the impurities and the conversion of the impure raw into pure white granulated sugar is the work of the refiner, which is dealt with in a subsequent chapter.

From the time the juice leaves the cane until it is crystallized it is kept at a high temperature, as cold juices or syrups are viscous and run slowly. High temperatures kill germs, prevent fermentation and expedite manipulation.

EVAPORATION

Under ordinary atmospheric pressure at sea-level, water boils at a temperature of 212 degrees Fahrenheit and sugar juice at a few degrees higher, according to its density. This temperature if long applied to sugar juice would tend to burn and destroy the sugar, but the juice can be heated to 250 degrees for a short time without deterioration.

The clarified juice contains about eighty-five per cent of water and fifteen per cent of solid matter. A large proportion of the water must be removed by evaporation. To accomplish this under ordinary atmospheric conditions would require heat increasing from 212 degrees Fahrenheit, as the solution increased in specific gravity above the standard of pure water. This would require a large amount of fuel, and the juice would also be more or less adversely affected by long maintenance of comparatively high temperature.

To obviate these conditions the juice is boiled in a multiple evaporator, the invention of Norberto Rillieux, whose first construction in New Orleans in 1840 was a double effect horizontal submerged tube apparatus which has since undergone many changes and improvements. The theory of evaporation _in vacuo_ was extended to two or more cells or vacuum bodies, using the steam or vapor from the first to heat the juice or syrup in the second and so on. At the present time the quadruple effect, or four-cell evaporator, is most commonly in use, although sextuple effects are not rare. The ordinary practice is as follows:

The juice enters cell No. 1 and covers the heating tubes, to which is admitted sufficient steam—generally exhaust from the engines—to cause the liquid to boil. The steam or vapor liberated from this first boiling is conducted through the vapor pipe directly into the heating tubes of cell No. 2, while the juice from cell No. 1 is passed into the second, or cell No. 2, and surrounds the heating surfaces which contain the hot vapor given off from the same juice in cell No. 1.

[Illustration: DELIVERING BAGASSE TO FIRE-ROOM]

[Illustration: GENERAL INTERIOR VIEW OF MODERN RAW-SUGAR MILL]

As there is little or no pressure above the liquid in the first cell, the juice boils at from 215 degrees to 220 degrees Fahrenheit. By maintaining a vacuum of five inches in the second cell, the temperature at which the liquid will boil is reduced to 203 degrees, and the vapor from cell No. 1 is hot enough to boil the juice in cell No. 2 without any addition of heat. The vapor from cell No. 2 in the same way enters the heating tubes of cell No. 3, while the juice entering this cell is exposed to a vacuum of fifteen inches, which reduces the boiling temperature to 180 degrees, so that the difference of 23 degrees between the conditions of cell No. 2 and cell No. 3 causes a third boiling and evaporation without any additional steam being added.

A vacuum of twenty-six inches in the last cell, No. 4, brings the final boiling temperature down to about 150 degrees. The vapor from this last cell enters a condenser, where it is exposed to a spray of cold water, is condensed and passes down a pipe not less than thirty-four feet long, terminating in a water seal, and called the Torricellian tube, after Torricelli, who discovered that mercury would rise thirty inches in a tube while water would rise thirty-four feet with a perfect vacuum.

The juice in passing through these evaporating cells is boiled to a syrup containing about thirty-five per cent of water and sixty-five per cent of solid matter. It is pumped out of the fourth cell into the receiving tank for the vacuum pan.

This quadruple system of boiling only requires about one-fourth the amount of heat that would be necessary to do the same work in a single vessel. As the evaporators operate continuously, a constant level of the boiling liquid is maintained in each cell, the juice being drawn from one to the other by increasing vacuum and controlled or regulated by means of valves.

A powerful vacuum pump draws the air and other incondensable gases from the condenser and maintains the vacuum, which is applied to the necessary extent in each cell. The heating tubes are connected to drain pipes, which remove the condensed vapors.

Vacuum, simply and concisely stated, is the absence of air or gas. It is usually obtained by pumps which suck the air or gas out of closed containers or pipes. No doubt many of the readers in their younger days have sucked on the end of a bottle and were amused to find the bottle hanging on the end of the tongue. It was the vacuum, or lack of air in the bottle, which caused it to hang thus. The outside atmospheric pressure (which at sea-level is fifteen pounds per square inch) was doing its best to gain an entrance through the tongue into the bottle from which the air had been extracted.

The pumps simply suck the air out of the containers or pipes and discharge it through valves, in much the same way that the air was sucked out of the bottle. It must be remembered, however, that in boiling water or juice, the vacuum is being continually broken or reduced by the liberation of air and gases from the juice, steam and condensing water. This action must be overcome by the constant work of the vacuum pump.

To determine the amount of vacuum carried in any container, a small mechanical contrivance, known as a vacuum gauge, is used. This, in its simplest form, is a bowl of mercury with a long glass tube leading from it. If the upper end of the glass tube is attached to the container from which the air is to be drawn, the mercury in the tube will rise in proportion to the amount of air extracted. When an absolute vacuum has been formed, the mercury in the glass will stand at a height of thirty inches.

[Illustration: FILTER PRESSES]

[Illustration: SET OF QUADRUPLE EVAPORATORS]

In commercial operations a vacuum greater than twenty-eight inches is seldom required, as this is sufficient for all practical purposes. The degree of vacuum for any container can be varied easily by mechanical manipulation, so that a vacuum anywhere from one to twenty-eight inches may be maintained.

CONCENTRATION AND CRYSTALLIZATION

From the receiving tanks the syrup is drawn into the pans by a vacuum ranging between twenty-five and twenty-seven inches. The pans are large cast-iron or copper cylinders, standing in a vertical position, with dome-like tops and conical bottoms, almost spherical in shape. Leading from the top is a large pipe through which the vapors from the boiling are drawn off and condensed. On the conical bottom is a large valve, which may be opened when the boiling is finished to allow the _massecuite_ (a French term meaning cooked mass) to drop out.

At regular intervals in the height of the pan there is a series of copper coils, connected with a steam line at one end and a drain line at the other.

The general principle involved in boiling sugar is the separation of the sucrose contained in a solution from the impurities present in that solution, and this is accomplished by evaporation and concentration through the agency of heat. After the sugar is once formed in definite crystals these crystals attract and appropriate the sucrose in solution in the process of building up the crystal structure, while repelling or excluding the impurities, so that, as a consequence, the latter remain in solution. The crystals thus formed are subsequently removed from the solution by means of centrifugal machines. Crystallization, whether in a pure or impure solution, will proceed to only a certain extent, and will only partially remove the sucrose from the solution in one boiling, the limit of crystallization being governed by the amount and nature of impurities present.

The process of boiling is begun by drawing some of the concentrated juice into the pan and turning steam into the coils, which starts the boiling. This is continued until the supersaturation is such that minute crystals of sugar form or “grain out.” By properly timed admissions of fresh concentrated juice, drawn into the pan by vacuum as before, the crystals grow in size and at last the pan becomes filled with a mass of sugar crystals of regular shape and size, immersed in a thick “mother liquor” containing sugar and the impurities that were not removed by the filters or settling tanks.

The size of the grain may be varied at will by the operator in charge, who is known as the sugar boiler. After the grains are once formed, their number (if the sugar boiler is an expert) does not increase, but the size does, as the original grain continually builds up on itself from the outside.

The question may be asked, why is all the moisture not boiled out in the pan and the sugar dropped in a dry, crystallized state? There are several reasons why such a course is impracticable; first, because the impurities, which must be eliminated by crystallization and which are carried off in the mother-liquor, would be boiled into the sugar and make it unsalable; second, because to aid crystallization and prevent scorching or burning on the hot steam coils the mass must be kept in active circulation during the boiling process, or, long before all the moisture could be driven off, a large part of the contents of the pan would be burned on the coils; and third, even if it were practicable to boil the contents down to a solid state, the grains would stick to each other and become one solid mass, which would have to be removed from the pan with bars, picks or chisels. Enough moisture, or rather liquor, is left in the mass to enable it to flow from the pan by gravity. This liquor, with the impurities it carries, is subsequently removed from the sugar by a drying or separating process which will be explained later on.

Massecuite is a viscous, sticky, semi-fluid mass of the consistency of half-formed ice.

[Illustration: VACUUM PANS]

[Illustration: CENTRIFUGAL MACHINES]

The reason sugar “grains” is because the water in the juice has the power to hold in solution only so much sugar. As it goes into the pan, the juice is almost a saturated solution, and as the water is driven off by evaporation, the solids that up to this point have been in solution must of necessity crystallize.

When the sugar boiler decides that the “strike,” that is, the massecuite contained in the pan at one boiling, is satisfactorily grained, he breaks the vacuum by opening a valve on the top of the pan, thus allowing the air to enter. He then opens the valve at the bottom of the pan and the mass drops into a long tank with a rounded bottom, called the mixer, in which a shaft, equipped with paddles, is revolving. The paddles are for the purpose of keeping the mass agitated and in an even condition. The agitation prevents the grains from dropping to the bottom of the tank and forming a solid block, called concrete.

PREPARATION OF CRYSTALS FOR THE MARKET

From the mixer the massecuite runs through spouts into the centrifugal machines. Centrifugal machines are cylindrical-shaped, perforated brass baskets, usually forty inches in diameter and twenty-four inches deep, hung on a central shaft suspended from beams overhead, and surrounded by a solid outside curb or casing.

On the shaft is a pulley, which is driven by a belt connected with an engine or an electric motor. The inside of the basket is lined with a fine-meshed brass screen, which retains the grains of sugar, but allows the liquor to escape freely into the outer casing.

As soon as the centrifugal machine is filled with massecuite from the mixer above, the power is turned on and the machine begins to spin around at an increasing speed until a velocity of one thousand revolutions per minute is reached. The centrifugal action forces practically all the liquor out through the screen and leaves in the machine all the grains of sugar that were formed in the pan. A little dry steam is sometimes turned in to assist in reducing the moisture in the sugar.

The centrifugal is then stopped, a valve in the bottom is opened, and the nearly dry crystallized raw sugar is dropped into bins. From the bins it is drawn off through spouts and packed in sacks containing about one hundred and twenty-five pounds each.

It has been demonstrated that raw sugar containing a large amount of moisture inverts or deteriorates more rapidly than that with a low-moisture content. It is apparent that as moisture adds to the weight, the transportation charges, which are based on tonnage, are greater in the case of wet sugar than in the case of dry. In many of the modern mills, therefore, a further treatment is given the sugar to reduce loss by inversion and lessen freight charges.

From the bins last mentioned the sugar is dropped into revolving drums six feet in diameter and twenty-six feet long, set at an incline so that as the drum revolves the sugar is carried round to the highest point on the circumference of the drum and dropped to the lower side, at the same time traveling from the receiving to the discharging end. The shape, motion and inclined position of the drum cause a perfect shower of sugar in the drum for its entire length and breadth. While it is revolving a current of hot, dry air is drawn through the drum by means of suction fans, and as a result the moisture in the sugar is absorbed by the air and carried out of the building. At this stage the product has a good hard grain of a yellowish-brown color; contains from ninety-six to ninety-seven per cent of pure sugar and about one-half of one per cent of moisture.

[Illustration: FILLING, WEIGHING AND SEWING SACKS]

[Illustration: TRAIN-LOAD OF RAW SUGAR LEAVING MILL]

From the end of the revolving drum the sugar is drawn off into sacks holding about one hundred and twenty-five pounds each. These sacks are sewed by machinery and put into railroad cars to be hauled to the docks at the shipping port, where the cars are switched under huge hoisting cranes or alongside speedy conveyors which carry the sugar into large seagoing steamers especially built for the trade. Some of these ships have a cargo capacity of two hundred and twenty thousand sacks, and they transport the sugar to the buyers on the mainland in San Francisco, New York or Philadelphia, as the planter directs.

The liquor thrown off by the centrifugals is not lost; it is taken back to the pans and reboiled. After this has been done several times and most of the sugar extracted, the purity is so low and the sugar content so small that it does not pay commercially to reboil further, and the residue is sold as molasses. It contains about thirty-five per cent of sugar and from twelve to fourteen per cent of invert sugar, or glucose, as it is generally called.

Some of the waste molasses is mixed with fodder and tender cane tops and fed to cattle and plantation stock, the sugar content proving of great value as a fattening agent and energy builder. Part of the molasses is sprayed on the bagasse as it leaves the crushers and serves, first, as a fuel under the boilers, and, second, as a fertilizing agent in the form of ashes after it has been burned. During the past few years much of it has been shipped in tank steamers to the mainland, where it is used for the manufacture of spirits and vinegar, and also as the principal ingredient in prepared stock foods which are much in demand today.

Every bag of sugar shipped from the plantation is marked to indicate the plantation from which it came. The net weight of the sugar in each bag is recorded, a sample of the sugar taken and its sucrose content ascertained, for it is on the basis of weight and sucrose content that raw sugar is bought and sold.

From the beginning to the end of the process of manufacture, chemists are vigilantly alert sampling, testing, analyzing and supervising the operations. Records are made of all analyses, temperatures, purities, densities, extractions, etc., and the results tabulated for future reference.

The average cost in Hawaii of preparing the fields, planting, irrigating, fertilizing, cultivating and cutting the cane, manufacturing the sugar and delivering it in the New York market, is about $56.00 per ton of two thousand pounds.

TRANSPORTATION AND DELIVERY OF RAW SUGAR

It has been explained that in Hawaii sugar is packed in one-hundred-and-twenty-five-pound sacks. Methods and customs vary in different countries. For instance, in Cuba it is put up in large gunny bags, each holding an average of three hundred and twenty-five pounds. The same custom prevails in Porto Rico. In Peru, and to a limited extent in Java, sacks containing two hundred and twenty-four pounds are used. A large part of the sugar in Java, however, is put up in bamboo baskets of native make, containing from five hundred to eight hundred pounds. They are about thirty inches in diameter, from thirty-six to forty-eight inches high, and are lined with coarse leaves to prevent the sugar from sifting out between the weavings of the bamboo. Philippine sugar is packed

in leaf-lined mats of tough vegetable fiber, each holding about seventy pounds.

These various styles of containers necessitate different methods of handling to and from the ships and by the buyers, but Hawaii will again serve as an example of efficient, modern practice. Outside of what is consumed locally, all Hawaiian sugars are shipped to the mainland of the United States by steamers or sailing vessels to San Francisco, or by steamers to New York or Philadelphia, via the Panama canal.

As sailing vessels are rapidly disappearing from the seas so far as the sugar trade is concerned, reference will be made to steamer traffic only. The steamers are specially built for carrying sugar, having a cargo capacity of from five thousand to thirteen thousand tons, and the best loading and discharging facilities.

When loading in Honolulu, the steamers usually lie alongside wharves covered with immense warehouses, where rapid-speed conveyors carry the sacks of sugar to a point above the ship's hatches and drop them into chutes which guide them down into the hold of the ship, where they are compactly stowed. On the off-shore side of the vessel small steamers from other island ports lie alongside and hoist the sacks by means of steam winches to a point over the hatch and deposit them in similar chutes. When steamers are loaded from both sides in this manner, as much as three thousand tons, or forty-eight thousand sacks, can be loaded in nine hours.

After a vessel is completely loaded and gets her clearance from the custom house, she departs for San Francisco, twenty-one hundred miles away, or for the Atlantic seaboard, via Panama, as the planter may direct.

The voyage ended, and the quarantine and health regulations complied with, she proceeds to the dock of the buyer, usually a sugar refiner. The Hawaiian planter invariably sells his sugar under contract prior to arrival of the vessel at destination.

Planters in other countries operate differently. Occasionally sugar is sold on the plantation at an agreed price, and the buyer arranges his own transportation. The planter sometimes ships his sugar unsold and negotiates its sale while it is en route. If so sold, it is delivered directly to the buyer on arrival; if not, it must be stored in a warehouse at the planter's expense pending sale.

The practice of the Hawaiian planter is to sell his sugar to refineries in San Francisco, New York or Philadelphia, under contracts extending over a term of years. It is agreed that the sugar shall be shipped as soon as made and that the refiner will receive it immediately on arrival, the price for each cargo being that quoted in the open New York market for ninety-six-degree centrifugal sugar on the day preceding its arrival.

[Illustration: STEAMER LOADING SUGAR ALONGSIDE DOCK]

[Illustration: LOADING SUGAR AT AN OUTPORT IN HAWAII]

The value of raw sugar, like that of other staples, is based on supply and demand, and the price fluctuates from day to day according to the requirements of the refiners or the necessities of the sellers.

There are certain rules or trade conditions governing all sales, so that when one man buys and another sells at an agreed price, each knows what he is bargaining for. For instance, raw sugar is bought on the ninety-six-degree centrifugal basis, that is, the price agreed to be paid is for centrifugal sugar containing ninety-six per cent of sucrose. If it contains more sucrose, a higher price is paid; if it contains less, a lower price is paid; all according to an established scale of additions and deductions. Then again, the time of payment for the sugar is well understood. It is usually ten days after the sugar has been finally discharged from the ship, as this allows a sufficient period in which to determine the exact weight of the sugar and the percentage of sucrose it contains. An instrument called a polariscope is invariably employed to determine the amount of sucrose present and the results obtained from its use are absolutely accurate. A description of the operation will undoubtedly prove interesting.

POLARIZATION

The practical working of the polariscope is based upon the property of sucrose to rotate a ray of polarized light to the right.

Ordinary light is the effect on the eye of vibrations of the ether. These vibrations occur in all directions, but by certain optical devices they may be confined to a single plane, and light thus confined is called polarized. If rays of polarized light pass through a layer of certain bodies, _e. g._, quartz, sugar and many others, the plane in which the vibrations occur is rotated, and the polariscope has been devised for the purpose of measuring the rotation of the plane of polarization.

Polarized light, as used in the polariscope, is obtained from the Nicol prism or some development of it. Ordinary light passing through crystals of certain bodies, of which Iceland spar is an example, is split into two rays, one of which is known as the ordinary and the other as the extraordinary ray. A Nicol prism is made of two wedge-shaped pieces of Iceland spar, cemented together with a film of Canada balsam.

The accompanying sketch gives a good idea of the arrangement of an ordinary polariscope.

[Illustration: POLARISCOPE]

A strong white light, _e_, enters the instrument through a lens at _f_, to the Nicol prism _b_, by which it is polarized. The ordinary ray is dispersed, while the extraordinary or polarized ray passes straight through and enters the sugar solution contained in the tube _c_, which has glass ends. In passing through this solution it is given a rotary motion to the right or to the left, according as the sugar in the solution is sucrose or levulose. When it emerges from the tube containing the sugar solution, the now rotated polarized ray encounters a second Nicol prism, of which one of the wedges is fixed and the other movable. This prism is called the analyzer. A pointer, controlled by a thumb screw, is attached to it, and when the correction of the polarized ray's rotation has been made with precision by adjustment of the wedges, the pointer will indicate directly and accurately on a scale the amount of sucrose in the solution under test, because the polarized ray was rotated in exact proportion to the amount of sucrose contained in the solution through which it passed.

The polariscope is made and set so that a standard weight of pure sugar (C■■H■■O■■), dissolved in a standard quantity of pure water, and placed in a tube of given length, will rotate the ray of polarized light in passing through, to a point on the scale marked one hundred degrees, the equivalent of per cent. Also, that by using the same quantity of water, but twenty-five per cent, fifty per cent, or seventy-five per cent less weight of sugar, the rotation will show seventy-five degrees, fifty degrees or twenty-five degrees of pure sugar, as the case may be.

A sample is drawn from each bag of sugar and all of these go to make up a general average sample. The standard quantity is carefully weighed, dissolved with the standard amount of water, clarified, filtered and poured into a tube with glass ends, which is then inserted in the polariscope between the eye of the operator and a strong artificial light. When the operator making the test applies his eye to the instrument, he sees a distinct shadow on a lens in the line of vision, one side being light and the other dark. He then turns the thumb screw which adjusts the analyzer until the whole field of vision is neutral, which indicates that the rotation of the polarized ray has been corrected. The pointer on the scale now shows the exact percentage of sucrose present in the raw sugar, ninety-four, ninety-five, ninety-six degrees, or whatever it may be. This test determines the real value of the sugar, based on the market quotation for ninety-six-degree sugar. If the polarization should show exactly ninety-six degrees, the price to be paid for the sugar and the market quotation will be identical.

In most sugar-producing countries the government imposes an import tax on all foreign sugars, in order to obtain revenue to defray governmental expenses and to protect the domestic industry, if any, against competition with other countries in which cost of materials and labor may be lower. Commodities produced in a country naturally add to its development and wealth, and this explains the fostering of the sugar industry by various governments.

The United States duty on foreign sugar is at present $1.256 per one hundred pounds of ninety-six-degree raw sugar. On account of our treaties with Cuba, the Cuban planter is allowed a deduction of twenty per cent, and, therefore, pays a duty of $1.0048 per hundred pounds, which, owing to trade conditions, is the duty effective today in the United States.

Sugars produced in the insular possessions, Porto Rico and the Philippine islands, are admitted free of duty.

In 1898, the Hawaiian islands, through annexation, became a part of the United States, consequently no duty is assessed on sugar or any other Hawaiian product.

Every vessel coming into a port of the United States must be entered at the custom house, where a record is kept of the port whence she came and of what her cargo consists. If from a domestic port, she is permitted to discharge her cargo without delay; if from a foreign one, customs officials are immediately sent on board to watch the cargo as it is discharged and supervise the tallying, checking or weighing, according to the class of merchandise. Besides being weighed, sugar is carefully sampled and the percentage of sucrose ascertained by the polariscope, for the customs duty is based upon the purity of the sugar, all raws testing not above seventy-five degrees polarization paying .71 cent per pound and .026 cent per pound for each additional degree. This is equivalent to 1.256 cents per pound for ninety-six-degree sugar.

The people of the United States used 4,257,714 short tons of sugar in the year 1915. It was nearly all produced within the United States or in countries enjoying tariff concessions, as follows:

SHORT TONS Hawaiian islands (Cane) 570,375, U. S. territory. Louisiana (Cane) 251,740, U. S. territory. Domestic production (Beet) 861,568, U. S. territory. ” ” (Maple) 17,248, U. S. territory. Porto Rico (Cane) 336,347, insular possession. Philippine islands (Cane) 134,626, insular possession. Cuba (Cane) 2,062,594, reciprocity treaty. Foreign sugar (Cane) 23,216, full duty-paying. ---------- 4,257,714

Aside from the small amount of full-duty-paying foreign sugar imported, the only sugar in the above list that paid duty came from Cuba. It is evident, therefore, that under ordinary conditions an increase in the crops of any of the places mentioned would result in a surplus of sugar in the American market. In 1916, with the beet production of Continental Europe locked up by the war, Cuba’s increased output has been absorbed by Great Britain, France, Italy and Greece.

Steamers from Hawaiian ports, after arriving and entering at the custom house and passing quarantine and health officers, proceed immediately to refinery docks to discharge cargo.

REFINING OF RAW SUGAR

Cane-sugar refineries are always located in great seaport towns for the reason that, as practically all cane sugar is grown in the tropics, it must be transported by water to the world’s markets.

The refining operation is by no means as simple as may at first appear. It is essential that the finished product be almost chemically pure (99.8 per cent), and the greatest care must be exercised to obtain a perfectly white color, as well as a hard, lustrous grain.

The question naturally arises, why do not the planters of Hawaii, Cuba, Java and other raw-sugar-producing countries carry their process a few steps further and make a pure white sugar as the refiners do? This has been attempted many times, but has almost always been found impracticable, notwithstanding the fact that there is no mechanical or chemical reason why.

Among the arguments in favor of a mainland seaport site, the following may be mentioned:

1. The producing centers are generally far distant from consuming markets. Refineries located in the tropics would be under unusual expense for transporting and selling the refined article.

2. A refinery in the tropics would be out of direct and prompt touch with the individual requirements of the buyers.

3. Refined sugar should be moved and sold as soon as possible after its manufacture, so there follows the necessity for adequate dock and rail facilities as means of quick communication with the market.

4. An abundant supply of pure, soft water for refining purposes, and salt or fresh water for condensing, as well as fuel for the generating of steam, must be readily available. Another most important requisite is skilled labor, which is more easily obtained in populous seaport cities than in the small, isolated towns of the tropics.

5. There are many commodities used in the refining of sugar and in packing it for shipment that can be purchased more advantageously, both as regards price and promptness of delivery, in the great commercial ports than in the sugar-growing districts. Among these are bone-char, lime, acids, cotton filter-bags, burlap, cotton cloth, boxes, barrels, cartons, iron, steel and machinery of all kinds.

6. A sugar refinery is operated the entire twelve months of the year, while a raw-sugar mill must of necessity take care of the crop of cane in about eight months. To refine sugar where it is grown would require refining machinery capable of handling the entire output in the eight-month period, and during the remaining four months the plant would remain idle. This would mean a larger investment proportionately than that made in a refinery in a consuming center, running steadily the year round.

7. Refined sugar very rapidly absorbs moisture, and while in transit from the tropic to the temperate zone it is very apt to become lumpy or caked, which would involve reprocessing at great expense at the point of consumption. The unavoidable damage to the packages in loading and discharging results in heavy expense, as all packages must be delivered to the buyer in first-class condition. To avoid hardening, refined sugar should never be piled very high, and it is an unsolved problem whether refined sugar will stand long ocean transportation in cargo lots without caking and damage by breaking of the inside cotton sacks. If shipped in

barrels, the freight rate is proportionately higher.

8. Larger capital would also be required, as refined sugar must be carried on hand and must await the consumer's demand, while raw sugar generally has a prompt and ready market and can be quickly converted into cash.

With these difficulties presenting themselves to a prospective sugar refiner in a raw-sugar-producing country, the shipping of raw sugar to refineries at great distances does not seem at all unreasonable.

Raw sugars show considerable variance in their component parts, and so it follows that some are less easily refined than others. Such differences are generally due to diverse methods of culture, amount of fertilizer used, the processes of manufacture and the efficiency of extraction. If the extraction be high, a large percentage of the salts in the cane is taken up, and these salts prevent or retard the complete crystallization of the pure sugar in refining. One part of ash prevents several times its own weight of sugar from crystallizing, hence it is readily seen that raw sugars with a low ash content are preferred by refiners.

[Illustration: A MODERN REFINERY—SHOWING WATER AND RAIL TRANSPORTATION FACILITIES]

[Illustration: PLAN ELEVATION OF A MODERN REFINERY]

Sugar refining is the production of pure white sugar in granular form, after the removal of the impurities from the raw product. Nine operations are necessary to bring about this result:

1. _Washing_:

Removal of superfluous impurities.

2. _Melting_:

Changing the solid raw sugar into liquid form by melting with water.

3. _Defecation_:

Precipitation of suspended and insoluble impurities.

4. _Bag and Bone-char Filtration_:

Removal of suspended impurities, color and soluble impurities.

5. _Crystallization_:

Production of crystals by concentration.

6. _Partial Drying_:

Purging crystals from syrup in centrifugals.

7. _Final Drying_:

The driving off of all remaining moisture.

8. _Sorting of Crystals_:

Sorting of grains according to size to meet market demands.

9. _Packing_:

Putting in various forms of containers.

A refinery consists of a group of buildings, each of which has been constructed for a special purpose and for convenience and economy in operation. They are as follows:

1. The melt or wash house. 2. The char house. 3. The pan house. 4. The packing house. 5. The boiler house. 6. The pump and power house.

In addition there are offices, shops, laboratories, and last, but by no means least, very extensive warehouses.

To begin at the beginning it will be necessary to start with the steamer laden with raw sugar and made fast to the wharf in front of the warehouse that forms part of the refining plant.

The sugar is hoisted out of the ships in sling-loads by powerful winches, and landed on a platform on the dock alongside the ship. Each sling-load consists of from twelve to twenty sacks, or the equivalent weight in baskets or mats, as the case may be. As soon as the sacks are landed, they are sorted according to mark, put on trucks to be run over a scale set in the floor, and their gross weight recorded.

As the truck leaves the scale, the samplers take a sample from each sack. This is done with a tryer, a long, hollow steel tube, open on one side and sharp at one end, with a handle on the other for the sampler to grasp when forcing the tryer into the sack. The individual sample from each sack of each different mark is deposited in large closed cans until the cargo is completely discharged, when an average sample of all the individual samples of each mark is made up and used in the laboratory to determine the polarization or sucrose content of the various lots comprising the entire cargo. The value of the sugar is fixed by this polarization.

The weights of the various truck-loads of sugar passing over the scales are totaled and the weight of the sacks, baskets or mats deducted, giving the net weight of the sugar.

Hawaiian sacks weigh exactly one pound; Cuban, Javan and Peruvian sacks about three and one-half pounds. Javan baskets weigh from twelve to fifteen pounds, and Philippine mats about four pounds.

In order to facilitate the weighing and simplify the calculations, in cases where the exact weight of the sacks is known, every truck is made to weigh the same by ascertaining the weight of the heaviest and then putting small iron nuts or washers on the rods of the other trucks until each of them exactly counterbalances the heaviest. One truck is then placed on the scale and the scale is brought to a perfect balance, just as though there were no truck on it. In this way the weight of the truck is never recorded, which greatly simplifies the entire weighing operation.

One crew of men will discharge from 1300 to 1500 sacks of sugar per hour from each hatch of a steamer, or a minimum of 731 tons per day of nine hours. As three hatches are usually worked at the same time, it will be seen that from 2200 to 2500 short tons are taken out every day.

[Illustration: STEAMER DISCHARGING RAW SUGAR AT REFINERY DOCK]

[Illustration: SUGAR STORED IN WAREHOUSE—TWENTY-FIVE THOUSAND TONS SHOWN IN THIS PICTURE]

From the scales the sugar is deposited on a depressed conveyor in the floor and carried directly into the melt house of the refinery, except the sugar that must of necessity be stored in the warehouse for future use, in which case it is dumped from the trucks on piling machines that elevate it to any height desired, and it is arranged neatly and compactly by the piling crew.

The wharves and docks of a sugar refinery are, as a rule, scenes of unusual activity and interest. Besides the large number of men engaged in hoisting, trucking, weighing, sampling and piling the sugar, there are the sailors, whose calling always possesses a certain fascination for the landsman. A motley crew they are, bronzed by wind and sun, gathered from all countries and climes. There is the simple, kindly native of Hawaii, gentle-eyed, soft of speech and born with a love for the sea; he prides himself upon his skill in swimming and diving, and when the day’s work is done, entertains his shipmates by singing the plaintive melodies of his native land, accompanying himself on the ukulele, the stringed instrument of the South Seas. Should there be a number of his fellow islanders among the crew, the evening’s program is almost certain to be varied by the native hula hula dance, which generally brings marked applause from the onlookers. Presiding over the galley, or ship’s kitchen, is the almond-eyed Chinaman, now shorn of his queue; an excellent cook who loves to gamble after his pots and pans are washed and put away in place; a shrewd gamester, but scrupulously honest. Beside him stands a fierce-looking Malay, sullen, morose and taciturn, whose sharp, white teeth carry a sinister suggestion of the good old days of cannibalism. His neighbor is a Filipino, short in stature, keen-eyed and alert, while in the background are one or two individuals who from their appearance might be direct descendants of the buccaneers who ravaged the Spanish Main in Sir Henry Morgan’s time.

The average sailor is fond of pets, and here there is no lack of them, parrots and monkeys for the most part, and the sayings of the former clearly indicate a total absence of Sunday-school training.

Sugar ships bring rare fruits and vegetables from the tropics, and the employés of the refinery have plenty of opportunities to enjoy such luxuries as fresh pineapples, bananas, guavas, papaias, alligator pears, breadfruit and mangoes.

A visit to the docks of a sugar refinery during the time vessels from foreign ports are lying there is well worth while, although in these days of steam, the picturesque features are not so pronounced as they were before the passing of the sailing vessel.

WASHING

REMOVAL OF SUPERFICIAL IMPURITIES

As a starting point in the refining process the melt house will be first considered. It is so called because it is there that the raw sugar enters the refining process by being melted or dissolved in water.

The conveyor, upon which the bags were deposited in the warehouse, delivers them on a platform on the top floor of the building. As they come to this platform from the conveyor, workmen with keen-edged knives seize them and, with a deft, swift slash, cut the twine sewing at the top of the bag without injuring the burlap fabric. The bag is then pulled off the platform, mouth downward, so that the sugar falls out and passes through an iron grating into a large bin beneath. If the sugar should happen to be caked or lumpy, it is sent through crushers and broken up.

[Illustration: CUT-IN STATION—SHOWING SUGAR FIRST ENTERING THE REFINING PROCESS]

[Illustration: CENTRIFUGAL MACHINE—MOTOR DRIVEN]

As a certain amount of sugar adheres to the inside of the bags, they are washed in large revolving machines and in this operation the sugar dissolves in the water (called sweet water), from which it is extracted later. They are then partially dried in centrifugal machines and hung on hooks on a traveling chain conveyor that passes through the upper part of the boiler house, where the waste heat thoroughly dries them. In returning, the conveyor passes through the bag room and, by means of an automatic device, the bags are dropped alongside the printing presses. Here the name of the refinery, the kind of sugar and the net weight they are to contain are printed upon them. These burlap bags are then lined with a white cotton bag, after which they are made into bundles and sent to the packing room to be filled with sugar. It will be seen, therefore, that the bags from Hawaii in which the raw sugar is received are put to good use. This, however, does not apply to those that come from Cuba or Java; they are too large to serve as containers for the refined product, and after being washed and dried are sold for what they will bring.

The white cotton bags are made at the refinery, and a plant turning out one thousand tons of sugar each twenty-four hours will use twenty-five thousand yards of cotton sheeting per day if all the output is packed in one-hundred-pound bags.

The bin into which the raw sugar is dumped holds enough sugar to keep the refinery supplied during the twenty-four hours run, but the entire quantity is “cut in” during the day. The advantages of this arrangement are that it avoids any delay in operation due to mechanical troubles with conveyors and because more efficient work is accomplished during the daylight hours. The employés prefer to work on the day shift and, wherever possible, night work is avoided.

From the bottom of the bin the sugar falls into a mixing machine, called the mingler. This is an oblong tank with a semi-cylindrical bottom, near which is a revolving horizontal shaft, with arms or paddles attached which thoroughly stir and mix the sugar with syrup that is added at this point. The reason for using syrup instead of water is that the former, being a saturated sugar solution, does not melt the sugar as water would.

The resultant mixture, called magma, looks a good deal like a soft, brown mortar. It is, in fact, raw-sugar crystals swimming in syrup. This consistency is needed to allow the magma to work freely in the centrifugals, the next operation. Most of the impurities contained in raw sugar are superficial, that is, adhering to the outside of the grain. They may be more or less readily removed by washing the surfaces of the crystals with water.

From the mingler the magma drops to the floor below into centrifugal machines running at the rate of 1100 revolutions per minute. A “charge” consists of about nine hundred pounds of magma. As the machine fills, the centrifugal force causes the magma to rise in a vertical wall around the inside circumference of the basket, at the same time throwing off the syrup that was added on the floor above, and leaving in the machine about five hundred pounds of the raw sugar as it came from the plantation. Water is then sprayed into the machine under high pressure, through a nozzle which divides it into very fine particles and throws it against the wall of sugar in the machine. The water, passing through the sugar by the centrifugal force, washes each face of each crystal and carries off the impurities, together with a certain amount of sugar. The quantity of water used per machine in each filling is from one to two and a half gallons, depending upon the quality of the sugar.

This water, now a syrup, with the impurities and sugar it contains, is drawn from the machine, part of it being pumped to the floor above to mix with new raw sugar coming in. The remainder is treated, filtered, boiled and made into raw sugar, which, in turn, goes direct to the melt or through the washing process again. The result of this washing is that the purity of Hawaiian raw sugar is raised from about 97.2 to 99.2 per cent, and there now remains but 0.8 per cent of impurities to be removed.

The washed sugar is dropped from the centrifugal basket through a large opening in the bottom of the machine with the aid of a mechanical device called a discharger, which greatly reduces the manual labor.

Until very recently the sugar was discharged from the centrifugals by hand, the men digging it out with wooden paddles in a difficult, laborious way. One day, a few years ago, a clear-brained, observant American lad working in a beet-sugar factory, conceived the idea that a centrifugal could be emptied by mechanical means. He worked long and assiduously upon the problem, and after much experimenting and many trials and disappointments was granted a patent by the United States government. Full of hope and confidence, he had several machines constructed and took them to a sugar refiner, sure of being favorably received. He met with rebuff and ridicule. The refinery engineer was too busy with other matters to examine or give any attention to the appliance. The next man to whom he presented it was even more indifferent than the first; he coldly informed the patentee that he had been in the sugar business for thirty years, that no such machine would work, and that the only way to take sugar out of a centrifugal was by hand.

After months of effort and repeated failures, he induced the superintendent of a beet-sugar factory to allow him to install and test the device at his own expense. It was thrown out after a few days' trial, and the inventor became well-nigh desperate, although still positive as to the merits of his discharger.

Finally he succeeded in gaining the ear of the manager of a large refinery, who, after listening attentively to his earnest argument, at length became convinced by it. As a result of the interview, it was arranged between them that the machines rejected by the beet-sugar factory should be installed in the refinery and operated for a period of thirty days, under the direct supervision of the inventor. The test was successful in every particular and conclusively proved the efficiency of the discharger.

The refiner was gratified because on account of the saving in time the capacity of the centrifugals was materially increased; the men operating the centrifugals were hugely pleased, as the arduous work of emptying by hand was entirely eliminated, and the inventor was happy, for he had vindicated himself.

An order for a large number of the machines was placed at once and every centrifugal in the refinery was equipped with one. Today they are installed in nearly every refinery and factory in the United States, and in many raw-sugar plantation mills as well.

MELTING

CHANGING THE SOLID RAW SUGAR INTO LIQUID FORM

From the centrifugals the washed sugar drops to the melter pan on the floor below. This is a cylindrical tank in the center of which is a revolving vertical shaft, to which are attached horizontal paddles that serve to facilitate the dissolving of the sugar with the hot water that is now added. Only enough water is added to bring the resultant liquor to a density of 58.6 per cent of solid matter.

The raw sugar having been washed and, to use a technical term, _melted_, leaves the melt house at this point.

DEFECATION

PRECIPITATION OF SUSPENDED AND INSOLUBLE IMPURITIES

From the "melt" the liquor is pumped to the top floor of the char house, which is usually a structure of from twelve to fourteen stories high. The reason for building to such a height is the advantage gained by utilizing the force of gravity and by this means handling the liquors and bone-char from floor to floor without mechanical aid.

The liquor is delivered into a number of cylindrical tanks equipped with a coil of pipe through which steam is passed for heating the liquor, each tank being capable of holding 25,000 pounds of liquor. Around the bottoms of the tanks are perforated pipes through which compressed air is forced to agitate and thoroughly mix the solution. On account of this air being blown in, these tanks are called blow-ups. By means of the steam coil the temperature of the liquor is kept at 190 degrees, which makes it less viscous than cold liquor, thus facilitating subsequent filtration and hastening the reaction of the lime and acid added at this point.

As the liquor comes into the blow-ups it varies in color from a straw yellow to a dark brown, and contains a considerable amount of suspended and insoluble impurities which must be removed. Some of these impurities are present in the raw sugar, and others, such as pieces of twine, lint from the bags, fine particles of leaves from the Java baskets and Philippine mats, are traceable to the opening of the containers in the melt house.

The process of removal is called defecation. In former years this was accomplished by adding bullocks' blood to the raw-sugar liquor in the blow-ups and heating the mixture until the scum which rose to the surface cracked, when the solution below was found perfectly clear, or, in the language of the refinery man, _bright_. Today, however, chemicals are the defecating agents, those most commonly used being phosphoric acid and lime. Phosphoric acid, neutralized with lime, throws down a heavy, flocculent precipitate which, as it settles, sweeps the solution and drags down all the suspended matter, gums, etc., leaving the liquor above clear and transparent.

The precipitate must now be removed, and this is accomplished by running the liquor through the bag filters on the floor below. These filters are tight iron boxes, about sixteen feet long, six feet wide and seven feet high. The top of the box is depressed about eight inches below the sides and ends, thus forming a tank. This top is perforated with five hundred holes, one and one-half inches in diameter. From the bottom of the iron box is an outlet pipe leading into tanks below.

In each of the holes on the inside top of the box is screwed a so-called "brass bottle," conical in shape, to which is securely attached a closely-woven cotton filter bag, about twenty-four inches wide and seventy inches long. This filter bag is encased in a heavier and stronger cotton sheath, or sleeve, about eight inches wide, which adds strength and keeps the twenty-four-inch bag in folds so as to give an effect similar to that of a folded paper filter, frequently seen in drug stores. Each bag filter contains five hundred of these bags, suspended vertically from the top.

Before any liquor is run on the filters, the bags and the iron box are heated by means of steam to bring the apparatus to a temperature of about 190 degrees Fahrenheit. This prevents the chilling of the sugar liquor by cold bags, which would cause the bags to become "blocked," as it is technically called. The liquor from the blow-ups, at 190 degrees temperature, is now turned into the depressed tank on the top of the filter and flows through the perforations into the bags attached on the inside, down through the bags, and finds an exit through the bottom of the filter into the tanks below.

As the first liquor comes through the bags, it is a little cloudy, but in a few minutes, as the pores of the bags fill with the insoluble substances, it becomes perfectly bright, all the suspended and insoluble impurities remaining in the bags, together with the precipitates drawn over from the blow-ups. The cloudy liquor is pumped to the top of the filter and clarified by being run through a second time. It is interesting to know that it is not really the bag that does the filtering, but the thin layer of sediment that is deposited from the liquor itself on the inner surface of the bag. The cotton bags are made in a particular manner, and from a fabric especially adapted to catch the sediment and to form, in conjunction with it, an excellent filtering medium.

[Illustration: BAG FILTERS—SHOWING BAGS IN PLACE]

[Illustration: FILTER PRESSES]

The liquor, as it runs into the tanks, must be carefully watched, for sometimes a bag inside the filter breaks, which causes cloudy liquor by allowing the precipitates to gain entrance into the clear liquor. As soon as this is noticed, samples are taken from the outlet of each filter and the defective one found and investigated.

When a bag is torn, or develops a hole, the liquor runs through the opening on the top of the filter so fast that it forms a little whirlpool, which shows the bag that is broken. A wooden plug is immediately driven into the opening and that particular bag cut out. The men on the bag filters soon become so expert that they detect broken bags and plug them before the cloudy liquor gets to the inspection station. It is essential that the liquor be freed from all suspended impurities at this station before the next step is taken, hence great care and watchfulness must be exercised.

In time the coating of sediment, gums and precipitates on the inside of the bag becomes so thick that the liquor runs very slowly and finally stops. The refinery term for this condition is "stuck-up." Depending on the impurities in the original liquor, the bag filters will continue to filter the liquor for from twelve to twenty hours and sometimes longer.

After the bags are "stuck-up," the liquor remaining in them is sucked out by means of vacuum through a small pipe attached to a long rubber hose and inserted in the bags through the holes in the top of the filter. The liquor thus sucked out of the "stuck-up" bags

is sent to the blow-ups and reprocessed with new liquor, thus beginning its journey anew.

As soon as the liquor is sucked out, hot water is run through to reduce the sugar contents of the filter. This water is saved and the sugar it takes up is subsequently recovered. The filter is then opened by means of an electric hoist traveling on an overhead track immediately above the filters. Chains are attached to the top of the filter and the hoist elevates top, bags and all, to a point sufficiently high for the bags attached to the top to clear the adjoining filters. The top and bags are then moved along the track to the washing station. Meanwhile another hoist has delivered a duplicate top, with fresh bags attached, to the filter, where it is lowered into place. In this way the filter is again in operation within five minutes. At the washing station the bags just taken from the filter are detached from the top for washing, and the top is sent to a point where clean bags are again attached. It is then ready to go into another filter.

At the washing station the dirty bags are pulled out of the sheaths and turned inside out in tanks containing water, thus releasing a large quantity of the impurities. The bags and sheaths are then thrown into washing machines, where all the remaining impurities and sugar are washed out of them. From the washers the bags are put into centrifugal machines, or through powerful wringers, and dried sufficiently to permit being rehandled. They are then resheathed and made ready to be attached to another top.

The water from the washers contains a large amount of sugar and is conducted to a tank similar to one of the blow-ups, where it is treated with lime and diluted with water at 190 degrees Fahrenheit until it contains only from ten to twelve per cent of solid matter. This liquid is then pumped through filter presses and the impurities removed. The “sweet water,” as it is termed, which now contains practically all the sugar, is collected in tanks and the sugar is ultimately extracted by evaporation, filtration and boiling to grain.

[Illustration: MAKING NEW BAGS AND LINING THE WASHED BAGS]

[Illustration: PRINTING THE EMPTY RAW-SUGAR BAGS]

The impurities removed by the filter presses consist of sand, portions of bags and baskets, phosphates, hair, lime, salts and gums, in fact every kind of foreign matter that finds its way into raw sugar either in the process of manufacture or in transportation. A small amount of sugar accompanies this refuse, but as its recovery would cost more than it is worth, it is allowed to run to waste. The filter-press cake, as it is called, contains valuable fertilizing agents, and when conditions permit it is used for fertilizing purposes, otherwise it is run to waste.

BONE-CHAR FILTRATION

REMOVAL OF COLOR

To resume the course of the bag-filtered liquor, from which the superficial, the suspended and insoluble impurities have been removed and which is now the color of clear amber, the next step is bone-char filtration.

Bone-char, bone-coal or bone-black, as it is variously called, is made from the bones of animals. After the fat and glue are removed, the bones are subjected to a dry distillation which carbonizes them. These charred bones are then broken into very small pieces, or until they will pass through a ten-mesh screen and remain on a thirty-mesh screen; in other words, the size of the grains used in a sugar refinery vary from one-tenth to one-thirtieth of an inch. If properly manufactured, the grains are hard, porous, and have a great affinity for moisture.

Bone-char has the peculiar property of removing from the sugar liquor, in some unknown mechanical way, not only the soluble salts but the coloring matter as well. The elimination of the salts and coloring matter facilitates the subsequent crystallization.

The char house is, therefore, by far the most important station in a refinery, for failure in the char house means failure throughout.

Contrary to the general practice in Europe, beet-sugar factories in the United States do not use bone-char, and consequently do not take all the coloring matter and salts out of the liquor. They secure a white sugar by other methods, which will be explained later on. In a cane-sugar refinery, however, the coloring matter and impurities are entirely eliminated, and the product is invariably pure and white.

The char filters are cast-iron cylinders, usually ten feet in diameter and twenty feet high, with doors at the top for entrance of the char and openings at the bottom through which it is removed. There are also many pipe connections for the introduction and outlet of liquors, steam, hot water and compressed air. The filters are insulated on the outside with asbestos or some other non-conductor

of heat to prevent the temperature of the liquor from being lowered as it passes through. Each filter has a capacity of from sixty thousand to eighty thousand pounds of bone-char.

At the bottom of the filter is a perforated iron plate. Over this is placed a coarsely woven cotton blanket, through which the liquor will pass, but which prevents the char from escaping from the filter with the liquor or wash water. After the blanket is set in place, the char is delivered by gravity through an overhead pipe into the filter, until it is entirely full. The char, as it goes in, has a temperature of from 170 to 180 degrees Fahrenheit, and the bag-filtered liquor which is then run on has a slightly higher temperature.

[Illustration: CHAR FILTERS]

[Illustration: CHAR FILTERS—SHOWING OUTLET PIPES]

When the liquor in the filter reaches the top and the char has settled in a compact mass, the cover is put on and fastened securely to prevent leakage. The liquor is again allowed to run into the filter by gravity, from the tanks about fifteen feet overhead. The valve on the bottom of the filter is then opened and the liquor, as it filters slowly through the char, is led through a copper pipe to the liquor gallery, to which station all the char-filtered liquor is delivered. This pipe, instead of leading downward from the filter, leads upward and nearly to the top, so that the flow of liquor through the char will be slow and uniform and the filter will always remain full of liquor. The diameter of the filter is ten feet, while that of the outlet pipe is two inches, so that the flow of liquor through the char is necessarily very slow. The reason for this is that the liquor must remain in contact with char a certain time to enable the char to absorb the coloring matter and soluble salts.

The first liquor from the filter appears cloudy and is sent back for refiltration, but it soon becomes bright, perfectly colorless and transparent as plate glass. This white liquor is pumped from the liquor gallery into the tanks on the top floor in the pan house, ready for the next process, which will be dealt with presently.

After a filter has been running for from twenty-four to thirty-six hours, depending on the character of the sugar in the liquor, the char becomes “tired” or spent. In other words, it has absorbed so much of the impurities and coloring matter from the liquor passing through it that its capacity to absorb more is gone and the liquor begins to show a slight straw or canary color. The inspector in the liquor gallery immediately notices this and orders the liquor stopped. Immediately afterwards a lower-grade liquor is turned into the filter, which forces the first liquor out before it. In due time the man at the liquor gallery notices the number two liquor coming from the filter and turns it into separate tanks. In time a still lower grade of liquor is turned on and the filter run until the bone-char is absolutely exhausted, when it is ordered “sweetened off.”

Hot water is then turned in at the top of the filter to wash out the remaining sugar liquor which gradually becomes more and more dilute. When its density has been lowered to about thirty-five per cent of solid matter, it is diverted to other tanks, and this is continued until only three-tenths of one per cent of sugar remains in the sweet water, as it is now called. The washing of the char in the filter in this manner, by hot water, is kept up for twelve hours, but as soon as the sugar content falls below three-tenths of one per cent the solution is allowed to run to waste, as the recovery of this small percentage of sugar would cost more than its value.

The sweet water is sent to the evaporators, concentrated to 58.6 per cent of solid matter, and it then begins its refining journey over again.

This long and continued washing of the filters is for the purpose of removing as much as possible of the organic and mineral impurities absorbed by the char.

The washing completed, compressed air is applied to the filter to force out the remaining water. The bottom doors of the filter are then opened and the char, containing about twenty per cent of water, drops to the floor below. Here it passes through mechanical driers and is delivered comparatively free from moisture to the kilns. There it is revivified, that is, the organic matter in the char which could not be removed by washing is converted into carbon by being heated to a cherry red in the absence of air. This is accomplished by allowing the char to pass by gravity through the red-hot retorts of the kilns.

As the wet char leaves the filter, it drops on a moving belt which carries it to large cast-iron hoppers leading to the driers immediately beneath, where the greater part of the moisture is expelled from the char prior to its being treated in the revivifying kilns. The driers are made up of a number of thin, hollow, cast-iron, triangular pipes, enclosed in a large, rectangular, outside casing. The wet bone-char passes over these hollow pipes as it falls slowly through the drier. The hot gases from the furnaces of the kilns below pass through these cast-iron pipes, giving off heat as they ascend, thus driving off the moisture in the char as it falls

down over the outer surface of the pipes. At the same time, hot air obtained from cooling the char in the cooling pipes below the retorts is drawn through the drier, coming in direct contact with the char. The moisture given off by the char is absorbed by this hot air and carried out of the drier and building by fans or smokestacks. By this means the water in the char is reduced to ten per cent, and in this comparatively dry, hot state it runs freely by gravity from the bottom of the drier into a second set of hoppers, through which it drops into the retorts of the kiln. The hot gases, after drying the char, pass out at the top of the drier through a flue leading to a stack outside the building.

[Illustration: TOP OF CHAR FILTERS—SHOWING PIPE CONNECTIONS]

[Illustration: EXTERIOR VIEW OF CHAR DRIER]

The kilns are large square boxes of brick, built around a strong supporting iron structure. On each side of these boxes are a number of large flat pipes of cast iron, nine feet long and twelve inches by three inches in section, the iron being three-quarters of an inch thick. These pipes are called retorts and are arranged vertically in the kilns, forty on each side. The space in the center between the retorts is known as the furnace and extends the entire length of the kiln, a distance of about sixteen feet. Intense fires are maintained in this central space and the flames playing around the retorts keep them red-hot. The upper ends of the retorts lead into the hoppers above and the lower ends to the cooling pipes below. As the char passes gradually through the red-hot retorts, it becomes heated to 900 degrees Fahrenheit and the organic matter it absorbed from the sugar liquor is changed into carbon. In this way the char becomes almost as good as new, or, as the term goes, revivified. Each kiln has a capacity of revivifying sixty thousand pounds of bone-char per day.

If the char in this red-hot state were suddenly exposed to the air, the contact with oxygen would bring about combustion and the char would be quickly reduced to ashes, so a cooling process is necessary. It is, therefore, drawn from the cast-iron retorts into cooling pipes located directly beneath. These pipes are of thin sheet-iron and are about three by four and a half inches in section. There are three under each retort, and a mechanical device at the bottom allows only a small amount of char to escape at a time. This amount can be regulated at will by the operator, and in this way the char is held in the retorts the exact time necessary for its revivification.

A current of cold air circulates continually around the cooling pipes, taking up the heat from the char and delivering it through pipes to the drier overhead, so that when the char leaves the bottom of the pipes its temperature is about 180 degrees Fahrenheit. From the cooling pipes, it drops on a belt conveyor from which it is carried by endless belt or chain bucket elevators to the top of the char filters to be used again.

The manipulation of the char filters varies in different refineries, some running the liquor over the char for a longer period than others, but a fair average of the time required for filling, settling running liquors and syrups, sweetening off, washing, applying air and emptying, is eighty-six hours, the shortest time being seventy-two hours. Taking eighty-six hours as a basis, it will be seen that the char is handled and revivified eighty-one times each year after making due allowance for Sundays, holidays and annual clean-up periods.

Each time the char is handled, a certain amount of it is broken into dust, and this is taken out by passing it over fine screens, and also by exhaust fans. Obviously, the amount of dust taken out each day must be replaced by its equivalent in new char. It is estimated that the original char put into the filters will last from five to six years before it finally becomes disintegrated and is taken out as dust.

[Illustration: INTERIOR ARRANGEMENT OF CHAR DRIER]

[Illustration: EXTERIOR VIEW OF CHAR KILNS—SHOWING OIL-BURNING APPARATUS]

As approximately one pound of char is required for every pound of sugar melted, it will be seen that as the liquor is in contact with the char for only twenty-four hours out of seventy-two, a refinery turning out two million pounds of sugar per day should have filter capacity for six million pounds of char. The amount of the latter that is handled each year is, therefore, very great and requires a large and costly plant to take care of it properly.

CRYSTALLIZATION

PRODUCTION OF CRYSTALS BY CONCENTRATION

The refining process has been described up to and including the purification and decolorizing of the sugar liquor, the last step being the delivery of the pure white liquor into the receiving tanks in the pan house.

After the white liquor leaves the char filters, the greatest care must be exercised to keep all the machinery, piping and apparatus scrupulously clean, for if any foreign matter becomes mixed with the liquor or sugar it can only be removed by refiltering or remelting.

By means of vacuum, the liquor is drawn from the tanks into the vacuum pans, this being the last operation in which the sugar is handled in a liquid state. From this point on it drops by gravity from floor to floor in a solid or semi-solid form, until it reaches the packing room as a finished product. In a first-class refinery, the vacuum pans, as well as all the piping through which the liquor passes, are made of copper instead of iron and steel, which eliminates the possibility of rust or scale getting into the sugar.

Refinery vacuum pans are usually from fourteen to sixteen feet in diameter and from sixteen to seventeen feet high, while in shape they appear almost spherical. The boiling takes from one hour and twenty-five minutes to one hour and forty-five minutes, and about forty-five tons of granulated sugar can be made at each boiling in a fourteen-foot pan. Before the liquor is drawn in, the pan is thoroughly cleansed with hot water and steam. All openings are then closed and the vacuum pump started. The air is quickly exhausted, a valve in the pipe line leading from the receiving tank is opened and the pan is given a charge of liquor. Steam is turned into the coils of the pan and the boiling process begins. Soon sufficient moisture is driven off to cause the sugar to “grain.” Shortly after the grain forms, another charge of liquor is drawn into the pan and the operation is repeated until the pan is full of a thick, white, mushy substance called massecuite, that looks very much like half-formed ice. The vapor driven off in the boiling passes out through a large pipe at the top of the pan and is condensed by being sprayed with cold water. On account of the high vacuum, the liquor boils violently at temperatures ranging from 140 degrees to 195 degrees Fahrenheit; thus the risk of scorching, discoloration or caramelization of the sugar is minimized.

On the front of the pan is a vertical row of windows made of heavy plate-glass, and through these the liquor is watched during the boiling. The massecuite in the pan is sampled at intervals by the sugar boiler, by means of a “proof stick,” a brass rod about three feet long and one and one-quarter inches in diameter, in the pan end of which there is a hollow space. This stick is pushed through an opening in the side of the pan into which it fits tightly, and then partly withdrawn. A small quantity of the contents of the pan remains in the hollow space, and this the sugar boiler removes and places on a piece of clear glass. On holding it up to the light, he sees exactly how the crystallization of the sugar is progressing, and by observing and feeling the crystals, he is enabled to control the boiling perfectly. When he concludes that the evaporation is complete and the massecuite of the proper consistency, the pump is stopped and the vacuum broken by opening a valve near the top of the pan, admitting the outside air. The foot valve is then opened and the massecuite drops from the pan into a mixer directly underneath. There it is kept constantly in motion by a revolving shaft with paddles, to prevent the crystals from sinking to the bottom. From the mixer it is drawn into the centrifugals and purged of the mother liquor, the pure crystals being left in the machine. The liquor thus drawn off contains whatever impurities may have remained in the original liquor. It is now pumped back and run through the char filters again, after which it is boiled in the vacuum pan and the granulated sugar taken out in the centrifugals. This completes the process of producing crystallized sugar by concentration.

[Illustration: A REFINERY VACUUM PAN AND PUMP]

[Illustration: ARRANGEMENT OF STEAM COILS IN A VACUUM PAN]

There are many interesting and intricate problems in connection with the extraction of the sugar from the wash waters, sweet waters and low-grade syrups that are constantly accumulating in a sugar refinery, but space will not admit of their being dealt with here. Suffice it to say that the process of extraction is carried to a point where the sugar recovered barely pays for the labor and fuel expended in the operation. The ultimate result is white sugar, table syrup and molasses.

This molasses is used largely in the manufacture of vinegar and alcohol. Mixed with grain and alfalfa meal, it makes an excellent stock food that cattle take to readily and that possesses high value as a fattening agent. The sucrose and glucose content of molasses as it leaves the refinery is about fifty per cent.

Naturally, in a process involving so much handling, filtering and boiling, there must be some loss, and the efficiency of a refinery is based upon the percentage of granulated sugar recovered from the raw article delivered to the melt. It may be stated for general guidance that, taking an average of the refineries of the United States, one hundred pounds of refined white sugar is made from

each one hundred and seven pounds of ninety-six-degree raw sugar melted. Some of the sugar lost is accounted for in the molasses, in the sediment from the filter presses, and in the wash waters from the char filters. The remainder is the undetermined loss in handling, in sugar destroyed by heating, and in sugar dust escaping during the manufacturing operation. As has been said, the component parts of raw sugars vary more or less, and the recovery in white sugar from two lots of raws, each polarizing ninety-six degrees, might differ considerably according to the refractory matter in the original raw sugar.

The following figures give a fairly accurate idea of the disposition of one hundred pounds of ninety-six-degree raw sugar in refining:

Water, which is eliminated .70 per cent Non-sugar, which is eliminated 3.30 ” Sucrose loss, undetermined .75 ” Sucrose left in molasses 1.75 ” Sucrose extracted in granulated form 93.50 ” ------ Raw sugar melted 100.00 ”

The undetermined loss includes every loss from the time the raw sugar is weighed into the warehouse until the granulated article is sold to the buyer. It is evident, therefore, that one of the principal items of refining cost is the actual loss of weight in converting raw into refined sugar. Assuming that the raw sugar costs four cents per pound, the refiner has lost on each one hundred pounds melted, four cents × 6½ pounds, or twenty-six cents, less the small value of the resulting molasses. If the raw sugar cost six cents, the loss would be thirty-nine cents. At four cents, the loss is equivalent to $5.20 per ton, or, in the case of a refinery melting two million pounds of raw sugar daily, $5,200.00 for each working day. This does not include any of the operating expenses, such as labor, fuel, bone-char, containers, selling expense or administration—just the actual value of the raw sugar lost in the process of refining.

[Illustration: REFINERY CENTRIFUGAL MACHINES]

[Illustration: EXTERIOR VIEW OF SWEATER]

PARTIAL DRYING

PURGING CRYSTALS FROM THE SYRUP

Returning to the sugar left in the centrifugals, the force developed in a machine forty inches in diameter, spinning at the rate of eleven hundred revolutions per minute, is so great that it quickly dispels all the liquor surrounding the crystals, leaving them nearly dry, in a solid, vertical wall. Water, filtered to insure its purity and cleanliness, is then sprayed on this spinning wall of sugar, only to be immediately thrown off through the sugar by the centrifugal motion. In passing through the sugar it washes the last of the syrup from the grains and leaves them perfectly white. Cold water, rather than hot, is used for this purpose, as it dissolves less sugar.

In former years a small quantity of bluing was added to the spraying water in order to enhance the whiteness of the sugar, just as bluing is employed in washing fine linen fabrics. Since the pure-food laws became effective, however, the practice has been discontinued in all cane-sugar refineries.

After the sugar is thoroughly washed, the centrifugal machine is stopped, a large valve in the bottom opened and the mechanical discharger rapidly ejects the sugar (now containing only about 1.2 per cent moisture) from the machine into a storage bin beneath.

FINAL DRYING OF CRYSTALS

For some reason not well understood, the next step in refining is called “granulation.” Actual granulation, or crystallization, takes place in the pans, and the process about to be described should properly be called drying. The manufacturing term, however, is as given.

Drying is effected in an apparatus consisting of two large cylindrical drums of wrought iron. These drums are about six feet in diameter, thirty feet long and have a slight downward pitch from the receiving to the discharging end. The first drum rests on the floor, directly below the storage bin, and is called the sweater. It turns slowly on revolving wheels, by means of circular tracks bolted to it. The power that moves it is delivered from an electric motor, through a pulley, shaft and pinion, the latter working in a gear bolted to the outside circumference of the drum. Fastened to the inner surface of this drum is a series of short, narrow shelves with saw-tooth edges that serve to carry the sugar to the top of the revolving cylinder, whence it falls to the lower side, causing a continual shower of sugar throughout the entire length and breadth of the drum. The sugar is delivered through a pipe at the upper end of the sweater, and the revolving motion together with the incline of the cylinder gradually works it down to the lower end. Here it drops through a chute to the granulator on the floor below, where the process of drying is completed.

A strong current of hot air is drawn through the sweater by a powerful fan connected to the upper end by a very large pipe. The air introduced in this way is brought to a high temperature by passing around a number of coils of pipe charged with steam, which are placed directly in front of the sweater. The hot air sweeping through the drum absorbs nearly all of the moisture in the sugar, which carries 1.2 per cent of water when it enters the drum and about 0.1 per cent as it leaves it.

The granulator, or lower drum, is the same size as the sweater and is constructed in very much the same manner, having shelves for carrying the sugar to the top and dropping it at the proper point, and being equipped with a large fan to draw off the hot, moist air. Instead of having steam coils in front, however, it has in its center a steam-heated drum about twenty-four inches in diameter that revolves with it. The sugar crystals, as they fall in a shower from the shelves, come in contact with the hot inner drum on their way through the granulator, and in this manner become thoroughly dried. The moisture in the sugar, as it emerges from the granulator, is less than four-hundredths of one per cent, an amount too slight to determine except with the most delicate apparatus.

[Illustration: FRONT VIEW OF SWEATER—SHOWING STEAM COILS FOR HEATING THE AIR]

[Illustration: INTERIOR VIEW OF SWEATER]

To insure perfect drying, the damp sugar must be fed to the upper drum or sweater with unfailing regularity. This is accomplished by the use of revolving screws located under the storage bins. By turning a certain number of revolutions per minute, they deliver an even and steady supply of sugar.

From the granulators the sugar is dropped on thin cotton belts that, passing around highly magnetized pulleys, carry it to the dry storage bins. The sugar is cooled to normal temperature before being packed in containers, thus preventing subsequent absorption of moisture and consequent caking.

Magnetic pulleys are used to extract any particles of iron scale or rust that may drop into the sugar after the liquor leaves the char filters. Rust sometimes forms in the pans, mixers, conveyors, elevators, sweaters or granulators, and should it get into the sugar the magnetic pulleys will surely remove it.

Storage bins and storage tanks are prominent accessories of all sugar refineries, for if a breakdown should occur at any point, there must always be a supply of material on hand to keep the refining operations going while the trouble is being remedied.

SCREENING

SEPARATING CRYSTALS INTO VARIOUS SIZES

The now thoroughly cold, dry and free-running granulated sugar is drawn from the storage bins through galvanized metal pipes and taken to the separators by screw conveyors, which deliver it at an even, steady feed—a most essential feature. The sugar as it comes from the pans is made up of crystals of various sizes. It also contains a number of small lumps formed in the centrifugal machines, or in some part of the process after it leaves the pans. It is necessary to separate the crystals according to size and to screen out the lumps, for the following reason:

In some parts of the country, people have been educated to use a coarse-grained sugar; in other sections, they are accustomed to sugar of a fine grain. For example, on the Pacific coast, the demand is for the fine-grained article; the consumers of the Mississippi river valley like a fairly large grain; while the Atlantic coast trade calls for a still coarser product. There is a difference, too, as to containers. In the East the preference is for the barrel package, while the Western buyer wants his sugar put up in bags.

There are many different types of separators commonly in use, but in all of them the governing principle is the same. It is the elimination of lumps and dust from the final product and the separation of the sugar crystals according to size. The separator here specifically referred to will explain the principle as well as any other type, and a glance at the accompanying illustration will give the reader a good idea of its construction. It is made up of a number of wire screens of various sizes, fixed at a sharp incline, one above the other, and all enclosed in a tight, dust-proof steel case. At the top of the case is a steel screw conveyor by which the sugar is fed evenly and steadily across the entire width of the top screen.

On the outside face of the case are a number of shafts to which hammers are attached. As the shafts revolve, the hammers tap the various screens below, lightly and at rapid intervals, thus causing them to vibrate.

[Illustration: SEPARATOR—CLOSED, READY FOR OPERATION]

[Illustration: SEPARATORS, ONE OF WHICH IS OPEN—SHOWING THREE SCREENS FOR SEPARATING THE SUGAR GRAINS]

The upper screen, called the scalper, is quite coarse and allows all the sugar to fall through except the lumps, which run down the face of the screen into a pipe that carries them to the melt, where they begin the refining process over again. These lumps, however, represent a very small proportion of the whole.

The second screen is finer than the scalper. It permits part of the sugar to pass through, but retains a certain amount which falls down on the face of the screen, whence it is led through a pipe to a special bin. Sugar of this size is known as coarse granulated.

The next screen lets the finer grains drop through, but catches the standard granulated, which in turn is drawn off to its special bin. The last screen, an extremely fine one, retains the extra fine granulated, and this in turn is delivered to its appointed bin. The sugar passing through the last screen is so fine as to be classed as “dust,” which, not being marketable, is usually remelted.

The amount of any one grade of sugar obtained from the separator may be changed, within certain limits, by the boiling in the vacuum pans. If a large proportion of fine-grained sugar is required, the sugar boilers are instructed accordingly. It is impossible, however, to boil all the grains in each strike a uniform size, or to boil any two strikes exactly alike, so the separators are necessary, especially for removing the lumps and dust. The dust is caused by the constant falling of the dry sugar crystals against each other in the driers and granulators, and by the grinding action upon the sugar crystals in the screw conveyors.

PACKING

FILLING VARIOUS KINDS AND SIZES OF CONTAINERS

When putting up his goods, a sugar refiner—like every other manufacturer—must needs cater to the wishes and tastes of the consuming buyer. The modern tendency in containers is in favor of sealed air-tight and dust-proof packages. Some refiners spend great sums of money every year in advertising the merits of special sugars packed in dust-proof cartons. Their rivals generally follow suit, as competition in the marketing of sugar is probably far keener than in any other line of business.

The plain truth is that all refined granulated cane sugar offered for sale in the markets of this country today is almost identical, irrespective of the manner in which it may be packed. The poorest quality of refined sugar made has, in all likelihood, a purity not lower than 99.5 per cent, while the highest grade cannot possibly exceed 99.9 per cent, a difference of only four-tenths of one per cent, hence it is evident that all refined sugars are practically pure, the fancy package simply meaning a fancy price.

The methods of transporting and handling the sugar after it leaves the refinery may justify the additional expense, but this is subject to argument. However, it makes but little difference to the manufacturer, as the cost of the package as well as the extra handling is always included in the selling price.

A few years ago all sugar went out in barrels or bags, while today a modern refinery turns out about twenty different styles of container, and twenty-four kinds of sugar. It is obvious, therefore, that the packing room of a refinery is an interesting place, covering as it does a large area and including a great amount of special, intricate machinery for filling, weighing and sewing or sealing packages.

In the bottom of the bins into which the sugar is delivered from the separators is a series of galvanized iron pipes, through which the sugar runs to the various filling devices, the latter being usually arranged in long rows. Under the end of each pipe is an automatic weighing machine. In packing bags, a workman hangs a bag on the weighing machine and presses a lever, thus allowing the sugar to run into the bag. As soon as the exact amount required is reached, the flow is automatically cut off. These weighing machines are so accurate that they gauge the amount to within a fraction of an ounce. The operative removes the full bag, places it on a conveyor that runs in and level with the floor and quickly adjusts an empty one on the weighing machine. These men become so expert that a single operative will fill two hundred and fifty one-hundred-pound bags per hour. The weighing machines are designed to fill and weigh four hundred and eighty one-hundred-pound bags per hour, but the operative cannot handle them at this rate.

[Illustration: FILLING, WEIGHING AND SEWING 100-POUND SACKS]

[Illustration: FILLING, WEIGHING AND SEWING 25-POUND SACKS]

Four sewing machines, specially designed for sewing the filled bags, are located immediately over the conveyor and in direct line with it. As the bag passes along on the conveyor, the operative at the first machine picks up the end of the inner cotton sack and passes it through his machine, stitching it securely. The bag then passes along to the third machine, where the operative takes hold of the outer burlap bag and sews it in the same manner. Each operative has a spare machine ready for instant use in case the one he is running gets out of order. Continuing its journey to the end of the conveyor, the bag is deposited on the main belt conveyor, which takes it without manual aid to the shipping floor or the storage warehouse. A sewing-machine operative will sew as many as seventeen bags per minute, but it is trying work and the men relieve each other at intervals during the day. Both the one-hundred- and the forty-eight-pound sacks are handled in this manner. Formerly the half sacks weighed fifty pounds, but since the Parcel Post law went into effect they have been changed to forty-eight pounds to permit of their shipment by mail. Those containing twenty-five, ten, five and two pounds are weighed and sewed in much the same way, by the aid of specially designed, rapid-handling machinery. The small package machines will accurately weigh and fill five-pound bags at the rate of twenty-five packages per minute, the others in proportion.

The paper boxes, or cartons as they are called, are weighed and filled by special machinery. This machinery seems to possess an intelligence almost human. One girl feeds the cartons (the tops and bottoms of which are open) into the machine at the rate of thirty-two per minute. The machine glues the bottom, weighs the sugar to within one thirty-second of an ounce, fills the carton, glues the top, seals it and passes it on to a conveyor which delivers the finished package to a table, from which it is packed into a box for shipment. Women are usually employed in putting up the lighter packages.

A short distance from the bag-weighing machines, and running parallel with them, is a line of pipes or spouts for filling barrels. On the floor under each spout is a barrel shaker. This is a heavy cast-iron plate that is lifted about one inch, first on one side, then on the other, by the action of two cams or arms attached to a revolving shaft underneath. The shaker drops back violently on the supporting frame after each lift, causing the sugar to settle compactly in the barrel as it is filled to an average weight of three hundred and fifty pounds. Naturally, the greater the amount of sugar packed in a barrel, the less the container costs per unit of output, and as the average cost of a sugar barrel in the United States is fifty cents, the container cost per one hundred pounds of sugar is 14.3 cents.

Without the shaker, not more than three hundred and thirty pounds of sugar could be put in a barrel, which would increase the cost per one hundred pounds to 15.1 cents. This difference on a single day’s output of two million pounds represents one hundred and sixty dollars, an eloquent argument in favor of the shaker.

[Illustration: FILLING BARRELS]

[Illustration: METHOD OF HANDLING BARRELS]

In packing barrels, the operative first lines the barrel with heavy paper to prevent the sugar from coming in contact with the rough wooden sides and to keep it from sifting out between the staves. The barrel, thus lined, is placed on the shaker, a valve on the spout opened and the shaking barrel filled to the top. The barrel is then removed and turned over to the cooper, who heads it up and rolls it on the scale for weighing.

Before an empty barrel reaches the packing room, it is weighed and the weight (generally from nineteen to twenty-five pounds) is stamped on its side. The gross weight of the filled barrel is determined by the packing-room scales. The weight of the empty barrel is deducted and the net weight of the sugar stenciled on the head. The full barrel is then sent down a chute to the waiting freight car or to the dock for steamer shipment, or to a conveyor that automatically delivers it to the storage warehouse.

In addition to the bags, barrels, half barrels, cartons and boxes, tins of various sizes are used for the different sugars. All of these are filled and weighed automatically, and taken from the packing room by conveyors. Some of the boxes are lined with paper and some with cotton cloth; some are nailed up in the ordinary way, and others are strapped with iron at each end. As a rule, the individual tins are cased with wood, but sometimes there are a number of tins in a case. Cartons contain two pounds, three pounds or five pounds of sugar. They are packed in fiber cases holding thirty twos, twenty threes or twelve fives and also in wooden cases which hold sixty twos, forty threes or twenty-four fives each. The style of package depends upon the demand of the trade catered to.

At this point a word or two about some of the specialties, such as cube, powdered and bar sugars, as well as yellow or soft sugars, may be of interest.

CUBE SUGAR

The sugar from which the cubes are made is of a rather fine grain, boiled in special pans from liquor that has been filtered over the char at least twice. From the centrifugals under the pan it falls into a hopper in which there is a revolving screw. Directly over the screw is a tank containing a warm, white sugar liquor, very sticky and viscous by reason of its density. A pipe leads from the bottom of this tank to a point over the screw, and the liquor, which is controlled by a valve, is allowed to drip upon the sugar. The action of the screw causes the sugar and the liquor to become thoroughly mixed and feeds the damp mass thus formed into a spout leading to the cube press, the machine in which cube sugar is made.

At the top of this machine is another hopper, into which the damp sugar drops from the spout overhead, and revolving in the last-mentioned hopper are a number of small shafts with brass pegs inserted at certain intervals along the length of the shafts, like spokes in the hub of a wheel. These pegs are like human fingers in their action and they press the sugar down into the pockets of a large revolving drum placed directly under the hopper. Each pocket is the size of a cube or half cube. Working in these pockets are plungers, which fall back as the revolving drum reaches the highest point directly under the mechanical fingers in the hopper. The fingers fill the open pockets and, as the drum turns, the plungers, at a certain point in its circumference where a heavy bronze bar is placed across its face, slowly enter the pockets and in so doing compress the sugar into cube form.

Two belts run through the machine under the cylinder, carrying galvanized iron plates about twenty-four inches wide, or the same width as the cylinder, and thirty inches long. As the line of pockets into which the sugar has been pressed reaches the lowest point on the circumference of the drum, the plungers drop down, forcing the pressed cubes out of the pockets onto the galvanized iron plates which the moving belt carries along out of the way of the next lot coming from the cylinder. Each plate, as it leaves the cube press, contains five hundred and four cubes and one hundred and sixty-eight half cubes, and the time required to fill a plate is between six and seven seconds.

[Illustration: CUBE-SUGAR MACHINE]

[Illustration: CARTON MACHINE]

The belts carry the plates to a series of ovens, or driers, so placed that a large number of plates with their contents may be inserted through a door on the belt side. When the ovens are filled with plates holding the soft, moist cubes, a current of hot air is turned on at the top of the ovens, passing out at the bottom. The hot air circulating in this manner dries the cubes and carries off the moisture. Eight hours in the ovens suffice to render the cubes thoroughly dry and hard. They are then removed through doors opposite to those through which they were put in. This arrangement prevents the men who are putting the cubes into the ovens from interfering with those taking them out, for the process is a continuous one and cubes are placed in and removed from the ovens at the same time. As the cubes are taken out of the ovens, they are deposited on a belt conveyor which delivers them into bins in the packing room, ready to be put into boxes, bags, barrels and other containers.

POWDERED AND BAR SUGAR

Powdered and bar sugars are made by grinding coarse granulated sugar into fine particles and then separating these particles by screening them through fine silk cloth. The bolting of flour is a similar process. Powdered sugar has a decided tendency to cake and become hard, and the coarse sugar from which it is ground should be particularly free from moisture. After being crushed or ground between corrugated rolls turning at high speed, the ground sugar passes into a screening or sifting device, of which there are many kinds in use, the most common being the horizontal, revolving centrifugal screen. The crushed sugar goes in at the head end, and, as it enters, a number of revolving arms throw it against a silk screen on a circular frame, revolving in an opposite direction, that permits the finest, or powdered, sugar to pass through a silk cloth having over sixteen thousand openings per square inch.

The powdered sugar extracted, the remainder drops into another screen where a similar sifting action takes place, the silk of the second screen being coarser than that of the first, and bar sugar is the result. Such grains as are too large to pass through the bar screen are carried back to the rolls and reground. The bar screen has about five thousand openings per square inch.

Bar sugar, as the name implies, is generally used in preparing beverages. It dissolves almost instantly when dropped in water. Singularly enough, the average housewife is not aware of the advantages attending the use of this grade of sugar. It does not become caked as readily as powdered sugar does, and is the ideal sweetening for berries and cereals served at the breakfast meal. It is far more desirable than powdered sugar for most of the purposes for which the latter is commonly used.

It is believed by many that _all_ powdered sugar is adulterated with chalk, starch, white corn meal or similar substances. Such is not the case, and it is safe to assume that no mixing whatever is done by any refiner in America. Powdered sugar has a strong tendency to cake or become hard, and some manufacturers who buy coarse granulated sugar from the refiners for grinding purposes use starch to the extent of from two to three per cent. Chalk is never used, nor are other non-edible or deleterious substances. Starch is not introduced for the purpose of making a greater profit, but to prevent the powdered sugar from caking. The adding of starch, in all probability, increases the cost of making powdered sugar, as starch costs almost as much as sugar, and the expense of handling it and feeding it into the grinding machinery is quite an item.

[Illustration: FILLING, WEIGHING AND SEWING 2-POUND, 5-POUND AND 10-POUND BAGS]

YELLOW SUGARS

Yellow sugars, or “softs” as they are usually called, comprise fifteen grades, ranging in color from a creamy white to a dark brown. These sugars are used chiefly by bakers in making gingerbread, pies and cakes, although a small quantity finds its way directly into households for ordinary domestic consumption.

The characteristics of yellow sugars are that they have a small grain and contain a sufficient amount of molasses to make them moist to the touch, properties brought about by a radically different method of boiling from that applied to white sugars. They also contain a certain amount of invert sugar which preserves the softness of grain and prevents subsequent caking or hardening.

To properly explain how yellow sugars are boiled, reference must be made to the method of boiling white sugars, which may be briefly summarized as follows:

The object to be attained in boiling white sugars is the separation of the crystallizable sucrose contained in a given solution from the impurities, moisture and non-crystallizable content of that solution. The formation of sugar crystals is a natural result of the evaporation of the moisture from the liquor or solution. In order to obtain pure white crystals, it is vitally essential that, as far as possible, all impurities and non-sugars, except water, be removed from the liquor before the boiling takes place, for if the coloring matter is not thoroughly taken out, obviously the crystals will be colored. The purifying and decolorizing operation is accomplished in the char filters. After the grain is once formed in definite crystals, these crystals attract and appropriate the sucrose in solution in the process of building up their structure, while repelling or excluding the impurities, so that in consequence the latter remain in solution. Irrespective, however, of whether crystallization of sucrose takes place in solutions of high or low purity, it will only partially remove the sucrose from the solution in one operation, the limit being fixed by the amount and nature of impurities present. In order to bring about further crystallization of sucrose the solution or mother liquor surrounding the crystals must be separated from them and be again diluted, filtered and concentrated.

Briefly, the procedure in boiling white sugar in a vacuum pan is to take liquors of the highest purity for the first boiling. After the first crystals have been removed from the mother liquor in the centrifugal machines, the liquor is again diluted, decolorized by bone-char and boiled to grain. This operation is continued a number of times, the purity of the liquor decreasing each time. Finally, when the purity of the liquor falls to a certain point, the boiling is discontinued, for at this point conditions do not admit of further formation of pure sucrose crystals, and, if the process were pursued further, the resulting sugar would not be white. Therefore, when this state is reached, these low-grade liquors are boiled into a semi-refined sugar, commonly called “refinery raw,” which corresponds fairly closely in test with the original raw sugar, or they are used for making soft yellow sugars as explained later on. This refinery raw is then washed, melted and put through the whole process all over again. The liquor, from which the crystals formed in repeated boilings have been removed as made, at length becomes so charged with impurities that further crystallization of sucrose is impossible and this residue, or final waste, is known as blackstrap molasses.

This manner of boiling white sugar has been called the “out and out” method, in contradistinction to the “in and in” method employed in boiling soft yellow sugars, of which a few words of explanation now follow.

In boiling soft yellow sugars, the aim is to produce a large number of small sucrose crystals having the property of attracting and combining with the molasses content of the liquor and that will retain some of the molasses after they are purged of mother liquor in the centrifugal machines. This process gives a sugar that may be described as a mechanical mixture of sucrose, invert sugar and the non-sugars in the molasses.

In the case of yellow sugars, the lighter the color the better price they bring. The greatest profit, therefore, is derived from the manufacture of sugars of the lightest color and carrying a reduced percentage of sucrose. In boiling such sugars, low-purity liquors from which the coloring matter has been removed as far as practicable by bone-char filtration are required. For the purpose, it is generally found most advantageous to use the liquors taken from white sugar massecuite at the point when, owing to repeated boilings, its purity has fallen so low that further extraction of pure white sucrose crystals is impossible.

As a result of the numerous filtrations through bone-char preparatory to reboiling in the manufacture of white sugar, these liquors are usually lighter in color than any of corresponding purity obtained in the refining process. Nevertheless, they are not necessarily the only liquors suitable for the purpose, and this particularly applies to the making of the lower grades of yellow sugars. It is, however, beyond the scope of this book to elaborate upon that phase of sugar refining. The object sought here is to give a general idea of how yellow sugars are boiled, without going into all the details.

As is the case with white sugars, yellow sugars are made by a succession of boilings in vacuum pans, the liquor used for each boiling or strike being that obtained from the massecuite of the previous strike. The operation is continued until the liquor becomes too low in purity and dark in color. Each successive strike boiled is lower in test than the preceding one, due to the fact that the sucrose crystals represent the purest part of the massecuite, and, consequently, each time they are removed the quality of the liquor is lowered. This accounts for the various grades of yellow sugar that are made, fifteen in all, starting with a creamy white and ending with a dark brown. The sucrose content of the best is about 92 per cent and that of the poorest about 80 per cent.

In making white sugars, the aim is to produce from liquors of high purity sucrose crystals that are pure white, hard and absolutely free from molasses.

In making yellow sugars, the object is to boil from low-purity liquors soft sucrose crystals that possess the property of attracting and retaining the molasses and to make this combination of crystals and molasses as complete as possible.

The essential difference between the two methods, as well as the appropriateness of the descriptive terms “out and out” and “in and in,” will be readily apparent.

The impurities in yellow sugars are natural and consist of invert sugar, glucose, organic non-sugars and salts, all of which were originally present in the raws or were formed in the process of refining.

It is not unusual to hear it said that yellow sugars are sweeter than granulated. To the average palate this is apparently so, but, as has been shown, granulated sugar contains 99.8 per cent of sucrose or sweetening matter, while the highest grade of yellow carries only 92 per cent. Soft sugars dissolve more readily on the tongue than granulated, and the syrup or molasses in them accentuates their sweet taste.

There are several other grades of sugar prepared for the consuming market, but lack of space precludes a description of them or the methods by which they are produced.

MECHANICAL DEPARTMENT

It is needless to say that the conveying, melting, filtering, boiling, drying, screening, weighing and packing of one thousand tons of sugar in twenty-four hours necessitates a great amount of steam and a multiplicity of machinery.

The boilers generate steam to drive huge pumps that deliver cold salt water to the condensers throughout the refinery, to drive vacuum pumps that make boiling and evaporation _in vacuo_ possible, and to drive large turbine or reciprocating engines that supply the electric power. The exhaust steam as it leaves the cylinders has a pressure of about fifteen pounds per square inch. It is conducted through pipes to the evaporators, pans, driers and tanks, where it is again used for concentrating the liquors, boiling in the pans, drying the sugar and keeping the liquors hot throughout the process. It leaves the various heating coils and tubes as hot water and is returned to the boilers for the generation of more steam.

Live steam, that is to say, steam just as it comes from the boilers, is used extensively in the vacuum pans for boiling the liquor to grain.

A refinery melting one thousand tons of raw sugar each day requires about 5500 boiler horse power. On the Atlantic coast coal is the fuel used, while on the Pacific coast oil is burned. The amount of fuel consumed in different refineries varies to some extent, but a fair average per ton of raw sugar melted is one and one-third barrels of oil, or one-third of a ton of coal.

In modern plants all the moving machinery, except the pumps and main engines, is usually driven by electric motors. This does away with many dangerous belts, as well as expensive transmission machinery. The motor drive is simple and efficient and therefore used extensively.

The mechanical department is under the general supervision of the superintendent, but in direct charge of a mechanical-electrical engineer. This man is known as the chief engineer, and he is directly responsible, not only for the operation of all the machinery in the plant together with its upkeep and repair, but he has also to cope with engineering problems that are constantly arising. Under his direction, a corps of draughtsmen is always busily engaged in planning and designing improvements and additions. He also maintains a force of mechanics, watching, operating and repairing the machinery. These men represent almost every trade, including machinists, blacksmiths, coppersmiths, tinsmiths, millwrights, boilermakers, riggers, masons, painters and many others.

The diversity of the mechanical work around a refinery is remarkable, and the engineer in charge must be a man of exceptional mechanical ability, as his duties include not only steam, electrical and civil engineering, but construction engineering of an advanced character. As refineries are always built on sites bordering on deep water, harbor engineering problems are also constantly before him.

In connection with every refinery there are many shops, where mechanical work incidental to repairs and construction is carried on. These shops are equipped with the necessary tools and implements for quick repairs and are under the supervision of the chief engineer. In addition, there is the cooper shop where many thousands of barrels are turned out daily, and the bag factory where twenty cotton bags and twenty burlap bags must be made for each and every ton of output packed in that manner.

The mechanical department of a modern refinery is as important as it is extensive, for failure in any one of its branches means costly delays. The machinery is run twenty-four hours each day, except Sundays, during about eleven months in the year. The plant is closed down the remaining thirty days for annual cleaning and repairs.

Intelligence and ability, tempered with good judgment, bring about the _esprit de corps_ that gives the necessary results. The mechanical is almost as important as the chemical department and, as before stated, it is subject to the general supervision of the chemical engineer.

[Illustration: LABORATORY]

[Illustration: OIL-BURNING BOILER PLANT]

LABORATORY

The chemical laboratory is really the heart of the institution, for upon it depends the success of every manufacturing operation. The superintendent of a refinery must possess a thorough knowledge of chemical engineering, for the process of sugar refining is largely chemical from beginning to end.

Competent chemical engineers, as distinguished from chemists, are rare, and yet their calling offers more promising prospects to young men than most other professions do today. It is clear to the intelligent observer that in these times of intensely keen competition, the manufacturer will, sooner or later, inevitably be driven to seek a considerable percentage of his profits in the utilization of by-products that now go to waste or bring but little return. The men to solve the manufacturing problems of the future will be chemical engineers. Broadly speaking, comparatively little has been done in this field in the United States, and its possibilities are incalculable.

In the laboratory, day and night, a corps of chemists is constantly engaged in the study of questions that arise in connection with the operation of the various departments. Polarizations for account of buyers and sellers of all raw sugars purchased, are made and checked there; hundreds of samples of liquors and syrups are tested daily for control work, as the purity of both must be known at all times and a record kept of their temperatures and densities. Samples of all the sugars entering the refining process, as well as of the finished product, are carefully analyzed, and upon these analyses are based elaborate calculations regarding yield and efficiency. The wash waters from the char filters are examined and tested frequently, the bone-char is tested every twenty-four hours as a check upon the process of revivification in the kilns, and once a month the bone-char is completely analyzed to determine the deterioration that has taken place in it.

Tests are made of materials used in the refining process, such as lime, soda, acids and lubricating oils; of the feed water for the steam boilers; of the fresh water used throughout the plant; and of the fuel, whether coal or oil. Even the gases from the fires under the boilers are tested as they pass through the smokestack, in order to determine whether or not the firemen perform their duties properly.

Taking all this in conjunction with frequent tests and experimental work on driers, condensers, evaporators and other apparatus, it will be seen that there is plenty to keep a large staff of chemists fully occupied.

In refinery work, what is to be feared more than anything is the house becoming “sour.” Raw sugars and sugar liquors, and particularly the sweet waters, have a tendency to ferment, and fermentation, like fire, if not checked and brought under control before it gains much headway, soon pervades the entire establishment, affecting all the liquors and syrups, thus turning the sucrose or sugar into glucose, which cannot be recrystallized. In a refinery of two million pounds daily capacity, there is double this quantity of sugar in the house in the form of liquors, syrups, sweet water, massecuite and raws. If all of this four million pounds turned “sour,” the money loss, with raw sugar worth four cents a pound, would be about one hundred and sixty thousand dollars. Such a contingency, while remote, clearly demonstrates that chemical control is an absolute necessity.

COST OF REFINING

In concluding that part of the story that deals with refining, some reference may be made to the refining cost and to the price at which refined sugar is sold.

The cost of refining sugar varies in different parts of the United States on account of the difference in the cost of commodities entering into the refining process, such as labor, fuel, cotton, burlap, containers, bone-char, etc. On the Pacific coast nearly all these items are higher than in New York, and consequently the cost of refining is probably greater.

In 1911 nearly all the sugar refiners of the United States appeared before the Hardwick Congressional committee at Washington and the testimony given by them before that body showed that the cost of refining ranged from 60 cents to 65 cents per 100 pounds.

On the day the Congressional committee began its investigation, raw sugar was selling in New York for 3.86 cents per pound, and the testimony regarding the cost of refining was no doubt based on this price for the raw sugar entering the refining operations.

It is therefore fair to assume that under normal conditions, with raw sugar at about 3¾ cents, the average cost of refining in the United States is 62½ cents per 100 pounds. This includes every item from the time the raw sugar is landed on the dock until the refined is loaded on the cars or boats for shipment. It includes the selling and overhead expenses, but not the transportation charges after the sugar leaves the refinery.

During the last six years (1909-14 inclusive) the actual differential in the United States between the purchase price of raw sugar and the selling price of refined has been 82½ cents per 100 pounds. The difference between this figure and the cost of refining represents the refiner’s gross profit; in other words, about 20 cents per 100 pounds, out of which he must pay for all additions and improvements to his plant. The remainder is available for returns on capital invested. This difference varies with the time of year and in different localities, but the average will probably hold good.

A refiner of cane sugar buys his raw product in the open market and must pay for all his operating and administration expenses and obtain his profit from the margin between the buying price of raw and the selling price of refined sugar. The cost of refining is not constant, as it varies with the fluctuating values of fuel, containers, labor, and particularly the cost of raw sugar. If it costs 62½ cents per 100 pounds to refine sugar with raws at 3.86 cents per pound, it will cost about 82½ cents per 100 pounds with raw sugars at 6 cents, assuming that such items as fuel, containers, labor, etc., remain constant. This is due to the greater value of the raw sugar lost in refining, to the heavier insurance premiums and higher interest charges. With high-priced raws, the margin between raws and refined must be proportionately greater to offset the increased cost of refining.

The refiner, like the consumer, would prefer to see sugar selling on a low basis, while the producer always hopes for the opposite.

SHIPPING DEPARTMENT

Here will be found every modern convenience for the rapid loading of cars and steamers. Adequate railway trackage is provided for the handling of shipments moving by rail, and on the waterfront side of the warehouses there is ample berth room for steamers that carry the sugar to cities and towns on the inland waterways and the seacoast, together with points tributary thereto. Facilities are also at hand for local delivery by drays.

Railroad cars are sometimes sent to refineries by water, on car barges, to be loaded with sugar and then towed to what are known as railroad terminals, where the cars are taken from the barges and started on their journey to destination. The capacity of a car varies from twenty-four thousand to one hundred thousand pounds. If an amount of sugar equal to that consumed in the United States in 1915 were loaded into cars containing 1000 sacks of 100 pounds each, it would require 81,087 cars, which would make up a train 768 miles long.

A large part of the product is delivered direct from the packing-room conveyors into the waiting cars and steamers, thus avoiding unnecessary handling. A single shipment frequently includes a number of different styles of package, and great care must be exercised to insure accuracy in count and description.

As dry granulated sugar readily absorbs moisture, every precaution must be taken to make the storage rooms thoroughly damp-proof, so that the sugar may always be in good condition when shipped from the refinery.

Shipments are made only on written orders from the sales department to the head of the shipping department. These orders set forth the name of the buyer, the kinds and quantity of sugar desired, the point to which the sugar is to go, the route by which it is to travel, the date on which it is to be shipped, and the terms of sale. At the proper time the sugar is loaded, shipped, and in due course delivered to the buyer.

[Illustration: INLAND-WATERWAY STEAMER LOADING SUGAR AT REFINERY DOCK]

[Illustration: CAR-FLOAT ARRIVING AT REFINERY DOCK]

MARKETING

The amount of sugar used in the United States in 1915 was 4,257,714 short tons. Of this, 3,389,175 tons were raw cane, the remainder consisting of 861,568 tons of domestic beet and 6,971 tons of foreign refined cane and beet. Of the 3,389,175 tons of raw cane, 150,000 tons were consumed in the raw state, and from the remainder, 3,239,175 tons, about 3,044,825 tons of refined sugar were produced. The per capita consumption was 83.83 pounds, and was made up of:

SHORT TONS PER CENT Refined made from raw cane 3,044,825 74.94 Domestic and foreign beet 862,694 21.23 Foreign refined cane 5,845 .14 Consumed in the raw state 150,000 3.69 --------- ------ 4,063,364 100.00

Among articles of food that contain a large percentage of sugar are jams, jellies, chocolate, canned fruits, condensed milk, confectionery, chewing gum and cordials. It is estimated by Willett & Gray that in 1915 the direct per capita consumption was 31.43 pounds, and that the remaining 52.40 pounds were used in various prepared or manufactured foodstuffs. Over ninety-nine per cent of all the cane sugar consumed in the United States is refined in New York, Boston, Philadelphia, New Orleans and San Francisco. The beet comes chiefly from California, Colorado, Michigan, Utah and Idaho; the maple from the New England states, Ohio and Canada; and the small amount of full duty-paying foreign cane from Java, Peru, Mexico, Central America and Santo Domingo.

During the past eleven years the consumption in the United States has grown at an average rate of 3.57 per cent per annum. In 1911, on account of the abnormally high prices, the increase was practically nil.

The annual per capita consumption of sugar in some of the other countries of the world is as follows:

1914 Servia 4.60 lbs. Greece 8.99 ” Bulgaria 9.94 ” Italy 10.45 ” Portugal 13.60 ” Spain 15.91 ” Roumania 17.12 ” Turkey 20.33 ” Russia 29.26 ” Finland 32.54 ” Austria-Hungary 37.38 ” France 39.01 ” Belgium 42.79 ” Holland 53.44 ” Norway 60.37 ” Sweden 60.48 ” Switzerland 74.87 ” Germany 74.95 ” England 89.69 ” Denmark 93.48 ”

The sale and distribution of large quantities of refined sugar is a serious problem and just as important as the production and the refining of the raw product. Competition is so keen, and the questions involved so complex, that the sale of the product really results in commercial warfare.

To dispose of the output of a large plant successfully requires great intelligence, a broad grasp of business principles, strict honor and integrity, and prompt, decisive action in times of fluctuating markets.

Sales managers of the sugar-refining companies of the United States command high salaries, for the success of the business depends to no small extent upon their ability and judgment. Their knowledge of human nature must be broad and sound and it is tested to the utmost in their selection of assistants and brokers, for representatives always reflect the ideals, principles and methods of the parent authority.

The selling of sugar by the refiner direct to the consumer has not been found practicable, as an organization complete enough to keep in touch with consumers in every city, town and village of the country would be so top-heavy and costly to maintain that the price of the commodity to the consumer would be needlessly increased.

As matters stand, people living in the frozen valleys of Alaska, in the scarcely accessible regions of the Rocky mountains and in the lumber and mining settlements of the West, many miles from railroads, can obtain their supply of sugar with almost the same facility as the residents of New York or San Francisco. A system of distribution that makes this possible leaves little to be desired, and a word or two concerning it will be timely at this point.

Sugar is sold by the refiner to the wholesale grocer through the medium of the refinery's broker. From the wholesaler it goes to the retailer, who in turn delivers it to the consumer.

Brokers are important factors in distribution. In every large city and consuming center, each refinery is represented by its own brokers, who keep in constant touch with all the wholesale grocers and manufacturers of their district.

A thorough knowledge of men and methods, sound business principles, diplomatic talents of no mean order and the capacity to act rapidly, but coolly, in business crises are found combined in the successful broker. He occupies a position between the seller and buyer, and it is just as much his prime duty to see that in all transactions full justice is accorded to both as it is to sell the sugar.

Every refinery having its own broker in each consuming center, it follows that the competition for business among the brokers is very keen. When a broker obtains an order from a jobber or manufacturer, he telegraphs it to his principal. The order is usually confirmed and the goods shipped promptly. For his services the broker receives three cents for every one hundred pounds of sugar sold. This compensates him for the services of his salesmen and himself, his office expenses and cost of telegrams, which is heavy.

Manufacturers of foodstuffs of which sugar is an ingredient, buy their supplies through brokers. They do not resell the sugar as such, but use it only in the manufacture of their own special products.

Wholesale grocery jobbers, of whom there are about twenty-five hundred in the United States, are also very important factors in the distribution of sugar. As a rule, they are located in the large centers of population, and have efficient organizations for the purchase and resale of all kinds of foodstuffs. They deal in as many as three thousand different commodities, and their expense of doing business is apportioned over all of these items, thus reducing to a minimum the expense of handling any one of them. Generally speaking, they have large establishments where stocks of all kinds of goods are carried ready for immediate distribution. The aggregate capital tied up in these stocks throughout the country is enormous, but necessary, as the jobber must at all times be ready to deliver to the retailer whatever is wanted in any of his lines. Wholesale jobbers occupy a unique position in the scheme of things. They are to the commerce of the country what the bankers are to its finances. In other words, they are the bankers of commodities. Their operating staff consists, first, of the buyers, and, second, of the salesmen.

The buyers are men possessing special knowledge concerning the various articles handled by the house. For instance, in the grocery line one will buy nothing but teas and coffees, another canned goods, another sugar, and so on. These men as a rule have devoted years of study to the particular commodity which they are delegated to buy. They are shrewd, keenly alert and always ready to take advantage of market fluctuations in their favor. The margin of profit between the buying and selling price of any commodity is usually so small that the acumen of the buyer is an important factor in the final results.

The salesmen are trained, tactful, tireless and efficient. They travel from town to town and place to place, visiting every nook and corner where human beings congregate, in order to sell the goods carried by the firm. While his calling is a most useful one, the life of a "knight of the grip" is not always pleasant, as he meets with many deprivations and discomforts.

To compensate him for capital invested, for the expense of doing business and for the losses he incurs in bad debts and declining markets, the jobber probably obtains a gross return of fifteen cents on each one hundred pounds of sugar he sells.

The next important link in the chain is the retailer. It is roughly estimated that there are three hundred thousand retail grocers in the United States, many of whom handle and distribute almost as many articles as the jobber. Their lot on the whole is not cast in pleasant places, because of the severe competition they meet in selling their goods.

Competition is a word regarded almost with affection by the buyer, but for the seller of goods it is probably the most unpleasant one in the English language. There is an old axiom which reads: “Competition is the life of trade.” It may be so, but the expression was no doubt coined by a buyer.

Among sellers, competition is in direct proportion to the number engaged in any particular business. It therefore follows that as there are three hundred thousand retailers in the United States, and hundreds in each of all the large cities, the struggle to keep on their feet and continue their various enterprises must be severe. The number of failures occurring every year amply substantiates this assertion. Reckless and unscrupulous men engage in every business, and the competition thus forced on all others in their line is not only unfair, but positively dishonest. Any individual can break a price or introduce new and expensive experiments in selling terms, which must be followed with equally attractive terms by the other sellers, thus resulting in great loss to all. It is no satisfaction that such men finally fail and go out of business, for the losses sustained in the interim can never be recovered.

Another grave difficulty with which the retailer has to contend is the fact that the average individual to whom he delivers his wares is apt to be rather callous when pay-day comes around. It is sad, but true, that those best able to pay are sometimes the most unsatisfactory customers of the retail grocer.

A retailer’s expense of doing business is proportionately much greater than that of the wholesaler, and his losses, due to bad or uncollectible accounts, are much heavier. The cost of delivering goods to the consumer’s door is high, and a fact that should be remembered, but which is frequently overlooked, is that it costs the grocer just as much to deliver a five-pound package of sugar as a wagon-load. Householders are proverbially careless, and telephone calls for late and urgent deliveries are a source of great annoyance and expense.

To create a pleasing impression, the grocer must keep a clean, sanitary store, and the expense incident to attractive window and shelf displays to invite attention is an important item. Department and other stores in his town or neighborhood often advertise “leaders” to attract the buying public, in the hope of selling with these leaders other goods at a profit, or because they are overstocked with a particular commodity. Every retailer must, as a rule, meet this unfair competition or lose his trade.

Sugar more than any other staple article is used as a leader, and, as a result, the retail grocer’s profit on it is very small. What remains to him out of the selling price of one hundred pounds of sugar does not exceed thirty-five cents, and more than likely it has cost him twenty-five cents to sell it. It is the retail grocer’s employé who delivers sugar in the quantity desired to the housewife at her door, and through her hands the pure, glistening crystals reach the family table.

BEET SUGAR

SHORT REVIEW OF THE HISTORY OF BEET SUGAR

The extraction of sugar from beets dates back to 1747, when Andreas Marggraf, professor of physics in the Academy of Science of Berlin, discovered the existence of a sugar in beets similar in its properties to that obtained from cane.

The discovery was little utilized at first, however, and the manufacture of sugar from beets did not attain commercial importance for over half a century, when Franz Karl Achard, a pupil of Marggraf, made discoveries which led to the construction of the first beet-sugar factory in the world, in Silesia, in the year 1799.

The work of Achard soon attracted the attention of Napoleon Bonaparte, who appointed a commission of scientists to go to Silesia to investigate Achard’s factory. Upon their return, two small factories were constructed near Paris. Although these two factories were not altogether a success, the results attained greatly interested Napoleon, and in 1811 he issued a decree appropriating one million francs ($200,000) for the establishment of sugar schools, and compelling the farmers to plant a large acreage to sugar beets the following year. He also prohibited the further importation of sugar from the Indies after January 1, 1813.

As a result of these and other drastic decrees, three hundred and thirty-four factories were erected in France during the years 1812 and 1813, and their production was seven million seven hundred thousand pounds of sugar, or an average of eleven and one-half tons to the factory.

[Illustration: _By permission of Truman G. Palmer, Esq._

SUGAR BEET]

[Illustration: _By permission of Truman G. Palmer, Esq._

ANOTHER TYPE OF SUGAR BEET]

With the fall of Napoleon Bonaparte, disaster came upon this, one of his greatest achievements, and but one factory survived. The industry was destined to flourish again, however, under the reign of Louis Philippe. In 1836-37 there were five hundred and forty-two factories in France, producing thirty-five thousand tons of sugar, as compared with fourteen hundred and eight tons in Germany, which country had only recently begun the culture of beets.

When Napoleon III became emperor, he so stimulated the industry that in 1853 the French output had doubled. Meanwhile the Germans were making rapid strides, and in 1880 the German output of sugar exceeded that of France. As a result of legislative encouragement, Germany today is the largest beet-sugar producer in the world.

The first successful beet-sugar factory in the United States was constructed by E. H. Dyer, at Alvarado, California, in 1879. The next successful factory was erected at Watsonville, California, in 1888, by Claus Spreckels. The Oxnard brothers followed with the construction in 1890 of a factory at Grand Island, Nebraska, one at Norfolk, Nebraska, and a third at Chino, California, the last built in 1891.

From this it will be seen that the commercial production of beet sugar in the United States really dates back to about 1890, since only three factories of small capacity had been established prior to that date. The development of the industry since the year 1892 has been rapid, and the general results of the beet industry in the United States in 1915 showed the following:

Factories in operation 67 Acres of beets harvested 611,301 Average yield of beets per acre 10.10 short tons Beets worked 6,150,293 ” Sugar manufactured 874,220 ”

The season of 1916 promises a notable increase in tonnage.

THE SUGAR BEET

The botanical name of the sugar beet is _Beta vulgaris_. It grows exclusively in the temperate zone, and with satisfactory soil and climatic conditions a yield of thirty tons per acre has resulted. The average yield in the United States, however, is slightly over ten tons per acre. There are many varieties of beets, some of which do better in one locality than another, so that great care must be used in the selection of the seed.

The beet, unlike sugar cane, grows below the ground, is white in color and shaped like the ordinary carrot, but larger. The beets vary greatly in size, depending upon variety, soil and climatic conditions, the average weight ranging between one and two pounds.

The foliage has a rich, brilliant green color and grows to a height of about fourteen inches. The leaves are numerous and broad and grow in a tuft from the center or crown of the beet, which is usually level with or just above the ground surface.

The average composition of a sugar beet is about as follows:

Sugar 17.3 per cent Marc or pulp 4.4 ” Ash and organic non-sugar .7 ” Water 77.6 ”

The value of the beet to a factory depends on the amount and purity of the sugar content. Factories as a rule decline to purchase beets containing less than twelve per cent of sucrose, as it is unprofitable to handle them. In order to induce the farmer to devote particular care and attention to the culture of his fields and thus increase the sugar content, the factories pay a premium for beets containing over fifteen per cent of sugar. The premium is usually twenty-five cents per ton of beets for each additional one per cent of sugar. Encouraged by this bonus, the California grower has improved the quality of his beets, until today they contain on an average about eighteen per cent of sugar of a purity from eighty to eighty-four.

[Illustration: _By permission of Truman G. Palmer, Esq._

PLOUGHING WITH CATERPILLAR ENGINE]

[Illustration: _By permission of Truman G. Palmer, Esq._

PLANTING BEET SEED]

SELECTION OF THE SOIL

The sugar beet, like sugar cane, needs a peculiar soil and climate for its successful cultivation. The most important requirement is that the soil shall contain a large supply of plant food, be rich in humus and have the property of retaining a great deal of moisture. A certain amount of alkali is not necessarily detrimental, as sugar beets are not especially susceptible to injury from this salt. The ground should be fairly level and well drained, especially where irrigation is practiced.

While the physical character is of secondary importance, as generous crops are grown in sandy soil as well as in heavy loams, still the ideal soil is a sandy loam, _i. e._, a mixture of organic matter, clay and sand. A subsoil of gravel, or the presence of hard-pan, is not desirable, as cultivation to a depth of from twelve to fifteen inches is necessary to produce the best results.

Climatic conditions, temperature, sunshine, rainfall and winds have an important bearing upon the success of beet culture. A temperature ranging from 60 degrees to 70 degrees Fahrenheit during the growing months is most favorable. Sixteen inches of rainfall are necessary to raise an average crop of beets without irrigation. High winds are very harmful, as they generally crust the land and prevent the young beets from coming through the ground. The best results are obtained along the coast of southern California, where warm, sunny days succeeded by cool, foggy nights seem to meet every requirement. Sunshine of long duration but not of great intensity is the most important factor in the successful cultivation of sugar beets. The nearer the equator is approached, the poorer the beets become in sucrose because of the shorter days and the greater heat of the sun. Beets have never been raised with success in the hot interior valleys, as the hot days followed by warm, dry nights sap the vitality of the plant. In the elevated Rocky mountain region of Colorado and Utah, where the temperature is high during the daytime but where the nights are cool, the quality of the beet is excellent.

In Michigan the long summer days and the influence of the great lakes result in satisfactory climatic conditions for sugar-beet culture, and the crops raised in that state are large.

In order to cultivate beets successfully the land must be properly prepared. Deep ploughing is the first principle of beet culture. It allows the roots to penetrate the subsoil without much obstruction, thereby preventing the beet from growing out of the ground, besides enabling it to extract considerable nourishment and moisture from the lower soil. If the latter is too hard, the roots will not penetrate it readily and, as a result, the plant will be pushed up and out of the earth during the process of growth. A hard subsoil is impervious to water and prevents proper drainage. It should not be too loose, however, as this allows the water to pass through more freely than is desirable.

The character of the surface soil is equally important. Careful preparation by harrowing should be done to afford a finely pulverized and clean bed for the seed.

To sum up, the soil should be deep, fairly fine and easily penetrable by the roots. It should also be capable of retaining moisture and at the same time admit of a free circulation of air and good drainage.

PLANTING

The preliminary preparation of the ground finished, the seed should be put in as soon as the soil is firm enough to allow it to germinate readily and the young plants to grow normally. The time of planting varies according to climatic conditions. In California planting begins as a rule in December and ends in March, while in Utah, Colorado and Michigan it ranges from March until May.

[Illustration: _By permission of Truman G. Palmer, Esq._

THINNING]

[Illustration: _By permission of Truman G. Palmer, Esq._

CULTIVATING]

About twenty pounds of seed to the acre are required to produce a satisfactory stand. The seed is planted in rows, about eighteen inches apart, and is drilled in solidly to a depth of from three-quarters to one and a half inches. The latter is the maximum, as any greater depth than this weakens the plant and should, therefore, be avoided. The soil around the seed is well packed by the planter in order to draw the moisture necessary for germination.

The production of beet seed presents many problems; the chief one is to obtain the particular kind of seed that will bring forth a hardy beet containing a large percentage of sugar of a high purity. The beets from which the seed is produced are selected with the greatest care, and for nearly a century the Luther Burbanks of Europe have devoted their time and skill to improving the quality. Until recently, practically all of the beet seed used in the United States was imported from Europe. Since the outbreak of the great war in 1914, however, the difficulties attendant upon securing a supply have caused the beet growers to turn their attention to raising seed in this country. Their efforts have been rewarded with a fair measure of success, and while the cost is greater than that of European seed, the germinating properties have proven to be excellent. The best results have been obtained in Idaho. Owing to the fact that the culture of the beets and the picking and sorting of the seed are done chiefly by hand, labor enters largely into the cost of production, and consequently, under normal conditions, the growers in the densely populated countries of Europe have a great advantage over those in the United States, where the main difficulty is securing labor for the field work.

Like sugar cane, beets are subject to plant diseases of various kinds, as well as to injury by insect pests, and great care has to be exercised to ward off these dangers.

Probably no other crop exhausts the soil so rapidly as beets, and, if they are planted for many years in succession, they deteriorate year by year. On the other hand, if crops are rotated so that beets are grown in the same ground every third year, peas, beans or grain being raised the other two years, it is a remarkable fact that all of these crops will improve each year. This is due to the intensive cultivation of the beets and to the humus left in the ground in the form of rootlets. Experience has taught the farmer that no other crop is so beneficial to the soil as beets grown in the right rotation and with proper care.

THINNING

As soon as the beets are up and the rows clearly defined, thinning becomes necessary. This is one of the most important features of beet culture and is a tedious and expensive operation. It consists of cutting out the plants so that individual roots remain, spaced about eight inches apart. The work is done by hand, a hoe being used to block out the spaces, and the roots surrounding the one which it is desired to retain are pulled up. Due partly to faulty germination, but principally to defective thinning of the beets, in which operation a great many of the small, tender beet plants are injured or killed, very much less than the theoretical number of mature beets are secured per acre. With rows eighteen inches apart and a plant every eight inches in the row, 43,000 beets per acre should be obtained, which, at an average weight of one and one-half pounds per beet, would mean 32.25 tons. Owing, however, to the facts just mentioned and to other causes, the actual yield is always much less. The average in California for a number of years past has been only 10.68 tons per acre.

[Illustration: _By permission of Truman G. Palmer, Esq._

FIELD OF RIPE BEETS]

[Illustration: _By permission of Truman G. Palmer, Esq._

TOPPING BEETS]

CULTIVATION

The purpose of cultivation is two-fold; first, to retain the moisture in the soil, and, second, to destroy the weeds and grass, as in the early stages of the growth of the beets weeds might spoil the stand by choking the plants.

Cultivation should be continued until the plants have attained such a size that the leaves cover the ground. It increases the fertility of the soil by opening the land to the atmosphere, thus facilitating the penetration of oxygen and absorption of air moisture and the resulting decomposition and assimilation of nutritious elements.

HARVESTING AND TOPPING

The time when harvesting takes place depends on the many factors that influence the growth and maturing of the beet. In the colder countries the harvesting lasts from September until the ground becomes frozen, while in warmer climates like that of California, where the seed is planted early, harvesting begins about July first and lasts for a period of from seventy-five to ninety days.

The beets are first loosened by means of a specially shaped plough, called the “puller,” which lifts them from the ground. They are then picked up by hand and the crown of each beet, together with the leaves, is cut off with a large knife. The leaves contain no sugar, and are, therefore, not taken into the factory, but are utilized for stock feeding, being quite valuable for this purpose. The sugar contained in the crown is accompanied by so many organic salts that it does not pay to extract it.

The topped beets are then loaded into wagons or railroad cars and transported to the factory, at which point they are carefully weighed. In this country most of the beets are raised by farmers and sold under contract to the factories, at so much per ton, so that the determination of the exact weight and sucrose content is important. For the season of 1915 the average price paid to the farmers for beets was $5.67 per ton.

On arrival at the factory a certain number of beets are taken from every wagon- or car-load, and these represent a fair average of all the beets of that particular delivery. They are sent to the laboratory and their exact weight ascertained, after which they are trimmed of all adhering roots, leaves and parts of the crown, if not properly topped in the field. Any remaining soil is carefully brushed off and the beets thoroughly cleaned. They are then reweighed and the difference between this and the first weight is the tare. This difference represents a certain percentage of the total of the sample beets weighed, and that small percentage is deducted from the gross weight of the total load. In this way the exact net weight of beets delivered by the farmer is determined and he is paid according to this net weight.

The sugar content of the beet and the purity of the juice must now be ascertained, for the price paid the farmer varies according to the amount of sugar the beet contains. As in the case of weighing, sampling and polarizing raw cane sugar, representatives of both parties—the farmer and the factory—are present when all weights are taken and tests made. There are several different methods for determining the percentage of sugar in the beet and the purity of the juice, but the following gives a fair idea of the general practice.

The sample beets having been cleaned, are cut into quarters, one-quarter of each beet being taken for the general sample. This general sample is placed in a grinding or shredding machine, the beets are disintegrated to a fine pulp and thoroughly mixed. A specific amount of this fine pulp is then accurately weighed and placed in a copper pan or dish called a capsule. A small quantity of dilute lead solution is introduced to assist in clarifying, and sufficient water added to bring the volume up to 200 cubic centimeters. It is then heated for about twenty minutes and vigorously agitated, so that the sugar-bearing juice of the beet will mix evenly with the water that was added. The mixture, after being allowed to stand for several minutes, is filtered through paper and a certain amount placed in the observation tube of a polariscope. The instrument will show the amount of sugar in the solution, and by multiplying the reading by two the per cent of sugar in the beets will be found. If in preparing the sample only sufficient water had been added to bring it to a volume of 100 cubic centimeters, the polariscope would give a direct reading of the percentage of sugar in the beets. Practice has demonstrated, however, that the method described is the more accurate.

[Illustration: _By permission of Truman G. Palmer, Esq._

HAULING BEETS]

[Illustration: _By permission of Truman G. Palmer, Esq._

DELIVERING BEETS TO THE FACTORY BY WAGON]

To ascertain the purity of the juice, the procedure is as follows: A part of the shredded sample is taken and the juice is squeezed out of it. The amount of sugar in this juice is determined by aid of the polariscope, and a Brix spindle shows the amount of solids it contains. By dividing the polarization by the Brix and multiplying by 100 the purity is obtained, which means the percentage of pure sugar in the total amount of solids contained in the solution.

The purity of the juice has an important bearing on the subsequent manufacture of the sugar. It is difficult and costly to extract sugar from low-purity juices, and the loss of sugar in the process is very high. The reverse is naturally true if the juices have a high purity. The purity of the juice in the beet is materially affected during the growing period by climatic conditions, rainfall, irrigation,

fertilization, state of soil and cultivation. Great care and attention must be given the beet to insure high purity and heavy content of sugar.

From the above it will be seen how the net weight and the percentage of sugar in any particular wagon- or car-load of beets are ascertained, as well as the purity of all the beets that enter a factory. The efficiency of the work in a factory is based on the figures thus obtained.

MANUFACTURE OF BEET SUGAR

The process of making sugar from the beet is highly technical in its details and cannot be fully discussed within the scope of this work. A brief description, however, will give an idea of the general methods followed.

The process of manufacture may be classified under seven headings:

1. Transportation and cleaning of beets. 2. Extraction of juice, slicing and diffusion. 3. Purification, carbonation, filtration, concentration and sulfitation. 4. Formation of grain. 5. Partial drying, purging crystals from syrup in centrifugals. 6. Final drying. 7. Packing.

TRANSPORTATION AND CLEANING

The beets, after delivery to the factory, are stored in V-shaped bins, in the bottom of which is a flume covered by removable boards. By removing the boards, one at a time, the beets are fed into the flume, where a swift current of water floats them into the factory. From this flume the beets are lifted by means of a large wheel, a helical screw or any other suitable device, and discharged into a washer.

The common form of washer consists of a horizontal, semi-cylindrical tank provided with rotating, kicking or stirring arms for keeping the beets in motion. In this tank the beet is completely cleaned and separated from adhering earth, weeds and pebbles.

[Illustration: _By permission of Truman G. Palmer, Esq._

DELIVERING BEETS TO THE FACTORY BY TRAIN]

[Illustration: _By permission of Truman G. Palmer, Esq._

GENERAL INTERIOR VIEW OF BEET-SUGAR FACTORY—SHOWING FILTER PRESSES IN FOREGROUND; PANS AND EVAPORATORS IN REAR]

The beets are delivered from the washer into an elevator, which takes them to a point near the top of the factory and discharges them into automatic weighing and recording scales. From the scales the beets fall by gravity into the slicing machines.

EXTRACTION OF JUICE, SLICING AND DIFFUSION

The slices are made in various shapes and forms. The slicing machines consist of revolving, corrugated knives which cut the beets into long, thin slices or “cossettes.” The object is to produce slices which expose the greatest amount of surface, and yet sufficiently firm to lie not too closely together when placed in the diffusion battery, thereby preventing the circulation of the diffusion liquors. The cossettes are conveyed on an endless belt, or through a hopper, to the cells of the diffusion battery.

As the term implies, the juice in the beet is extracted by diffusion, and not by crushing, as in the case of cane. When two liquids, separated by a membrane, are brought in direct contact with each other and allowed to stand for a time, they mix uniformly without the assistance of mechanical or other force.

Beets are made up of a great number of plant cells, the walls of which are porous membranes. These cells are placed in contact with water or juice of lesser sugar content than the juice in the plant cell, in consequence of which the juice is gradually diffused from the beet and carried away in the circulating water which is added. When this water, or rather juice, has reached a certain stage of concentration, it is drawn out of the cells and sent to the next stage in the process of manufacture.

A diffusion battery, or the apparatus in which the process of diffusion is carried on, consists of a number of tanks or cells, usually from ten to fourteen, cylindrical in shape and terminating in truncated cones provided with covers. There are two ways of arranging the cells of a diffusion battery; in the one case the cells are placed in a straight line; in the other they are grouped in a circle. These

cells are filled with cossettes in rotation, and water is introduced into the one in which the cossettes were first placed.

Thus the water enters the tank in which the cossettes are nearly exhausted of their sugar, and it flows successively through the other cells that contain cossettes of greater sugar content until the last cell, or the one containing fresh cossettes, is reached. The juice passing through this cell is alternately sent to the measuring tank or to the next cell, which has just been filled with fresh cossettes. The process is continuous, one cell being emptied of exhausted cossettes while another is being filled with fresh ones, and the juice flowing either to the measuring tank or to the freshly filled cell.

The exhausted cossettes, now called pulp, are dropped from the bottom of the diffusion tanks into a large bin, from which they are conveyed or pumped to pulp separators and presses for the separation of the surplus water. This pressed pulp is usually stored in large bins or silos, where it is allowed to ferment before being fed to cattle.

Recently the practice of drying the pulp has been carried on to a large extent. In this process the moisture in the pulp is reduced to ten per cent, the same proportion as in cured hay. Dried to this point, it is packed in bags and may be stored for an indefinite period without deteriorating. After being treated thus it forms an excellent stock food, particularly if waste molasses is sprayed on it before drying.

PURIFICATION OF JUICE, CARBONATION AND FILTRATION

The diffusion juice obtained as above described is quite dark in color, and after passing through the measuring tanks it is conveyed to carbonation tanks where it is treated with from three to four per cent of caustic lime in the form of a thick milk.

[Illustration: _By permission of Truman G. Palmer, Esq._

DIFFUSION BATTERY—SHOWING DIFFUSION CELLS IN CIRCULAR ARRANGEMENT]

[Illustration: _By permission of Truman G. Palmer, Esq._

DIFFUSION BATTERY—SHOWING DIFFUSION CELLS IN STRAIGHT LINES]

After being thoroughly agitated, the mixture is treated with carbonic acid gas obtained from the lime-kilns, as the result of the decomposition of limestone and the combustion of the fuel used for burning it.

By this process some of the impurities in the juice are removed and the color reduced to a brilliant amber. As is the case in the cane mills and refineries, it is essential to keep the juice hot throughout the process. The carbonation is continued until the juice is only slightly alkaline, when it is passed through filter presses for the removal of the precipitated lime carbonate and other solid matter. The solid matter in suspension is retained in the frame of the press, and, as soon as the frame is full, the cake is washed by passing water through it. When the sugar content of the cake has been sufficiently reduced, the press is opened and the cake discharged and sent to the fields to be used as a fertilizer.

As a rule, the filtration is repeated for the elimination of any solids that may have passed through the first filtration. This double filtration is usually practiced in all the filtrations in the course of the juice through the factory.

The juice after being filtered a second time is again treated with carbonic acid gas for the further reduction of the caustic lime and then undergoes a third filtration, following which it is sent to the evaporators for concentration.

CONCENTRATION OF JUICE

When the juice reaches the evaporators it contains about eighty-two per cent of water, which, by concentration, must be reduced to about forty per cent. As already explained, the removal of water is generally accomplished in multiple-effects. The apparatus consists of a number of boiling bodies connected in such a manner as to secure a progressive decrease in atmospheric pressure.

The thin juice enters the first body where evaporation takes place under a slight pressure. The steam for this evaporation is usually the waste or exhaust from the engines and pumps. The vapors generated by the evaporation of water from the juice in the first body enter the heating tubes of the second body and are used in further concentrating the somewhat concentrated juice from the first body. The evaporation in this second body is conducted at a higher vacuum and corresponding lower temperature than in the first body. This proceeding is continued until five or even six bodies are used in the series. The last body is usually under a vacuum of about twenty-six inches of mercury.

It is obvious that by this arrangement the concentration of the thin juice is effected with the maximum of economy, direct steam being admitted into the first body only and the rest of the operation accomplished by the steam generated in the boiling of the juice.

SULFITATION

The thickened liquor leaving the last body of the evaporators is sent to the sulphur station and treated with sulphur fumes, in order to further precipitate the soluble impurities and reduce the color of the liquor. It is then heated to boiling point in closed tanks and passed through a double set of cloth filters. This is the final process in the purification of the beet juice, and it is then ready for graining.

In a cane-sugar refinery no sulfitation of the liquor takes place, and in a beet factory there is no char filtration for removal of color and impurities in the liquor. These two points constitute the main difference in the methods of making white sugar from the cane and the beet in the United States. In Europe, however, many factories make a raw beet sugar, which is subsequently refined with the aid of bone-char.

[Illustration: _By permission of Truman G. Palmer, Esq._

WEIGHING, FILLING AND SEWING BAGS IN A BEET FACTORY]

[Illustration: _By permission of Truman G. Palmer, Esq._

CATTLE FEEDING ON BEET PULP]

FORMATION OF GRAIN

The formation of the crystallized grain and its progress through the vacuum pans, centrifugals, driers, granulators and screens, and into the bags in the packing room, is identical with the process in a cane refinery, which has already been described.

STEFFEN PROCESS

In some of the beet factories the sugar left in the final molasses is extracted by what is known as the Steffen process. The final low-purity molasses is diluted with water and cooled to a very low temperature, after which finely powdered lime is constantly added to the solution at a uniform and slow rate. The sugar combines with the lime and a saccharate of lime is formed which is insoluble in the liquid. The suspended matter or saccharate is then separated and washed in filter presses.

The cake from these filter presses, which is the saccharate of lime, is mixed with sweet water to a consistency of cream and takes the place of milk of lime in the carbonation process. When the Steffen process is employed, about ninety per cent of the sugar originally in the beet is extracted. The loss of sugar that does take place is accounted for in the exhausted cossettes or pulp, in the pulp water which surrounds them when they are dumped from the diffusion cells, in the cake and wash waters from the carbonation presses and in the waste and wash waters from the Steffen process. As the water used in washing the saccharate press cake is rich in fertilizing qualities, it is used for irrigating the lands adjoining the factory.

The 6,511,274 tons of beets harvested in the United States during the season of 1915 contained an average of 16.49 per cent of sucrose, of which 14.21 per cent found its way into the sacks as white sugar. The difference, 2.28 per cent, represented the loss in working up the beets. As only a few factories, however, were using the Steffen process, a considerable amount of sugar was left in the waste molasses. For the same period, the beets produced in California contained 17.82 per cent of sugar, of which 15.64 per cent found its way into the sacks, showing a loss of only 2.18 per cent. This may be accounted for by the fact that probably more of the California factories were equipped with the Steffen process than the average for the United States, and that the purity of the juices of California beets was higher than the average for the United States.

A factory equipped with the Steffen process and running on beets containing 17.82 per cent sugar, with a purity of 82, should lose not over 1.9 per cent of the sugar in the beet. The same factory without the Steffen process would probably lose 5.04 per cent of the sugar.

It is interesting to know that, according to the testimony given before the Hardwick committee, the average cost of producing and selling one hundred pounds of white beet sugar in the United States today is about three dollars and fifty cents. The selling price, which is from ten to twenty cents per one hundred pounds less than the selling price of refined cane sugar, fluctuates with the value

of raw cane sugar. For instance, if raw cane sugar is selling in New York at four dollars per one hundred pounds, the selling price of refined cane will probably be four dollars and eighty cents. Beet sugar, therefore, would be four dollars and seventy cents or four dollars and sixty cents. On the other hand, if raw cane were selling for three dollars per one hundred pounds, refined would probably be three dollars and eighty cents and beet sugar three dollars and seventy or three dollars and sixty cents. In the one case the beet factory makes a large profit; in the other a very small profit.

As the value of raw sugar is determined absolutely by the law of supply and demand in the world's markets, it is clear that the fortune or misfortune of the beet-sugar producer is beyond his control.

[Illustration: _By permission of Truman G. Palmer, Esq._

THE FIRST SUCCESSFUL BEET-SUGAR FACTORY IN AMERICA—ALVARADO, CALIFORNIA]

[Illustration: _By permission of Truman G. Palmer, Esq._

A MODERN BEET-SUGAR FACTORY]

PART II

History of the Industry

EARLY HISTORY

India, the land that Kipling has called "the grim stepmother of mankind," is, according to the best authorities, the original habitat of the sugar cane; and there is but little doubt that the properties of the plant were known to the Hindustani many centuries before the Christian era. Nothing concerning it is found in the Old Testament, the Talmud or in the oldest Hindu literature; and even in Buddha's time (500 B. C.) it was little known.

The legend runs that sugar cane was created by the famous hermit Vishva Mitra to serve as heavenly food in the temporary paradise arranged by him for the sake of Raja Trishanku. It was the desire of this prince to be translated to heaven during his lifetime, but Indra, the ruler of the celestial realms, had refused to admit him. In order to gratify Trishanku's wish, Vishva Mitra prepared a temporary paradise for him. When a reconciliation between Indra and Trishanku was brought about, the paradise was demolished and all its luxuries destroyed save a few, among which was sugar cane. This subsequently spread over the land of mortals as a lasting token of Vishva Mitra's miraculous deeds.

Among the Chinese the first historical mention occurs in writings of the eighth century B. C., where the fact is recorded that their knowledge of sugar cane was derived from India. That it was considered of great value by the Chinese is shown by manuscripts of 200 B. C., wherein it is stated that the kingdom of Funan paid its tribute to China in sugar cane. From this it may be inferred that the secret of extracting crystals from the sugar-cane juice had not been discovered.

More than three centuries before Christ, the triumphant progress of Alexander the Great was halted upon the banks of the river Indus by the refusal of his troops to venture farther eastward. On their return journey, the Macedonian soldiers carried the "honey-bearing reed" to Europe.

A number of classical writers of the first century allude to the sweet sap of the Indian reed and to the granulated, salt-like product imported from India under the name of _saccharum_, or σ■κχαρι, from the Sanskrit _çarkar■_, gravel, sugar. The names of sugar in modern European languages are derived through the Arabic from the Persian _shakar_.

The people dwelling in the valleys of the Ganges possessed a knowledge of boiling sugar juice, and this spread from there to China in the first half of the seventh century. Sugar refining, however, could not then have been known, for Marco Polo[5] states that the Chinese learned this from Egyptian travelers only during the Mongol period, some five hundred years later. Von Lippmann says that solid sugar began to be known in India somewhere between 300 and 600 A. D., probably nearer the latter date.[6] In the Middle Ages, the best sugar came from Egypt[7]; and in India today, coarse sugar is still called "Chinese" and fine sugar "Cairene" or "Egyptian."

The Nestorians, a Christian religious sect in Gondis■p■r, India, planted sugar cane in Persia about 500 A.D. When Heraclius,[8] the Byzantine emperor, pillaged the palace of Dastargerd, Persia, in 627 A. D., solid sugar was taken among the other loot.[9] This

is the first authentic evidence of crystallization. At the time of the Arabian conquest in the year 639, sugar was “prepared with art” in Gondis■p■r; and its manufacture on a large scale was carried on at Shuster, S■s[10] and Askar-Makram[11] through the Middle Ages. Thaálibí, a writer of the eleventh century, says that Askar-Makram had no equal for the quality and quantity of its sugar, “notwithstanding the great production in Ir■k, Jarj■n and India.” It used to pay fifty thousand pounds of sugar to the Sultan in annual tribute.[12] Persian physicians of the time attributed extraordinary healing powers to sugar, and used it freely in the practice of their art.

Mohammed’s[13] religious wars carried the knowledge of sugar throughout the cities of the then civilized world. The Arabs first learned of it when they overran Persia. They took to it eagerly, and under their rule a great number of plantations were started. Artificial irrigation was employed in the growing of the cane, and the juice was expressed by means of millstones. At this period, however, sugar was looked upon as a rare and costly luxury, to be indulged in only by the wealthy, and sparingly even by them.

Arabian doctors who were well advanced in learning gave sugar an important place in their pharmacopœia. The Moslem armies took it westward with them; and when Amru[14] conquered Egypt (640-646 A. D.), it was introduced in that country. Careful methods of cultivation, coupled with the Egyptians’ intimate knowledge of chemistry, brought about excellent results. This cultured people had a simple process for purifying and recrystallizing saltpeter, and they soon found that sugar could be similarly treated.

The first crystals were remelted; and to the liquor so obtained albumen and lime were added. The precipitated impurities were removed by filtration, and the clear syrup boiled down to a grain once more. The syrup, or mother-liquor in which these grains remained after boiling, was eliminated by washing, leaving the white sugar crystals, which in point of quality far surpassed any product then known.

From this time forward, the traffic in sugar began to gain in importance and volume. Nasiri Khosrau, in his account of his travels in Egypt in the eleventh century, narrates that at the celebration of the great Ramazán feast, the Sultan’s table was decorated with sweetmeats consisting entirely of marzipan[15] modeled into shapes of orange trees and statues.

The continuation of the movement of the Arabs toward the west carried the cultivation of sugar over the entire northern coast of Africa and thence into Spain in the year of the conquest of Granada by the Moors (715 A. D.). It made its way to Sicily in 703; it was found growing at Assuan, on the Nile, in 766, and the Crusaders discovered important sugar plantations in Tripoli, Mesopotamia, Syria, Palestine, Antioch and other places in the Levant. Commercial relations between these points and the principal Italian cities were established during the Crusades, and a considerable trade in sugar followed.

Sugar-cane cultivation seems to have appealed to the Crusaders as a profitable venture—so much so that they actively interested themselves in it, making Tyre an important center of the traffic. King Baldwin and various orders of knighthood established large cane plantations in Antioch, Syria and Cyprus and did much to advance sugar production in those countries.

The Crusaders who had acquired a taste for sugar when in the Far east naturally wished to continue its use after their return home; thus, a trade sprung up between northern Europe and Venice, Genoa and Pisa.

After the fall of Acre in 1291, the Crusaders lost their foothold in Asia Minor; but Tyre, Beirut, Antioch and the valley of the Jordan continued to produce good crops of sugar, while Damascus and Tripoli became refining centers. Cyprus, still under Venetian rule, extended its trade in sugar, and sent considerable quantities annually to the mother city. All this time the production in Egypt went steadily forward.

This prosperity was rudely interrupted by the aggression of the Turks. Constantinople was captured in 1453 and Trebizond fell in 1461. The other commercial towns of Asia Minor and all of Genoa’s Black Sea colonies followed in quick succession. Trade between Europe and Asia Minor decreased as a matter of course and the manufacture of sugar languished under Turkish rule.

In 1517 Cairo was taken by the Turks, and Egypt became a province of the Ottoman empire, with disastrous results to the sugar industry there. In 1522 Rhodes, and in 1571 Cyprus, passed under the sway of the Turk; but by that time sugar cultivation in these islands had fallen off greatly, while in Sicily it had completely died out.

Other causes militated to bring about the decline of the sugar trade in these countries. The Portuguese took sugar cane to Madeira in 1419. In 1432 they captured and colonized the Azores; and between 1456 and 1462 they acquired the Cape Verde islands. São Thomé, Principe and Annobon were annexed in 1496; and in that same year the Spaniards colonized the Canaries. Sugar cane grew luxuriantly in the mild, moist climate of these islands, and the cost of production by slave labor was so low that neither Cyprus

nor Sicily could compete; consequently, the once large and prosperous sugar trade of the Mediterranean became a thing of the past.

During the Middle Ages, Venice was the chief sugar-distributing center in Europe. One of the earliest references to sugar in Great Britain is that concerning one hundred thousand pounds shipped to London in 1319 by Tomasso Loredano, a Venetian merchant. Wool, which at that time constituted the most important staple of English products, was exchanged for sugar. In the same year, an entry appears in the accounts of the Chamberlain of Scotland, showing a payment for sugar at the rate of one shilling and nine pence halfpenny per pound. It is said that at the end of the fifteenth century a citizen of Venice received a reward of 100,000 crowns ($111,940) for having invented the process of making loaf sugar. Vasco da Gama's exploit in finding the way to Calicut by sea in 1498 deprived Venice of her position as a dominant commercial center; and new routes for the world's trade were opened up. The discovery of America exercised a still greater influence upon the production and distribution of sugar.

Christopher Columbus' first attempt to establish sugar growing in Santo Domingo in 1493[16] was not a success; but when negro slaves were brought to the West Indies by the Portuguese and the Spaniards, the industry took a new lease of life, and with slave labor, ideal climate and fertile soil, it increased abundantly. As illustrative of the extensive development in Santo Domingo, it is interesting to note that Charles V of Spain obtained from import taxes on Santo Domingan sugar the vast sums of money expended in the building of the royal palaces at Madrid and Toledo.[17]

Brazil was discovered by Pinzon in 1499[18] and sugar cane was taken there from Madeira. About thirty-three years later plantations had been laid out and the first sugar factory built. The year 1590 saw one hundred and two mills in operation in the provinces of Bahia and Pernambuco; and in 1600 the quantity of sugar exported from Brazil was 15,000 tons. At that time Brazil belonged to Spain, which had annexed Portugal and her colonies in 1580. It was conquered by the Dutch in 1629, and a great many sugar plantations and factories were destroyed; but these were subsequently restored by the new rulers. The Dutch, in turn, were expelled in 1655; and in 1661 Brazil was acknowledged to be a Portuguese possession. The sugar trade suffered, however, on account of the banishment of twenty thousand Dutch in 1655, and also through the discovery of gold in 1725, which drew the laborers from the sugar fields and mills; and the production fell off to a large extent.

[Illustration: _Christopher Columbus_

Fra Sebastiano Del Piombo

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The island of St. Christopher (now St. Kitts) was occupied in 1625 by both the English and the French. Ten years later the French took Guadeloupe and Martinique; Barbados became a British possession in 1627, and Jamaica was annexed in 1656. Sugar cane was planted in all these colonies, but through lack of knowledge and experience the product obtained was of indifferent quality. A decided improvement was brought about when the Dutch, who were expelled from Brazil, came to the islands in 1655.

Santo Domingo was taken over permanently by the French in 1697 after it had previously been occupied and abandoned by them. From this date the industry throve there and for upward of one hundred years Santo Domingo ranked among the foremost of the sugar-producing islands of the West Indies. Tyranny and cruel treatment caused the slaves to revolt in 1791; the whites who failed to escape were exterminated and the sugar plantations and mills were destroyed.

Santo Domingo has never recovered the prestige in the sugar world that she lost in this way. Her misfortune gave a great opportunity to Jamaica, whose production increased so rapidly that at the close of the eighteenth century she outstripped all the other West Indian islands. The falling off in Santo Domingo stimulated the industry in Cuba as well. As a dependency of Spain, Cuba was hampered by a number of restrictions; these were repealed in 1772, after which the sugar tonnage grew apace.

St. Eustatius and Curaçao belonging to the Dutch, and St. Croix, St. John and St. Thomas to Denmark, also came in for their share of the benefit growing out of the impetus given to the sugar trade at this time. It must be borne in mind, however, that they were conveniently situated for sugar smuggling, of which there was not a little during the American Revolutionary war.

In the countries of South America, Brazil excepted, the sugar trade had become well established. French planters settled in Cayenne in 1634 and in Surinam six years later, but production was handicapped by the difficulty attendant upon securing labor, and this condition continued to exist even after the taking of Surinam, Essequibo, Demerara and Berbice by the Dutch. Finally the trouble was overcome by bringing in slaves, and with the end of the French war the sugar industry began to prosper, especially in

Surinam. During subsequent hostilities these colonies were taken by France, afterwards by England, and later still they reverted to the Dutch. Today they are all British with the exception of Surinam and Cayenne.

Sugar cane was not known in Peru at the time of Pizarro's first expedition to that country (1527), but it was brought there shortly afterward. In Chile and the Argentine its introduction was comparatively recent. The Jesuits took it from Santo Domingo to Louisiana in 1751, and in Mexico it dates back to the time of Cortés.

The rapidity of the increase in the production of the Americas threatened the plantations of Madeira, the Cape Verde islands and the Canaries with extinction and drove them from the world's markets.

Sugar cane was planted by the French in the Ile de France (Mauritius) in 1747, and some years later in Bourbon (Réunion) and sugar made in these islands was sent to Europe about the end of the eighteenth century.

In Java sugar cane has been grown since a very remote period. It was probably brought there by Chinese traders and there is evidence that the Chinese introduced it in the Philippine islands, as the names of the implements and methods used there distinctly point to Chinese origin.

The cultivation of sugar cane in Australia was begun only fifty years ago; it was started in the Fiji islands in 1880, while Captain Cook found cane growing luxuriantly in the Hawaiian islands when he discovered them in 1778.

The wars between Great Britain and France during the latter part of the eighteenth century and the beginning of the nineteenth had a very bad effect on the cane-sugar trade and its development. There was constant fighting in West Indian waters and many merchant vessels were taken as prizes; a disastrous state of affairs for planters and merchants alike. After the battle of Trafalgar had definitely established British supremacy on the seas, Napoleon put into effect his "Continental System," which dealt a severe blow to cane sugar. This opens up a new and interesting chapter in the history of the industry.

BEET SUGAR IN EUROPE

The destruction of the French fleet by Nelson in 1805 thwarted Napoleon's long-cherished plans for the invasion of England. Nothing daunted, however, he immediately bent his efforts toward isolating Great Britain and cutting commercial communications between her and the continent of Europe. The Berlin edict of 1806 prohibited all trade relations with England and made her goods and those of her colonies subject to seizure. England's reply was to forbid ships of all nationalities to enter French ports under penalty of confiscation. Napoleon followed this with the Milan decree which made any vessel that had submitted to English examination or paid dues in English ports subject to confiscation. The one government vied with the other in preying on commerce. The interference with the importation of sugar due to this condition drove prices upward to a point where only a few could afford its use.

Napoleon was fully cognizant of what a privation this was to his people, but he felt confident that means would be found to bring sugar from the Far east to western Europe by way of Constantinople and Vienna; besides, he had strong hopes that a substitute for cane sugar could be produced in Europe itself. He encouraged experimental and research work, keeping thoroughly informed as to progress made, and on March 25, 1811, he issued the famous decree that set in motion the beet industry of the world.

[Illustration: DAN SWEENEY

Olivier de Serres]

[Illustration: DAN SWEENEY

Andreas Marggraf]

The original home of the sugar beet (_Beta vulgaris_) is not definitely known. The plant was found in a wild state in southern and middle Asia and it is said to have been cultivated in southern Europe and northern Africa in olden times. According to Professor Griffin,[19] Herodotus mentions the sugar beet as one of the plants that served to nourish the builders of the pyramids. Dr. von Lippmann cites the same instance and also quotes Voltz as authority for the statement that the Romans first brought the beet into Gaul.

When the beet was originally grown in southern latitudes it was an annual, but when it was taken north it became a biennial, storing sugar the first year and not developing its seed until the second.

Jules Hélot, an eminent French authority, in his “Histoire Centennale du Sucre de Betterave,” says:

“A great French agronomist, called the father of agriculture, Olivier de Serres (1539-1619), was able to find out that the beet-root contained sugar, long before Marggraf set about to extract sugar from this root. Olivier de Serres wrote: ‘The beet-root, when being boiled, yields a juice similar to syrup of sugar, which is beautiful to look at on account of its vermilion color’.”

Dr. von Lippmann, however, contends that Olivier de Serres never claimed in his writings that he discovered the sugar content in the beet, and that the statement “that the boiled juice of the red beet was similar in appearance to sugar syrup” cannot be construed as evidence that de Serres actually recognized the presence of sugar in the beet-root.

In the year 1747 Andreas Marggraf, a chemist and a member of the Royal Academy of Science and Literature of Berlin, demonstrated that various kinds of beet-root contained sugar and that the sugar could be extracted and crystallized. This discovery, however, was regarded for many years as being merely a laboratory determination and without practical value. In 1786 Franz Karl Achard, a pupil of Marggraf, attacked the problem of beet-root cultivation and succeeded in extracting sugar from beets on a scale hitherto unknown. He issued a report of the methods employed and the results obtained and stated that a good muscavado sugar should be made from beets for six cents per pound. His claims met with incredulity and no little ridicule, but the French Institute made a careful investigation of what he had done and found that the sugar content of the beets was over 6 per cent. From a number of tests of Achard’s process, they estimated that the cost of producing refined sugar from beet-roots on a commercial basis would be eighteen cents per pound.

Frederick William III, king of Prussia, took a keen interest in the making of sugar from beets, and, after having convinced himself that Achard was on the right track, he bought the crown land at Cunern, Silesia, for exploitation on a large scale. He provided Achard with funds for the erection of the first real sugar factory built in Germany, at which operations were begun in 1802. The king also supplied money for the construction of other factories in Brandenburg, Silesia, and Pomerania, and lent his support to the growers of beets as well as to the manufacturers of sugar. Despite the reverses in war suffered by the Prussians, the progress in sugar making was so manifest that in 1810 it was clear that the industry was bound to succeed under intelligent management.

[Illustration: DAN SWEENEY

FRANZ CARL ACHARD]

[Illustration: FIRST BEET-SUGAR FACTORY IN THE WORLD—BUILT AT CUNERN, SILESIA, 1802]

Achard, who was of French extraction, had corresponded with a number of scientific men in France and through them reports of his work reached the French Institute. The verdict of this body was favorable and two sugar factories were built, one at St. Ouen and the other at Chelles. Both of these enterprises failed through lack of practical knowledge and the inferior quality of the beet-roots. Although this setback brought the manufacture of beet sugar to a standstill for a time, there is plenty of evidence to show that hope of ultimate success was never abandoned. The effect of the closing down of these two beet factories was to divert the attention of scientists to making sugar from grapes. Proust and Parmentier, both chemists of note, demonstrated that it could be obtained from this source and the French government issued instructions for the preparation of sugar and syrup from the vine. Parmentier published a bulletin advising against the attempt to make beet sugar in France as the soil of the country would not produce beet-roots containing sugar. In 1810 Napoleon ordered an appropriation of 200,000 francs to be divided as a premium among the factories recovering the highest percentage of sugar from grapes. Meanwhile the friends of the beet movement had not been idle, and early in March, 1811, the Society for the Encouragement of National Industry submitted to the emperor a report of what had been accomplished in the manipulation of beets, together with samples of the sugar obtained, and on the 25th of that month Napoleon issued the edict that established the manufacture of beet sugar in France. The decree provided that 79,000 acres of land in various parts of the empire should be devoted to the raising of beets and directed that all the acreage named should be under cultivation the first year, or at latest the second. It created six experimental stations for the instruction of the farmers and land owners in cultivation and also for the furtherance of the interests of the manufacturer.

Delessert had established a factory at Passy in 1801 and by dogged perseverance, despite many failures, obtained excellent results by a new method of clarification and the use of charcoal. Napoleon visited his plant in 1812 and ordered the construction of ten new factories at once. On January 1, 1813, all further imports of sugar from the East and West Indies were prohibited.

In 1812 and 1813 the output of sugar in France was 2200 tons and the factories of Germany and Austria gave promise of soon supplying the wants of their respective countries. During the following two years there were unusually heavy rains and the beet fields of France were occupied by hostile troops. The defeat of Napoleon at Waterloo and the consequent abolition of the blockade caused a decline in the price of sugar to a point where the new beet industry was unable to compete and only one factory succeeded in avoiding the general disaster.

From 1816 to 1821 the average yearly output of beet sugar was 1000 tons. The domestic product had a great advantage over the foreign article, as all sugars coming into France from abroad were subject to a heavy duty, while no tax was levied on home-grown sugar. In 1821, a duty of 49.5 francs was imposed upon every 100 kilograms (220.4622 lbs.) of raw sugar coming from French colonies and 70 francs on white sugar. The tax on sugar from foreign countries was 90 francs per 100 kilograms, and this was increased to 125 francs in 1829.

Shortly afterward the surtax[20] on foreign sugar was increased and an extra duty was exacted on sugar brought into France in foreign bottoms. Even with this protection the domestic producers were not satisfied. French colonial sugar, when exported, received the benefit of customs drawback of 120 francs per 100 kilograms, and the same privilege was accorded home-grown sugar upon which no duty whatever had been paid. This was tantamount to an export premium of 120 francs per 100 kilograms, and it may well be imagined that under this paternal arrangement old factories came back to life and new ones sprang into being. Under this régime by 1836 nearly one-third of the sugar refined in France was beet. The payment of this premium was so great a drain on the government treasury that in 1840 the authorities seriously considered the buying up of all the beet-root sugar factories then in operation for forty million francs and the equalizing of the tax on foreign and domestic sugar. The scheme was not carried out, but in 1843 beet-root sugar and cane sugar were placed on the same basis. This hurt the domestic industry severely, and if it had not been for the setback to the cane production by the abolition of slavery, the beet interests might have met with ruin. Nevertheless, in spite of many adverse turns of fortune, the general trend was forward.

[Illustration: NAPOLEON I]

Beginning with the year 1836, the beet-sugar industry in Germany, which had been paralyzed by the raising of the Continental blockade, went ahead rapidly. The German manufacturers gradually succeeded in obtaining a higher extraction of sugar from the beet and consequently their operations showed an increased profit. Krause of Austria and Schubarth of Prussia, both of whom had studied beet-sugar making in France, did much by their efforts to rehabilitate the industry in Germany, where it has steadily grown in importance ever since.

The manufacture of beet sugar was revived by Austria in 1831 and by 1840 there were many factories in operation. In 1854 the output of domestic sugar equaled the tonnage brought in from foreign countries and beet sugar had established itself throughout Europe as a strong competitor of the cane sugar of the colonies.

The European consumption, however, had grown at such a rate that the domestic beet-sugar production did not keep pace with it, hence the cane manufacturer was scarcely sensible of the competition for some years; in fact Europe took rather more than less cane from the tropics for a time.

During the nineteenth century Europe became less and less dependent upon the cane countries of the New world for its supplies. The abolition of slavery in most of the European possessions (1825-50), the development of the cultivation of cane in India and Java, and the expansion of the bounty-fed beet-sugar industry in Europe all contributed to bring this about and many colonial cane growers found themselves on the brink of ruin.

Slavery, upon which cane sugar raising so greatly depended, was entirely abolished in British possessions in 1834, in France in 1848 during the Second Republic, in the Dutch West Indies in 1863, in Porto Rico in 1873, in St. Thomas in 1876, and in Cuba in 1880. Great Britain appropriated the sum of £20,000,000 sterling as an indemnity, and of this £16,500,000 went to West Indian planters, the remainder going to Mauritius and the Cape, but indemnification, while most welcome, did not restore the supply of labor. Many of the freed slaves refused to work and great numbers of them left the plantations. British colonists were at a serious disadvantage, too, as after their slaves were liberated slavery still existed in other West Indian islands, and to offset this a special import tax was imposed on sugar produced by slave labor.

Strenuous efforts were made to secure an adequate labor supply. Chinese coolies, free negroes and Hindus were tried, but the cost was great and the number available was insufficient for the proper cultivation and upkeep of the plantations. This condition

obtained in the British West Indies, Cuba, Louisiana, Peru, Brazil, the Guianas, Mauritius, Réunion and other places, and the cane growers had hard work to keep from going under during the adjustment period, when they were learning how to operate their plantations with a limited number of hands. Importation of labor, subdivision of cane lands into small tracts, to be rented or sold to farmers—many plans were tried—but naturally under such circumstances development was impossible, and beet sugar, which had been steadily increasing, finally outstripped cane in 1883-84, while in 1899-1900 cane only furnished 34.7 per cent of the world's crop. In 1912-13 the cane tonnage exceeded that of beet by 211,082 tons of 2240 pounds. The great war in Europe has curtailed the production of beet sugar in that country to such an extent that of the world's output for 1915-16 the proportion of cane to beet was roughly as two-thirds to one-third in favor of the former. The actual figures are:

Cane 10,533,039 tons Beet 5,986,404 " ---------- Excess of cane over beet 4,546,635 tons

The following table giving the world's production of cane and beet from 1852 to 1916 will be of interest, but it should be borne in mind that this comparison between beet and cane is not a fair one, because the figures are incomplete as far as cane is concerned.

In some instances in former years, only the quantity exported from a country was included in the world's statistics and the amount consumed at home was left out of the calculations. This is particularly noticeable in the case of India, whose production of over two million tons of sugar annually was omitted from the older estimates as it all went into domestic consumption—while the beet figures were invariably given in full.

The world's crop figures as furnished by Willett & Gray for the period from 1852 to 1916 include British India's production for the last eleven years only:

BEET-ROOT YEAR SUGAR CANE SUGAR TOTAL PER CENT TONS TONS TONS CANE SUGAR

1852-53 202,810 1,260,404 1,463,214 86.0 1859-60 451,584 1,340,980 1,792,564 74.3 1864-65 529,793 1,446,934 1,996,727 73.5 1869-70 846,422 1,740,793 2,586,915 67.3 1874-75 1,302,999 1,903,222 3,206,221 59.4 1880-81 1,820,734 2,027,052 3,847,786 52.7 1883-84 2,485,300 2,210,000 4,695,300 47.0 1884-85 2,679,400 2,225,000 4,904,400 45.4 1885-86 2,172,200 2,300,000 4,472,200 51.4 1886-87 2,686,700 2,400,000 5,086,700 47.1 1887-88 2,367,200 2,541,000 4,908,200 51.7 1888-89 3,555,900 2,359,000 5,914,900 40.0 1889-90 3,536,700 2,138,000 5,674,700 37.7 1890-91 3,679,800 2,597,000 6,276,800 41.2 1891-92 3,480,800 3,501,900 6,982,700 51.6 1892-93 3,380,700 3,040,500 6,421,200 47.3 1893-94 3,833,000 3,561,000 7,394,000 48.2 1894-95 4,725,800 3,531,400 8,257,200 42.7 1895-96 4,220,500 2,839,500 7,160,000 39.6 1896-97 4,801,500 2,841,900 7,643,400 37.2 1897-98 4,695,300 2,868,900 7,564,200 38.0 1898-99 4,689,600 2,995,400 7,785,000 38.5 1899-00 5,410,900 2,880,900 8,291,800 34.7 1900-01 5,943,700 3,646,000 9,589,700 38.0 1901-02 6,800,500 4,079,000 10,880,500 37.5 1902-03 5,208,700 4,163,900 9,372,600 44.4 1903-04 6,089,468 4,244,206 10,333,674 41.0 1904-05 4,918,480 4,613,540 9,532,020 48.4 1905-06 7,217,366 6,733,626 13,950,992 48.2 1906-07 7,143,818 7,334,207 14,478,025 50.6 1907-08 7,002,474 6,912,520 13,914,994 49.6 1908-09 6,927,875 7,634,125 14,562,000 52.4 1909-10 6,587,506 8,339,888 13,927,394 59.8 1910-11 8,560,346 8,421,534 16,981,880 49.5 1911-12 6,820,266 9,066,964 15,887,230 57.0 1912-13 8,976,271 9,232,543 18,208,814 50.7 1913-14 8,908,470 9,879,275 18,787,745 54.3 1914-15 8,241,974 10,165,565 18,407,539 55.2 1915-16 5,986,404 10,533,039 16,519,443 63.7

France held the first place in output of beet sugar until 1880, when Germany took the lead and has maintained it ever since. The beet industry assumed important proportions in Austria-Hungary, Russia, Holland and Belgium shortly after 1850, but it was not established in Sweden, Spain and Italy until comparatively recent times.

The laws that were passed by the various European countries for the encouragement and protection of beet sugar were so beneficial in their effect that these countries not only were able to supply their own domestic demand, but found themselves able to export sugar. This stimulation finally led to abuses, as a result of which the Brussels convention was brought about and the bounties abolished.

Apart from certain details, the various regulations in European countries for the purpose of building up the manufacture of beet sugar and making it a revenue producer were very much alike. The essential features were a prohibitive import duty and a slightly lower excise tax. The latter provided revenue for the government, and the difference between the import duty and the excise shut out foreign competition and fixed the amount of profit the domestic beet-sugar producer could make. Still worse, it created pools or combinations for the control of both output and price.

With increased production, which was more than sufficient to supply the home demand, these countries were in a position to export sugar, and in order to enable their manufacturers to compete in outside markets, a drawback of the excise was allowed on all exported sugar. A peculiar condition of the law affecting this drawback was that it really, though not directly, provided for a bounty on export sugar, and while this was not the original intent of the law, the improvements that it encouraged accomplished the purpose.

In Germany the principle was that the excise was levied upon the quantity of beet-root sliced, while the export drawback was allowed on the actual sugar produced.[21] At the time of the passing of the law that was in operation from September, 1869, to July, 1886, the assumption was that the yield in sugar would be 8.51 per cent of the weight of the beets, allowing 11.75 tons of beets for one ton of sugar, and on all raw sugar exported the manufacturer was given $2.03 per hundredweight drawback, the exact equivalent of the excise tax, which was 17 cents per hundredweight of beets.

For some years after this law became effective it took twelve tons of beets to make a ton of sugar, consequently the drawback allowed the exporter did not represent all of the excise. Thus it became the aim of the manufacturers to raise the sugar content of the beets and to improve the extraction. By 1882 they had succeeded so well that a ton of sugar was produced from 10.46 tons of beet-roots instead of 11.75 tons, as predicated when the law was drawn up. The drawback, however, was still allowed at the rate of $2.03 per hundredweight, which netted the producer a clear gain of 22 cents.[22]

In France from 1864 to 1875 the calculations were made from the quantity and purity of the juice. In other words, a certain arbitrary _rendement_[23] of sugar from the beet-root was the basis of taxation, while any excess recovery was exempt. This was equivalent to an indirect bounty, but the French government saw to it that the estimates and the actual outturn did not get too far apart. No bounty whatever was paid on French sugar from 1875 to 1884.

About 1880 the sugar production of Germany exceeded that of France, so that in 1884 the French authorities revived the indirect bounty system to put new life into the industry, and the effect of this action was soon apparent.

Sugar legislation in other sugar-producing countries of Europe was similar in general principles and gave practically the same results. Amendments were made from time to time with a view to bringing the basis provided for in the law closer to what was actually attained in production, but the manufacturers by constantly improving their processes managed to keep the advantage and consequently to receive a secret indirect bounty or rebate.

The payment of these drawbacks taxed the treasuries of the different countries concerned and in the case of Austria-Hungary amounted to more than the entire revenue from sugar. This brought new regulations and the payment of direct bounties instead of hidden or indirect. Furthermore, a limit was set upon the total that could be paid in any one year.

Nevertheless, the producers in all the sugar-raising countries used their utmost efforts to send as much sugar as they possibly could to foreign markets in order to secure the drawback. It naturally followed that the production was stimulated to an abnormal degree, and toward the end of 1883 there was a slump in prices that affected all raisers of sugar, both beet and cane, throughout the world.

The governments of Europe came to find these bounties a serious burden, and when Lord Salisbury arranged for a convention to be held in London in 1886, the proposal to do away with all bounties met with a good deal of favor. France, however, opposed the idea, as she wished to discontinue the direct bounty only and to leave the indirect still in force, while the British themselves, who used prodigious quantities of sugar and who, under the bounty plan, got all they needed at a price below the actual cost of production, did not wish to forfeit this advantage. So the interests of the British colonists were sacrificed and the London conference accomplished nothing.

In 1890 Germany resolved to divest sugar of all its privileges in order that the treasury should receive the entire amount of the taxes. A measure was proposed in 1891 providing for direct export bounty. This was to be reduced in 1895 and entirely abolished by 1897.

Owing, however, to a severe agricultural crisis at this time, American cereals were brought into Europe at such low prices that the home grower could not compete. It therefore became necessary to find another crop for the land that had been sown to corn and the beet-root was the logical substitute. The increase in beet production from this cause was followed by a crash in sugar prices. With such a condition confronting it, the German government could not do away with, or even reduce, the bounty, especially as none of its neighbors seemed to have any intention of doing anything in this direction. In the interests of the beet growers, the

output of beets in 1895, instead of being restricted as proposed, was doubled, and the export bounty on raw sugar was raised from 1.25[24] marks to 2.50 marks per 100 kilograms and on refined from 2 marks to 3.55 marks per 100 kilograms.

This legislation was meant to foster the export trade and bring the sugar business of foreign countries to German manufacturers, and the framers of the law were confident that other countries would not venture to follow suit. In this they were utterly mistaken. Germany's competitors simply raised their bounties to her figures, thus nullifying her plans for expansion of her export sugar trade.

In 1897 the United States levied a countervailing duty on all bounty-nourished sugar, in addition to the regular protective tariff, so that the bounty paid by European countries on sugar exported to the United States simply went to enrich the United States treasury.

The manufacturers of Germany and Austria enjoyed a profit over and above the bounty by the adoption of what was termed a cartel, or pool, a plan borrowed from Russia.

In Russia the government fixes the amount of sugar required each year for domestic consumption and this quantity may be sold by the manufacturer. Then it determines what quantity shall be kept in reserve, to be sold when the price exceeds that named by the government commission (4.30 rubles[25] per pood[26] in winter, or 4.45 rubles in summer). Should the production exceed the amounts fixed for domestic consumption and reserve, exportation is permitted and the exporter gets back the excise, 1.75 rubles per pood, or if he elects to sell this excess at home, he may do so by paying double tax, or 3.50 rubles per pood. Of the alternatives, exporting the surplus is the more advantageous to the owner of the sugar, as the fixed price for domestic sugar is a profitable one. He therefore can afford to take a loss on the sugar he sells for export and still make money on the total operation. The stipulation that the contingent interest in the profitable home market shall keep pace with the growth of the output of the factory is also a substantial encouragement to manufacturers to increase their production. Regulations like these naturally have the effect of supplying foreign markets with cheap sugar. The manufacturer makes an excellent profit and the domestic consumer pays the entire bill.

Primarily, the intent may have been to keep the price of domestic sugar at one level and to enable the manufacturer to fill the home demand without having to go outside the country for his raw-sugar supply. But the plan in its actual working fosters exportation at the expense of the home consumer.

While in Russia the cartel was a government measure, the pooling of interests by German and Austrian manufacturers in their respective countries accomplished the same end. A cartel formed in Russia in 1890 came to grief after four years through the individual greed of its members. In 1898 a new combination of raw-sugar producers and refiners was formed, with the express proviso that the manufacturers of raws were to sell their product only to refiners who were members of the cartel. The domestic trade in white sugar was prorated among the refiners, in consideration of which they had to allow the producer a fixed price of 30 kronen ($6.08) per 100 kilograms (220.4622 lbs.) for raw sugar, the market price of which was paid by the buyer and the difference by the cartel, which got the money by notching up the price of domestic refined sugar.

With the cartel the only seller of refined, and sugar from foreign countries shut out by the high surtax (the difference between the impost on imported and domestic sugars), the consumer had to pay the price demanded by the cartel as long as the difference between the world's price and that established by the cartel was less than the surtax.

The profit thus obtained constituted a working fund to be used in forcing into line such factory owners as remained outside the pool, either by reducing the price when a factory was about to begin to make white sugar, or by buying stock in the corporations that still held out. Out of the rest of the fund was paid the difference between the market price (with 22 kronen per 100 kilograms as a minimum) and the 30 kronen. Any amount remaining was the cartel's profit. To illustrate and estimating that no kilograms of raw sugar produced 100 kilograms of refined:

Price of refined sugar for domestic use per 220.4 lbs. $17.25 Raw sugar 242.4 lbs. @ $4.46 per 220.4 lbs. $4.91 Refining cost and profit 1.53 Revenue tax 7.71 14.15 ---------- Net profit of cartel $3.10

With an open market price of $4.46 for raws, the difference between that and the arbitrary figure of $6.08 is $1.62 per 220.4 lbs. on 242.4 lbs. 1.78 ---------- Net profit from cartel for refiners $1.32

Reference has been made to the abortive results of the London conference of 1886, when a deaf ear was turned to the appeal of the planters of the British West Indies on account of the advantage to the British manufacturer and consumer of securing all the

sugar they wanted at a figure lower than it cost to produce.

In 1895, Joseph Chamberlain, then Colonial Secretary of Great Britain, appointed a royal commission to investigate conditions in the West Indian colonies. The facts brought out in its report came as a surprise to the statesmen of the mother country and remedial measures were undertaken.

The anxiety of the Austrian and German governments to get rid of the bounty incubus led them to sound France as to her views, and in 1898 the Belgian government invited representatives of Great Britain, Germany, Austria, the Netherlands, France, Russia, Spain and Sweden to meet in conference in Brussels, but no definite agreement was arrived at, chiefly because of France's unwillingness to discontinue the giving of indirect bounty. The meeting adjourned on June 1st with the understanding that it would again convene at the call of Belgium, when the preliminary negotiations through Belgium's good offices had progressed sufficiently to make unanimity possible.

Meanwhile, public opinion in England with regard to the West Indies had undergone a change, partly on account of the report submitted by the Chamberlain commission and partly owing to the fact that Britain, needing the support of her colonies in her South African war, was anxious to shape her policy to please them.

A third conference was held in Brussels in December, 1901.

In the discussion concerning the German and Austrian cartels, it had developed that the heavy surtax permitted the Germans and Austrians to realize such high prices in their home markets that, even with the bounty repealed, their overproduction was very great and the large tonnage exported by them depressed values in foreign markets. Great Britain and Belgium, therefore, demanded that the surtax be reduced to a point where, while giving protection against foreign sugar, it would afford no inducement for the formation of cartels. Austria and Germany demurred to this and it looked as if a deadlock would again be reached, when Great Britain declared that if nothing came of the conference a measure would be introduced in Parliament excluding bounty-fed sugars entirely, or that some action equally drastic would be taken. It was further pointed out that an extra duty of an amount equal to the cartel profit had already been under consideration by the Indian government.

With a countervailing duty effective in the United States, the market of Great Britain was the only important outlet left for bountied export sugars from the Continent. Then again, the British colonies had to be reckoned with, for if preferential privileges were accorded to their sugars Continental beet would suffer. Great Britain's ultimatum, therefore, carried the day, and on March 5, 1902, the convention was signed by the plenipotentiaries of Great Britain, France, Germany, Austria, Belgium, Spain, Italy, the Netherlands, Norway and Sweden.

The most important provisions of the convention were:

1. The suppression of all bounties, direct or indirect.

2. The limitation of the surtax, _i. e._, the excess of import duty over domestic revenue tax, to 53 cents per 100 pounds on refined and 48 cents per 100 pounds on raw sugar.[27]

3. Prohibition of importation of bounty-fed sugar from other countries, unless a countervailing duty is imposed.

4. Great Britain and the Netherlands pledge themselves that no preferential treatment will be given sugar from their colonies during the life of the agreement.

5. The agreement to come into force September 1, 1903, and to remain effective for five years from that date, and in case none of the signatory powers notifies the Belgian government of its intention to withdraw, it shall continue to remain in force for one year and so on from year to year.

6. The appointment of a permanent commission charged with supervising the execution of the provisions of the convention.

7. Spain, Italy and Sweden not to be bound by the principal restrictions, so long as they do not export sugar.

Russia declined to come into the pact, stating as her reason that she paid no bounty.

Great Britain's action in joining the Brussels convention aroused a good deal of feeling at home. The contention was made that it worked an injury to the British consumer in causing an advance in prices; it was also argued that the plea put forth in behalf of the West Indies was really instigated by the selfishness of British investors in colonial sugar plantations. The rise in price that followed

the convention was stimulated by the shortage in the European beet crop in 1904, and provoked much agitation and dissatisfaction in England, so that it was not certain that Great Britain would be a party to a renewal of the pact upon its expiration.

Subsequently Peru, Luxembourg and Switzerland joined the convention, and the contracting parties were so well satisfied with results obtained that they extended the agreement for five years beginning September 1, 1908. The conditions were to remain unchanged, except for an amendment that permitted Great Britain to disregard the article that prohibited the importation of bountied sugar, unless paying countervailing duty. This prohibition directly affected Russian sugars, of which England did not wish to be deprived.

Russia joined the convention in 1908, with the understanding that her existing fiscal laws and excise regulations should not be interfered with and that the method of fixing the price of sugar for home consumption should rest undisturbed. On her part, Russia undertook not to export more than one million tons during the next five years outside of Finland, Persia and neighboring Asiatic countries.

The convention with these modifications was thus extended to September, 1913, and on March 15, 1912, it was agreed to prolong it until August 31, 1918, on practically the same conditions as the 1908 convention. Because of the great drought in central Europe in the summer of 1911, there was a shortage of 2,000,000 tons in the beet-sugar crop of 1911-12, as compared with the former year, and, on account of the consequent rise in price, England demanded that the Russian exports be increased. The other signatory powers agreed to this and the amount that Russia was permitted to export in the seven years beginning September 1, 1911, was fixed at 1,650,000 tons.

In August, 1912, Sir Edward Grey gave notice of Great Britain's intention to retire from the convention on September 1, 1913, and on that date she ceased to be a party to it. Nevertheless, after her withdrawal she undertook to observe all the obligations of the convention, and in return the signatory powers agreed not to discriminate against her manufactures of sugar.

The convention stopped exportation of beet sugar at abnormally low prices. It was instrumental in lowering the revenue tax, increasing the consumption and abolishing artificial conditions.

The outbreak of the war in Europe in August, 1914, interrupted the operations of the convention, and it remains to be seen whether or not, when hostilities come to an end, it will be renewed and its terms reaffirmed according to procedure customary when peace is concluded between warring nations.

As soon as the industry got on a sound basis, cane began to feel the benefit of the new order of things. Factories that had been closed were put in operation again and new enterprises were undertaken. Up to the year 1880 the manufacture of cane sugar had been conducted in a slipshod manner. The planters were lavishly extravagant and spent their incomes as they made them, giving no thought to putting aside funds for extensions and betterments. Hard times taught them a severe lesson, by which they profited, and with admirable courage they bent all their energies to the improvement of methods of cultivation and cutting down the cost of production. This was particularly true of Java; beginning with 1884, abundant new capital was brought in, experimental stations and laboratories were built and equipped and all that scientific knowledge, energy and sound business judgment could do was done. At the same time Hawaii, Mauritius, Porto Rico and Cuba made extraordinary progress, but each of these countries deserves an individual chapter.

BEET SUGAR IN THE UNITED STATES

While the manufacture of sugar from beet-roots is one of the foremost industries in the United States today, the early stages of its growth and development were marked by numerous failures and setbacks. The first beginning was made by a company headed by John Vaughn and James Ronaldson, which built a small factory in Philadelphia in 1830, where a few hundred pounds of sugar were produced. Owing to lack of knowledge of beet culture and extraction of sugar from the roots, the venture proved unsuccessful and no further attempt has been made in Pennsylvania.

Northampton, Massachusetts, was the scene of the next experiment in 1838 and 1839 by David Lee Child, who had studied the growth and manufacture of beet sugar in Europe for a year and a half. He succeeded in getting 6 per cent of sugar and 2½ per cent of molasses from the beets and his estimate of the cost of the sugar per pound was eleven cents. After producing 1300 pounds of sugar he abandoned the enterprise.

A report made in 1838 by the Committee on Agriculture, a government body, contains the following statement: “From all the information which the committee have been able to obtain, they are induced to believe that no country in the world is better adapted for the production of sugar beets than most parts of the United States, whether we consider the soil, the climate or the people.”[28]

In 1851 John Taylor, who afterward succeeded Brigham Young as president of the Mormon church, was carrying on missionary work in England, and in September of that year he met Elias Morris, whom he engaged to go to Utah to establish a plant for the manufacture of beet sugar.

Machinery for the purpose was purchased in France and sent to Liverpool, from where it was shipped to New Orleans in charge of Morris in March, 1852. From New Orleans it was taken up the Mississippi river to St. Louis, thence to Kanesville, Ohio, where it was loaded on wagons for transportation across the plains. The journey from the river was begun on July 4th, with oxen as the motive power. It proved long and arduous, but the members of the party reached Green river, Wyoming, four months later, having suffered much from hunger and cold. There they were met by a detachment sent out from Salt Lake city by Brigham Young and they finally arrived at their destination about the middle of November.

The original intention was to start operations at Provo, and the sugar machinery was taken there, but the company that John Taylor had organized was dissolved and the machinery turned over to the church, under whose direction it was installed in an adobe building still standing in Salt Lake city.

Once more lack of knowledge resulted in failure. Instead of sugar, the Mormons only succeeded in making a massecuite that was utterly inedible.[29]

In 1856, a coppersmith named Bepler erected a small beet-sugar factory at Ocean View, near San Francisco, California, but the enterprise was unsuccessful.[30]

The next noteworthy attempt was made at Chatsworth, Illinois, in 1863 by the brothers Gennert, who came from Braunschweig, Germany, and who were familiar with the methods of beet-sugar making. They formed the Germania Beet Sugar company, planted a thousand acres of land in beets and sent to Europe for machinery, but their highest extraction of sugar from the beet-roots was only 5.5 per cent. Weather conditions were unfavorable and the soil they selected was not suited to beet culture, so six years of effort ended in failure and the loss of more than a quarter of a million dollars. The plant was removed to Freeport, Illinois, where the final result was disaster.

Otto and Bonesteel, two Germans, established a factory at Fond-du-lac, Wisconsin, in 1866,[31] and during the two following years they achieved some measure of success. Subsequently, they moved to Alvarado, California, where they began operations in 1870. They managed to keep their factory running for a few years, but finally gave up the struggle in 1876.

In 1872 the state of New Jersey passed a law providing that all capital and property employed in the raising of sugar beets should be free from taxation for ten years. New ventures were undertaken in California, Delaware and Maine, and these states stimulated the industry by bounties, or tax exemption, or both. A factory was built at Hartford, Maryland, in 1879, but it was afterward abandoned, and the only going concerns engaged in the manufacture of beet sugar east of the Alleghanies during recent years were the small plants in New York at Rome and Lyons. Dismantled in 1905 and 1911, respectively, part of the machinery of the former was moved to Visalia, California, and the latter plant in its entirety to Anaheim, California.

All of these failures were traceable to the lack of practical knowledge of beet culture and the making of sugar from beet-roots. Then, too, the agricultural lands at first selected were unsuited to the purpose and the seed used up to the year 1890 gave beets of a low sugar content, from 6 per cent to 8 per cent. The development of the Western states gave the beet-sugar industry a permanent place in California, and a little later in Utah, Colorado, Idaho, Montana and Wyoming.

[Illustration: BUILDING IN SALT LAKE CITY, UTAH, IN WHICH THE FIRST BEET-SUGAR MACHINERY BROUGHT TO THE WEST WAS INSTALLED]

[Illustration: E. H. DYER. THE FATHER OF BEET SUGAR IN AMERICA]

The California Beet Sugar Manufacturing company was organized by E. H. Dyer and C. S. Hutchinson in 1869 with $250,000 capital and a factory was erected at Alvarado on Mr. Dyer’s ranch. Otto and Bonesteel were induced to leave Fond-du-lac, Wisconsin, and come west to assume the management. Operations were begun in 1870 and on November 17th of that year the first beet sugar was made in California. The factory and equipment cost $125,000; the daily capacity was fifty tons of beets and one

hundred and twenty-five men were employed. Between one thousand and fifteen hundred acres were planted in beets, the factory paying $3.50 per ton for them. The finished product cost about ten cents a pound, while the market price ranged from twelve to fifteen cents a pound. The first year's output was 250 tons, the second 400 tons, the third 562 tons and the fourth 750 tons. Then financial troubles came and the plant was closed. The machinery was sold to a new concern, which built a factory at Soquel, Santa Cruz county. This enterprise failed in 1876, but the plant was put in operation again in 1880, when 150 tons of sugar were produced. That was the end of the Soquel venture.

In 1879 Mr. Dyer bought the buildings and land of the old California Beet Sugar Manufacturing company, and, with O. F. Giffin, formed the Standard Sugar Manufacturing company, with a capital of $100,000. Subsequently a reorganization was effected under the name of the Standard Sugar Refining company and the capital was increased to $200,000. The machinery and diffusion batteries of a plant built at Brighton by some Sacramento people about eight years previous were purchased and installed at Alvarado in buildings newly erected for the purpose. While it is true that in the operation of this company there was a constant struggle to overcome obstacles and difficulties, it is nevertheless a fact that it achieved success from the beginning. In 1884 the capacity of the mill was increased to 100 tons of beets per day, but disaster overtook the concern toward the end of 1886. Two of the boilers exploded, making it impossible to operate during the season of 1887-88.

Nothing daunted, Mr. Dyer grappled with the problem once more and succeeded in floating a new corporation, the Pacific Coast Sugar company, with $1,000,000 capital and headed by John L. Howard as president. In 1887 and 1888 this company built the middle part of the present factory at Alvarado, where it installed most of the machinery from the old plant, together with some new apparatus. The campaign of 1888 was barren of results and in March of the following year the Pacific Coast Sugar company sold its property to a new concern, the Alameda Sugar company, whose first president was M. H. Hecht. In 1890 two additions to the factory were built, one at each end.

From small beginnings, this Alvarado enterprise, the pioneer of American success in the production of sugar from beets, continued its yearly operations from 1879 until 1914, with the exception of the year following the boiler explosion. In 1889 the output was 872 tons, in 1911 it reached 9966 tons. At the beginning of 1914, sugar prices were low and tariff prospects very discouraging. Under such conditions, the owners of the plant did not believe that they could make sugar at a profit, and the factory remained closed during that season. The sharp advance in sugar values, due to the war in Europe, completely changed matters; beets were planted and 6363 tons of sugar were produced in 1915.

For a long time Mr. Dyer was looked upon as an enthusiast and a dreamer whose sincerity was unquestioned, but whose energies were misdirected. In the midst of the gloomy forebodings of those around him, he held tenaciously to his purpose and devoted his brains and his money to the solution of the problem confronting him. That the beet-sugar industry of the United States proved a success when it did is due to his unfailing courage and persistent effort.

A year before the Alvarado factory was built, a number of moneyed men of Sacramento, head by Julius Wetzlar, then president of the Capital savings bank, conceived the idea of starting a beet-sugar plant there. After some experimenting with local beets, the Sacramento Valley Sugar company was organized and machinery for a seventy-ton plant was ordered from Germany. Construction was delayed for a year, and thus the Sacramentans lost the honor of being the first in the field. In 1871 they built a factory at Brighton, six miles east of Sacramento, near the American river. An expert was brought out from Germany and work was begun on November 18th. The first diffusion battery used in the United States was employed in the extraction of sugar from the beets. The season of 1871 gave good results, but the following year the crop suffered greatly from the ravages of the army worm. The campaign of 1873 opened on August 5th, lasting until November 22nd. The yield of beets was ten tons per acre, the average sugar content 8 per cent and the total output 982,120 pounds of sugar, including all grades.

This enterprise struggled along until 1875, in spite of troubles from drought, army worm, grasshoppers and last, but not least, lack of experience. The plant was then closed and the equipment put up for sale. Briefly, it may be said that at the outset very poor sugar was turned out, and later, when the quality was improved, the cost of manufacture was found to be greater than what the sugar would bring. The final outcome was that the stockholders lost nearly all the money they had invested.

About 1874,[32] the California Sugar Manufacturing company was formed. Sixty-eight acres of land at Isleton were bought, a factory structure of brick was erected and machinery installed, the total expenditure being about $250,000. Sugar of good quality was made, but the financial result was disastrous. Isleton land was ill suited to beet culture, as when the Sacramento river was high the beet fields were covered with water. One authority states that the original idea was to manufacture sugar from watermelons,

and when it was found that this was not practicable, attention was turned to beets.

In 1876 numerous mechanics' liens were filed against the company. Later, the factory was leased to H. M. Ames of Oakland, who operated it during the campaign of 1880. Two years afterward the entire plant was sold at sheriff's sale for $10,000. The land and building were purchased by P. H. Gardiner of Isleton and the machinery went to a San Francisco junk dealer. This venture is said to have caused financial distress to many of the farmers in the vicinity.

In 1888, Claus Spreckels, so long a prominent figure in the sugar world, established a beet factory at Watsonville, Santa Cruz county, in the rich Pajaro valley. At first its capacity was 300 tons of beets per day, and, the result of the operations being favorable, this was increased from time to time until it reached 1000 tons of beets per day. The Watsonville factory developed into the largest beet plant in America and remained so until 1898, in which year Mr. Spreckels erected a modern 3000-ton plant at Salinas, fifteen miles distant. Since then the new factory has sliced all of the beets grown in that territory and the old one has been dismantled. The capacity of the Salinas plant now is greater than that of any other beet factory in the United States, being 4000 tons per day.

The Oxnard brothers, Henry T., Benjamin, James G. and Robert, with J. G. Hamilton, W. Bayard Cutting and R. Fulton Cutting, organized the Oxnard Beet Sugar company in 1889, and in December of that year broke ground for a beet-sugar factory of 350 tons slicing capacity at Grand Island, Nebraska. In 1891 they built two more, one at Norfolk, Nebraska, and one at Chino, California, both of the same size as the Grand Island plant. The machinery for the first two factories was bought in France and that for the last one came from Germany. Toward the end of 1897, construction at Oxnard was begun, and in 1899 a consolidation of all these factories was effected under the corporate title of the American Beet Sugar company.

At the close of 1890, sixty years after the first experiment at Philadelphia, there were only three beet-sugar factories in operation in America; those at Alvarado, Watsonville and Grand Island. The total capacity of the three plants was eight hundred tons of beets a day, or ten thousand tons of sugar a year. France in the same period increased her production from 5000 to 770,000 tons a year through favorable legislation providing for the payment of bounties.

In the United States, whenever beet-sugar enterprises have been started, there has generally been some legal provision for payment by the state of bounty on the quantity of sugar produced. The story of how this responsibility was evaded is hardly a pleasant one. In Nebraska, for example, three different legislatures enacted laws providing for bounty on beet sugar, but in each case the following legislature either repealed the act or failed to make appropriations for the necessary funds. In the early nineties, Michigan passed a bounty law which resulted in several beet factories being established in that state, but when the claims for bounty were presented for payment, the state auditor refused to honor them, and his action was upheld by the state supreme court on the ground of unconstitutionality. A similar condition arose in Idaho. Minnesota paid bounties in 1890 and 1899, after which the law was declared unconstitutional.

The McKinley bill of April, 1891, was the first national legislation to encourage the beet industry. It called for a bounty of two cents on each pound of domestic sugar produced testing over 90 degrees, and admitted beet seed and sugar machinery free of duty. This encouraged the Oxnards to build the factories at Norfolk, Nebraska, and Chino, California, of which mention has already been made. At the same time Thomas R. Cutler and his associates put up a beet factory at Lehi, Utah, which state offered a bounty in addition to that granted by the Federal government.

The tariff act of August 28, 1894, abolished the bounty on sugar and fixed an ad valorem duty of 40 per cent. As a result of the loss of the bounty and the financial stress that reigned at that time, no beet factories were started except that at Menominee Falls, Wisconsin, which was a flat failure.

The following résumé of the United States tariffs on sugar since the year 1846 may be found useful for purposes of reference:

Tariff act July 30, 1846: All sugars 30 per cent ad valorem.

Tariff act March 3, 1857, to be effective from and after July 1, 1857: All sugars 24 per cent ad valorem.

Tariff act March 2, 1861, effective April 1, 1861: ¾c per pound on raw, 2c per pound on refined.

Tariff act August 5, 1861: 2c per pound on raw. Sugars above 12 D. S. and not yet refined, 2½c per pound. 4c per pound on refined.

Tariff act July 14, 1862, effective August 1, 1862: Sugars not above 12 D. S., 2½c per pound. Sugars above 12 D. S., not above 15 D. S., 3c per pound. Above 15 D. S., not above 20 D. S., and not stove dried, 3½c per pound. Refined and above 20 D. S., 4c.

Joint resolution of April 29, 1864, in effect for sixty days: Sugars not above 12 D. S., 2½c per pound plus 50 per cent equals 3¾c per pound. Sugars above 12 D. S. and not above 15 D. S., 3c plus 50 per cent equals 4½c per pound. Sugars above 15 D. S. and not above 20 D. S., 3½c per pound plus 50 per cent equals 5¼c per pound. All refined sugars 4c per pound plus 50 per cent equals 6c per pound.

Tariff act June 30, 1864, effective July 1, 1864: Sugars not above 12 D. S., 3c per pound. Sugars above 12 D. S., not above 15 D. S., 3½c per pound. Sugars above 15 D. S., not above 20 D. S., and not stove dried, 4c per pound. All refined sugars and all sugars over 20 D. S., 5c per pound.

Tariff act July 14, 1870, to be effective on and after December 31, 1870, which means January 1, 1871. Later amended by tariff act of December 22, 1870, to be effective immediately: Sugars not above 7 D. S., 1¾c per pound. Sugars above 7 D. S., not above 10 D. S., 2c per pound. Sugars above 10 D. S., not above 13 D. S., 2¼c per pound. Sugars above 13 D. S., not above 16 D. S., 2¾c per pound. Sugars above 16 D. S. and not above 20 D. S., 3¼c per pound. All sugars above 20 D. S. and all refined, 4c per pound.

Tariff act March 3, 1875: Sugars not above 7 D. S., 1¾c per pound plus 25 per cent equals 2.19c per pound. Sugars above 7 D. S., not above 10 D. S., 2c per pound plus 25 per cent equals 2.50c. Sugars above 10 D. S., not above 13 D. S., 2¼c plus 25 per cent equals 2.81c per pound. Sugars above 13 D. S., not above 16 D. S., 2¾c plus 25 per cent equals 3.44c per pound. Sugars above 16 D. S., not above 20 D. S., 3¼c plus 25 per cent equals 4.06c per pound. All sugars above 20 D. S. and all refined sugars, 4c per pound plus 25 per cent equals 5c per pound.

Tariff act March 3, 1883, effective June 1, 1883: Sugars not above 13 D. S. and not above 75-degree polarization, 1.40c per pound and .04c additional per degree or fraction thereof. Sugars above 13 D. S., not above 16 D. S., 2.75c per pound. Sugars above 16 D. S., not above 20 D. S., 3c per pound. Sugars above 20 D. S., 3½c per pound.

Tariff act October 1, 1890, effective April 1, 1891 (McKinley bill): Bounties effective July 1, 1891. Bounties declared unconstitutional by the United States supreme court: Bounty on domestic productions, sugars testing 80 degrees to 90 degrees, 1¾c per pound. Bounty on domestic productions, sugars testing at least 90 degrees, 2c per pound. All sugar not above 16 D. S., free. All sugar above 16 D. S., duty ½c per pound. All sugar above 16 D. S. from bounty-paying countries, duty ■/■■c per pound.

Tariff act August 27, 1894, effective August 28, 1894 (Wilson bill): Bounty on domestic production repealed. All sugars 40 per cent ad valorem. All sugars above 16 D. S. and all sugars discolored, 40 per cent and ■c per pound. All sugars from bounty-paying countries, ⅛■■c per pound additional.

Tariff act July 24, 1897 (Dingley bill): Raws not above 16 D. S. and not above 75-degree polarization, .95c per pound. Each additional degree or fraction thereof, .035c per pound additional. Sugar above 16 D. S. and all refined, 1.95c. All sugars from bounty-paying countries, countervailing duties equal to bounties additional.

Tariff act August 5, 1909 (Payne-Aldrich bill): Raws not above 16 D. S. and not above 75-degree polarization, .95c per pound. Each additional degree or fraction thereof, .035c per pound additional. Sugar above 16 D. S., and all refined, 1.90c per pound. All sugars from bounty-paying countries countervailing duties equal to bounties additional.

Tariff act October 3, 1913, effective March 1, 1914 (Underwood bill): Raws testing not above 75-degree polarization, .71c per pound. Each additional degree or fraction thereof, .026c per pound additional. No. 16 D. S. clause repealed. All Philippine sugars to be admitted free. After May 1, 1916, all sugars to be admitted free of duty.

In April, 1916, a bill was passed by Congress repealing the free-sugar clause of the tariff act of October 3, 1913. The President signed the bill on April 27, 1916.

The Democratic party was defeated in 1896 and the following year saw the passage of the Dingley bill, which levied a duty of 1.685 on 96-degree raw centrifugals under 16 D. S. in color and 1.95 on raws over 16 D. S. and on refined sugars. Under the beneficial influence of this law the industry revived and within a period of about two years from the enactment of the bill twenty-four beet factories sprang into being. One-half of the number were unsuccessful[33] because the stimulating provisions of the new tariff caused ventures to be made hastily and without regard to actual conditions. Of the twelve factories that survived, nearly all were situated in California and Michigan.

From 1900 to 1902 the building of beet plants was not so rapid, for the reason that the failures just mentioned and the popular demand for preferential terms for Philippine and Cuban sugars were not exactly encouraging. A 25 per cent preferential was given to Philippine sugars March 8, 1902, and a concession of 20 per cent of the duty was allowed Cuba December 27, 1903; still, notwithstanding the failures and the political agitation, five or six beet factories were erected each year during this period. The number of beet factories operating in the United States in 1915 was sixty-seven and the total daily slicing capacity was 73,320 tons. The acreage harvested was 611,301 acres, ninety-three per cent of which was worked by independent farmers and seven per cent by the factories. The total amount of beets sliced during that season was 6,150,293 short tons, which produced 874,220 short tons of sugar.

The following is a list of the factories themselves:

DATE SLICING BUILT CAPACITY ARIZONA

Southwestern Sugar & Land Co.[34] Glendale 1903 600 tons

CALIFORNIA

Alameda Sugar Co. Alvarado 1870 750 ” American Beet Sugar Co. Chino 1891 900 ” American Beet Sugar Co. Oxnard 1898 3000 ” Anaheim Sugar Co. Anaheim 1911 800 ” Holly Sugar Co. Huntington Beach 1911 1200 ” Los Alamitos Sugar Co. Los Alamitos 1897 800 ” Santa Ana Co-op. Sugar Co. Dyer 1912 1000 ” Southern California Sugar Co. Santa Ana 1909 600 ” Spreckels Sugar Co. Spreckels 1899 4000 ” Union Sugar Co. Betteravia 1898 900 ” Sacramento Valley Sugar Co.[34] Hamilton City 1906 700 ” San Joaquin Valley Sugar Co. Visalia 1906 450 ” Pacific Sugar Co.[34] Corcoran 1908 600 ”

COLORADO

American Beet Sugar Co.[34] Lamar 1905 400 ” American Beet Sugar Co. Las Animas 1907 800 ” American Beet Sugar Co. Rocky Ford 1900 1600 ” Great Western Sugar Co. Brush 1906 1100 ” Great Western Sugar Co. Eaton 1902 1000 ” Great Western Sugar Co. Fort Collins 1903 2000 ” Great Western Sugar Co. Fort Morgan 1906 1150 ” Great Western Sugar Co. Greeley 1902 1000 ” Great Western Sugar Co. Longmont 1903 2000 ” Great Western Sugar Co. Loveland 1901 1800 ” Great Western Sugar Co. Sterling 1905 1000 ” Great Western Sugar Co. Windsor 1903 1100 ” Holly Sugar Co. Swink 1906 1200 ” National Sugar Mfg. Co. Sugar City 1900 500 ” Western Sugar & Land Co. Grand Junction 1899 600 ”

IDAHO

Amalgamated Sugar Co. Burley 1912 725 ” Utah Idaho Sugar Co. Blackfoot 1904 860 ” Utah Idaho Sugar Co. Idaho Falls 1903 950 ” Utah Idaho Sugar Co. Sugar 1904 900 ”

ILLINOIS

Charles Pope Riverdale 1905 450 ”

INDIANA

Holland St. Louis Sugar Co. Decatur 1912 800 ”

IOWA

Iowa Sugar Co.[34] Waverly 1907 500 ”

KANSAS

Garden City Sugar & Land Co. Garden City 1906 900 ”

MICHIGAN

Continental Sugar Co. Blissfield 1905 900 ” German American Sugar Co. Bay City 1901 1500 ” Holland St. Louis Sugar Co. Holland 1899 400 ” Holland St. Louis Sugar Co. St. Louis 1903 600 ” Menominee River Sugar Co. Menominee 1903 1150 ” Michigan Sugar Co. Alma 1899 1400 ” Michigan Sugar Co. Bay City 1899 1400 ” Michigan Sugar Co. Caro 1899 1200 ” Michigan Sugar Co. Crosswell 1902 700 ” Michigan Sugar Co. Carrollton 1902 900 ” Michigan Sugar Co. Sebewaing 1902 850 ” Owosso Sugar Co. Lansing 1901 600 ” Owosso Sugar Co. Owosso 1903 1200 ” Mt. Clemens Sugar Co. Mt. Clemens 1902 600 ” Western

Sugar Refining Co.[34] Marine City 1900 600 ” West Bay City Sugar Co. West Bay City 1899 900 ”

MINNESOTA

Minnesota Sugar Co. Chaska 1906 700 ”

MONTANA

Billings Sugar Co. Billings 1906 2000 ”

NEBRASKA

Scottsbluff Sugar Co. Scottsbluff 1910 1850 ” American Beet Sugar Co. Grand Island 1890 400 ”

NEVADA

Nevada Sugar Co.[34] Fallon 1911 600 ”

OHIO

Continental Sugar Co. Fremont 1900 500 ” Continental Sugar Co. Findlay 1911 800 ” German American Sugar Co. Paulding 1910 900 ” Ottowa Sugar Co. Ottowa 1912 600 ” Toledo Sugar Co.[34] Toledo 1912 1100 ”

UTAH

Amalgamated Sugar Co. Lewiston 1905 900 ” Amalgamated Sugar Co. Logan 1901 750 ” Amalgamated Sugar Co. Ogden 1898 750 ” Utah Idaho Sugar Co. Elsinore 1911 620 ” Utah Idaho Sugar Co. Garland 1903 950 ” Utah Idaho Sugar Co. Lehi 1891 1165 ” Utah Idaho Sugar Co. Payson 1913 700 ” Layton Sugar Co. Layton 1915 450 ”

WISCONSIN

Chippewa Sugar Refining Co. Chippewa Falls 1904 500 ” Rock County Sugar Co.[34] Janesville 1904 600 ” U. S. Sugar Co. Madison 1906 600 ” Wisconsin Sugar Co. Menominee Falls 1901 600 ”

WYOMING

Sheridan Sugar Co. Sheridan 1915 750 ” ---------- Total capacity (76) U. S. factories 73,320 tons

TERRITORY OF HAWAII

The Hawaiian islands lie in the north Pacific ocean, between 18 degrees 54 minutes and 22 degrees 15 minutes north latitude and 154 degrees 50 minutes and 160 degrees 30 minutes west longitude. The group consists of eight inhabited islands and a number of small barren islets extending several hundred miles in a west-northwesterly direction.

The area of the various inhabited islands in square miles is as follows:

Hawaii 4210 Maui 728 Oahu 600 Kauai 547 Molokai 261 Lanai 139 Niihau 97 Kahoolawe 69 ---- Total 6651

All of them are of volcanic and comparatively recent origin, and their age, or at least the time since the last eruptions on them, decreases from west to east. On Hawaii, the largest and most easterly of the group, the volcanic forces are still active and its surface is covered with lava thrown up at no very remote period. The principal port is Hilo and the highest mountain peaks are Mauna Kea (White mountain), 13,823 feet, and Mauna Loa (Great mountain), 13,675 feet.

Maui is formed by two mountains connected by an isthmus. Mauna Haleakala, the higher of the two, rises to a height of 10,032 feet.[35] Kahului is the most important town and seaport.

Oahu is of irregular quadrangular shape. Two nearly parallel mountain ranges traverse it from southeast to northwest and between them is a plateau that slopes down to the sea both in a northerly and southerly direction. The principal port is Honolulu, the “cross-roads of the Pacific,” a flourishing city of about 60,000 inhabitants and the capital of the group. It is admirably situated on a fine harbor and, in addition to its commercial importance, is one of the most attractive spots in the world on account of its balmy climate and wondrously beautiful surroundings. It is strongly fortified and a considerable military force is maintained there.

Pearl Harbor lies about seven miles from Honolulu in a westerly direction. Here the United States government has established a great naval station, one of the finest in existence. It has the most improved apparatus for supplying coal or fuel oil to vessels; there are machine shops, storehouses and barracks; and the huge dry-dock when completed will accommodate the largest dreadnaughts. The entrance from the sea has been dredged to make it navigable for ships of the greatest draft and the station is protected by powerful long-range guns of the most modern type.

Kauai, the oldest island of the group, is irregularly circular in shape, with a maximum diameter of about 25 miles. On the northwest a precipice rises to a height of 2000 feet and beyond that is a mountain plain, but the other portion of the island consists of shore plains with the mountain peak, Waialeale, 5250 feet high, in their midst. The shore plains are broken by ridges and broad, deep valleys and the island is well watered on all sides by mountain streams. There are a number of ports, but no large towns.

The climate of the Hawaiian islands near sea-level does not vary greatly from one year's end to the other. It is cooler than other regions in the same latitude and extremely healthful. The northeast trade winds blow with periodic variations from March to December, or, as one writer says, 264 days out of 365 every year.[36] The leeward coast, protected by high mountains, is refreshed by regular land and sea breezes. The heaviest rainfall is from January to May, and naturally the greatest precipitation takes place on the windward side of the principal islands. The extremes of local rainfall in the larger islands have been known to range from 12 inches to 300 inches for the year. In Honolulu the average temperature runs from 72 degrees to 74 degrees, the maximum about 88 degrees and the minimum 52 degrees Fahrenheit. In ascending the mountains a lower temperature will be encountered as a matter of course and some of the highest mountain peaks are covered with snow nearly all the year round. Winds seldom blow with extreme violence and hurricanes are unknown.

Singular it is that so little should have been written upon a subject so important as the history of the growth of the sugar industry of the Hawaiian islands. Jarves and Thrum bring the narrative down to 1875 and Mr. H. P. Baldwin, in his book entitled "The Sugar Industry in Hawaii" (1895), contributes a fund of valuable information which is freely drawn upon in this chapter.

Tradition has it that a Japanese junk touched at the island of Maui during the thirteenth century and a Spanish vessel is said to have put in on the south coast of Hawaii during a voyage from Mexico to the Philippines in 1550. Be this as it may, our knowledge of these islands dates only from the time of their discovery by Captain Cook in 1778. He found sugar cane growing there when he landed and speaks of it in his description of his first visit as being "of large size and good quality." According to the old natives, it grew wild and luxuriant in the valleys and lowlands. As far back as 1837 Mr. D. D. Baldwin recalls having seen fields of white cane on the edge of the woods at Hana, Maui, at an elevation of 2000 to 3000 feet. The natives made no attempt to use sugar cane except as an article of food, although it is said that in ancient days it served as an offering to their gods, particularly the god "Mano" (shark).

Cleveland[37] says that upon his first visit to the Sandwich group in 1799 the natives came alongside the ship in canoes bringing many fruits and vegetables, among which was sugar cane.

L. L. Torbert, one of the early planters, in a paper read before the Royal Agricultural Society in January, 1852, claims that the earliest sugar factory was put up on the island of Lanai in 1802 by a Chinaman who came to the islands in one of the vessels trading for sandalwood. He brought with him a stone mill and boilers, and after grinding one small crop and making it into sugar, went away the next year taking his apparatus with him.

Anderson[38] makes a statement that 257 tons of sugar were exported from the islands in 1814, but cites no authority upon which to base his assertion.

According to Jarves[39] the first instance of the manufacture of sugar goes back beyond 1820, but the name of the pioneer planter is unknown. It is certain that at first molasses was manufactured and then sugar some time before 1820.

Don Francisco de Paula Marin made sugar in Honolulu in 1819, the year before the arrival of the first missionaries. Lavinia, an Italian, did the same thing in 1823. His method was to pound the cane with stone pestles on huge wooden trays (poi boards) by native labor, collecting the juice and boiling it in a small copper kettle.

Accounts from various sources agree that the making of sugar and molasses was general in 1823-24. This undoubtedly had direct connection with the manufacture of rum, which was extensively carried on at that time.

In 1828 a considerable amount of cane was raised in the neighborhood of Honolulu and mills were built in the Nuuanu valley and Waikapu, Maui. A pioneer cane grower, Antonio Silva by name, lived at the latter place, and some Chinamen had a sugar mill near Hilo. In those days mills were made of wood, very crudely put together and worked by oxen.

The first attempt at sugar cultivation on a large scale was made at Koloa, Kauai, by Ladd & company, a Honolulu merchant firm, in 1835. This was the beginning of what is now known as the Koloa plantation, and the first breaking of the soil for planting cane was done with a plough drawn by natives. A mill was established here at the same time, and the enterprise was managed by a Mr. Hooper.

As has been said, the general character of the mills was rude and primitive and it continued to be so up to 1850. The rollers were generally of wood and the kettles in which the juice was boiled were whalers' trypots. The buildings were adobe or simple grass huts. Only one grade of sugar was made. The juice was boiled to a thick syrup and put into coolers to grain, after which the granulated mass was packed in mats, bags, boxes or barrels with perforated bottoms for the molasses to drain off. The mills were run by bullocks, horses and in some cases by water power, and were fed by hand, one stalk at a time. The whole process, both in the field and in the mill, was very crude and imperfect.

The value of the sugar exported from the islands from 1836 to 1841 was $36,000 and that of the molasses for the same period $17,130.

An article by the late William Ladd on the "Resources of the Sandwich Islands," published in the "Hawaiian Spectator" for April, 1838, speaks thus prophetically of the manufacture of sugar, then in its infancy:

"It is a very common opinion that sugar will become a leading article of export. That this will become a sugar country is quite evident, if we may judge from the varieties of sugar cane now existing here, its adaptation to the soil, price of labor and a ready market. From experiments hitherto made, it is believed that sugar of a superior quality may be produced here. It may not be amiss to state that there are now in operation, or soon to be erected, twenty mills for crushing cane propelled by animal power, and two by water power."

Just here it may be remarked that at that time the price of labor was a potent argument in favor of making the islands a sugar-producing country, for native labor was available in abundance and the current rate of wages was from 12½ cents to 37½ cents per day, or $2.00 to $5.00 per month.

In an article on commercial development,[40] Thrum says:

"Hawaiian produce in the early days had to seek distant markets, for we find shipments of sugar, hides, goat skins and the first shipment of raw silk moving to New York per the bark _Flora_ in 1840. A trial shipment of sugar was sent to France, but it did not offer sufficient encouragement for any renewals. The Sydney market was also exploited with sugar, where it obtained better figures than similar grades of Mauritius."

Between the years 1840 and 1850 a cane field and rude mill in Lahaina, Maui, were owned by David Malo, a well-known Hawaiian, who made molasses and sold it for home consumption. His apparatus consisted of three whaling-ship trypots set up on adobe and stone mason work. The crushing was done with wooden rollers, strengthened by iron bands.

In 1841, Kaukini, governor of Hawaii, planted about one hundred acres of cane in Kohala and the crop when harvested was ground under contract by a Chinese named Aiko.

In Wyllie's "Notes" on the islands, published in the "Friend," December, 1844, the quantity of sugar exported from the island of Kauai is estimated at about 200 tons, and the molasses at 20,000 gallons. Hilo, in the same year, exported 42 tons of sugar. Maui had, at that time, two mills, but the amount of sugar produced is not reported.

In 1851, D. M. Weston, then manager of what is now the Honolulu Iron Works, invented the first centrifugal machine for drying sugar, and this machine was installed on the East Maui plantation in the same year. This, it is claimed, was the first centrifugal to be used for the purpose anywhere.

Prominent among the early planters are the names of Stephen Reynolds, William French, Ladd & company, Dr. R. W. Wood, L. L. Torbert, W. H. Rice, and later on S. L. Austin, A. H. Spencer and Captain Makee.

In the year 1854 or 1855, Captain Edwards of the American whaler _George Washington_ brought from Tahiti two varieties of cane, one known as Cuban and the other as Lahaina. The latter proved to be profitable to raise and fifteen or sixteen years later began to displace other species throughout the islands. Since then its popularity continued to increase and up to twenty years ago it was the variety most in favor on all Hawaiian plantations.

Twelve varieties of cane were imported from Queensland, Australia, in 1880, but of these only one—the Rose Bamboo—compared with the Lahaina in productiveness, and that only in high altitudes.

In 1898 Lahaina and Rose Bamboo seemed to have outlived their usefulness on the Hamakua coast of the island of Hawaii, and while they continued to give excellent results in the low, sheltered valleys, it became evident that they could not be profitably grown on the uplands. The yields in the Hamakua region were becoming smaller each year and the plantation owners had to seek a new variety. A cane known as Yellow Caledonia[41] solved the difficulty and wonderful crops of it have been raised uninterruptedly in that section ever since.

In 1856 no fertilizers were used and practically nothing was known of irrigation. The average yield of sugar at that time was one ton per acre. The extraction of sugar from the cane was less than 50 per cent, while today in the best mills it exceeds 98 per cent and the average result from all Hawaiian factories shows over 90 per cent.

The industry struggled along under severe handicaps and discouraging circumstances until 1857, when the number of plantations on the islands had dwindled down to five: Koloa and Lihue on Kauai, the East Maui and the Brewer on Maui and a Chinese outfit near Hilo, Hawaii.

In 1858-59 steam was adopted as the motive power in the mills; wooden mills were superseded by those built of iron and in 1861 the first vacuum pans were introduced. The same year saw the number of plantations increase to twenty-two, nine of which employed steam for the grinding of the cane.

The outbreak of the Civil war in the United States cut off the supply of sugar drawn from the Southern states and caused the price of Hawaiian sugar in kegs to advance to ten cents a pound. This gave the Hawaiian producers their first real start. In 1863 the export tonnage was 2600, and this increased until in 1860 it reached 8869 tons.

A small plantation was started at Paia, Maui, by a Captain Bush in 1868 and in the following year he disposed of it to S. T. Alexander and H. P. Baldwin. The former gentleman was then manager of the Haiku plantation and the acquisition of his interest in the Paia venture necessitated his going to Honolulu to borrow the sum of $9000, which he managed to do, but not without difficulty. Mr. Alexander was the father of irrigation in Hawaii. He promoted and built the Haiku ditch, which was the forerunner of the present magnificent water-distributing system of the islands.

The period from 1869 to 1876 was one of arduous struggle for the planters. Their very existence was at stake. The duty levied on imports by the United States cut their margins down to nothing, labor was scarce and the cost of obtaining it great, the rate of interest was from ten to twelve per cent, agents' commissions for buying and selling ran from five to ten per cent; in short, many plantations were threatened with utter ruin, and so seriously discouraged did the business men become that the only gleam of hope for the salvation of the sugar industry seemed to be annexation.

Repeated efforts were made to negotiate a reciprocity treaty with the United States. Finally this was accomplished; the treaty was consummated in 1876 and a new Hawaii was born.

The expansion that followed was more rapid than the finances of the country could stand. Depression ensued, and as a result the resources of the islands were taxed to the utmost.

The demand for labor during this period of expansion was so great that the pay of the laborers in the fields was raised to one dollar a day, with free rent, fuel and medical attendance. Laborers were sought for in the far corners of the earth, and in consequence the islands have a race mixture rarely found anywhere else in the world.

In 1876 the annual crop of the islands could have been put in one vessel of the capacity of those that are now engaged in freighting Hawaiian raw sugars to the United States, the total being in the neighborhood of 13,000 short tons. At that time, however, this seemed an enormous amount to the planters with their small acreage and mills. It is well known that one planter was very much exercised as to how he was possibly going to handle the extraordinary production of 1100 tons from his plantation, which was then the largest in the islands.

The crop came on the market in such small quantities that it was of no value to refiners, as they could not depend upon definite deliveries. It was therefore put up in special containers, known as “island kegs,” and sold directly to the wholesale grocers on the Pacific coast.

Some plantations turned out sugars that found especial favor with the trade, and these grades brought as high as 14 cents per pound.

Under the benefits of reciprocity the crop increased by leaps and bounds and in a short time the planters ceased selling these raw grocery sugars and turned their attention to supplying the wants of refiners. The “island keg” became a thing of the past and the small sailing vessels which had heretofore carried all the island products to the mainland gave way to steamers. At the present day there is only one sailing vessel plying regularly between San Francisco and the islands, and she usually loads at a port where the large freighting steamers do not care to venture.

Annexation to the United States in 1898 was the next important step in the development of Hawaii. Its immediate effect was to create a feeling of security and confidence in every direction, for while the reciprocity treaty had produced excellent results, the danger of its being made the subject of attack in Congress was ever present. The hoisting of the American flag in the islands permanently dispelled any anxiety on that score.

Of all the early pioneers whose steadfastness and courage kept the sugar industry alive through so many vicissitudes, but few survive. Their descendants have succeeded to their possessions and responsibilities, and today in Hawaii cane cultivation and sugar manufacture have attained a higher degree of development than has been reached by any other country in the world. Crude methods and appliances have long since disappeared. Scientific principles govern the treatment of the land and the selection and care of the cane. The irrigation works are marvels of engineering skill. The mills are modern steel-frame structures, with concrete floors and equipped with machinery of the most improved type. And the end is not yet. The minds of many highly trained men are constantly at work upon the various problems presented by the industry, and what the fruit of their effort will be, who shall say?

Production of Hawaii since 1837 in tons of 2240 pounds:

1837 2 1838 40 1839 45 1840 161 1841 27 1842 ... 1843 511 1844 229 1845 135 1846 134 1847 225 1848 223 1849 292 1850 335 1851 9 1852 312 1853 287 1854 257 1855 129 1856 248 1857 313 1858 538 1859 816 1860 645 1861 1,144 1862 1,342 1863 2,363 1864 4,649 1865 6,838 1866 7,915 1867 7,646 1868 8,175 1869 8,171 1870 8,386 1871 9,715 1872 7,587 1873 10,326 1874 10,967 1875 11,197 1876 11,640 1877 11,418 1878 17,157 1879 21,884 1880 28,386 1881 41,870 1882 50,572 1883 50,941 1884 63,685 1885 76,496 1886 96,528 1887 94,984 1888 105,307 1889 108,110 1890 115,977 1891 122,761 1892 109,178 1893 136,269 1894 148,600 1895 133,596 1896 201,632 1897 224,200 1898 204,834 1899 252,506 1900 258,522 1901 321,463 1902 317,510 1903 391,063 1904 328,103 1905 380,579 1906 383,226 1907 392,872 1908 465,288 1909 477,818 1910 461,687 1911 506,090 1912 531,480 1913 488,212 1914 550,926 1915 577,183 1916 545,000

LOUISIANA

The cane crop of Louisiana comes from the southern part of the state, principally along the banks of the Mississippi, the Bayou Teche and the Bayou Lafourche. As this region is outside the tropics, being between 29 degrees and 31 degrees north latitude, frosts must be looked for in winter. The sugar industry of Louisiana, therefore, as well as that of Texas, Florida and Georgia, has to cope with climatic conditions that are unknown in most other cane-producing countries.

All of the sugar plantations are situated in the low plains, the highest elevation above sea-level not exceeding 83 feet. The annual rainfall varies from 67 to 95 inches, and 80 inches may be taken as a fair average, which amply suffices for the needs of the growing cane. In December, January and February there is always the danger of frost and planters must be constantly alert to guard against this as far as possible. During the autumnal equinox much damage to the cane is caused by hurricanes that rush in from the Gulf of Mexico.

Sugar cane was brought to Louisiana in 1751. According to Gayarré, two ships that were transporting troops from France to Louisiana touched at a port in Hispaniola during the voyage and the Jesuits of the island obtained permission to put some sugar cane on board these vessels to be taken to Louisiana and there delivered to their Jesuit brethren.

The same means were employed to send a number of negroes to cultivate the cane, which was planted according to direction on a piece of ground belonging to the order situated just above the present course of Canal street, New Orleans. The cane grew to maturity and was sold in the market as a luxury.

In 1759 a rich colonist, Dubreuil by name, built a mill and attempted to make sugar, but his efforts were unsuccessful and the idea was abandoned. _Tafia_, a kind of rum, was made from sugar cane shortly afterward.

In 1791 Don António Mendez, an officer of the Spanish crown who lived in St. Bernard parish, bought from a Spanish refugee from Santo Domingo named Solis his land, crop of cane and distilling outfit and attacked the problem with a firm determination to conquer it. He called in a Cuban sugar maker named Morin to assist him, but whether it was that he lacked the means to erect a proper factory, or whether he became discouraged, the fact remains that he only succeeded in turning out a few small barrels of sugar. There is evidence that he did something in the way of refining as well, but not in an appreciable quantity.

The first crop of sugar sufficiently large and profitable to serve as an incentive to others was raised by Etienne de Boré about 1794. Of this achievement Gayarré says: “When the whole agricultural interest of Louisiana was thus prostrated and looking around for the discovery of some means to escape from annihilation, and the eager and anxious inquiry of every planter was ‘What shall I do to pay my debts and support my family?’, the energy of one of the most spirited and respected citizens of Louisiana suddenly saved her from utter ruin and raised her to that state of prosperity which has increased with each successive year.”[42]

In 1794 de Boré purchased seed cane from Mendez and Solis and after planting it he went ahead with his preparations for harvesting, crushing and manufacturing. The following year the sugar he produced sold for $12,000, a considerable sum of money in those days. The boiling of the sugar juice to grain was done under the direction of Antoine Morin, the former associate of Mendez. The method was naturally very primitive, the mill being driven by animal power, and much sugar was lost in the bagasse.

Following the example of de Boré, many planters set out cane and built sugar mills. Their operations were highly successful and they all became wealthy within a comparatively short period.

The industry continued to flourish and prosper, and the year 1820 marked a decided step forward. Up to that time the only two kinds of cane that had been grown in Louisiana were the Creole (from Malabar or Bengal) and the Tahiti. The cane originally planted by de Boré and from which he made his first sugar was the Creole; the Tahiti variety was not introduced from Santo Domingo until 1797. It became patent to the planters that neither of these canes was suited to the Louisianan climate, and they set about looking for a hardier plant. Toward the middle of the eighteenth century the purple and striped varieties were brought by the Dutch from Java to the island of St. Eustatius, and from there a quantity of these canes was taken to Savannah, Georgia, about 1814. They throve extremely well and a former resident of Savannah who had moved to Louisiana and become a planter there, having heard about them, secured some for seed purposes. His experiment proved wonderfully successful and from this single estate the cultivation of the new canes spread over the entire sugar-producing region. As these varieties could stand greater cold than the Creole and the Tahiti, the planters were able to extend their growing area northward and in this way greatly increase their acreage. As recently as 1897 these canes still constituted the crops of Louisiana with a few exceptions.

Of late years, however, seedling canes obtained from Demerara have come into great favor in consequence of the researches of the botanists at the experiment station. In addition to an advantage both in cane and sugar over the varieties previously used, the time of vegetation is shorter, so that the canes mature earlier, and this, on account of the short season in which Louisianan cane has to ripen, makes the Demeraran decidedly desirable. It has also been proved that Demeraran cane is better able to resist damage by storms, so that taking it all in all it would appear that the newer varieties are quite likely to displace the older kinds.

Cane is usually planted in the same ground every three years. The crop of plant cane is followed by a crop of ratoons and then maize is put in. As soon as the maize is cut the field is sown with a species of large pea (_Vigna sinensis_) and when summer is over the pea vines and the maize stubble are ploughed under. A month after this is done, furrows are dug about six feet apart and early in October cane is planted once more. In this operation two rows of whole cane stalks are placed in the furrows and covered with five or six inches of earth as a protection against frost. Most of this layer of earth is removed in the spring to help the growth of the young cane shoots. Stable manure, cotton-seed meal, nitrates, phosphates and kainite are used as fertilizers.

Harvesting begins at the end of November, and, weather permitting, the cane is allowed to remain standing in the fields until required for grinding. If, however, the Government Weather Bureau should predict cold, the cane is cut without delay, piled in the furrows and covered with dry cane leaves to prevent it from freezing. Cane stored in this manner keeps well so long as the weather

remains cold, but as soon as warm weather comes it rapidly deteriorates.

Labor in Louisiana is both scarce and costly, consequently agricultural machinery is used in the fields as far as possible.

[Illustration: HAULING CANE IN THE FIELDS, LOUISIANA]

[Illustration: HAULING CANE IN THE FIELDS, LOUISIANA]

The steam engine was first employed in the crushing of cane in the year 1822. About this time, when slavery was such a tremendous factor in the South, sugar raising was marked by a tendency toward the large plantation method. From 1830 to 1840 the number of plantations in Louisiana decreased, but the number of slaves employed on them increased 40 per cent. Later, however, the plantations began to grow in number and by 1853 there were more than fifteen hundred of them, as against 668 thirteen years previous. In those days, each plantation had its own sugar mill, so that 1853 may be taken as close to the high-water mark for the number of mills in the South. With the outbreak of the Civil war, the industry was virtually wiped out of existence, and when its rehabilitation was begun, it was carried on along entirely different lines and the separation of the raising of sugar from the manufacture was gradually brought about. Year by year the small mills were abandoned and the crops of cane raised by the planters, large and small, were brought to the central factory to be worked up. Today, where large plantations still exist, it is the practice to rent subdivisions of land from twenty to fifty acres in size to tenants who grow cane for the central mill.

In 1880 there were 1144 small sugar mills in Louisiana and their output of sugar was 121,886 tons. In 1911, 187 mills handled a crop of 5,930,000 tons of cane which gave 308,439 tons of sugar, and this would have been considerably exceeded had it not been for a disastrous freeze. In 1880, 273 factories used horse power, in 1900 only 5, in 1905 none at all. The advent of the vacuum pan and the consequent abolition of the open-kettle method marked another great advance in manufacturing development. In 1880 about 42 per cent of the sugar produced in Louisiana was turned out by factories equipped with vacuum pans. The government statistics for 1909 show a total of 316,829 tons of sugar boiled in vacuum pans and only 3,678 tons of open-kettle sugar.

As has been said, the growing season for cane in Louisiana is limited and the harvesting is done before the plant has attained its full maturity. Whether or not this has any effect upon the flavor of the sugar and molasses produced is a moot point. It is none the less true, however, that the Louisiana “Clarifieds” and the so-called New Orleans molasses possess a flavor distinctively their own.

In the plantation fields, too, the scientists have worked wonders. To illustrate the benefit resulting from the application of modern methods to the cultivation of cane, in 1885 the average yield of cane per acre in Louisiana was about three-quarters of a ton, while in 1909 the average yield per acre in cane was about 20 tons, the recovery of sugar per ton of cane over 157 pounds, or 3140 pounds of sugar per acre.

The Louisiana state experiment station was established by the sugar planters at Audubon park, New Orleans, in 1885 and endowed for a term of years. This institution has grown in importance until at the present time it has ample grounds, well-equipped laboratories and a sugar house with an installation of the latest and best sugar-manufacturing machinery, all directed and operated by the students of the institution. Here is carried on the work of developing seedlings, improvement of cane varieties, investigation of cane diseases, together with the study of all questions of bettering plantation and factory methods.

The sugar production of Louisiana in long tons from 1860-61 to the present time is as follows:

1860-61 117,431 1861-62 235,856 1862-63 43,232 1863-64 39,690 1864-65 5,331 1865-66 9,287 1866-67 21,074 1867-68 19,289 1868-69 42,617 1869-70 44,382 1870-71 75,369 1871-72 65,635 1872-73 55,891 1873-74 46,078 1874-75 60,100 1875-76 72,958 1876-77 85,102 1877-78 65,835 1878-79 106,909 1879-80 88,836 1880-81 121,886 1881-82 71,304 1882-83 136,167 1883-84 128,318 1884-85 94,372 1885-86 127,958 1886-87 80,858 1887-88 157,970 1888-89 144,878 1889-90 128,343 1890-91 215,843 1891-92 160,937 1892-93 201,816 1893-94 265,836 1894-95 317,306 1895-96 237,720 1896-97 282,009 1897-98 310,447 1898-99 245,511 1899-00 147,164 1900-01 270,338 1901-02 321,676 1902-03 329,226 1903-04 228,476 1904-05 355,530 1905-06 336,751 1906-07 188,571 1907-08 302,855 1908-09 273,178 1909-10 269,431 1910-11 263,308 1911-12 315,066 1912-13 137,119 1913-14 261,337 1914-15 216,696 1915-16 122,768

PORTO RICO

Porto Rico, the most easterly and the fourth in size of the Greater Antilles, lies at the entrance to the Caribbean sea, between 17 degrees 50 minutes and 18 degrees 30 minutes north latitude and between 65 degrees 30 minutes and 67 degrees 15 minutes

west longitude. It is about 100 miles long by 36 miles wide and has an area of 3606 square miles.

A range of mountains from 2000 feet to 3700 feet in height runs from east to west. The south slope of the island rises abruptly from the foothills, while on the north the ascent is more gradual and broken to a great extent by rugged spurs and deep ravines. There is but little coastal plain on the north, except at the river mouths, but on the south a considerable stretch of lowlands is found. Although many indentations occur in the coast line, few of them afford safe shelter for ships. There are thirty-nine rivers and a great number of smaller streams, but none of the rivers is navigable for more than a mile or two from the sea.

The climate is healthful and is tempered by the northeast trade winds that, with certain modifications due to local conditions, blow steadily the year round. The mean annual temperature is about 80 degrees Fahrenheit. The rainy season begins in May and ends in November and the average yearly precipitation at the foot of Mount El Yunque on the northeast coast is 120 inches. At San Juan it is 55 inches, while other sections of the island are semi-arid or subject to severe droughts. Porto Rico is particularly free from epidemics. The last case of yellow fever was reported in 1897. Cholera and bubonic plague are unknown, and dysentery diseases, formerly common, are steadily decreasing. Like other West Indian islands, it is subject to hurricanes, that of 1899 having been unusually disastrous. The census of 1910 gave the population as 1,118,012.

[Illustration: _A. Moscioni, Photo._

SUGAR PLANTATION SCENE IN PORTO RICO]

[Illustration: _A. Moscioni, Photo._

SUGAR-SHIPPING PORT, PORTO RICO]

The soil is fertile and may be divided into three classes. First, the red soil, generally found in the mountains; second, the black soil, containing much humus, and third, the coral sand soil of the coast plains. The black has proved to be the best for sugar cane, although excellent yields have been obtained from the coast lands. Notwithstanding the fact that both soil and climate are well suited to cane cultivation, the extension of the industry is checked by the formation of the country. The hilly character of the island and the comparatively limited transportation facilities do not admit of cane being grown in the interior. All of the modern plantations are near the coast, where sugar can be easily transported to steamers. In the north cane may be raised without irrigation, but in the south, where the greater part of the crop is produced, irrigation is necessary. About 400,000 acres of the surface of Porto Rico are under cultivation and half of this area is devoted to sugar. The cane grows chiefly on the rich alluvial lowlands along the coast. On the southern seaboard there is plenty of good land that has never been planted, but to make this available for agriculture means the construction of costly irrigation works with extensive aqueducts and much tunneling.

Porto Rico was discovered by Columbus in 1493. The name Puerto Rico dates from 1521, when gold was found in the island. The natives suffered cruelly at the hands of their conquerors up to the year 1544, when they were set free by the order of King Charles I of Spain.[43] Out of a population originally estimated at 600,000 only a few hundred remained. Great numbers had died and many had fled to Mexico and Peru, but the Spaniards soon filled their places with African negroes.

For three centuries the island was harried by the English, attacked by pirates and freebooters, torn by rebellion among the slaves or terrorized by the fleets of the Dutch, who were intent upon its conquest, so that Spain was kept constantly on her guard to prevent her colony from being wrested from her. This state of affairs naturally did not encourage population. The country could not meet the cost of its administration and the deficit had to be paid out of the revenues of Mexico. Up to 1778 only Spaniards were allowed to settle there, but after that date the privilege was granted to people of other countries, provided they were of the Roman Catholic faith, and in 1815 all restrictions were removed. Foreigners were welcomed to the island and many inducements offered them. Trade with the United States was permitted in 1815, but only in Spanish ships.

This liberal policy brought many planters from the British and French islands, and as they had experience, capital and slaves, they did much to develop the resources of the colony. Subsequently many refugees came from Haiti, Santo Domingo and Venezuela.

Slavery in Spanish possessions was abolished in 1873 and 34,000 slaves in Porto Rico received their freedom.

After Alphonso XII ascended the Spanish throne in 1875, commercial conditions in the island showed a certain improvement, but politically the situation was deplorable, reflecting as it did all the bad features of an obsolete system of government, complicated by a liberalism that was premature. By reason of its arbitrary decrees and many acts of persecution, the administration stirred up a feeling of bitter antagonism on the part of the colonists. A step toward reform was taken in 1877, when the provincial deputation

was re-established, and eighteen years afterward, the home government, in response to vigorous demands from foreign nations, attempted to pass measures to effectively remedy existing evils, but it was far too late. The island received a grant of autonomy in November, 1897, and in July of the following year it was taken over by the United States.

[Illustration: _A. Moscioni, Photo._

PLOUGHING CANE FIELD WITH STEAM PLOUGH, PORTO RICO]

[Illustration: _A. Moscioni, Photo._

UNLOADING SUGAR CANE AT A MILL, PORTO RICO]

As soon as this became an accomplished fact, there was a marked improvement in conditions, especially from a sugar point of view. Up to this time much attention had been given to the cultivation of coffee, and sugar production had suffered to a certain extent in consequence. Spain had admitted Porto Rican coffee free while protecting it by duties levied on foreign coffee, but when the island passed into the hands of America, this advantage to the coffee raiser disappeared. Besides, the hurricane of 1899 had caused great damage to the coffee plantations and the combination of circumstances proved a severe setback to the coffee industry.

The sugar planters, on the other hand, benefited greatly by annexation. In 1889 the government allowed a reduction of 85 per cent on the duty assessed on Porto Rican sugars entering the United States. In 1901 they came in absolutely free and Porto Rico has enjoyed the full protection of the tariff ever since.

In 1900 Congress passed a law known as the Foraker act, which provided that no corporation should be allowed to acquire more than 500 acres of land in Porto Rico and that no stockholder in any agricultural company operating there should be permitted to hold shares in any other corporation of the kind. The object of the law was, of course, to prevent capitalists from buying up great tracts of land for the cultivation of sugar on a large scale to the detriment of the native land owner.

The act, however, did not serve the interests of the small Porto Rican farmer as its framers apparently intended it should. The owners of large holdings were non-resident and the small farmers lacked the money and enterprise to carry on the industry in a proper manner. The law excluded that which was most urgently needed, namely foreign capital, and when this fact became apparent, the provisions of the measure were construed liberally by the authorities, so that of late years extensive sugar estates have been started in Porto Rico with American, British and French backing, and the production has grown from 85,000 tons in 1902 to 378,509 tons in 1916.

Formerly the Porto Rican planters used to harvest cane from the same lands year after year, without using fertilizers of any kind. When they planted new cane, the soil was only partially prepared; the subsoil was never cleared of roots and rough grasses and cultivation was only indifferently done. The result is that many cane fields are now practically exhausted and some planters find that their lands are becoming spoiled by rapidly multiplying weeds.

Today the usual method is to plough the ground twice before putting in the seed. Deep ploughing is taking the place of scratching the surface and steam ploughs are being used on the larger estates. Where the soil is heavy and the rainfall abundant, the furrows are dug about eight feet apart and two feet deep and the cane planted in double rows at four-foot intervals. In dry, sandy soil the planting is in single rows and the distance between the furrows ranges from four to six feet, according to how rich the soil is. The fields are kept free from weeds and manure is used but seldom.

The greater part of the cane is planted during the last four months of the year and crushing is begun in the second January following, which gives the cane a growing period of fourteen months or more. Some planting is done in January, February and March and this cane is cut in twelve months. Then a certain amount is planted between March and June, and if the sugar content proves satisfactory, it is ground the following season; if not, it is allowed to remain standing for another year. Planting is done every four years and the best results are obtained from the first and second ratoon crops. The yield of cane per acre averages about 18 long tons, although this has been exceeded in good years. The cane is cut close to the ground with a _machete_ and loaded on ox-carts to be taken to the mill or the railway station, according to the location of the field.

Almost all of the cane grown in Porto Rico is ground in the large central factories, but it is only during the last ten or twelve years that this has been done. The small mills have disappeared for the most part, although a few have been able to struggle along.

The centrals usually raise about one-half of the cane they grind. The rest they buy from the _colono_, who grows cane either on his own land or upon ground rented to him by the central owner. As a rule the price paid to the _colono_ for his cane is 5 per cent of the weight of the cane in sugar, although this is subject to modification at times. As the central factories are of recent construction, they are equipped with the newest and best machinery and the most scientific methods govern their operation.

In 1853 Porto Rico exported 112,000 tons of sugar; the following year the amount was 70,000 tons and during the next twenty years it remained nearly stationary. In 1871 the production reached 105,000 tons, dropping back to 89,000 tons in 1885 and 65,000 tons in 1886. The crop of 1900 was very small—35,000 tons—owing to the havoc wrought by an unusually severe hurricane, but from that time on it has increased year by year.

As most of the diseases and pests that attack sugar cane are met with in Porto Rico, it is obvious that the work of the United States agricultural station at Mayaquez has been of inestimable benefit to the planters. Experimenting with different varieties of cane, importing seed cane from other countries, analysis of soils, scientific advice upon the use of fertilizers and instruction as to the best means to destroy or control harmful parasites, these are but a few of the many important services rendered by the station.

The outlook for Porto Rico's sugar industry seems hopeful. Labor is cheap and abundant, climatic and soil conditions are favorable and an irrigation project at present under way promises to convert lands now arid into productive cane fields.

Since 1900 the production of sugar in Porto Rico in tons of 2240 pounds has been:

1900 35,000 1901 80,000 1902 85,000 1903 85,000 1904 130,000 1905 145,000 1906 213,000 1907 210,000 1908 200,000 1909 245,000 1910 308,000 1911 295,000 1912 320,000 1913 350,323 1914 325,000 1915 308,178 1916 378,509

THE PHILIPPINES

This group of islands is situated about 500 miles off the southeast coast of Asia, between 4 degrees 10 minutes and 21 degrees 10 minutes north latitude and between 116 degrees 40 minutes and 126 degrees 34 minutes east longitude. It is bounded on the west and north by the China sea, on the east by the Pacific ocean and on the south by the Celebes sea. It comprises 3141 islands, of which 2775 contain less than one square mile each. According to the Philippine census of 1903 the total area is 115,026 square miles,[44] although some authorities estimate it to be as much as 127,800 square miles. Two-thirds of this is forest land and not more than 9½ per cent of the entire archipelago was classified under _Farms_ in 1903. The area devoted to sugar cane the year previous was 177,628 acres, about 5 per cent of the cultivated land.

The islands are chiefly of volcanic origin and their surface is much broken by hills, isolated volcanoes and mountain ranges running north and south, northwest and southeast or northeast and southwest. There are twelve active volcanoes in the group and eight others with well-defined cones that are either dormant or extinct. The highest elevation in the islands is Mount Apo, an extinct volcano on Mindanao, 10,312 feet, with Mount Mayon, an active volcano on Luzon, next, 8970 feet. Earthquakes are frequent and occasionally violent.

The most important of the group are Mindanao, Luzon, Samar, Palawan, Panay, Negros, Leyte, Mindoro, Cebú, Masbate and Bohol. The coast line, which is over 11,000 miles in length, is fringed with coral reefs and indented by many gulfs and bays. There are plenty of good natural harbors, the principal one being Manila in Luzon, which affords perfect shelter for shipping, even in the severest storms. Next in importance are the harbors of Iloilo and Cebú.

Climatic conditions vary widely. However, it may be said in a general way that the climate is characterized by a uniformly high temperature, excessive humidity, heavy rainfall and violent tropical storms. Near the seacoast, it is moderate between November and the first of March. The latter part of March and the months of July, August and September are warm and very hot weather comes in April, May and June. The nights, however, are always cool. The temperature naturally changes as the elevation above the sea increases, but at ordinary levels it averages 77 degrees Fahrenheit in January, and 83 degrees in May.

The annual rainfall is about 74 inches, and two-thirds of this comes in July, August, September and October. Of course the precipitation in certain localities is affected by mountain ranges that cause condensation from moisture-laden trade winds. In the lowlands that are not protected by mountains, the rainfall is regular. Typhoons occur between April and October, but they are not nearly so severe as the hurricanes that visit the West Indies and Mauritius. In October, 1882, a typhoon did a great deal of damage in Manila, and there was a serious loss of life in the great storm that visited Samar and Leyte in 1897. The well-appointed observatory in Manila sends out warnings of the approach of typhoons and much life and property are saved by this means.

The soil is generally reddish-brown in color and is largely made up of disintegrated lava with an admixture of decayed vegetable matter; sometimes decomposed coral limestone is present.

[Illustration: PLOUGHING FIELD BEFORE PLANTING CANE, PHILIPPINES]

[Illustration: PLOUGHING AT LA CARLOTA, OCCIDENTAL NEGROS, PHILIPPINES]

John W. Dwinelle, in an address delivered in San Francisco in 1866, said: “Previous to the discovery of America by Columbus in 1492, the Portuguese had discovered the Azore islands in longitude 31 W., and on the strength of that discovery claimed that the countries discovered by Columbus belonged to the crown of Portugal, and that the Spaniards should be wholly excluded from them. But the Spaniards refused to admit this pretension and referred the matter for decision to the Pope, Alexander VI. It was then part of the law of nations, and of the public law of the world, that the Pope was the ultimate source of all temporal power; that he could make and unmake kings, and dispose of all the kingdoms of the earth—powers which he frequently exercised and against which it were vain to contend. He was therefore, by general consent, the acknowledged source of all lawful title to land. He assumed to decide the case thus referred to his decision, and on May 3d, A. D. 1493, determined the matter in dispute between the crowns of Portugal and Spain, by drawing an imaginary line of longitude one hundred leagues west of the Azores, and granting to the Spanish monarchs all countries inhabited by infidels, which they had already discovered, or might afterwards discover, lying to the west, and to the crown of Portugal all those lying to the east of that line. This line was afterwards removed two hundred and seventy leagues further to the west, by a treaty subsequently made in the year 1494, between the kings of Portugal and Spain; but so thoroughly was the title thus conceded by the Pope respected by the civilized world, that when Henry VII of England was afterwards about to intrude upon some of the dominions thus granted to Spain, he abandoned his project upon being warned by the Pope to desist.”

This division of the surface of the globe into two parts gave to Portugal all the territory both known and unknown east of the arbitrary meridian drawn 470 miles west of the Cape Verde islands, and to Spain everything west of this line.

Ferdinand Magellan, the famous Portuguese navigator, in the service of the Emperor Charles V of Spain, set out on a voyage west-bound with the object of taking possession of the Moluccas, as they lay west of the line of demarcation. Sailing around Cape Horn, Magellan discovered the Philippine islands in 1521, landing first on Malhou, between Samar and Dinagat. Afterward, he touched at Mindanao, from which he sailed to Cebú. Thence he went to the small island of Mactan, where he was killed in a skirmish.

But little action was taken with regard to this territory until after the accession of Philip II (hence “las Filipinas”—Philippines), when an important expedition was fitted out at the Mexican port of Navidad. It sailed in November, 1564, under the command of Miguél Lopez de Legaspi, the distinguished conquistador, who, in the following year established on the island of Cebú the first permanent settlement in the Philippines. The city of Manila was founded in 1571 and became the capital of the group. Through his tact, courage and resourcefulness, Legaspi won the confidence of the people and placed the colony on a sound footing. At the same time he checked all attempts at encroachment on the part of the Portuguese. Spanish rule was undisturbed until 1762, when a British naval force bombarded Manila and occupied it. At the conclusion of the war between Great Britain and Spain in 1764, the British withdrew and the domination of Spain endured until 1898, when the Spanish fleet was destroyed by Dewey at Manila bay.

The title to the Philippines therefore passed through the Pope to Spain and from Spain to the United States.

When Magellan reached these islands he found that sugar was made in a primitive fashion. The methods employed were very much like those in vogue in China, and the sugar, when made, greatly resembled the Chinese product. This is very strong presumptive evidence that cane and the knowledge of its manufacture were originally brought to the Philippines by the Chinese.

[Illustration: HAULING CANE, PHILIPPINES]

[Illustration: CARABAO MILL, PHILIPPINES]

The industry, however, amounted to very little prior to 1849, in which year the island of Negros was placed under the jurisdiction of the religious order of Recoletos, who did much to encourage the manufacture of sugar, and this movement was stimulated by the high prices resulting from the Crimean war. In consequence, cane sugar was exported with profit from Negros, Luzon and Cebú. Notwithstanding the lack of capital, the rough, crude mills, the planters’ scant knowledge of manufacturing methods and the wretched transportation facilities, the sugar trade forged rapidly ahead until in 1893 the exports totaled 257,550 long tons. A slump in the price of silver, however, brought on a financial crisis, and subsequently internal dissensions affected the crops so that in 1901

only 51,448 tons were exported. Since then a change for the better has taken place and the figures for 1915-16 indicate a production of 345,000 tons.

Sugar cane is used as a delicacy in all of the inhabited islands of the Philippine group, but the growing and manufacture of it as a regular industry are confined to Negros, Mindoro, Cebú, Panay, Luzon and Leyte. In 1914-15 about 350,000 acres altogether were planted in cane, and the quantity of sugar exported during 1916 was about 300,000 tons.

The first care of the United States after its occupancy of the Philippines was the bettering of conditions in sanitation, education, banking methods, railway communication and deep water terminals. Apart from the primitive character of the sugar mills and the loss growing out of poor extraction of juice, open-kettle boiling and curing in earthen pots, the sugar producer was generally in debt to the buyer for advances that carried a high rate of interest. The government has taken steps to correct this evil and has made it possible for the farmer to get credit on reasonable terms, limiting its loans, however, to those who have Torrens titles to their property,[45] but the Filipino has been under the influence of the money-lenders too long for him to break his bonds entirely. Besides, his instinctive dislike for anything new is a hindrance to progress in this direction.

In addition to the measures just alluded to, a special law was passed in 1902, under which all Philippine sugars entering the United States paid 25 per cent less than the regular customs tariff. The Payne-Aldrich bill of August 5, 1909, provided for free admission of Philippine sugars up to 300,000 gross tons, and it stipulated that the small producer (less than 500 tons per annum) was to receive first consideration in the event of the importation exceeding 300,000 tons. Any excess coming into the United States would have been assessed the full tariff. During the life of this legislation, however, the largest production of the islands was that of 1913-14, which amounted to 265,000 tons, of which 225,000 tons were exported.[46] The tariff act of 1913, which became effective March 1, 1914, admits all Philippine sugars free of duty without any restriction as to quantity.

The religious orders were formerly large land owners in the Philippines, and the feeling of discontent that ultimately led to the insurrection of the Filipinos against Spain in 1896 was largely due to agrarian difficulties between the friars and their tenants. When the revolution came, the friars had to flee for their lives, and after peace was restored by the United States, the insular government felt that if they returned to their possessions they would be in constant danger from the hostility of the natives. It was, therefore, decided to acquire these lands and to that end Congress passed an act authorizing the Philippine government to issue bonds to the amount of $7,000,000 and to purchase the lands of the various orders with the money so raised. With one or two minor exceptions, all of these lands, amounting to something over 600,000 acres, were bought by the government and are being resold on long-term payments at a price that will reimburse the government. In disposing of this property preference is always given to the resident tenants.

[Illustration: OLD-STYLE SUGAR MILL, PHILIPPINES—SHOWING POOR CRUSHING]

[Illustration: TINGUIAN CANE CRUSHER, LINGAYEN, PHILIPPINES]

A measure was carried through the Philippine legislature approving the sale of the unoccupied portions of these friar estates to individuals without restriction as to acreage, and it was under the provisions of this act that large tracts of land were acquired by the interests connected with the Mindoro company in the San José estate in Mindoro and by the people associated with the Calamba estate in the Calamba, Santa Rosa and Biñan districts of Laguna province, Luzon.

Apart from these so-called friar lands, the public lands in the Philippine islands are held for sale or lease subject to the following conditions: Corporations can purchase or lease up to 1024 hectares, or 2500 acres, and individuals up to 64 hectares, or 158 acres. The terms of sale are a minimum of 10 pesos, or $5 per hectare, 25 per cent of which must be paid at the time the contract is entered into and the remainder within five years, with interest at 6 per cent, or leased at a minimum rental of 50 centavos, or 25 cents, per hectare per annum, leases running for fifty years.

The Mindoro and Calamba companies, controlling 55,000 and 20,000 acres respectively, and the San Cárlos Milling company of San Cárlos, Negros, have erected the first and only modern sugar mills in the Philippines, and they have gone into cane cultivation and sugar manufacture in a scientific way. The management of these three enterprises has been entrusted to men who have had thorough field and factory experience in Hawaii.

Unlike the other two large companies, the San Cárlos Milling company operates a _central_ pure and simple. The company owns no land except the site for the mill and the outbuildings connected with it. It has, however, acquired leases of a certain amount of railway trackage. The capacity of the mill is 1000 tons of cane per day, which means about 125 tons of centrifugal sugar. It was

completed at the end of 1913 at a cost of about one million dollars, and the first cane ground was from the 1914 crop.

In the Philippines cane is not planted every year. Herbert S. Walker, in his work “The Sugar Industry in the Island of Negros” (Manila, 1910), says: “A decidedly large proportion of the total land under cultivation in Negros is not replanted every year, but is allowed to ratoon, from two to eight crops being taken off without replanting. This is especially true in the rich soils of the districts around Ilog-Cabancalan, Binalbagan-Isabela, San Cárlos and Bais. Theoretically, cane planted in some of these alluvial soils, which are flooded and fertilized each year by silt brought down from the mountains by the overflow of a river, might go on ratooning indefinitely. Practically, the period between plantings is limited strictly by financial considerations.

“Much time and expense are saved by not being obliged to replant. On the other hand, the yield from plant cane is, as a rule, greater than even from first ratoons, and with each successive ratoon crop the total amount of sugar produced per hectare of land is decidedly diminished. This is partially due to the shorter time in which the cane is allowed to ripen. Owing to excessive rains prevalent in this country, canes must be cut every year, and the practice so common in Hawaii of allowing ratoons to ripen for eighteen months or more, is here out of the question. A further obstacle, especially when canes are planted closely in rows, is the tendency of ratoons to spread out in every direction from the original plant so that in the course of a few years the cane rows lose all semblance of regularity, and proper tillage of the soil is rendered very difficult; thus many young ratoons are stunted in their growth by weeds.”

[Illustration: OLD WATER-DRIVEN MILL, ISLAND OF NEGROS, PHILIPPINES]

[Illustration: MILL DRIVEN BY WATER POWER, OCCIDENTAL NEGROS, PHILIPPINES]

The time of planting in most parts of the islands is usually from December until April, but in Negros, where the soil is good and the rainfall well distributed, planting can be done at almost any time, except during the period of very heavy rains, _i. e._, from July to October.

The yield of sugar per acre may be approximated as follows:

Plant cane 2.5 tons First ratoons 2.0 ” Second ratoons 1.75 ” Third ratoons 1.50 ” Fourth ratoons 1.25 ”

When the yield drops as low as eight-tenths of a ton of sugar per acre, replanting is necessary, and allowing for the reduced yield of first and second ratoons, it may be reckoned that one-half of the production is from plant cane and the other half from ratoon crops.

The length of time during which the cane is allowed to remain in the ground varies from nine to fourteen months and will probably average between eleven and twelve.[47]

The labor problem is present in the Philippines as in all cane-sugar countries. The natives are willing enough to work, but shrink at the idea of leaving their homes to take employment at any considerable distance away.

Apart from the three modern factories previously mentioned, sugar-making facilities are greatly behind the times, although there are a few minor exceptions. Over one thousand small mills were in operation in the islands in 1907 and of these 528 were driven by steam, 470 by carabao (water oxen) or natives, and 77 by water power. The carabao mills, however, are rapidly disappearing. The capacity of most of these small mills is from 50 to 60 tons of cane per day, and, as the cane is only crushed once, there is a considerable loss in recovery. A little lime is added to the juice to clarify it and it is then boiled to grain in a series of five or six open pans. The general arrangement is shown by the accompanying sketch, which is taken from Herbert S. Walker’s “Sugar Industry in the Island of Negros.”

[Illustration]

The drawing shows two sets of pans, each set being built over a separate furnace. The number 5 pan, into which the juice from the crusher flows, is connected to both sets. The furnaces are fed directly under number 1 pan, where the final boiling is done and where the greatest heat is required. The two furnaces converge when they reach the boiler, which may be fired separately, so that grinding and boiling may, if necessary, be done independently of each other. As the juice leaves the crusher through an open wooden trough, particles of cane and other matter are removed by straining through a cloth or a close-meshed wire screen. It runs into the receiving pan—number 5—and is heated to between 160 and 175 degrees Fahrenheit, which brings certain impurities to the surface in the form of froth. This is skimmed off and thrown into the scum tank; the juice is then ladled by hand as required into the smaller pans (number 4) where lime is added for clarification. Violent agitation takes place in pans numbers 3 and 2, and as fast

as scum forms it is skimmed off. The clarified juices are then concentrated in pans number 2 and number 1, after which the massecuite is put into wooden trays and stirred with a spade until it granulates. It is then ready to be taken to market.

[Illustration: NATIVE SUGAR FACTORY, PAMPANGA PROVINCE, PHILIPPINES]

[Illustration: INTERIOR OF CAMARIN, PHILIPPINES]

As has been pointed out, the loss in this primitive method of manufacture is very heavy. Notwithstanding the fact that all of the molasses is retained in the sugar, the amount of sucrose that is lost or wasted is 44 per cent, and over one-half of this is left in the bagasse.

Apart from centrifugals, Philippine sugars consist of the following grades: _Superior_, _Humedo_ (wet) and _Corriente_ (current). Sugars polarizing from 87 to 88.9 degrees are called Superior No. 1, those testing from 85 to 86.9 degrees, Superior No. 2, and those running from 80 to 84.9 degrees, Superior No. 3. Humedo sugars polarize from 76 to 79.9 degrees and Corriente from 70 to 75.9 degrees. Roughly speaking, the proportions are about 85 per cent of Superior of 84 degrees purity and 15 per cent of wet sugar testing somewhere near 75 degrees.

The Bureau of Agriculture of the Philippines maintains experiment stations at La Granja, near La Carlota, Occidental Negros, and at Calamba, Luzon, for the study of cane, soil analysis and the solving of fertilization problems. This work of scientific investigation is sure to be of great benefit to the industry. Some experimental work with sugar cane is also carried on at the station at Alabang, Laguna province, Luzon.

American control in the Philippines promises much for the future of the sugar industry of these islands, for when it is remembered that for many years, in spite of the handicap of crude, uneconomic methods, export duties at home and import duties abroad, sugar was made and sold at a profit in the markets of the world, it is not unreasonable to look for a considerable stimulus to be given to production by advanced scientific management and free admission of the commodity to the markets of the United States.

Quantity of sugar exported from the Philippine islands from 1895 to 1916, in tons of 2240 pounds:

1895 227,279 1896 226,279 1897 198,899 1898 177,962 1899 91,583 1900 61,752 1901 51,448 1902 90,617 1903 88,144 1904 82,656 1905 103,334 1906 122,417 1907 120,050 1908 140,197 1909 125,276 1910 114,506 1911 203,394 1912 190,702 1913 155,201 1914 232,761 1915 207,679 1916 300,000

[Illustration: LUZON SUGAR REFINERY, MALABON, RIZAL, PHILIPPINES]

[Illustration: LOADING SUGAR ON LORCHAS, PHILIPPINES]

CUBA

The island of Cuba lies between 74 degrees and 85 degrees west longitude and 19 degrees 40 minutes and 23 degrees 33 minutes north latitude; its length is about 730 miles, running nearly east and west, and its width varies from 25 to 100 miles. In area it comprises about 45,883 square miles, or 29,365,120 acres, which is approximately that of Pennsylvania or Louisiana. Habana, the capital, is almost on the same parallel as Honolulu and the City of Mexico.

With the exception of a strip of the central-southern coast, Cuba rises boldly out of the sea and presents a rugged appearance to the eye on approach. About one-quarter of its surface is mountainous; three-fifths consists of gently sloping country, valleys and rolling plains; the rest is swampy.

A variety of topographic and climatic characteristics divides the island naturally into three distinct parts. The eastern end is high and broken, with tall commanding peaks; the wide central region, lying well above sea-level, is made up of excellently drained, undulating plains, interrupted at intervals by low, wooded hills; the western portion is a picturesque country of mountain and valley, but of lower altitude than the eastern end. The entire island is covered with a mantle of luxuriant verdure, kept always green by warm mists and generous rains.

A coral reef extends around the greater part of the coast, but between the forbidding rocks and the marshes there are a number of good harbors, chiefest among which is that of Habana, one of the finest in the world. The distance from Cuba to Key West, Florida, is one hundred miles. The census of 1908 placed the population at 2,048,890.

The prevailing winds are the northeast trades, but these are interrupted at frequent intervals by variable winds from other directions which bring changes in temperature and rainfall. Compared with those of Hawaii, the mountains are low, usually not over 2000 feet, and do not produce the effect of a wet side and a dry side to the island, as the trades sweep it from end to end and not transversely. To give an idea of climatic conditions, the average maximum temperature in Habana in 1914 was 90 degrees Fahrenheit, the minimum 53 degrees and the mean average 77 degrees. The total rainfall was 46.15 inches. Seventy-five per cent of the rain occurs in the summer months, between the first of May and the first of October, and the precipitation is greater in the eastern part of the island than in the western. The winters are comparatively dry. This combination of dry winters and wet summers is extremely favorable to the growing and harvesting of sugar cane.

The low plains along the coast are of coral formation and the soil overlying the coral is often found to be shallow. The richest and most productive soil is that of the uplands some distance from the sea. In Cuba the soils may be said to consist of two kinds—the red and the black. The red is generally of great depth, from 30 to 50 feet, and rests on a stratum of free limestone. The black soil, varying in color from a mulatto to a “gumbo” black, overlies a clay formation, and as a general rule is not so deep as the red soil. Owing to the fact that the black soil retains such a large percentage of water during the extremely rainy period, the cost of cultivation is double that of working the red soil.

[Illustration: _American Photo Co., Habana._

CENTRAL FACTORY, GENERAL VIEW, CUBA]

[Illustration: _American Photo Co., Habana._

CUBAN CENTRAL—GENERAL VIEW]

The date of the introduction of sugar into Cuba is uncertain. Different authorities place it anywhere from shortly after the discovery of the island in 1492 to 1580. Von Humboldt is silent on the point, but says that Cuba did not participate in the sugar industry to any extent in the sixteenth century, so that its importance in that respect belongs to a later period.[48] Up to 1772 sugar cultivation was greatly hampered by restrictions of the Spanish government; after that date special privileges were canceled and the right to grow sugar was given to all Spaniards. This naturally encouraged production, which from 4390 tons in 1760 increased to 14,000 tons in 1790. The revolution which destroyed the sugar plantations and mills of Santo Domingo in 1791 stimulated the development in Cuba still further. During the ten years that followed, the number of mills increased from 473 to 870, and by 1802 the output of sugar reached 40,800 tons. In those days mills were very small, crude affairs and were worked by oxen.

Cuba, in common with all sugar-raising countries, felt the effects of the European wars very severely, but her sugar trade revived after the overthrow of Napoleon and the resumption of commerce through normal channels.

With increased production the question of labor became a serious one. The number of slaves on the island had been sufficient as long as the sugar crop was limited, but with expansion came the need for more African negroes, so in 1834 the governor, Miguél Tacon, caused many new slaves to be brought in. He did much to help the industry in other directions, particularly by suppressing abuses, and under his administration the planters enjoyed prosperity such as had never been known. Fresh lands were brought under cultivation and the shipping ports grew in importance and activity.

While figures showing the annual production of Cuba were tabulated, beginning with 1850, their accuracy was open to question until 1882, in which year an export duty was imposed, and the records kept by the authorities from that time forward are reasonably correct. Nevertheless, it is known beyond any doubt that 610,000 tons were produced in 1870 from 1200 small mills.

The first war with Spain (1868-78) and the abolition of slavery worked havoc with the industry. All children born of slaves were proclaimed free in 1872 and slavery was entirely abolished in 1880, without any indemnification to the slave owners. Sugar producers found freeman labor both costly and hard to obtain, the island was ravaged by fire and sword, and in the markets of the world beet-root sugar, protected by bounties, was proving a powerful competitor. These were dark days for the planter.

With the restoration of peace, conditions improved. By 1890, 470 mills were in operation and their production in that year was 625,000 tons. In Cuba a change in methods came about, just as had been the case in Louisiana; the cultivation of sugar was gradually dissociated from its manufacture, and as mills became fewer in number, plantings increased. The manufacturers leased tracts of land to farmers, from whom they bought the cane raised on it. Independent planters, too, sold their cane to the central mills, and the plan was adopted so generally throughout the island that but little cane was grown by the owners of the centrals.

During this period of peace and development, the tonnage mounted steadily upward and in 1894 it totaled 1,054,214 tons.

[Illustration: _American Photo Co., Habana._

CANE FIELD, CUBA]

[Illustration: _American Photo Co., Habana._

LOADING CANE ON OX-CARTS, CUBA]

The following year saw the renewal of hostilities with Spain, which dragged along with brutality and devastation until May, 1898, when the United States declared war against Spain and finally established the Cuban republic. The period of this second rebellion against Spain was marked by ruthless destruction of property, the burning of mills and cane in the fields, and the killing of the cattle that were used for transport purposes. In 1897 the output of sugar had shrunk to 212,051 tons. The work of reconstruction after the expulsion of the Spaniards was slow, involving as it did a tremendous amount of effort and the investment of a great deal of new capital. Manufacturers who were unable to raise money to rebuild or re-equip their mills turned planters and grew cane for the nearest centrals. Some, more fortunate, succeeded in securing the money they needed and restored and extended their property. Far the greatest number, however, being unable to command the ready cash for immediately necessary repairs, incorporated or sold their holdings outright to newcomers. The many small, old-fashioned mills have given way to a limited number of large plants, or centrals, that are under corporate ownership and governed by scientific business principles. This process of consolidating several small factories into one big one is constantly going on, and in addition American capital and enterprise are opening up new lands to cultivation in many parts of the island. To a great extent the old-time planter has had to make room for the corporation, with its powerful resources and modern methods, and while the individual has suffered in many instances, the industry has greatly benefited.

Cuban plantations may be divided into two classes, the ingenios and the centrals. The ingenio is a small plantation whose lands lie in the neighborhood of the mill, while the central, in addition to its own cane, handles the crops of a number of ingenios. The ingenio hauls all of its cane to the factory by ox-carts; the central is served by railroads, both privately and publicly owned, and its equipment and machinery are of the most modern type.

Approximately 90 per cent of the cane grown in Cuba comes from what are termed _colonias_, _i. e._, farms varying in size from a few acres up to several hundred.

Colonos, or farmers, may be classified in three groups: in the first is the man with his small _estancia_, or farm, on which he raises foodstuffs and cattle, and who takes his few hundred _arrobas_[49] of cane to the central when the price is good, or feeds it to his animals when the pasturage is short. In this class, too, is the man who has a hundred or two hundred _caballerías_[50] of land, but whose chief interests are in other channels and whose operations in cane growing are merely an adjunct to his regular business.

In the second group is the independent farmer, who owns his land and cane and sells his crop to whom he pleases.

The third and most numerous group comprises those who plant cane on lands belonging to the central. These people either pay rent, or receive a certain fixed amount for their cane, or both. Their work is at all times subject to inspection by the central administration and under such circumstances they may be likened to contractors or employés, whose compensation is based upon the success of their own efforts.

The average size of a colonia, exclusive of those owned by colonos of the first-mentioned class, who are independent of cane growing, doubtless depends upon what would afford a man a decent living with a few luxuries. H. C. Prinsen Geerligs, in his book “The World’s Cane Sugar Industry,” states that one hundred arrobas (2500 pounds) of cane costs the Cuban farmer $2.07 at the mill. If 2½ cents be taken as an average price for sugar and $900 per annum as a fair living wage, then the colono who gets an average yield of 50,000 arrobas per caballería and is paid for it at the rate of 5 per cent, receives $1560 per caballería for cane that has cost him $1035 to produce. According to this reasoning, a colonia should not be less than 1.75 caballerías in size, but of course this is purely speculative.

The farmer who owns his land is paid about six per cent[51] of the weight of the cane he furnishes in centrifugal sugar of 96 degrees, sacked and ready for shipment, and occasionally delivered at the nearest shipping port. Sometimes settlement is made in cash, based upon the value of the agreed percentage of sugar at the Habana quotation on the day the cane is delivered. In other

words, for every one hundred pounds of clean cane in bundles, delivered on board the cars, the plantation pays the grower about six per cent of 96-degree centrifugal sugar, or its equivalent in money.[52]

Where the land is furnished by the plantation, the farmer is paid from four to five per cent of the weight of the cane in sugar. He is given a house free of rent and an acre or two of garden land as well. All material, labor or stores supplied to him are debited to him to be accounted for when final settlement is effected.

Planting cane in Cuba is a simple matter. In preparing virgin forest land for seed, no ploughing whatever is done; the trees and shrubs are cut down and allowed to dry, the valuable timber is carried away, and the remainder is burned. When this is done the land is found to be smooth and level, as a rule. Planting consists in making holes in the ground with a heavy pole shod with iron that is driven obliquely into the earth at regular intervals, the seed is then dropped in these holes and covered with earth, completing the operation. Grassy ground, however, must be ploughed, in which case furrows are made six feet apart. The seed cane is planted in them at intervals of from six inches to twelve inches, covered with earth and left to grow. There are the spring plantings and the autumn plantings, the first from April to June and the second in October and November, that is to say, one at the beginning and one at the end of the rainy season. In the case of the former, if the rains come soon after planting, the cane can be cut in the following March or April, _i. e._, after a growing period from nine to twelve months. If, however, the rains are late the cane cannot mature before the advent of the new rains and therefore cannot be ground until the following December. Cane planted in the fall ripens in December of the next year or sometimes a month later.[53]

Notwithstanding the little care given to the planting, the cane once started yields a generous crop, which is followed by profitable ratoon crops for a number of years without fertilization or a great amount of tillage. Finally, when through age the cane ceases to produce a paying crop of ratoons, the old roots are taken up,[54] and the same soil reseeded brings forth excellent results for another period of years without any rotation of crops being necessary. Not more than ten per cent[55] of the total area of Cuba is devoted to the growing of cane. In addition to the ground on which cane is actually planted, large tracts are needed as pasture for draft cattle. Besides, there is much forest land and many barren spaces that are undoubtedly included in the acreage classified as being under cane cultivation. According to Dr. W. D. Horne,[56] the average yield is from fifteen to twenty tons of cane per acre[57] and the crops are usually allowed to ratoon for ten years.

[Illustration: _American Photo Co., Habana._

TRAIN-LOAD OF SUGAR CANE, CUBA]

[Illustration: _American Photo Co., Habana._

SELF-DUMPING CANE CAR, CUBA]

In Cuba, cane diseases are of rare occurrence, but in dry years swarms of mice invade the fields and cause great damage by gnawing the cane. They rapidly disappear, however, as soon as the wet season sets in. It is the weather that brings success or failure to the sugar crop, for the growth of the cane is entirely dependent upon rainfall and a long period of drought is extremely hurtful. Hurricanes that sweep in from the Caribbean sea work havoc in the plantations, beating the cane flat to the ground or uprooting it altogether, which results in heavy damage both to the growing crop and the one following it.

Harvesting is generally begun in December and over in May, although one or two centrals continue in operation practically all the year round. Weather conditions determine when the grinding starts and ends, for, as a rule, the cane has to be hauled from the fields to the weighing station in huge carts drawn by oxen. When the roads are dry, three pairs of oxen can pull a load of 7500 pounds of cane with ease, but as soon as the heavy rains set in the ground quickly softens, the roads become impassable and the movement of cane by carts is out of the question.

The cane is cut close to the ground with a long, heavy knife, called a _machete_. It is “topped,” cut into two- or three-foot lengths, tied in bundles and loaded on the ox carts to be hauled to the scales and thence by rail to the mill. The stumps that remain in the ground are covered over with dry leaves to conserve the moisture in them. Nourished by occasional showers, the roots quickly sprout and a year afterward a crop of ratoons is ripe and ready to be harvested.

Wages in Cuba are higher than in most important cane-producing countries in the tropics, and Dr. V. S. Clark quotes a number of authorities to show that inefficiency makes Cuban labor costs in most lines of work relatively higher than in the United States and other countries on the American continent, although he says that American supervision has in some instances increased efficiency

greatly.[58] (Bureau of Labor, Bull. [L. of C.] 41, pp. 712, 778.)

Complete, reliable and up-to-date information and statistics concerning Cuba's sugar industry are not obtainable at the moment, nevertheless it is well known that the Cuban plantations and mills that are operated by modern scientific methods can produce sugar at lower costs than Germany or any of the beet-raising countries, while as regards cane-growing countries, Java is the only possible rival. And yet, despite the optimistic views of Cuba's supporters, the fact remains that the full development of her resources is still a matter of uncertainty, though the possibilities for expansion are enormous, provided that certain obstacles, notably the labor problem, can be overcome. At the present time it is doubtful whether the production of sugar could be largely increased, chiefly because of the growing difficulty of securing adequate help in the fields.

During the season ending midsummer, 1915, Cuba's output of sugar was 2,592,667 long tons, the largest crop raised in any country in the world, and the vast amount of cane from which it was manufactured was ground by 176 central factories. It is estimated that the production for 1916 will reach 3,000,000 tons.

When it comes to the marketing of her sugar the United States is Cuba's best customer, only a comparatively small amount being taken by Europe.[59] The 20-per-cent preferential allowed on Cuban sugar duty under the reciprocity treaty, however, does not always go to the Cuban manufacturer. The real beneficiary is the consumer in the United States, for this reason: when the grinding of the Cuban crop is in full swing, the weekly production of raw sugar is approximately 150,000 tons, which speedily exhausts the available storage capacity of the island, so that movement of the sugar is imperative; besides this, the natural anxiety of the planter to realize in order to meet his current expenses causes a strong pressure to sell. It becomes with him a question of whether he can net better figures in New York or the United Kingdom, and owing to difference in port charges and dispatch, the New York results are generally more satisfactory, even with the concession of a part, or at times all of, or even more than, the 20-per-cent preferential. Inversely, it follows that when raw sugars are in keen demand, the planter pursues his advantage to the limit.

The total production of sugar in Cuba from 1850 to the present year is as follows, but the figures prior to 1882 are not entirely dependable, as has been previously explained:

YEAR TONS

1850 223,145 1851 263,999 1852 251,609 1853 322,000 1854 374,000 1855 392,000 1856 348,000 1857 355,000 1858 385,000 1859 536,000 1860 447,000 1861 446,000 1862 525,000 1863 507,000 1864 575,000 1865 620,000 1866 612,000 1867 597,000 1868 749,000[60] 1869 726,000[60] 1870 726,000[60] 1871 547,000[61] 1872 690,000[60] 1873 775,000[60] 1874 681,000[60] 1875 718,000[60] 1876 590,000[60] 1877 520,000[60] 1878 533,000[60] 1879 670,000 1880 530,000 1881 493,000 1882 595,000 1883 460,327[62] 1884 558,932 1885 631,000 1886 731,723 1887 646,578 1888 656,719 1889 560,333 1890 632,368 1891 816,980 1892 976,000 1893 815,894 1894 1,054,214 1895 1,004,264 1896 225,221[63] 1897 212,051[63] 1898 305,543[63] 1899 335,668 1900 283,651[64] 1901 612,775 1902 863,792 1903 1,003,873 1904 1,052,273 1905 1,183,347 1906 1,229,736 1907 1,444,310[65] 1908 969,275[66] 1909 1,521,818 1910 1,804,349 1911 1,483,451 1912 1,895,984 1913 2,428,537 1914 2,597,732 1915 2,592,667 1916 3,000,000[67]

JAMAICA

Jamaica lies 80 miles south of the eastern end of Cuba, between 17 degrees 43 minutes and 18 degrees 32 minutes north latitude and 76 degrees 10 minutes and 78 degrees 20 minutes west longitude. It is 144 miles long and 50 miles across at its widest part, with a total area of 4207 square miles.

The island is traversed from east to west by a mountain range from which a number of spurs run out to the northwest or southeast. This range is more sharply defined in the eastern end, where the highest point is Blue Mountain Peak, 7360 feet above sea-level. The mountains gradually slope westward down to the hills of the western plateau, which is of limestone formation and comprises two-thirds of the island's surface. As a rule the highlands terminate abruptly in steep bluffs, a strip of level land lying between them and the sea. On the south coast there are extensive plains. Fully one hundred rivers and streams empty themselves into the Caribbean, but the greater number of them are not navigable and in flood time they become raging torrents. In 1911 the population, of whom only 2 per cent are white, was estimated at 831,123. It is made up of Maroons, descendants of the slaves of the Spanish; descendants of African negro slaves; a mixture of British and negro; laborers from India; a sprinkling of Chinese, and the white settlers.

On the coast the climate is hot and humid, but at the higher elevations it is mild and delightful. The temperature at Kingston and the low sea-level region generally ranges between 70.7 degrees and 87.8 degrees Fahrenheit. At Cinchona, which is 4907 feet high, it runs from 57.5 degrees to 68.5 degrees. With rare exceptions, rain falls during every month in the year, and there are two wet seasons, each of about three weeks duration, one in May and one in October. The amount varies considerably; the yearly average for Kingston is 32.6 inches, for Cinchona 105.5 inches and for the entire island 66.3 inches. Hurricanes, which were of frequent occurrence during the early part of last century, have not visited the island so often of late years. Earthquakes take place from time to time, that of 1907 having been particularly violent and destructive.

Transportation facilities are excellent, the roads are good and a railway 180 miles long connects Port Antonio, Kingston and Montego bay.

Jamaica was discovered by Columbus on May 3, 1494, and was called Santiago by him, but this never supplanted the original Indian name Jaymaca, “the island of springs,” modified into its present form, Jamaica. Columbus put in at the island for shelter in 1505, and four years later his son Diego sent out Don Juan d’Esquivel to take possession of it in the name of the Spanish crown. Sant’ Iago de la Vega, now Spanish Town, founded in 1523, was destroyed by the British in 1596 and was rebuilt after their departure. The British raided the island again in 1635, and twenty years later they occupied it permanently, expelling the Spaniards entirely by 1658. During the three years that followed, Jamaica was under military rule and then a constitution modeled upon that of the mother country was established.

About this time the island became a rendezvous for the buccaneers. These gentry quite often combined the roles of merchants or planters and pirates or sea-rovers. In 1670 the treaty of Madrid confirmed the British in their possession of the island and the buccaneers were suppressed. Jamaica then became a great slave market, and the growing of sugar cane and the manufacture of sugar on an extensive scale were begun. Civil disturbances retarded the progress of the colony until 1728. The town of Port Royal was destroyed by a great earthquake in 1692, while in 1712 and 1722 hurricanes of extreme violence carried destruction throughout the island.

When the Dutch were driven from Brazil by the Portuguese in 1655 many of them settled in Jamaica, Barbados and other West Indian islands. They brought their slaves with them, and, besides, they had a good knowledge of sugar and the necessary capital, so that the industry entered a new phase of development after their arrival. The keenest competitors of the British islands were the French sugar producers of Saint Dominique, Guadeloupe and Martinique, as they were more skilled in manufacturing methods and made sugar at a lower cost. A heavy export tax affected the sugar trade of Jamaica and her sister colonies adversely. The refining of sugar was prohibited and heavy import duties placed upon sugar and syrup entering British North American possessions closed that market to the Jamaican product. Notwithstanding these drawbacks the industry continued to grow and in 1791 the destruction of the plantations of Saint Dominique removed a formidable rival.

Since the passage of the emancipation act in 1834 and the granting of £16,500,000 as partial indemnity to the planters for the loss of their slaves, there has been persistent agitation by the planters, both in Parliament and outside of it. It became very loud when the protection afforded West Indian sugars as against sugars raised in slave-owning countries was lessened and finally withdrawn. It subsided somewhat with the abolition of slavery in the colonies of other European nations, and it was renewed with added vigor when the competition of bounty-nourished beet-root sugar manufactured on the continent of Europe made itself felt. As has been shown, bounties and cartels enabled the European beet-sugar manufacturers to sell their product in foreign markets below actual cost, while realizing a handsome profit in the quantity sold for home consumption. Jamaica and the other cane-producing colonies which had no domestic trade to fall back upon found themselves in a grievous plight.

By 1895 matters had reached such a pass that a royal commission was appointed to make a thorough investigation of conditions and report to the home government. The main features of the remedial measures adopted as a result of the work of this body were:

First: The establishing of the farmers as owners of land, that is to say, parcels of land were sold to small farmers, who were assisted by money advances in the cultivation of their crops, with the understanding that they were to grow cane at their own risk and sell it to the mills.

Second: Planters were encouraged to raise crops other than sugar.

Third: Agricultural experiment stations were built and equipped in Barbados, Trinidad and Jamaica with sub-stations in a number of the smaller islands.

Fourth: A direct steamship service to Canada was established. The service between Jamaica and England was improved and regular steamer communication between the islands was provided.

It was stipulated that the cost of building and maintaining the experiment stations was to be borne by the home government until the results obtained justified their being supported by the colonies. In addition, a grant of money was authorized by Parliament to take care of the pressing needs of the planters during the year before the Brussels convention became effective.

With improved steamship facilities between Jamaica and the mother country, the volume of the trade in fresh fruit was greatly increased.

[Illustration: _Photo by H. H. Cousins_

MORELANDS SUGAR MILL, VERE, JAMAICA]

[Illustration: THE FLEET, MORELANDS, VERE, JAMAICA]

In 1907 the value of the fruit shipments in pounds sterling was as follows:

Bananas £842,689 Citrus fruits 90,468

as against

Sugar 122,328 Rum 98,923

On January 14, 1907, an appalling earthquake occurred. The buildings in Kingston and Port Royal were destroyed or badly damaged and about one thousand people were killed.

In 1906 the area under cultivation in Jamaica was 750,000 acres and of this only 26,000 were devoted to cane. Sugar planting has been in a stagnant condition for years and only a limited number of the estates that still carry on the industry are making money. Many have stopped growing cane entirely and have turned to bananas, cocoanuts, coffee or cattle raising. In certain districts there is plenty of fertile alluvial land, ample water and cheap labor, but proper cultivation is lacking, so that the results are far from what they should be. Planting simply consists of sticking a piece of cane stalk in a hole in the ground and very little ploughing is done, consequently the weeds are never under control. It takes about twelve months for the cane to ripen and the yield per acre varies widely, ranging from ten to forty-five tons. The average may be taken as about twenty tons per acre.

The island boasts of three central factories and eighty-two small mills, only twelve of the latter having vacuum pans. The others make muscavado sugar and rum. In the operation of boiling by no means all of the sugar is extracted, as a pure liquor is needed for the manufacture of good rum and quite a large amount of cane juice is made into rum direct.

In the process of making muscavado sugar in Jamaica, the cane juice after being brought to boiling point in an open kettle is transferred into a second kettle, where it is treated and the heavy impurities allowed to settle. The clear juice then goes into copper walls, a series of three or more large open copper pans, called teaches. These pans rest above an open fire fed by bagasse, cane trash and wood. After the juice has been boiled to a certain density in the first pan it is transferred to the second and the final concentration takes place in the third or fourth, as the case may be. In some mills the last boiling is done with steam in what is called an Aspinall pan, instead of over an open fire. When the mass becomes sufficiently thick, it is put into large tanks and left to crystallize. Sometimes it is kept in motion during crystallization, but usually no stirring whatever is done. Crystallization completed, the mass is packed in hogsheads with perforated bottoms. These hogsheads are allowed to stand over drainage troughs for two or three weeks so that the molasses may run off. The holes are then plugged up and the sugar is ready to be shipped.

The percentage of sugar, glucose and water in Jamaica muscavados is approximately:

No. 1 Sucrose 88.6 Glucose 5.30 Water 3.42 2 86.2 4.40 3.72 3 83.9 5.92 4.66 4 83.0 6.98 3.84

Management is slipshod and the extraction is poor. It takes fifteen tons of cane and sometimes more to produce a ton of sugar.

As for the future of the sugar industry in Jamaica, much in the way of improvement could be done by the introduction of systematic management, proper cultivation, adequate fertilization and scientific methods of manufacture. Labor is plentiful and cheap, and it would seem that sugar could be produced in Jamaica at as low cost as in Cuba. Thus far, however, there have been no signs of a real awakening.

As regards production, the following figures are taken from Willett & Gray:

1903-04 crop 14,255 tons 1904-05 ” 16,000 ” 1905-06 ” 18,000 ” 1906-07 exports 13,971 ” 1907-08 ” 10,718 ” 1908-09 ” 11,453 ” 1909-10 ” 12,000 ” 1910-11 ” 19,960 ” 1911-12 ” 21,835 ” 1912-13 ” 8,728 ” 1913-14 ” 15,583 ” 1914-15 ” 15,063 ” 1915-16 ” 15,000[68] tons

BARBADOS

Barbados, the most easterly of the Windward islands, lies seventy-eight miles east of St. Vincent in 13 degrees 4 minutes north latitude and 59 degrees 37 minutes west longitude. It is twenty-one miles long, fourteen and one-half miles at its greatest breadth and its area is 166 square miles. It is of coral origin and at certain points the coral reefs extend out to sea as far as three miles and are a menace to navigation. The island is low and flat, except in the central and northeastern part. Mount Hillaby, the highest peak, rises 1148 feet above sea-level and from it the land slopes in terraces in every direction. Carlisle bay on the southwest is a natural harbor, but only available for vessels of light draft. Barbados is densely populated. In 1906 the number of inhabitants was 196,287, of whom by far the greater number were negroes, who, in proportion to the whites, are as nine to one.

The climate is agreeable, with well-defined wet and dry seasons, and for eight months in the year the heat is modified by the northeast trade winds. The dry, or cold, period is from December to May. The temperature ranges from 70 degrees to 86 degrees Fahrenheit, seldom falling below 65. There is a plentiful rainfall, the annual average being sixty inches, and September is the wettest month. Moisture readily penetrates the coral subsoil and collects in subterranean reservoirs. Porous soil, thorough cultivation and the absence of swamps give miasma no opportunity and fever is unknown, but hurricanes are the scourge of the colony. The soil is thin, but extremely fertile, and there is a theory that it was originally formed of volcanic ash, carried by the winds from St. Vincent during times when La Soufrière was in eruption.

It is said that the Portuguese were the first Europeans to visit the island; be this as it may, they never took possession of it. A British ship touched there in 1605, and, finding no inhabitants, annexed it in the name of King James I. Since that time British ownership has continued without interruption. An actual settlement was established in 1625, in which year the king made a grant of the island to Lord Leigh, afterward the Earl of Marlborough. Bridgetown, the present capital, was founded in 1628.

Barbados was the first of Great Britain’s island colonies to grow sugar cane. The plant was brought there in 1642 during Philip Bell’s governorship, and slaves were imported at the same time. A number of Dutch who were expelled from Brazil in 1655 took refuge in the island, and their knowledge of sugar and experience in its manufacture did much to stimulate the industry. Beginning with the middle of the seventeenth century, Barbados became an important sugar-producing center.

Following emancipation in 1834, the Barbados planters received £1,720,000 to indemnify them for the loss of over 83,000 slaves. At the same time a large number of the freed blacks continued to work on the sugar plantations as before, but under pay; hence abolition did not bring on the same hardships in Barbados as it did in some of the other West Indian colonies.

Labor is plentiful and cheap, so that cultivation is done carefully and in a thorough manner. The naturally rich soil is treated with fertilizers of various kinds, and planting is done every year as a rule, although ratoon crops are often raised on the uplands. Formerly Bourbon cane was grown exclusively, but owing to the falling off in the yield, it was discontinued and the varieties now in favor are White Transparent and seedling canes raised locally. The crops suffer from time to time through hurricanes and droughts, as well as from the common run of cane diseases. Of the entire area of 106,470 acres, about 100,000 acres are cultivated; between 60,000 and 70,000 acres of this are in sugar cane.

In 1902 there were 440 estates on the island, the average area being 168 acres. Of these, 23 exceeded 500 acres and 139 contained less than 100 acres; 19, comprising 6707 acres, were owned by corporations. Each estate had its own mill, and 432 of them made muscavado and eight of them centrifugal sugar. Today the number of factories is estimated at 335, of which 221 are driven by windmills. A few plants are equipped with vacuum pans and modern machinery, but muscavado sugar and molasses still represent nearly all of the production. The molasses obtained in the open-kettle process has a higher value and finds a much readier sale than that resulting from boiling in vacuum pans. Therefore in making comparisons between the yield in sugar from the open-kettle process with that from the vacuum-pan method, the increased price brought by the rich-flavored molasses made in the old-fashioned way must be taken into account.

On an average, the sugar content of the cane is 13.5 per cent and the recovery is about 7.5 per cent muscavado sugar and 3.5 per cent molasses. It is evident that imperfect crushing and crude manufacturing methods cause a considerable loss in sugar on most of the estates.

In 1898 the Imperial Department of Agriculture established its chief West Indian station in Barbados. This station has rendered great service to the planters in improving cane varieties, giving expert advice concerning fertilizing and fighting cane pests.

Undoubtedly much could still be done to better conditions, but the small estates are generally mortgaged and their owners are in no position to borrow more money to enable them to operate on a more extended scale. On the other hand, they are extremely tenacious of their holdings and will not part with them to capitalists who might establish large central factories. It therefore seems altogether improbable that there will be any expansion in the sugar industry of the colony in the near future.

The production of Barbados during the last twenty years in long tons has been as follows:

1895 33,331 1896 45,170 1897 51,275 1898 46,878 1899 40,442 1900 44,250 1901 56,912 1902 45,576 1903 33,795 1904 55,785 1905 41,210 1906 50,630 1907 33,033 1908 31,353 1909 15,571 1910 36,389 1911 32,514 1912 exports 30,548 1913 ” 11,479 1914 ” 33,387 1915 ” 32,578 1916 ” 50,000[69]

TRINIDAD

Trinidad lies six miles off the northeastern coast of Venezuela, between 10 degrees 3 minutes and 10 degrees 50 minutes north latitude and 60 degrees 39 minutes and 62 degrees west longitude. Its average length is forty-eight miles, it is thirty-five miles in width and has an area of 1754 square miles. It is the largest of the British West Indian islands, with the exception of Jamaica, and the population in 1914 was estimated to be 255,148, one-third of whom were East Indians.

The surface is level or rolling, with a mountain range in the north, which rises to 3100 feet at its highest point, Tucuche Peak. In the south there is a ridge of hills about 600 feet high, and in the central part an upland belt runs from east to west by south. There are a number of small rivers, none of them navigable.

The island enjoys an equable climate, the temperature varying from 70 degrees to 87 degrees Fahrenheit, the mean being 78.6 degrees. The seasons are regular, rainy from May to January, with a four weeks’ interval of fine weather in October, and dry from the end of January until May. The average rainfall is 66.26 inches, but in the cane-growing region it is about 80 inches. Hurricanes, earthquakes and long spells of drought are unknown.

Christopher Columbus discovered Trinidad in 1496 and the Spaniards occupied it ninety years later. It remained in their hands until 1797, when it was taken by the British, to whom it was formally ceded in 1802.

As was the case in other West Indian islands, the aborigines were quickly exterminated by the Spanish conquerors and their places filled with negro slaves. A number of French and Creole settlers came to Trinidad in 1780, and about the middle of the following century Portuguese refugees from Madeira joined the colony. After the abolition of slavery by Great Britain in 1834, many Hindus were brought in under contract.

The soil of the island is very rich and well adapted to the growing of sugar cane and other tropical products. The sugar plantations are found in the level country bordering on the Gulf of Paria, where the soil is a dark clay, and which has been described as one of the finest stretches of sugar land in the West Indies.

As a result of the financial distress of 1895, which caused the home government to pass relief measures, a number of plantation owners were compelled to dispose of a portion of their land to farmers, who grew cane upon it and sold the crop to the sugar factories. It is estimated that today about twenty-five per cent of the cane worked up by the factories is furnished by these small growers, the remainder being raised by the owners of the estates. Grinding begins in January and is finished in May or June.

Trinidad has its own agricultural station, which is chiefly devoted to the study of sugar-cane culture. It has been of great service to the industry in determining the kinds of cane that can be most profitably grown, in fighting cane diseases and pests and in working out fertilization problems.

From 1855 to 1887 an average crop of 59,774 tons was turned out by ninety estates. Of this total, 28,500 tons were vacuum-pan sugar and the rest muscavado. In 1896, 62,975 tons of sugar were made by thirty-nine estates. Seven of these made 2000 tons of

common muscavado, six made 5500 tons of centrifugal muscavado, and the remaining twenty-six made vacuum-pan sugar. A report made in that year concerning sugar estates in Trinidad sets forth that advantage has been taken of the most modern improvements in boilers, furnaces, multiple evaporators, crushing mills and other machinery. Trinidad produces a large amount of what are known as “yellow crystals,” which are sold in the British market for direct consumption and command a premium over the ordinary raw sugar.

Statistics compiled in 1909 show that the colony then had sixteen sugar factories, which turned out 52,972 tons of sugar, and the recovery represented 8.74 per cent of the weight of the cane; 451,801 tons of this cane were grown by the estates and 154,663 tons by the small farmers. There were 11,401 of the latter, 6077 of whom were East Indians and 5324 West Indians. Trinidad is the only West Indian colony where the attempt to fill the places of negro laborers with coolies from India has been successful. The production of sugar since 1900 has been as follows:

1900 41,269 tons 1901 51,077 ” 1902 44,913 ” 1903 46,029 ” 1904 50,744 ” 1905 38,240 ” 1906 62,975 ” 1907 50,564 ” 1908 48,933 ” 1909 52,972 ” 1910 exports 44,139 ” 1911 ” 37,282 ” 1912 ” 32,557 ” 1913 ” 31,665 ” 1914 ” 47,251 ” 1915 ” 49,107 ” 1916 ” 55,000 ”[70]

SANTO DOMINGO

Haiti is divided into two unequal parts, the republic of Haiti (République d’Haiti), comprising 10,204 square miles, and the republic of Santo Domingo (República Dominicana), with an area of 19,325 square miles. It is one of the four large islands of the West Indies and lies between 17 degrees 37 minutes and 20 degrees north latitude and 68 degrees 20 minutes and 74 degrees 28 minutes west longitude. Its length from east to west is about 407 miles and its greatest width is 160 miles. The total population is 2,737,700.

The surface of the island is exceedingly mountainous, three distinct ranges traversing it from east to west. The loftiest peak, Loma Tina, near the city of Santo Domingo, reaches a height of 10,300 feet. The extensive intervening valleys are fertile and watered by numerous rivers, none of which, however, are deep enough to be navigable.

The climate is hot and humid. An average temperature for the month of January would be about 75.4 degrees Fahrenheit, for July 84 degrees, and for the year 79.2 degrees. There are no active volcanoes, but great damage is done from time to time by earthquakes and hurricanes. The yearly rainfall is abundant, averaging about 120 inches. In San Pedro de Macoris, however, where the greater part of the sugar crop of the island is grown, the annual precipitation is in the neighborhood of 60 inches. As this is not sufficient for the needs of the growing cane, the planters have to do a certain amount of irrigating, and the water for this purpose is obtained from artesian wells.

The soil of the sugar-growing territory is of porous limestone formation, which shows evidence of disturbances and upheavals due to volcanic agency. Overlying this is a deposit of decomposed vegetable matter from three to twelve inches in thickness, and there are areas where a rich black or red soil, varying from one to two feet in depth, is found.

On December 5, 1492, Columbus sighted the northern coast of Haiti and found safe anchorage there. The newly discovered island was named Española, which was afterward latinized to Hispaniola. Later still, the settlement founded by the Spaniards in the southern part under the name of Santo Domingo gave its name to the entire island. When Columbus set foot on its shores, Haiti had 2,000,000 inhabitants, who were governed by five caciques, each holding both religious and political sway over the separate kingdoms. At the outset the newcomers were received with welcome and honor, but it was not long before their tyranny caused a rupture between them and the natives. A war of extermination followed, and by 1506 the entire island had fallen into the hands of the invaders.

Left in possession of a depopulated country, the Spaniards restocked it with African negro slaves. Meanwhile the interior of the island had been explored, settlements had been established, mines opened up and progress made in agriculture. In 1506 sugar was brought in and its cultivation soon assumed important proportions. About 1625 the French and English began to give trouble to Spain in the western archipelago, and a few years later a number of Englishmen and Frenchmen, who had been expelled from St. Kitts by the Spaniards, took refuge on Tortuga island and became famous under the name of Buccaneers. They succeeded in establishing themselves in a part of Haiti, and in 1697 their right of possession was acknowledged and the territory occupied by them was ceded by Spain to France by the treaty of Ryswick. The new colony was called Saint Dominique, and it entered immediately into an era of prosperity in which the expansion of the sugar industry was the principal factor. When the French revolution broke out, the exportations of sugar amounted to 80,000 tons, and this large production necessitated the employment of

a great number of slaves. The whites were few and the unequal proportion led to disaster. The population consisted of whites, free colored people (most of whom were mulattoes) and negro slaves. The mulattoes demanded the same civil rights as the white people and these privileges were accorded them in 1791. Incensed beyond measure, the whites clamored loudly for a reversal of this decree and finally obtained it. On August 23, 1791, a violent insurrection of the blacks broke out; the plantation slaves were joined by the mulattoes and a massacre of the whites followed. Those who escaped the slaughter fled, leaving all their possessions behind; the sugar plantations were destroyed and the entire sugar industry came to an abrupt end.

In 1793 Saint Dominique was attacked by England and Spain, whereupon the French government, in order to conciliate the blacks and retain its dominion over the colony, proclaimed all the slaves free. By the terms of the Peace of Bâle in 1795, the whole island passed into the hands of the French.

Toussaint Louverture, a negro of marked military ability, was appointed commander-in-chief by the directory, and by 1801 he succeeded in restoring order. Unfortunately, the measures that he endeavored to put into effect aroused the suspicions of Napoleon, who sent out an army to subdue him and to restore slavery. This expedition met with such determined resistance that the commander, General Leclerc, opened negotiations and Toussaint was induced by solemn promises to lay down his arms. He was treacherously seized and taken to France, where he died in 1803. The blacks immediately renewed hostilities under Jean Jacques Dessalines, and in November, 1803, the French withdrew completely. In the following year the independence of the island was declared and its ancient name of Haiti was restored. Dessalines was first made governor for life and in October, 1804, he proclaimed himself emperor. He was assassinated in 1806. From that time to the present the country has been in a state of turmoil and the end is not yet. In 1844 the people of the eastern end of the island seceded and formed the republic of Santo Domingo. Ever since then there have been two distinct governments in the island, with the strongest political antipathy existing between them.

But little sugar cane is raised in Haiti, and the most of this small quantity is either consumed as cane or made into a beverage called _tafia_.

The sugar plantations of Santo Domingo are found on the southern coast, in the level stretches of Arua and Romana, in the valleys near the city of Santo Domingo and in the region near San Pedro de Macoris. No sugar is grown in the interior. While most of the factories are land owners and cultivate cane, they do not grow all that they grind. A good deal is raised by colonos under the following conditions: The factories assign parcels of land to the colonos rent-free and in addition allow them the use of draft cattle and farming implements. When necessary a certain amount of actual cash is advanced. The colonos plant and till the land, furnish their own labor and deliver the cane at the point where it is loaded on the railway cars. The field hands are either natives or negroes brought from nearby islands, and their pay ranges from 50 to 75 cents gold per day.

The ground is tilled in an indifferent fashion and no fertilizing whatever is done. When virgin soil is planted, the seed is put in at seven-foot intervals, sometimes greater, without any holes or furrows having been made; the cuttings are simply stuck in the ground and partly covered with earth. The cane ripens in fourteen months or more. Ratooning follows until the yield gets so small that replanting is necessary. When this time comes, the old roots are ploughed up and furrows from four to six inches in depth are made about five or six feet apart. The seed cane is planted in these furrows at four- or five-foot intervals. The yield from virgin soil is very heavy and has been known to reach ninety tons to the acre, but the sugar content of such crops is low, whereas the subsequent ratoons with a decreased tonnage of cane per acre give juice of a better quality. A fair average production on a plantation having 4000 acres in cane would be about twenty-four tons to the acre. Naturally this estimate would be affected by the relative proportions of plant cane and ratoons, as well as by the character of the soil. Planting is generally done in June and October, while the harvesting begins in December and continues until April.

Manufacturing methods in Santo Domingo admit of much improvement. Single crushing is the method employed for the most part, so that the loss in extraction is considerable. The juices are treated and the suspended impurities allowed to settle at the bottom of the tanks. Filter presses are the exception rather than the rule, and for want of them the sugar in the resultant mud is lost. The clear juices are then concentrated and boiled to grain in vacuum pans. First sugars generally polarize between 95 degrees and 97 degrees, seconds about 86 degrees. The molasses is either made into rum or permitted to run to waste. Notwithstanding the crude character of the factories and machinery, the recovery of sugar is generally good, the average being between 9 per cent and 11 per cent of the weight of the cane, with single crushing.

Almost all of the factories are managed by Americans, but, as has been said, the equipment they have to work with is by no means modern, and under the extremely uncertain political conditions that prevail there is scant encouragement for outside capital to come

in and improve matters. Just when a change for the better will come is impossible to say.

Messrs. Willett & Gray give the yearly figures since 1903 in long tons, as follows:

1903-04 47,000 1904-05 47,000 1905-06 55,000 1906-07 60,000 1907-08 62,235 1908-09 69,483 1909-10 93,003 1910-11 89,979 1911-12 96,046 1912-13 84,661 1913-14 105,778 1914-15 108,267 1915-16 120,000

GUADELOUPE AND MARTINIQUE

GUADELOUPE

The French West Indian colony of Guadeloupe consists of two islands that lie in the middle of the Leeward group between 15 degrees 57 minutes and 16 degrees 31 minutes north latitude and 61 degrees 10 minutes and 61 degrees 49 minutes west longitude. They are separated by a channel from one hundred feet to four hundred feet wide, called Rivière Salée.

Basse-Terre, the western island, is twenty-eight miles long, from twelve to fifteen miles wide and its area is 364 square miles. It presents a rugged surface, broken by hills and highlands, and a backbone of mountains runs through it from north to south. It is of volcanic origin, having been thrown up by four volcanic centers, Grosse Montagne (2590 feet), Les Mamelles (2536 feet and 2368 feet), Morne sans Toucher (4855 feet), and La Soufrière (4868 feet). The last-named volcano was in eruption in 1797, and in 1843 its disturbances wrecked several towns; today, however, the only evidences of life are a few hot springs and the emission of sulphurous vapors at certain points.

Basse-Terre is watered by a number of streams that become swollen and turbulent during the rainy season.

Grande-Terre, the eastern island, is low and level, the greatest elevation being only 450 feet. It consists of a plain of limestone formation with a conglomerate of sand and broken shells. It is about twenty-two miles long from north to south and its area is 255 square miles. The population is 190,273, chiefly negroes and mulattoes. For water supply it is dependent upon ponds and cisterns, as, owing to the porosity of the soil, no rivers or streams exist.

The climate is warm and humid. The mean yearly temperature is 78 degrees Fahrenheit, the minimum 61 degrees and the maximum 101 degrees. The wet season is from July to November, and on the coast the annual rainfall is about eighty-six inches, with a great deal more in the interior. Terrific storms visit the island and hurricanes have wrought much destruction.

The soil is fertile and rich and the principal crop is sugar cane, which is grown on over half the total cultivated area. The principal sugar centers are Point-à-Pitre, St. Anne and Le Moule in Grande-Terre, all of which have well-appointed usines. There is also a large usine in Basse-Terre.

Guadeloupe was discovered by Columbus in 1493. One hundred and forty-two years afterward l’Olive and Duplessis took possession in the name of a French company called the Compagnie des Iles d’Amérique. The native Caribs did not long survive the cruel treatment accorded them by l’Olive, and efforts at colonization were the reverse of successful, in fact four chartered companies were ruined in the attempt. In 1674 the islands passed into the possession of the French crown and they were governed from Martinique for a long time. In 1759 they were captured by the British, in whose hands they remained for four years. The British again occupied them in 1794, but were driven out the following summer by Victor Hugues with the help of liberated slaves. The last British occupation took place during the Hundred Days of 1815, and they finally withdrew in 1816. Slavery in Guadeloupe was abolished in 1848.

MARTINIQUE

The French colony of Martinique is the most northerly of the Windward islands. It is situated between 14 degrees 55 minutes and 14 degrees 23 minutes north latitude and 60 degrees 48 minutes and 61 degrees 16 minutes west longitude. Its area is 381 square miles, its greatest length from northwest to southeast 36 miles, and its extreme width 18 miles. The population, negroes and half-castes for the most part, numbered 190,000 in 1913.

The surface is mountainous, the highest peak being Mt. Pelée, which rises 4428 feet above sea-level. The appalling eruption of this volcano in May, 1902, was one of the greatest disasters of modern times and cost the lives of 40,000 people. About one-third of the island’s surface consists of extensive plains, most of them occurring in the south. The soil of the northern part is of volcanic formation, while in the south it is composed of clay. There are a number of streams, some of them of considerable size.

Near the coast the average temperature for June is 83 degrees, and for January 77 degrees, the mean for the year being about 80 degrees Fahrenheit. The wet season extends from June to October and the total yearly rainfall approximates 87 inches. August is the wettest month and March the driest. In the low region of the sea coast the climate is not healthful for Europeans during the hot period, but a more salubrious atmosphere and a temperature 10 degrees lower is found in the wooded uplands, 1500 feet above the sea. Fresh, dry northerly winds prevail from November to February, easterly winds from March to June, and damp, warm southerly winds from July to October. Earthquakes are frequent, but hurricanes seldom visit the island.

Martinique was discovered by Columbus on June 15, 1492, and the French Compagnie des Iles d'Amérique took possession of it in 1635. It was settled in the same year by Pierre Belain, captain-general of the island of St. Christopher, and in 1674 it became the property of the crown.

Sugar culture was begun in 1650, and a few years later the aboriginal Caribs were exterminated, their place being filled by negro slaves, of whom there were 60,000 in the island by 1736. Slavery was abolished in 1848.[71]

During the seventeenth century Martinique was attacked several times by the British and the Dutch. It was captured in 1762 by the British under Admiral Rodney, but restored to the French in the following year. It was held by the British from 1793 to 1801 and also between 1809 and 1814.

The capital of the island is Fort de France, on the west coast. It is situated upon a fine harbor and has 18,000 inhabitants. Besides the chief product, sugar, the colony raises coffee, cocoa, tobacco and cotton.

GUADELOUPE AND MARTINIQUE

Sugar planting in these islands dates from 1635, the year in which they were first occupied by the French, and the industry grew apace, so that much sugar was exported to France during the latter half of the seventeenth century. The import duties levied by France in 1664 shut out foreign raw sugars from that country, while protecting raw sugars from her colonies; but at the same time the tariff laws excluded white sugar produced in the colonies. This was a death blow to the refineries of Martinique. A decree entirely prohibiting the refining of sugar in the colonies and the exportation of raw sugar to foreign countries was issued in 1669, while an export duty was imposed upon the raw sugar shipped to France. The tax upon raw sugar was removed in 1682, but the duty on refined was increased. The colonial planters then turned their attention to the manufacture of clayed sugars, which they sold in North America and southern Europe.

In 1717 France established relations with her colonies that were almost tantamount to free trade. No duties were assessed upon French goods going into the colonies, and commodities produced in the colonies entered the mother country without duty. As a result of this policy, the sugar industry grew until the production of Guadeloupe, Martinique and Saint Dominique was more than France could consume, and a law was passed permitting the sale of the surplus in other countries.

During the closing years of the eighteenth century, the war between England and France crippled the trade of the French West Indies, but when peace was finally restored the sugar industry revived and continued to flourish until the abolition of slavery in 1848.

When the slaves were freed, the planters cast about them to find laborers, and India was one of the first sources of supply. Over ten thousand Hindus were brought to Martinique between 1852 and 1862, and with very few exceptions they remained in the island after their five-year contract expired. During the twenty-two years that followed 1862, 25,500 laborers came to Martinique from Pondicherry, Yanaon, Karikal and Calcutta with the permission of the Indian authorities, but emigration from that country under government auspices was discontinued in 1885. In addition to Hindus, free African negroes, Chinese and Annamese were brought in.

The sugar plantations of Guadeloupe and Martinique are situated on the low, alluvial lands around the coast, although some are found in the interior. The hilly character of the latter, however, is not favorable to cane culture, as the heavy rains wash the arable soil down the slopes, thus interfering with the growth of the cane.

The ground to be planted in cane is first cleared and then ploughed. Furrows about two feet deep and four and one-half feet apart are then made and the seed cane is planted in holes five inches deep. Three weeks afterward the cane is banked and fertilizer applied. The soil between the canes is loosened from time to time and the crop is cut after a year's growth. As a rule, ratooning is limited to two years, one crop being produced each year. The land is then allowed to rest for a time, after which planting is begun

anew.

Bourbon cane is the variety principally grown, although seedling canes have been brought in from Barbados and British Guiana of late years. The average yield per acre of plant cane is twenty-four tons; first ratoons give sixteen tons and second ratoons about eight tons. After the cane is cut it is loaded on large carts and taken to the factories. Some estates are equipped with field railways, the cars being drawn by mules or locomotives.

As mentioned in the chapter on Jamaica, the early sugar producers of Saint Dominique, Guadeloupe and Martinique excelled the manufacturers of the other West Indian islands in the preparation of the commodity. The result was that their lead was gradually followed by the others, and a brief description of the methods they employed will be of interest.

The cane juice was boiled in a series of five or six copper kettles placed over a furnace fed by bagasse and wood. These kettles were of different sizes, the largest being farthest from the fire and the size of each decreased as the furnace door was approached, the smallest being directly above the fire. The kettle next to the largest was set a little higher than the largest one, the third higher than the second and so on until the last and smallest, which was the highest of the series. Clarification was done with lime and wood ashes, and sometimes a little crude antimony. As soon as the raw juice reached the first and largest kettle the clarifying material was thrown in and the boiling began. The scum was removed as soon as it formed, and when the juice became sufficiently clear it was quickly transferred to the second kettle; a small amount of alkali was mixed with it and further boiling and skimming was done. The liquor was then ladled into kettle number three, potash lye and an extract of herbs were added, and after being boiled for a time it was passed to kettle number four, and finally concentrated in the last and smallest kettle immediately above the fire. When the required consistency was reached, the massecuite was put into vessels to cool, at the same time being kept in motion by stirring until the grains began to form. It was then placed in moulds, and after having become thoroughly cool it was dumped into hogsheads that had perforated bottoms. These hogsheads stood on racks, beneath which there was a receptacle to catch the molasses as it drained on through the holes in the bottom. The draining was allowed to continue until about one-half the weight of the contents of the hogshead was crystallized sugar. The holes were then plugged up and the sugar was ready for shipment. The molasses was manufactured into rum.

A superior grade, called _sucre terré_, or clayed sugar, was also made. In its preparation, juice from the best and ripest cane was taken and as little lime as possible was used in clarification. Antimony was excluded entirely, on account of its tendency to darken the color of the juice. As the juice was transferred from kettle to kettle during the various boilings, it was strained through a cloth each time, instead of being ladled direct from one kettle to the next. When the syrup was concentrated it was put into earthenware sugar-loaf moulds that held between thirty and thirty-five pounds of massecuite apiece. These moulds had perforations in the bottom that were stopped up before the mass was put in. In filling a mould, one quarter of its capacity was put in at one time, making four operations. Fifteen minutes after the last lot of massecuite was put in the mould, a layer of crystals formed on the surface, and this was thoroughly stirred into the mass, which was then left to cool. A couple of days later the plugs were removed so that the molasses might drain from the mould. In case it did not run off properly, the massecuite was remelted, but if the drainage was satisfactory, the next step was the claying of the sugar. If the top of the loaves was uneven or dark-colored, it was scraped smooth and covered with a layer of crushed sugar. The surface was then hammered level and even. A special kind of clay brought from Rouen was mixed with water and the mould was filled to the top with this mixture. Windows and doors were shut to prevent evaporation of the moisture, and the water draining from the clay gradually passed down through the sugar crystals, washing the syrup from them. After ten days had elapsed, the clay, then thoroughly dried, was removed, the surface of the sugar-loaf was cleaned, another layer of wet clay was applied and allowed to remain as long as the first. When this second layer was taken off, the loaves were removed from the moulds and allowed to dry in the air for a time. Further drying was done in a drying room, heated for the purpose, and the sugar, when all the moisture had been driven from it, was crushed by wooden pestles. Refined sugar was packed for shipment in casks containing between 600 and 700 pounds. The first molasses was made into rum or boiled into second sugar, and the syrup washed from the loaves was made into a sugar called _cassonade_.

This primitive method of manufacture has been entirely supplanted by newer processes and appliances. As a rule, today cane is crushed twice and maceration is often employed. The juice is treated with sulphur while still cold, and it is then pumped into defecation tanks, where powdered lime is added; after this is done heat is applied. As soon as the scum cracks, the steam is turned off and the clear juice is separated from the sediment by a siphon and run to the evaporators, while the muddy precipitate goes to the filter presses.

Concentration of the juice takes place in double, triple or quadruple effects of rather an old type, which means lack of economy in steam and consequent large fuel consumption. As the quantity of bagasse available does not afford sufficient fuel to generate all the steam that is required, a considerable amount of wood and coal is used in addition for the purpose. The unwise and short-sighted policy of denuding the hillsides of their timber has had the effect of lessening the rainfall, a condition that has brought great injury to the planter.

The vacuum pans are small and of old style; the centrifugal machines, too, are of obsolete design and slow to operate. After the liquor has been boiled to grain in the pans and the sugar crystals have been separated from the mother liquor in the centrifugals, the sugar is dried and packed for the market in barrels or bags. The first molasses is reboiled and the resulting massecuite sent through the centrifugals. After this operation has been repeated three or four times, the final molasses is made into rum.

Today there are eighteen factories in Guadeloupe and fifteen in Martinique. The average extraction of sugar is 9.70 per cent of the weight of the cane, the loss of sugar in the bagasse is 2.15 per cent, the mechanical loss in manufacture is .90 per cent, and the percentage of sugar not recovered from the molasses is 1.75. This gives an average total of 14.50 per cent of sugar in the cane.

The manufacturers are dependent upon the small farmers for their raw material, and the price paid for the cane is determined by a very complex agreement, which nevertheless seems to be entirely satisfactory to both buyer and seller.

The outlook for the sugar industry in Guadeloupe and Martinique is far from bright. There is labor in abundance, but the natives are averse to working steadily, and consequently are unreliable. There are great possibilities for improvement, but little can be expected under the circumstances that prevail at the present time.

Since 1894 the production of the two islands in long tons has been as follows:

MARTINIQUE GUADELOUPE 1894 36,353 42,395 1895 28,777 29,394 1896 33,886 42,616 1897 34,185 39,493 1898 30,971 36,550 1899 31,165 39,259 1900 33,234 27,895 1901 39,121 38,086 1902 38,905 39,995 1903 28,578 37,891 1904 23,561 35,348 1905 29,986 26,905 1906 42,231 42,535 1907 36,764 38,345 1908 35,943 35,485 1909 37,757 24,812 1910 39,950 44,289 1911 35,438 38,384 1912 39,433 39,368 1913 40,000 32,000 1914 38,730 39,920 1915 40,000 40,000 1916 40,000 40,000

MEXICO

The United States of Mexico lie between 14 degrees 30 minutes and 32 degrees 42 minutes north latitude and 86 degrees 46 minutes and 117 degrees 7 minutes west longitude. On the north the boundary is the United States of America; on the east the Gulf of Mexico, the Caribbean sea, British Honduras and Guatemala; on the south British Honduras and the Pacific ocean, and on the west the Pacific ocean. The superficial area of the country is 765,537 square miles. Its greatest length is 1942 miles and its greatest width is 762 miles. It has a coast line of 5486 miles, of which 1603 miles are on the Gulf of Mexico and the Caribbean sea and 3883 miles on the Pacific ocean and the Gulf of California.

The surface of Mexico rises sharply from the seacoast levels by a series of terraces to a central plateau, that varies in height from 4000 to 8000 feet and runs northwest and southeast. This tableland has been formed by the material deposited during the gradual erosion of the mountains and by matter thrown up by a great number of volcanoes. In this manner the original valleys became completely filled up and those that now exist are of later formation. To illustrate this filling process, buried mountains whose peaks appear above the surrounding mass are found in the higher parts of the plateau, while elsewhere they are met with as continuous ridges. The eastern coast is low and sandy, except in a few places where the mountains come down close to the shore. The Pacific coast lands are also low, but occasionally broken by mountain spurs. Owing to the terraced character of the country, very little river navigation is possible, but on the other hand an enormous amount of power can be developed from the numerous waterfalls. Two high mountain ranges, one on each coast, run parallel to the sea the entire length of Mexico. The eastern chain is about ten miles inland, while on the west there is only a narrow shelf of land between the sea and the cordilleras. This western range has several branches that run in different directions, the most important being the Sierra Madre Occidental. In Mexico the highest mountains are volcanoes. On the Pacific side and west of the plateau are found the Volcán de Colima (12,750 ft.) and the Nevado de Colima (14,354 ft.). Southwest of the City of Mexico is the Nevado de Toluca (16,610 ft.) and to the south and east are the snow-crowned giants Popocatepetl (17,540 ft.) and Ixtaccihuatl (15,705 ft.). Still farther east are Orizaba (16,176 ft.) and Cofre de Perote (14,309 ft.). Popocatepetl and Orizaba may be classified as dormant cones, for the reason that aqueous and sulphurous vapors are constantly being emitted from their perfectly formed craters. One of the highest lakes in the world is found in the crater of the Nevado de Toluca. Colima has been in eruption continuously for many years and is still active. The snow never leaves the summits

of Orizaba, Popocatepetl and Ixtaccihuatl, and on the last the ice cap attains a development sufficient to form true glaciers.

On the western coast the principal ports are Guaymas, Mazatlan, Topolobampo, Acapulco, La Paz and Salina Cruz; on the eastern seaboard, Tampico, Vera Cruz, Puerto Mexico, Campeche and Merida. Of the numerous rivers, the most important is the Rio Grande, 1550 miles long, which forms a natural boundary between Mexico and the United States from El Paso to the Gulf. However, the conformation of the country does not admit of river navigation to any extent.

According to the census of 1910, the population was 15,063,207, of which 20 per cent were whites, 43 per cent of mixed blood and the remainder of Indian extraction.

In Mexico there are three distinct climates and a wide range of temperature. The hot country, _tierra caliente_, extends from the seacoast inland to an altitude of about 3000 feet. Here the mean annual temperature is between 80 degrees and 88 degrees, and the highest between 100 degrees and 105 degrees Fahrenheit. In this region the winter climate is delightful, except when severe gales sweep down from the north. In summer the extreme heat is not so great as in New York, because of the moderating effect of cool breezes.

The temperate region, _tierra templada_, extends from 3000 to 6500 feet above sea-level, and it is here that the ideal climate of Mexico is found, the mean annual temperature being between 73 and 77 degrees Fahrenheit, with a total variation of possibly not over 6 or 8 degrees during a season. In this dry, clear atmosphere the hygienic disadvantages of the seacoast, the sharp, cold winds of the upper altitudes, sudden changes in temperature, heavy frosts, extreme humidity and harmful insects are unknown, and in the dry season there is no malaria.

Tropical and semi-tropical growths flourish side by side, and there are estates on which wheat and sugar cane are raised almost in touch of each other.

The cold country, _tierra fria_, extends from the 6500-foot level to the snow line, but here the term cold is used in a comparative sense, as distinguished from the heat of the seacoast. The average temperature runs between 59 degrees and 62 degrees Fahrenheit, with slight variations. At times, however, a norther will drive the mercury down to 40 degrees or 35 degrees and sprinkle the streets of Mexico City with white.

As a rule, in Mexico the rainy season begins in May or June and ends in October. The annual rainfall varies greatly according to locality, ranging all the way from fifteen to fifty inches. Earthquakes are of common occurrence, especially on the western coast.

Sugar cane was brought to Mexico by the Spanish conquistadors. Prescott, in his “Conquest of Mexico,”[72] says that the sugar cane was transplanted from the neighboring islands to the lower level of the country, and that, together with indigo, cotton and cochineal, it formed a more desirable staple for the colony than its precious metals. He also states that it was Hernan Cortés himself who introduced the cane from Cuba. This famous soldier established the Atlacomulco plantation, which lies an easy hour’s ride distant from Cuernavaca in the state of Morelos, and there, in 1520, a hundred years before the landing of the Pilgrim Fathers at Plymouth, he erected the first sugar mill in Mexico. This mill is owned by the descendants of Cortés and is still in operation.

Thirty years later sugar was shipped from Mexico to Peru and Spain, and the production of the commodity was maintained steadily until 1791. In that year all the cane-growing countries of western America received a stimulus from the wholesale destruction of the plantations and mills of Santo Domingo.

In Mexico natural conditions are very favorable to sugar culture, but the growth of the industry has been retarded by the primitive methods in vogue, the inadequacy of transportation facilities and political disturbances. In the seaboard states the sugar plantations are found chiefly in the rich lowlands bordering on the Pacific ocean and the Gulf of Mexico. In the Gulf states the rainfall is ample to insure good crops. The largest sugar producer, however, is the inland state of Morelos, and there, as well as on the west coast, irrigation is necessary. The higher levels do not give such good crops as the lowlands; on the latter the yield is between forty and sixty tons to the acre, and on the former it runs between twenty-five and forty-five tons to the acre. Sugar beets have been grown on the plateau with marked success. In the low, tropical regions seven or eight crops of ratoons can be raised, but on the higher lands replanting must be done every two or three years. The best-known plantations are situated on large estates that have been owned by the same families for many generations. For instance, in Morelos, where about sixty per cent of Mexico’s crop is produced, the estates are owned by non-resident families and, as a rule, managed by Spaniards. Labor is cheap and abundant, the cane is rich in juice and the sugar content is high, but the extraction in the small, crude mills is poor, the recovery of sugar, as a rule, not exceeding six per cent of the weight of the cane. There are a few large factories in Mexico where the methods and results

should be more closely in accordance with modern practice.

The nineteenth century saw the industry maintained on a fairly even basis, but about 1900 an improvement was noted, as the following table will show:

1899-1900 75,000 tons 1900-1901 95,000 ” 1901-1902 103,000 ” 1902-1903 112,000 ” 1903-1904 107,000 ” 1904-1905 107,000 ” 1905-1906 107,500 ” 1906-1907 119,000 ” 1907-1908 123,000 ” 1908-1909 143,000 ” 1909-1910 148,000 ” 1910-1911 161,602 ” 1911-1912 151,735 ” 1912-1913 148,672 ” 1913-1914 130,000 ” 1914-1915 110,000 ” 1915-1916 75,000 ”

The effects of the internal disturbances in Mexico are plainly reflected in the crop figures. In addition to the sugar tonnage shown, about 50,000 tons of _piloncillo_ or _panela_ (concrete sugar) are turned out annually by the small mills and the production of molasses is large. A considerable amount of the latter is used in the manufacture of rum and alcohol.

As regards the future of sugar in Mexico, there is much to justify belief in ultimate expansion and prosperity. Labor is cheap and plentiful, there are vast tracts of rich virgin land awaiting cultivation, irrigation possibilities are great, and when the present political disorders shall have been quieted and stable conditions established, a movement forward will surely follow.

PERU

Peru is situated on the west coast of South America and extends from 3 degrees 21 minutes to 18 degrees south latitude and from 70 degrees to 81 degrees 40 minutes west longitude. Its area, including certain disputed territory, is 676,638 square miles. Physically, it is divided into three distinct regions, the coast, the sierra and the montaña. In the first, or the dry side of the Andean slope, spurs run out from the main range of mountains toward the ocean, forming extensive valleys, some of which are well watered and very fertile. The spaces that lie beyond the life-giving influence of the rivers have the appearance of sandy deserts, but they only need water to make them productive. The Andes proper occupy the sierra region, which abounds in plateaus, deep ravines, rich sheltered valleys and snow-capped mountains of stupendous height. East of the Andes lies the montaña, or wet side. It is traversed by broad navigable rivers and embraces the sub-tropical forests in the ravines and on the eastern slopes of the Andes, as well as the dense tropical forests of the wide valley of the Amazon.

According to the 1915 edition of the Century atlas, the population is 4,609,999. About 57 per cent of the inhabitants are Indians, 13 per cent whites, 2 per cent Asiatics, 2 per cent negroes, the remainder being mixed races.

The sugar plantations are found on the west or dry side in the coast region.

The valleys of this coast country have been upraised from the ocean at a comparatively recent geological period, and the fertile soils of these valleys are the result of erosion and deposit through the agency of mountain torrents.

The most important cane-growing districts lie seven or eight degrees south of the equator, and yet the climate of that section cannot be called really tropical. It is influenced by the cold antarctic currents and the steady winds that sweep northward. Observations on the Cartavio plantation during the period 1904-1907 showed the highest maximum temperature to be 95.5 degrees and the lowest minimum to be 52 degrees Fahrenheit. In the coast territory the rainfall is limited and the cane crops depend upon irrigation.

The soils of the coast valleys range from silt to an extremely fine sandy loam, and vary in thickness. As a rule they are deep, retentive of moisture, well drained, rich in plant food, easy to cultivate and, with intelligent treatment, very productive.

Ricardo Palma, in his work, “Tradiciónes Peruanas,” sets forth that sugar cane was not known in Peru when Francisco Pizarro and his followers first landed there in 1527, but that it was brought in a short time afterward. The first plantation was established in 1570 and the first factory was erected on an estate in the valley of Huanuco. Meanwhile, the sugar used in Lima came from Mexico, and the owner of the Huanuco mill, realizing that his product could not compete with Mexican sugar, had recourse to a clever stratagem. He loaded a vessel with sugar and sent her to Mexico. The ruse was successful, for the Mexican manufacturers at once concluded that if sugar could be shipped from Peru to Mexico, the production must be large and the cost very low. Consequently, they discontinued their shipments from Acapulco to Peru, much to the advantage of the astute factor of the Huanuco valley. In the beginning, the estates were worked by slaves, and, as happened in other sugar countries, after the abolition of slavery the plantation owners were compelled to look abroad for their laborers. As many as 90,000 Chinese were imported from Macao[73] between 1849 and 1874, but so many of them succumbed to the severe treatment they received that the Macao authorities put a

stop to the labor traffic altogether. The Chinese living in Peru at the present time are tradespeople and the work on the sugar plantations and in the mills is done by the native Indians.

[Illustration: LEVELING A CANE FIELD, PERU]

[Illustration: LEVELING GROUND BY STEAM, PERU]

The year 1860 marked an important change in the industry, which up to that time had been carried on in a very primitive manner. A large amount of fresh capital was put into sugar enterprises, new mills were built, the most approved machinery was installed and the factories were equipped with the best appliances that money could buy. The apparatus for some of the plants was brought from the United States, while that for others was supplied by European countries, so that the methods and workmanship of various nationalities are found in the Peruvian factories. No expense was spared in any department and all went well so long as the price of sugar kept up; what was easily made was liberally administered, but when in 1875 the market dropped, severe competition drove many operators into difficulties and a number of them went under entirely. The war with Chile in 1878 and the subsequent revolutionary disturbances impeded the progress of the industry, but a restoration of tranquillity came in 1895, and since then the sugar business of Peru has prospered and increased in volume.

An experiment station was established near Lima in 1906 for the study of cane cultivation, irrigation problems and the improvement of yield and quality by the introduction of new varieties of cane. The manufacturing side of the question has also been gone into with great care, and much is being done to increase efficiency in that direction.

Today there are 47 modern factories in Peru and 125,000 acres planted in sugar cane. Outside of these modern plants, crushing is also done in a crude manner in wooden-roller mills on small plantations that are scattered throughout the interior. The juice obtained in this way is worked up to _chancaca_[74] or _panela_ or made into an alcoholic beverage called _cañaso_ or _chacta_.

As the plantations do not depend upon any special season of rainy or dry weather, planting and harvesting may be done at any time. In Peru the land upon which sugar cane is grown is generally gently sloping. On the large haciendas, when preparing virgin soil for planting, the brush is first cleared away and the holes filled. The ground is then ploughed and cross-ploughed by steam-ploughs and broken fine by clod-crushers; roadways and drainage ditches are laid out, forming squares or rectangles, and furrows are made at intervals of three to four feet. This done, the ground is ready for planting. The cane tops used for seed are cut during harvesting, loaded on cars and sent to the field that is to be planted. The seed cane is placed horizontally in the furrow and covered with a few inches of earth, and as soon as the whole field is planted in this manner, water from the irrigation ditch is turned in and the cane left to grow. The first weeding is done when the cane shoots are a foot high, and it is continued at intervals until the cane leaves become large enough to shade the ground and prevent weed growth. The cane matures in from eighteen to twenty-four months, according to location, soil and weather conditions. Some weeks before harvesting, irrigation is discontinued in order to allow the cane to ripen.

In cultivating the first ratoons, when the cane gets to be a few feet high the crest of the furrow is thrown down into the furrow so that the irrigation water passes between the rows of cane instead of along the furrows, as in the case of plant cane.

Ratooning is kept up until it ceases to be profitable. At the Hacienda Cartavio, four ratoon crops have been grown in some places, and as many as seven in others, with good results.

[Illustration: PLANTING CANE, PERU]

[Illustration: PORTABLE BRANCH LINE OF FIELD RAILWAY AND CANE CUTTERS, PERU]

The principal ingredient of the fertilizer used is guano, which is mixed with lime, nitrate of soda, potassium sulphate, or ashes from the bagasse furnaces, and it is applied in various ways. Some planters throw it in the furrows with the seed cane and allow it to remain there a time before turning on the water; others place it in the furrows a few months after the planting and cover it immediately, while still another method is to apply it and turn on the water at the same time. On certain plantations the fertilizer is ground and spread over the entire field just before replanting.

Water for irrigating is obtained from the mountain streams, which are dammed at certain points, and but little is pumped from wells. The quantity needed is far less than in Hawaii, owing to the nature of the soil and the presence of underground moisture close to the surface. A fixed amount is assigned to each estate by the government and this is never exceeded during the dry season. In flood time, however, the regulations are somewhat relaxed, as there is then enough for all and to spare.

The water is brought on the land by large ditches, and thence to the cane fields through smaller ones. From these field ditches it flows directly into the cane rows at the upper end of the field or section, and, owing to the slight slope of the land, it passes freely through the parallel rows from the upper to the lower end of the section. It is retained in the furrow by means of a dam at the lower end. Other ditches are made at the lower ends of the sections for drainage purposes. The amount of irrigating done varies according to the nature of the land; in some cases water is applied only once during the season, in others as many as twenty-four times. The average number of waterings is five.

When the cane is ripe it is cut by laborers with heavy knives, or machetes, and loaded by hand into cars that run through the fields on portable tracks. These cars, which hold from two to ten tons each, are made up into trains and drawn by a locomotive to the mill. The average yield per acre in 1912 was about 34 tons, but the planters are seeking for better results through improved field methods and new varieties of cane. Pests and disease do little damage in Peru, although the borer gives some trouble. Owing to the long period of growth in a dry climate, Peruvian cane is high in fiber and low in juice, but the juice is rich and very pure; this combination of high fiber content and high percentage of sugar in the juice, however, brings about an unusual loss of sugar in the bagasse.

Nearly all of the sugar manufactured is a coarse-grained centrifugal raw, polarizing about 96.5 degrees and known to the trade as “Peruvian crystals.” Part of it is marketed in the United States and the rest goes to Great Britain, while the second and third sugars are sent to Chile to be refined there. A certain amount of white sugar for home consumption is made by washing the brown centrifugal sugar.

[Illustration: HAULING CANE-LADEN CARS WITH OX-TEAM, PERU]

[Illustration: TRAIN-LOAD OF CANE EN ROUTE TO THE FACTORY, PERU]

At the beginning of the Chilean war the output was approximately 80,000 tons. In 1905 the production of sugar and molasses was 159,294 long tons, and 132,222 tons of this were exported.

The following table gives the outturn in long tons since 1905:

YEAR CONSUMPTION EXPORTS TOTAL

1905 27,077 132,136 159,213 1906 32,178 134,592 166,770 1907 30,110 108,886 138,986 1908 31,895 122,940 154,836 1909 29,173 123,393 152,567 1910 29,189 119,744 148,933 1911 31,988 121,758 153,745 1912 36,129 145,106 181,236 1913 34,976 140,669 175,645 1914 32,555 173,910 206,465 1915 40,000 208,487 248,487

The possibilities for expansion in Peru’s sugar industry are large. Further impounding and conservation of the flood waters from the mountains would bring under cultivation many thousands of acres that are now unproductive. Good flowing wells have been sunk on some estates, and it is likely that many more will be found, thus adding substantially to the present water supply. As to cost, it would seem that Peru should be able to compete successfully with other cane-growing countries. The plantation lands are level or slightly sloping, so that cultivating machinery may be used to good advantage. Grinding can be carried on without interruption throughout the year, which means economical factory capacity and an even distribution of labor. The cost of labor, too, is reasonable, and great quantities of fertilizers lie close at hand. In short, Peru enjoys many advantages, and if her planters and refiners keep pace with scientific development, she will take a prominent place among the cane-sugar countries of the world.

BRAZIL

Brazil is the largest political division of South America. Its area is 3,270,000 square miles, or slightly greater than that of the United States, excluding Alaska. From Cape Orange, in 4 degrees 21 minutes north latitude, it extends 2629 miles southward to the river Chuy, in 33 degrees 45 minutes south latitude, and from Olinda 2691 miles west to the Peruvian border, between 34 degrees 50 minutes and 73 degrees 50 minutes west longitude. According to the latest census returns at hand, the population numbers 20,515,000.

Speaking generally, Brazil is a tropical country with sub-tropical and temperate regions in the south and in a large part of the high central plateau. The sugar-producing states are Maranhão, Rio Grande do Norte, Parahyba, Pernambuco, Alagoas, Sergipe, Bahia, Minas Geraes, Rio de Janeiro and São Paulo. The plantations themselves lie between 4 degrees and 21 degrees south latitude, and being swept by the moisture-laden eastern trade winds, they receive a fair amount of rain during the wet season, that

is, from January to May.

Traces of a vanished civilization had already given rise to the belief that the history of Brazil, like that of Mexico and Peru, extended far into remote ages, when, in 1845, the discovery in the interior of the country of the ruins of a large and very ancient city, with magnificent buildings bearing inscriptions in unknown characters, confirmed this opinion.

Nevertheless, the known history of Brazil dates only from the end of the fifteenth century. It was discovered in February, 1499, by Vicente Yañez Pinzon, a companion of Columbus. The following year it was annexed to Portugal by Pedro Alvares Cabral, but the new territory received little attention from the Portuguese monarchs until 1531, when an attempt at colonization was made. Shortly afterward a sugar mill was erected in São Vicente Piratininga, now São Paulo, and as the soil and climate of that part of the country were well adapted to cane culture, the industry grew and other factories were built. In 1580 there were 120 mills, the greater number being in Bahia and Pernambuco. That same year Philip II of Spain usurped the crown of Portugal, and Brazil, with the rest of the Portuguese possessions, came under Spanish rule. Under the new régime she was exposed to attack by powerful foes. Dutch forces occupied Bahia in 1624, only to be expelled by the Spaniards a year later; in 1629, however, they obtained a foothold in Pernambuco. They took Olinda and its port, but were unable to extend their influence beyond the borders of the town until the arrival of the newly appointed governor, Count John Maurice of Nassau-Siegen, in 1636. This able executive carried the Dutch dominion along the coast from the mouth of the São Francisco to Maranhão, and an expedition sent out by him captured Angola and São Thomé on the west African coast, thus securing a supply of negro slaves, while depriving the enemy of them. He did much to build up the sugar industry, so severely crippled by the war, and when in 1644 he resigned his post, the importance of Brazil as a sugar-producing country had been re-established. The Portuguese threw off the yoke of Spain in 1640 and immediately set about to retake their former colony, Brazil. After years of fighting, the Dutch were finally overcome and in 1655 a government decree drove them from the country. This banishment deprived Brazil of the Dutch sugar planters, with their slaves, their capital, their practical knowledge and skill. From the time of their exodus the Brazilian sugar industry began to decline. The greater number of these refugees established themselves in the West Indies, where they again engaged in sugar planting with marked success.

Brazil became an independent power in 1825 as an empire, with Dom Pedro I, son of the Portuguese king, on the throne. This monarch abdicated in 1831 in favor of the five-year-old heir apparent, who took the name of Dom Pedro II and reigned until 1889, when the empire gave way to a republic. The wars carried on by Brazil against her neighbors between 1851 and 1870 brought her provinces into touch with each other, as well as with the outside world.

In 1826 she pledged herself to Great Britain that, beginning with 1830, she would suppress the traffic in African negro slaves. This promise, however, she failed to keep, so the British parliament passed an act directing the seizure of all slave ships found in Brazilian waters. In every instance the slaves were liberated and the slave dealers brought before British tribunals. Complete suppression of the importation of slaves was the result. In 1871 children born of slave parents were declared free by law, and the movement in favor of emancipation continued until 1888, when slavery was entirely abolished without any indemnity to the slave owners.

The long reign of Dom Pedro II was marked by progress and prosperity. The emperor had the best interests of his people always at heart and concerned himself more with economic development than with political activities. Broad and liberal in his views, he made no attempt to prevent the spread of socialistic doctrines, which, about the year 1880, began to seriously affect the thought of the educated classes. The feeling of unrest and the desire for change engendered in this way culminated in the military conspiracy of 1889, and, as was only natural, the former slave owners, smarting under their losses, took sides against the emperor. The monarchy fell and was replaced by a republican form of government, which, despite several attempts to restore the empire, has endured to the present day.

In the sugar-growing regions of the north and center methods of cultivation do not show much improvement over the practice of early times. Cane is planted in holes about nine inches deep and five feet apart, no fertilizer being used. Some five weeks later the soil is turned up and after fifteen months' growth the cane matures. In São Paulo, however, the planters work on more scientific lines, and ploughing, furrowing, tilling, fertilizing and weeding are done in a thorough manner. The crop depends upon rainfall entirely, and in a normal season ripens in from fourteen to sixteen months. As soon as the cane is cut the dry cane leaves are burned and ploughing begins. The plough passes close enough to the cane roots to tear them more or less, thus helping the new growth. Shortly after the new cane shoots appear, the ground is spaded up or ploughed, just as in the case of plant cane. Ratoons ripen in twelve or fourteen months, and as a rule four to six ratoon crops are grown before replanting is done.

The yield of cane varies with the rainfall and the richness of the soil, and ranges from 20 to 30 tons per acre for first ratoons, diminishing with succeeding crops. The sugar content frequently reaches 18 per cent.

Cane is grown either by colonos or by indentured laborers. In the colono system a tract of land from 9 to 36 acres in size and planted to cane is assigned by the estate to a group of colonos according to their number. The colonos care for the cane during its period of growth and harvest it when ripe. For this they receive the equivalent of $12.50 American gold per acre. Assuming that the yield per acre is 20 tons, the cost to the owner of the estate of cultivating and harvesting a ton of cane is 62½ cents. The colono is given pasture land for his cattle, fuel and house rent free.

The indentured laborers are allotted a certain amount of untilled ground, which they prepare, plant and cultivate. Seed cane, houses and pasturage are furnished gratis, and when the cane is ripe they harvest it. The amount paid the indentured laborers for cane raised in this way fluctuates according to the market value of sugar. For example, in São Paulo when the price of sugar is $4.41 gold per hundredweight, the laborer gets $2.23 per ton for his cane; when the price exceeds $4.41 and is less than $5.90 per hundredweight, he receives $2.55 per ton; when sugar sells between $5.90 and $8.60 per hundredweight, his share is $3.18 per ton; should the price go over $8.60, he gets $3.82 per ton.

The practice in Bahia is somewhat different. Taking as a basis a price of $2.939 gold per hundredweight for sugar, the cane brings $1.646 per long ton, and for every .147 cent (■ cent) per pound fluctuation in the price of sugar, the value of cane changes 9.88 cents per ton up or down as the case may be.[75]

In the small factories the methods of manufacture are very old-fashioned. The cane is crushed between rolls of hard wood, and the juice, after being strained to remove the suspended impurities, is boiled to grain in copper kettles. The magma is then run into large wooden moulds having cone-shaped, perforated bottoms. The holes in the bottom of these moulds are closed when the hot massecuite is dumped in, but as soon as it cools the plugs are taken out and the molasses allowed to drain off. A layer of very wet clay is then spread over the top of the sugar, and as the water slowly drains from the clay it passes through the sugar crystals, carrying the mother liquor with it. After this washing process has gone on for some time, the sugar is removed from the moulds, and the upper portion is found to be white, or nearly so, while underneath the color deepens into yellow and from that to brown as the bottom is reached. The sugars are carefully separated according to their color, then dried and packed in bags containing 60 kilograms or about 132 pounds each.

[Illustration: SUGAR PLANTATION BETWEEN RIO DE JANEIRO AND SÃO PAULO, BRAZIL]

It will readily be seen that the loss in extraction by such means is very great. In fact, from cane having a sugar content of 15 per cent, sometimes not more than between 5 per cent and 6 per cent of sugar is recovered. The best results are naturally obtained in the large factories, or usines, but even there, owing to poor crushing, 9 per cent of the weight of the cane in sugar is considered satisfactory.

In the usines the juices are treated with sulphur and neutralized with lime. They are then allowed to settle, after which they are boiled to grain and the crystals separated from the mother liquor in centrifugal machines. The sugar is dried and the remaining liquor is returned to the pans for reboiling.

The various grades produced are:

Cristaes blancos (white washed sugar) Cristaes amarellos (first yellow, termed Demerara) Mascavinhos (second yellow, fine grain) Mascavos (dark brown sugar, final product)

The greater portion of the sugars made in Brazil is refined, but a certain amount goes directly into consumption in its raw state. Refining on a large scale according to European methods has been tried at various times, but, owing to the high cost of labor, fuel and transportation, all these attempts have proved unsuccessful. Then again, the demand for sugar prepared in the European way is not great, the Brazilians preferring the moist fine-grained sugar made in the small refineries. This sugar has a molasses taste, polarizes about 91 degrees and carries about 2 per cent of glucose. In manufacturing the white grade, a liquor of 31 degrees Baumé[76] is first made from raw sugar. This is clarified with ox-blood and filtered through bone-char, after which the clear liquor is boiled at a temperature of 266 degrees Fahrenheit over an open fire until only about 4 per cent of water remains. It is then removed from the fire, a small quantity of dry granulated sugar is added and the mass is stirred with a wooden paddle. Cool, dry, fine-grained sugar is the result. The yellow grade, or _terzira_, as it is called, is made in exactly the same manner, except that no clarifying or filtering is done. The rich molasses odor and taste of this sugar please the popular palate to such an extent that it commands a

higher price than white granulated sugar refined by the most modern processes. In fact nearly 75 per cent of the sugar consumed in Rio de Janeiro is terzira. Its manufacture does not require expensive equipment or any great amount of technical skill, hence it appeals to the native merchants and confectioners.

Recently the government has put forth some effort to encourage and improve the sugar industry, but so far without much success. A law was passed in 1875 guaranteeing a return of 7 per cent upon the money expended in constructing central factories, a given number being allowed each state. This act was modified some years later and the rate of interest reduced to 6 per cent, but as the refunding period was longer it met with more favor than the first and a number of concessions were granted. In 1889 the state of Pernambuco appropriated a sum equal to $135,000.00 gold to be divided among forty factories, with the understanding that repayment was to be begun after the harvesting of the third crop and extended over a period of twenty years. All this legislation had no definite result.

A few years ago, a combination of the producers was formed for the purpose of maintaining a high price for domestic sugar by setting aside a certain fixed amount for export. At first this was 20 per cent, but it was afterward increased to 40 per cent. The plan, however, was ineffectual. A heavy import duty (about 5.86 cents per pound) prohibits the bringing in of foreign sugars, so that Brazil must provide for her requirements within her own borders.

Accurate information concerning production, distribution and prices is hard to obtain. Bad transportation facilities, diversity of customs regulations between the states, and the vast number of small producers who sell to the consumer direct, make the compilation of dependable data almost an impossibility. The statistics that are submitted, therefore, are approximative.

Brazil's sugar exports grow less and less. The United States no longer depends upon her for supplies, so that the outlook for the industry in Brazil is not bright at the present time. Modern refining methods are not regarded with favor by the people and any considerable extension in production seems remote.

PRODUCTION IN BRAZIL

1891 185,000 tons 1892 200,000 ” 1893 275,000 ” 1894 275,000 ” 1895 225,000 ” 1896 210,000 ” 1897 205,000 ” 1898 151,500 ” 1899 175,000 ” 1900 256,460 ” 1901 312,957 ” 1902 254,693 ” 1903 187,500 ” 1904 197,000 ” 1905 195,000 ” 1906 275,000 ” 1907 215,000 ” 1908 180,000 ” 1909 248,000 ” 1910 253,000 ” 1911 287,000 ” 1912 235,000 ” 1913 204,000 ” 1914 203,394 ” 1915 240,000 ” 1916 194,000 ”

BRITISH GUIANA

Guiana, in its widest meaning, is the name given to that part of South America that lies between 8 degrees 40 minutes north and 3 degrees 30 minutes south latitude and 50 degrees and 68 degrees 30 minutes west longitude. This vast territory, about 690,000 square miles in area, comprises Venezuelan Guiana, British Guiana, Dutch Guiana (Surinam), French Guiana (Cayenne), and Brazilian Guiana. The first of these divisions is now part of Venezuela and the last is included in Brazil.

The coast of British Guiana is fringed by low, alluvial flats, the result of deposit by the rivers. Beginning at three feet below high-water mark, these flats extend inland 25 or 30 miles, rising imperceptibly about 15 feet. Beyond is a broad, rolling region of sandy clay formation, 150 feet above sea-level, which runs back to the forest-covered hills. Two ranges of mountains traverse the country from west to east and a third chain forms the southern boundary and the watershed between the Essequibo and the Amazon. The highest mountain peak is Roraima on the western border, 8635 feet.

The rivers of British Guiana and their tributaries form a network of waterways throughout the country and they are practically the only transportation routes from the coast into the interior. The most important are the Essequibo, the Demerara, the Berbice and the Corentyn. The Essequibo has its source in the Acari mountains near the equator at 850 feet above the sea, and it flows north about 600 miles, reaching the Atlantic by an estuary 15 miles wide, in which there are a number of large and fertile islands. At one time sugar cane was grown on four of these islands, but today only one, Wakenaam, has a sugar mill.

For the ten months beginning with October and ending in July, the temperature on the coast is even, as the northeast trade winds keep it down to 80 degrees Fahrenheit on an average, but the cessation of the trades in August and September makes the heat oppressive. Hurricanes are unknown and but little damage is caused in the coast regions by earthquakes, owing to the character of the soil. In the interior the year is divided into one wet and one dry season, but in the low-lying coast country, where the sugar plantations are, there are two wet and two dry periods. The long wet season begins about the middle of April and lasts until August;

the long dry period is from September to the end of November. The rainfall varies greatly according to locality; on the coast the yearly average is 80 inches. In 1914 the population was estimated to be 304,089; of these 120,000 were negroes, 124,000 East Indians, 11,600 Portuguese, 4300 Europeans of other nationalities, 6500 aborigines and over 30,000 of mixed race.

Guiana was sighted by Columbus in 1498 and by Alonzo de Ojeda and Amerigo Vespucci in the year following. Vicente Yañez Pinzon is credited with having sailed up some of the rivers in 1500 and Sir Walter Raleigh ascended the Orinoco in 1595 in quest of the mythical city El Dorado. Dutch traders reached Guiana in 1598 and by 1613 they had established several settlements on the coast of Demerara and Essequibo. Meanwhile English and French adventurers were endeavoring to obtain a foothold in Surinam and Cayenne, which they succeeded in doing in 1652. The colony of Essequibo was under the administration of the Dutch West India company from 1621 until 1791, when the company was dissolved. A Dutch settlement established on the Berbice river in 1624 was the beginning of the colony of that name, which was taken under the protection of the States-general of Holland in 1732. Demerara, formerly a dependency of Essequibo, became a separate colony in 1773. In 1781 the three colonies, Essequibo, Demerara and Berbice, were captured by British privateers. The following year they were taken by France, and restored to Holland in 1783. The British took possession a second time in 1796, retaining them for about six years, at the end of which period they passed back into the hands of Holland once more. The British occupied them in 1803 and they were formally ceded to Great Britain in 1815. The three colonies were consolidated into one under the name of British Guiana in 1831.

Essequibo, Berbice and Demerara all produced a considerable amount of sugar during the Dutch régime. The plantations were on coast and river lands that had been diked and drained. Like all sugar-growing countries, this colony was adversely affected by the abolition of slavery, but owing to the success that attended the introduction of coolies from Hindustan, the labor situation never became so acute as it did in many islands of the West Indies. Traffic in African negro slaves was forbidden in 1808. After 1834 the sugar planters sought free laborers in the neighboring islands and in Madeira. Many people who had been deprived of their means of livelihood by the destruction of the vineyards of Madeira by disease settled in British Guiana. The importation of free negroes from British African possessions was sanctioned by the home government in 1840, and between that year and 1865 a large number of slaves taken by British war ships from Cuban and Brazilian slavers were landed in British Guiana, where they found employment as free laborers. This source of labor supply was cut off by the abolition of slavery in Brazil and other countries. In 1867 the importation of free blacks from British Africa was prohibited and the movement to supply laborers from China came to an end. The Chinese experiment was repeated in 1874 and 1878, but never since. The bringing in of British Indians, however, proved a success ever since the time it was first done in 1838. These laborers are indentured for five years, and five years after the expiration of their contract they have the privilege of being taken back to their homes, without charge. During the five years following their contract term they can obtain work as free hands and they may acquire small parcels of land. In fact many of them have become land owners and have settled permanently in the colony. There are also a considerable number who, after having gone back to India, return to British Guiana of their own volition and at their own expense to work as free laborers.

Most of the sugar plantations are found on the seacoast on lands formerly marshy that have been diked and drained either by sluices or by pumping. The plantations along the river banks, too, are on reclaimed lands that have been drained by sluices. In 1911 there were 160,000 acres of reclaimed land in the colony, and 81,000 acres of it were devoted to sugar cane. The plantations are oblong in shape, one end fronting on the sea or the river, as the case may be. Originally they varied in size from 500 to 1000 acres, but in many instances consolidation has taken place. The dike next to the sea is naturally the strongest and most carefully built, while those at the sides and rear are less substantial. As a rule, there is a broad road that runs through the middle of the plantation, with a navigable canal on either side. These canals contain fresh water, salt water and flood waters being kept out by a gate through which excess fresh water may run off at low tide. Short feeder canals run at right angles, and as they are not connected with the drainage canals they may contain salt water if necessary. In crossing a transportation canal, the waters of drainage canals pass underneath through a siphon. Between these transportation canals are the cane fields, from ten to twenty acres in size, and separated from one another by small drainage ditches. The largest transportation canals are between sixteen and twenty feet wide at the top, between twelve and sixteen feet wide at the bottom and four to five feet deep. The smaller transportation canals are twelve feet wide at the top, nine feet wide at the bottom and four to five feet deep. The large drainage canals are fifteen feet wide and four feet deep, and the irrigation ditches are from two to three feet wide and three feet deep.

Before planting cane in virgin soil the trees are cut down, the ground is cleared of grass and weeds, canals are dug, furrows are made at intervals of from six to seven feet, and then the planting is done. A month later weeds are removed, the young shoots are banked and the ground between the furrows is loosened. When five months old the cane is trashed[77] and weeding is done if necessary. After an interval of three months this operation is repeated, and when the cane is a year old the final trashing is done,

the harvesting following two weeks afterward.

When the cane has been cut, the ground is loosened once more, the dry leaves are put in the spaces between the furrows and covered with earth, the young cane shoots come up, and in another year the ratoons are ready for harvesting. Two or three ratoon crops are grown on the same land, but as soon as the yield gets too small the ground is left fallow and planting is done elsewhere. Until recently Bourbon cane was the only variety raised in British Guiana. Of late, however, many kinds of seedling cane have been introduced, and today it is estimated that more than one-half of the crop comes from seedling stock. Fertilizing is done with phosphates, guano, potash, sulphate of ammonia and stable manure.

The cane is brought from the fields to the mills by canal in flat-bottomed boats. The equipment in the factories is good, as a whole; crushing is efficiently done and the juices are boiled to grain in vacuum pans.

In addition to 96-degree centrifugals and second sugars, the celebrated “Demerara crystals” are produced. In making the latter the juice is kept acid throughout the process, from one to five per cent being lost through inversion. Chloride of tin is added in the vacuum pan to heighten the yellow color. The greater part of the molasses goes into the manufacture of rum, and a certain quantity, mixed with ground bagasse, finds a market in England as cattle food.

While on virgin soil the yield of cane runs as high as sixty to seventy tons to the acre, the average is about twenty tons per acre, and the extraction of sugar equals 8½ per cent of the weight of the cane. In late years the number of sugar mills has grown less, owing to the merging of many small plants into a few large ones. In 1908 the area planted in cane was 73,471 acres, and there were forty-two plantations, six of them less than 1000 acres, twenty-five over 1000 acres, six over 2000 acres, four over 3000 acres, and one over 7000 acres in size.

Over half of the sugar exported goes to Canada, the remainder being taken by Great Britain and the United States.

As to the future of British Guiana’s sugar industry, early in 1915 a letter was sent by the government secretary of the colony to the West India committee in London in which it is stated that the possible annual crop on suitable sugar lands eastward of the Pomeroon river is not less than 1,000,000 tons, while, if the large virgin alluvial areas to the east of the Pomeroon river and between there and the Venezuelan boundary were brought under cultivation, the maximum total output might reach 2,500,000 tons per annum. This letter was in reply to a communication addressed by the West India committee to the governors of all of the British sugar-growing possessions for the purpose of securing information regarding the possibilities of development of the industry. Hitherto the United Kingdom has been largely dependent upon foreign countries for its sugar supply, and the movement thus set on foot by the West India committee is to urge upon the home government the importance of drawing the entire sugar requirements of the country from its colonies. This of course would mean the establishment of a preferential tariff.

Exports from British Guiana since 1895, in tons of 2240 pounds:

1895-96 101,059 1896-97 107,073 1897-98 100,839 1898-99 96,648 1899-00 84,783 1900-01 94,745 1901-02 105,694 1902-03 120,127 1903-04 125,949 1904-05 101,278 1905-06 121,693 1906-07 120,334 1907-08 99,737 1908-09 117,176 1909-10 101,843 1910-11 108,297 1911-12 83,294 1912-13 83,922 1913-14 103,774 1914-15 113,632 1915-16 110,000[78]

[Illustration: TRAIN-LOAD OF CANE EN ROUTE TO THE INGENIO LA MENDIETA, ARGENTINA]

[Illustration: UNLOADING A CAR OF CANE, TUCUMÁN, ARGENTINA]

ARGENTINA

The Argentine republic occupies the southeastern extremity of South they would still have done the same thing, for our experiences had taught us to dispense with fear. Whatever of timidity, of shrinking from pain or hardship any of us had originally possessed, it had all vanished. There were no terrors that we were not now ready to face.

The year 1909 marks an important point in our struggle, partly because of this decision of ours, never again to submit to be classed with criminals; and partly because in this year we forced the Liberal Government to go on record, publicly, in regard to the oldest of popular rights, the right of petition. We had long contemplated this step, and now the time seemed ripe for taking it.

In the closing days of 1908 Mr. Asquith, speaking on the policy to be carried out in 1909, commented on the various deputations he was obliged at that time to receive. They called on him, he said, "from all quarters and in all causes, on an average of something

like two hours on three days in every week." The deputations all asked for different things, and, although all of the things could not possibly be included in the King's speech, Mr. Asquith was inclined to agree that many of them ought to be included. This declaration from the Prime Minister that he was constantly receiving deputations of men, and listening favourably to their suggestions of what policies to pursue, aroused in the Suffragettes feelings of deep indignation. This in part they expressed on January 25th, when the first meeting of the Cabinet Council took place. A small deputation from the W. S. P. U. proceeded to Downing Street to claim the right to be heard, as men were heard. For knocking at the door of the official residence four of the women, including my sister, Mrs. Clark, were arrested and sent to prison for one month.

A month later the seventh of our Women's Parliaments was called against this and against the fact that no mention of women had been included in the King's speech. Led by Mrs. Pethick Lawrence, Lady Constance Lytton and Miss Daisy Solomon, a deputation of women endeavoured to carry the resolution to the House of Commons. They were promptly arrested and, next day, were sent to prison on sentences of from one to two months. The time was rapidly approaching when the legality of these arrests would have to be tested. In June of the year 1909 the test was made.

It will be remembered that we had endeavoured to force the authorities to make good their threat to charge us under the obsolete Charles II "Tumultuous Petitions Act," which prescribes severe penalties for persons proceeding to Parliament in groups of more than twelve for the purpose of presenting petitions. It had been stated that if we were charged under that act our case would be given a hearing before a judge and jury instead of a police magistrate. Since this was exactly what we desired to have happen we had sent deputation after deputation of more than twelve persons, but always they were tried in police courts, and were sent to prison often for periods as long as that prescribed in the Charles II Act. Now we determined to do something still more ambitious; we resolved to test, not the Charles II Act, but the constitutional right of the subject to petition the Prime Minister as the seat of power.

The right of petition, which has existed in England since the earliest known period, was written into the Bill of Rights which became law in 1689 on the accession of William and Mary. It was, in fact, one of the conditions attaching to the accession of the joint monarchs. According to the Bill of Rights, "It is the right of subjects to petition the King and all commitments, and prosecutions for such petitionings are illegal." The power of the King having passed almost completely into the hands of Parliament, the Prime Minister now stands where the King's majesty stood in former times. Clearly, then, the right of the subject to petition the Prime Minister cannot be legally denied. Thus were we advised, and in order to keep within the strict letter of the law, we accepted the limitations of the right of petition laid down in the Charles II Act, and decided that our petition should be carried to the House of Commons by small groups of women.

Again I called together, on the evening of June 29th, a Parliament of women. Previously I had written to Mr. Asquith stating that a deputation of women would wait on him at the House of Commons at eight o'clock in the evening. I wrote him further that we were not to be refused, as we insisted upon our constitutional right to be received. To my note the Prime Minister returned a formal note declining to receive us. Nevertheless we continued our preparations, because we knew that the Prime Minister would continue to decline, but that in the end he would be forced to receive us.

An incident which occurred a week before the date of the deputation was destined to have important consequences. Miss Wallace Dunlop went to St. Stephen's Hall in the House of Commons, and marked with printer's ink on the stone work of the Hall an extract from the Bill of Rights. The first time she made the attempt she was interrupted by a policeman, but two days later she succeeded in stamping on the ancient walls the reminder to Parliament that women as well as men possess constitutional rights, and that they were proposing to exercise those rights. She was arrested and sentenced to prison for one month, in the third division. The option of a heavy fine was given her, which of course she refused. Miss Wallace Dunlop's prison term began on June 22d. Perhaps her deed had something to do with the unusual interest taken in the approaching deputation, an interest which was shown not only by the public but by many members of Parliament. In the House of Commons a strong feeling that the women ought this time to be received manifested itself in many questions put to the Government. One member even asked leave to move the adjournment of the House on a matter of urgent public importance, namely the danger to the public peace, owing to the refusal of the Prime Minister to receive the deputation. This was denied, however, and the Government mendaciously disclaimed all responsibility for what action the police might take toward the deputation. The Home Secretary, Mr. Gladstone, when asked by Mr. Kier Hardie to give instructions that the deputation, if orderly, should be admitted to St. Stephen's, replied: "I cannot say what action the police ought to take in the matter." Our Women's Parliament met at half past seven on the evening of June 29th, and the petition to the Prime Minister was read and adopted. Then our deputation set forth. Accompanying me as leader were two highly respectable women of advanced years, Mrs. Saul Solomon, whose husband had been Prime Minister at the Cape, and Miss Neligan, one of the

foremost of the pioneer educators of England. We three and five other women were preceded by Miss Elsie Howey, who, riding fast, went on horse-back to announce our coming to the enormous crowds that filled the streets. She, we afterward learned, progressed as far as the approaches to the House of Commons before being turned back by the police. As for the deputation, it pressed on through the crowd as far as St. Margaret's Church, Westminster, where we found a long line of police blocking the road. We paused for a moment, gathering strength for the ordeal of trying to push through the lines, when an unexpected thing happened. An order was given from some one, and instantly the police lines parted, leaving a clear space through which we walked towards the House. We were escorted on our way by Inspector Wells, and as we passed the crowd broke into vociferous cheering, firmly believing that we were after all to be received. As for myself I did little speculating as to what was about to happen. I simply led my deputation on as far as the entrance to St. Stephen's Hall. There we encountered another strong force of police commanded by our old acquaintance, Inspector Scantlebury, who stepped forward and handed me a letter. I opened it and read in aloud to the women. "The Prime Minister, for the reasons which he has already given in a written reply to their request, regrets that he is unable to receive the proposed deputation."

I dropped the note to the ground and said: "I stand upon my rights, as a subject of the King, to petition the Prime Minister, and I am firmly resolved to stand here until I am received."

[Illustration: INSPECTOR WELLS CONDUCTING MRS. PANKHURST TO THE HOUSE OF COMMONS

June, 1908]

Inspector Scantlebury turned away and walked rapidly towards the door of the Strangers' Entrance. I turned to Inspector Jarvis, who remained, to several members of Parliament and some newspaper men who stood looking on, and begged them to take my message to the Prime Minister, but no one responded, and the Inspector, seizing my arm, began to push me away. I now knew that the deputation would not be received and that the old miserable business of refusing to leave, of being forced backward, and returning again and again until arrested, would have to be re-enacted. I had to take into account that I was accompanied by two fragile old ladies, who, brave as they were to be there at all, could not possibly endure what I knew must follow. I quickly decided that I should have to force an immediate arrest, so I committed an act of technical assault on the person of Inspector Jarvis, striking him very lightly on the cheek. He said instantly, "I understand why you did that," and I supposed then that we would instantly be taken. But the other police apparently did not grasp the situation, for they began pushing and jostling our women. I said to the inspector: "Shall I have to do it again?" and he said "Yes." So I struck him lightly a second time, and then he ordered the police to make the arrests.

The matter did not end with the arrest of our deputation of eight women. In recurring deputations of twelve the Suffragettes again and again pressed forward in vain endeavour to reach the House of Commons. In spite of the fact that the crowds were friendly and did everything they could to aid the women, their deputations were broken up by the police and many of the women arrested. By nine o'clock Parliament Square was empty, an enormous force of mounted police having beaten the people back into Victoria Street and across Westminster Bridge. For a short time all looked tranquil, but soon little groups of women, seven or eight at a time, kept appearing mysteriously and making spirited dashes toward the House. This extraordinary procedure greatly exasperated the police, who could not unravel the mystery of where the women came from. As a matter of bygone history the explanation is that the W. S. P. U. had hired thirty offices in the neighborhood, in the shelter of which the women waited until it was time for them to sally forth. It was a striking demonstration of the ingenuity of women opposing the physical force of men, but it served still another purpose. It diverted the attention of the police from another demonstration which was going on. Other Suffragettes had gone to the official residence of the First Lord of the Admiralty, to the Home Office, the Treasury and Privy Council Offices, and had registered their contempt for the Government's refusal to receive the deputation by the time-honoured method of breaking a window in each place.

One hundred and eight women were arrested that night, but instead of submitting to arrests and trial, the Women's Social and Political Union announced that they were prepared to prove that the Government and not the women had broken the law in refusing to receive the petition. My case, coupled with that of the Hon. Mrs. Haverfield, was selected as a test case for all the others, and Lord Robert Cecil was retained for the defence. Mr. Muskett, who conducted the case for the prosecution, tried to prove that our women had not gone to the House of Commons to present a petition, but this was easily demonstrated to be an unwarranted claim. The speeches of the leader, the official articles published in our newspaper, _Votes for Women_, and the letters sent to Mr. Asquith, not to speak of the indisputable facts that every member of the deputation carried a copy of the petition in her hand, furnished evidence enough of the nature of our errand. The whole case of the subject's right of petition was then brought forward

for discussion. Mr. Muskett spoke first, then our council, Mr. Henle, then Lord Robert Cecil. Last of all I spoke, describing the events of June 29th. I told the magistrate that should he decide that we and not the Government had been guilty of an infraction of the law, we should refuse to be bound over, but should all choose to go to prison. In that case we should not submit to being treated like criminals. "There are one hundred and eight of us here to-day," I said, pointing to the benches where my fellow-prisoners sat, "and just as we have thought it is our duty to defy the police in the street, so when we get into prison, as we are political prisoners, we shall do our best to bring back into the twentieth century the treatment of political prisoners which was thought right in the case of William Cobbett, and other political offenders of his time."

The magistrate, Sir Albert de Rutzen, an elderly, amiable man, rather bewildered by this unprecedented situation, then gave his decision. He agreed with Mr. Henle and Lord Robert Cecil that the right of petition was clearly guaranteed to every subject, but he thought that when the women were refused permission to enter the House of Commons, and when Mr. Asquith had said that he would not receive them, the women acted wrongly to persist in their demands. He should, therefore, fine them five pounds each, or sentence them to prison for one month in the second division. The sentence would be suspended for the present until learned counsel could obtain a decision from a higher court on the legal point of the right of petition.

I then put in a claim for all the prisoners, and asked that all their cases might be held over until the test case was decided, and this was agreed to, except in regard to fourteen women charged with window-breaking. They were tried separately and sent to prison on sentences varying from six weeks to two months. Of them later.

The appeal against Sir Albert de Rutzen's decision was tried in a Divisional Court early in December of that year. Lord Robert Cecil again appeared for the defence, and in a masterly piece of argumentation, contended that in England there was and always had been the right of petition, and that the right had always been considered a necessary condition of a free country and a civilised Government. The right of petition, he pointed out, had three characteristics: In the first place, it was the right to petition the actual repositories of power; in the second place, it was the right to petition in person; and in the third place, the right must be exercised reasonably. A long list of historical precedents were offered in support of the right to petition in person, but Lord Robert argued that even if these did not exist, the right was admitted in the Charles II "Tumultuous Petitions Act," which provides "That no person or persons whatsoever shall repair to His Majesty or both or either Houses of Parliament upon pretence of presenting or delivering any petition, complaint, remonstrance, or declaration or other address, accompanied with excessive number of people ..." etc. The Bill of Rights had specially confirmed the right of petition in so far as the King personally was concerned. "The women," pursued Lord Robert, "had gone to Parliament Square on June 29th in the exercise of a plain constitutional right, and that in going there with a petition they had acted according to the only constitutional method they possessed, being voteless, for the redress of their grievances."

If then it were true, as contended, the subject not only possessed the right to petition, but to petition in person, the only point to be considered was whether the right had been exercised reasonably. If persons desired to interview the Prime Minister, it was surely reasonable to go to the House of Commons, and to present themselves at the Strangers' Entrance. Mrs. Pankhurst, Mrs. Haverfield and the others had, as the evidence showed, proceeded along the public highway and had been escorted to the door of the House of Commons by an officer of the police, and could not therefore, up to that point, have been acting in an unlawful manner. The police had kept clear a large open space opposite the House of Commons, the crowd being kept at a certain distance away. Within the open space there were only persons having business in the House of Commons, members of the police force and the eight women who formed the deputation. It could not possibly be contended that these eight women had caused an obstruction. It was true that a police officer told them that the Prime Minister was not in the House of Commons, but when one desired an interview with a Member of Parliament one did not make his request of a casual policeman in the street. Moreover, the police did not possess any authority to stop anyone from going into the House of Commons.

The letter given the women, in which the Prime Minister said that he could not or would not see them, had been cited. Now, had the Prime Minister, in his letter, said that he could not or would not see the women at that time, that the time was not convenient; but that he would at some future time, at a more convenient time, receive them, that would have been a sufficient answer. The women would not have been justified in refusing to accept such an answer, because the right to petition must be exercised reasonably. But the letter contained an unqualified refusal, and that, if we allow the right of petition to exist, was no answer at all. Last of all Lord Robert argued that if there is a right to petition a Member of Parliament, then it must be incumbent on the part of a Member of Parliament to receive the petition, and that no one has a right to interfere with the petitioner. If the eight women were legally justified in presenting their petition, then they were also justified in refusing to obey the orders of the police to leave the place.

In an address full of bias, and revealing plainly that he had no accurate knowledge of any of the events that had led up to the case in hand, the Lord Chief Justice delivered judgment. He said that he entirely agreed with Lord Robert Cecil as to the right to present a petition to the Prime Minister, either as Prime Minister or as a Member of Parliament; and he agreed also that petitions to the King should be presented to the Prime Minister. But the claim of the women, he said, was not merely to present a petition, but to be received in a deputation. He did not think it likely that Mr. Asquith would have refused to receive a petition from the women, but his refusal to receive the deputation was not unnatural, "in consequence of what we know did happen on previous occasions."[1]

Referring to the Metropolitan Police Act of 1839, which provides that it shall be lawful for the Commissioner of Police to make regulations and to give instructions to the constable for keeping order, and for preventing any obstruction of thoroughfares in the immediate neighbourhood of the House of Commons, and the Sessional Order empowering the police to keep clear the approaches to the House of Commons, the Lord Chief Justice decided that I and the other women were guilty of an infraction of the law when we insisted on a right to enter the House of Commons. The Lord Chief Justice therefore ruled that our conviction in the lower court had been proper, and our appeal was dismissed with costs.

Thus was destroyed in England the ancient constitutional right of petition, secured to the people by the Bill of Rights, and cherished by uncounted generations of Englishmen. I say the right was destroyed, for of how much value is a petition which cannot be presented in person? The decision of the high court was appalling to the members of the W. S. P. U., as it closed the last approach, by constitutional means, to our enfranchisement. Far from discouraging or disheartening us, it simply spurred us on to new and more aggressive forms of militancy.

FOOTNOTE:

[1] Mr. Asquith had never, since becoming Prime Minister, received a deputation of women, nor had he ever received a deputation of the W. S. P. U. So it was absurd of the Lord Chief Justice to speak of "what did happen, on previous occasions."

CHAPTER V

Between the time of the arrest in June and the handing down of the absurd decision of the Lord Chief Justice that although we, as subjects, possessed the right of petition, yet we had committed an offence in exercising that right, nearly six months had passed. In that interval certain grave developments had lifted the militant movement onto a new and more heroic plane. It will be remembered that a week before our deputation to test the Charles II Act, Miss Wallace Dunlop had been sent to prison for one month for stamping an extract from the Bill of Rights on the stone walls of St. Stephen's Hall. On arriving at Holloway on Friday evening, July 2nd, she sent for the Governor and demanded of him that she be treated as a political offender. The Governor replied that he had no power to alter the sentence of the magistrate, whereupon Miss Wallace Dunlop informed him that it was the unalterable resolution of the Suffragettes never again to submit to the prison treatment given to ordinary offenders against the law. Therefore she should, if placed in the second division as a common criminal, refuse to touch food until the Government yielded her point. It is hardly likely that the Government or the prison authorities realised the seriousness of Miss Wallace Dunlop's action, or the heroic mould of the Suffragettes' character. At all events the Home Secretary paid no attention to the letter sent him by the prisoner, in which she explained simply but clearly her motives for her desperate act, and the prison authorities did nothing except seek means of breaking down her resistance. The ordinary prison diet was replaced by the most tempting food, and this instead of being brought to her cell at intervals, was kept there night and day, but always untouched. Several times daily the doctor came to feel her pulse and observe her growing weakness. The doctor, as well as the Governor and the wardresses argued, coaxed and threatened, but without effect. The week passed without any sign of surrender on the part of the prisoner. On Friday the doctor reported that she was rapidly reaching a point at which death might at any time supervene. Hurried conferences were carried on between the prison and the Home Office, and that evening, June 8th, Miss Wallace Dunlop was sent home, having served one-fourth of her sentence, and having ignored completely all the terms of her imprisonment.

On the day of her release the fourteen women who had been convicted of window breaking received their sentences, and learning of Miss Wallace Dunlop's act, they, as they were being taken to Holloway in the prison van, held a consultation and agreed to follow her example. Arrived at Holloway they at once informed the officials that they would not give up any of their belongings, neither would they put on prison clothing, perform prison labour, eat prison food or keep the rule of silence.

The Governor agreed for the moment to allow them to retain their property and to wear their own clothing, but he told them that they had committed an act of mutiny and that he would have to so charge them at the next visit of the magistrates. The women then

addressed petitions to the Home Secretary, demanding that they be given the prison treatment universally allowed political offenders. They decided to postpone the hunger strike until the Home Secretary had had time to reply. Meanwhile, after a vain appeal for more fresh air, for the weather was stiflingly hot, the women committed one more act of mutiny, they broke the windows of their cells.

We learned this from the prisoners themselves. Several days after they had gone to prison, my daughter Christabel and Mrs. Tuke, filled with anxiety for their fate, gained admission to an upper story room of a house overlooking the prison. Calling at the top of their voices and waving a flag of the Union, they succeeded in attracting the prisoners' attention. The women thrust their arms through the broken panes, waving handkerchiefs, Votes for Women badges, anything they could get hold of, and in a few shouted words told their tale. That same day the visiting magistrates arrived, and the mutineers were sentenced to terms of seven to ten days of solitary confinement in the punishment cells. In these frightful cells, dark, unclean, dripping with moisture, the prisoners resolutely hunger struck. At the end of five days one of the women was reduced to such a condition that the Home Secretary ordered her released. The next day several more were released, and before the end of the week the last of the fourteen had gained their liberty.

The affair excited the greatest sympathy all over England, sympathy which Mr. Gladstone tried to divert by charging two of the prisoners with kicking and biting the wardresses. In spite of their vigorous denials these two women were sentenced, on these charges, one to ten days and the other to a month in prison. Although still very weak from the previous hunger strike, they at once entered upon a second hunger strike, and in three days had to be released.

After this each succeeding batch of Suffragette prisoners, unless otherwise directed, followed the example of these heroic rebels. The prison officials, seeing their authority vanish, were panic stricken. Holloway and other women's prisons throughout the Kingdom became perfect dens of violence and brutality. Hear the account given by Lucy Burns of her experience:

"We remained quite still when ordered to undress, and when they told us to proceed to our cells we linked arms and stood with our backs to the wall. The Governor blew his whistle and a great crowd of wardresses appeared, falling upon us, forcing us apart and dragging us towards the cells. I think I had twelve wardresses for my share, and among them they managed to trip me so that I fell helplessly to the floor. One of the wardresses grasped me by my hair, wound the long braid around her wrist and literally dragged me along the ground. In the cell they fairly ripped the clothing from my back, forcing on me one coarse cotton garment and throwing others on the bed for me to put on myself. Left alone exhausted by the dreadful experience I lay for a time gasping and shivering on the floor. By and by a wardress came to the door and threw me a blanket. This I wrapped around me, for I was chilled to the bone by this time. The single cotton garment and the rough blanket were all the clothes I wore during my stay in prison. Most of the prisoners refused everything but the blanket. According to agreement we all broke our windows and were immediately dragged off to the punishment cells. There we hunger struck, and after enduring great misery for nearly a week, we were one by one released."

How simply they tell it. "After enduring great misery--" But no one who has not gone through the awful experience of the hunger strike can have any idea of how great that misery is. In an ordinary cell it is great enough. In the unspeakable squalor of the punishment cells it is worse. The actual hunger pangs last only about twenty-four hours with most prisoners. I generally suffer most on the second day. After that there is no very desperate craving for food. Weakness and mental depression take its place. Great disturbances of digestion divert the desire for food to a longing for relief from pain. Often there is intense headache, with fits of dizziness, or slight delirium. Complete exhaustion and a feeling of isolation from earth mark the final stages of the ordeal. Recovery is often protracted, and entire recovery of normal health is sometimes discouragingly slow.

The first hunger strike occurred in early July. In the two months that followed scores of women adopted the same form of protest against a Government who would not recognise the political character of their offences. In some cases the hunger strikers were treated with unexampled cruelty. Delicate women were sentenced, not only to solitary confinement, but to wear handcuffs for twenty-four hours at a stretch. One woman on refusing prison clothes was put into a straightwaistcoat.

The irony of all this appears the greater when it is considered that, at this precise time, the leaders of the Liberal Party in the House of Commons were in the midst of their first campaign against the veto power of the Lords.

On September 17th a great meeting was held in Birmingham, on which occasion Mr. Asquith was to throw down his challenge to the Lords, and to announce that their veto was to be abolished, leaving the people's will paramount in England. Of course the Suffragettes seized this opportunity for a demonstration. This course was perfectly logical. Denied the right of petition, shut out now from every Cabinet Minister's meeting, the women were forced to take whatever means that remained to urge their cause upon the

Government. Mrs. Mary Leigh and a group of Birmingham members addressed a warning to the public not to attend Mr. Asquith's meeting as disturbances were likely to happen. From the time that the Prime Minister and his Cabinet left the House of Commons until the train drew in to the station at Birmingham they were completely surrounded with detectives and policemen. The precautions taken to guard Mr. Asquith have never been equalled except in the case of the Tsar during outbreaks of revolution in Russia. From the station he was taken by an underground passage a quarter of a mile in length to his hotel, where he dined in solitary state, after having been carried upstairs in a luggage lift. Escorted to the Bingley Hall by a strong guard of mounted police, he was so fearful of encountering the Suffragettes that he entered by a side door. The hall was guarded as for a siege. Over the glass roof a thick tarpaulin had been stretched. Tall ladders were placed on either side of the building, and firemen's hose were laid in readiness--not to extinguish fires, but to play upon the Suffragettes should they appear at an inaccessible spot on the roof. The streets on every hand were barricaded, and police, in regiments, were drawn up to defend the barricades against the onslaughts of the women. Nobody was allowed to pass the barricades without showing his entrance tickets to long files of police, and then the ticket holders were squeezed through the narrow doors one by one.

Their precautions were in vain, for the determined Suffragettes found more than one way in which to turn Mr. Asquith's triumph into a fiasco. Although no women gained access to the hall, there were plenty of men sympathisers present, and before the meeting had proceeded far thirteen men had been violently thrown out for reminding the Prime Minister that "the people" whose right to govern he was professing to uphold, included women as well as men. Outside, mingling in the vast crowds, bands of women attacked the barricades, the outer barricades being thrown down in spite of the thousands of police. From the roof of a neighbouring house Mrs. Leigh and Charlotte Marsh tore up dozens of slates and threw them on the roof of Bingley Hall and in the streets below, taking care, however, to strike no one. As Mr. Asquith drove away the women hurled slates at the guarded motor car. The fire hose was brought forth and the firemen were ordered to turn the water on the women. They refused, to their credit be it said, but the police, infuriated by their failure to keep the peace, did not scruple to play the cold water on the women as they crouched and clung to the dangerous slope of the roof. Roughs in the streets flung bricks at them, drawing blood. Eventually the women were dragged down by the police and in their dripping garments marched through the streets to the police station.

The Suffragettes who had rushed the barricades and flung stones at Mr. Asquith's departing train received sentences from a fortnight to one month, but Miss Marsh and Mrs. Leigh were sent to prison for three and four months respectively. All of the prisoners adopted the hunger strike, as we knew they would.

Several days later we were horrified to read in the newspapers that these prisoners were being forcibly fed by means of a rubber tube thrust into the stomach. Members of the Union applied at once both at the prison and at the Home Office to learn the truth of the report, but all information was refused. On the following Monday at our request, Mr. Keir Hardie, at question time in the House, insisted on information from the Government. Mr. Masterman, speaking for the Home Secretary, reluctantly admitted that, in order to preserve the dignity of the Government and at the same time save the lives of the prisoners, "hospital treatment" was being administered. "Hospital treatment" was the term used to draw attention from one of the most disgusting and brutal expedients ever resorted to by prison authorities. No law allows it except in the case of persons certified to be insane, and even then when the operation is performed by skilled nursing attendants under the direction of skilled medical men, it cannot be called safe. In fact, the asylum cases usually die after a short time. _The Lancet_, perhaps the best known medical journal in the language, published a long list of opinions from distinguished physicians and surgeons who condemned the practice as applied to the suffrage prisoners as unworthy of civilisation. One physician told of a case which had come under his observation in which death had occurred almost as soon as the tube had been inserted. Another cited a case where the tongue, twisted behind the feeding tube, had, in the struggle, been almost bitten off. Cases where food had been injected into the lungs were not unknown. Mr. C. Mansell-Moullin, M.D., F.R.C.S., wrote to _The Times_ that as a hospital surgeon of more than thirty years' experience he desired indignantly to protest against the Government's term "Hospital treatment" in connection with the forcible feeding of women. It was a foul libel, he declared, for violence and brutality have no place in hospitals. A memorial signed by 116 well-known physicians was addressed to the Prime Minister protesting against the practice of forcible feeding, and pointing out to him in detail the grave dangers attaching to it.

So much for medical testimony against a form of brutality which continued and still continues in our English prisons, as a punishment for women who are there for consciences' sake. As for the testimony of the victims, it makes a volume of most revolting sort. Mrs. Leigh, the first victim, is a woman of sturdy constitution, else she could scarcely have survived the experience. Thrown into Birmingham prison after the Asquith demonstration, she had broken the windows of her cell, and as a punishment was sent to a dark and cold punishment cell. Her hands were handcuffed, behind her during the day, and at night in front of her body _with the

palms out_. She refused to touch the food that was brought to her, and three days after her arrival she was taken to the doctor's room. What she saw was enough to terrify the bravest. In the centre of the room was a stout chair resting on a cotton sheet. Against the wall, as if ready for action stood four wardresses. The junior doctor was also on hand. The senior doctor spoke, saying: "Listen carefully to what I have to say. I have orders from my superior officers that you are not to be released even on medical grounds. If you still refrain from food I must take other measures to compel you to take it." Mrs. Leigh replied that she did still refuse, and she said further that she knew that she could not legally be forcibly fed because an operation could not be performed without the consent of the patient if sane. The doctor repeated that he had his orders and would carry them out. A number of wardresses then fell upon Mrs. Leigh, held her down and tilted her chair backward. She was so taken by surprise that she could not resist successfully that time. They managed to make her swallow a little food from a feeding cup. Later two doctors and the wardresses appeared in her cell, forced Mrs. Leigh down to the bed and held her there. To her horror the doctors produced a rubber tube, two yards in length, and this he began to stuff up her nostril. The pain was so dreadful that she shrieked again and again. Three of the wardresses burst into tears and the junior doctor begged the other to desist. Having had his orders from the Government, the doctor persisted and the tube was pushed down into the stomach. One of the doctors, standing on a chair and holding the tube high poured liquid food through a funnel almost suffocating the poor victim. "The drums of my ears," she said afterwards, "seemed to be bursting. I could feel the pain to the end of the breast bone. When at last the tube was withdrawn it felt as if the back of my nose and throat were being torn out with it."

In an almost fainting condition Mrs. Leigh was taken back to the punishment cell and laid on her plank bed. The ordeal was renewed day after day. The other prisoners suffered similar experiences.

CHAPTER VI

The militant movement was at this point when, in October, 1909, I made my first visit to the United States. I shall never forget the excitement of my landing, the first meeting with the American "reporter," an experience dreaded by all Europeans. In fact the first few days seemed a bewildering whirl of reporters and receptions, all leading up to my first lecture at Carnegie Hall on October 25th. The huge hall was entirely filled, and an enormous crowd of people thronged the streets outside for blocks. With me on the stage were several women whom I had met in Europe, and in the chair was an old friend, Mrs. Stanton Blatch, whose early married life had been spent in England. The great crowd before me, however, was made up of strangers, and I could not know how they would respond to my story. When I rose to speak a deep hush fell, but at my first words: "I am what you call a hooligan--" a great shout of warm and sympathetic laughter shook the walls. Then I knew that I had found friends in America. And this all the rest of the tour demonstrated. In Boston the committee met me with a big grey automobile decorated in the colours of our Union, and that night at Tremont Temple I spoke to an audience of 2,500 people all most generous in their responsiveness. In Baltimore professors, and students from Johns Hopkins University acted as stewards of the meeting. I greatly enjoyed my visit to Bryn Mawr College and to Rosemary Hall, a wonderful school for girls in Connecticut. In Chicago, I met, among other notable people, Miss Jane Addams and Mrs. Ella Flagg Young, superintendent of schools. My visit to Canada will always be remembered, especially Toronto, where the mayor, dressed in the chains of his office, welcomed me. I met too the venerable Goldwin Smith, since dead.

Everywhere I found the Americans kind and keen, and I cannot say too much for the wonderful hospitality they showed me. The women I found were remarkably interested in social welfare. The work of the women's clubs struck me very favourably, and I thought these institutions a perfect basis for a suffrage movement. But at that time, 1909, the suffrage movement in the United States was in a curious state of quiescence. A large number of women with whom I came in contact appeared to think it only just that they should have a vote, but few seemed to realise any actual need of it. Some, it is true, were beginning to connect the vote with the reforms for which they were working so unselfishly and so devotedly. It was when talking with the younger women that I came to feel that under the surface of things in America, a strong suffrage movement was stirring. Those young women, leaving their splendid colleges to begin life were realising in a very intelligent fashion that they needed and would be obliged to secure for themselves a political status.

On December 1st I sailed on the _Mauretania_ for England, and on arriving I learned that the prison sentence which hung over me while the petitions case had been argued, was discharged, some unknown friend having paid my fine while I was on the ocean.

The year 1910 began with a general election, precipitated by the House of Lords' rejection of Mr. Lloyd-George's 1909 budget. The Liberal Party went to the country with promises of taxes on land values. They promised also abolition of the veto power of the Lords, Irish Home Rule, disestablishment of the Church of Wales, and other reforms. Woman suffrage was not directly promised,

but Mr. Asquith pledged that, if retained in office, he would introduce an electoral reform bill which could be amended to include woman suffrage. The Unionists under the leadership of Mr. Balfour, had tariff reform for their programme, and they offered not even a vague promise of a possible suffrage measure. Yet we, as usual, went into the constituencies and opposed the Liberal Party. We had no faith in Mr. Asquith's pledge, and besides, if we had failed to oppose the party in power we should but have invited Mr. Asquith and Mr. Balfour to enter into an agreement not to deal with the suffrage, with the view of keeping the cause permanently outside practical politics. We were in something of the same position as the Irish Nationalists in 1885, when neither the Liberal nor the Conservative leaders would include home rule in their programme. The Irish opposed the Liberal Party, with the result that it was returned by such a narrow majority that the Liberal Government was dependent on the Irish vote in Parliament in order to remain in office. On this account they were obliged to bring in a Home Rule Bill.

The other suffrage societies and many of the Liberal women begged us not to oppose the Liberal party at this election. We were implored to waive our claim "just this once" in view of the importance of the struggle between the Commons and the House of Lords over the budget. We replied that the same plea had been made in 1906 when we were implored to waive our claim "just this once" on account of the fiscal issue. For women there was only one political issue, we said, and that was the issue of their own enfranchisement. The dispute between the Lords and the Commons was far less vital than the claims of the people--represented in this case by women--to be admitted to citizenship. From our point of view both Houses of Parliament were unrepresentative until women had a voice in choosing legislators and influencing law making.

We opposed Liberal candidates in forty constituencies, and in almost every one of these the Liberal majorities were reduced and no less than eighteen seats were wrested from the Liberal candidates. It really was a terrible election for the Government. Mr. Asquith travelled from one constituency to another accompanied by a body guard of detectives, and official "chuckers out," whose sole duty was to eject women, and men as well, who interrupted his meetings on the question of Votes for Women. The halls where he spoke had the windows boarded up or the glass covered with strong wire netting. Every thoroughfare leading to the halls was barricaded, traffic was suspended, and large forces of police were on guard. The most extraordinary precautions were taken to protect the Prime Minister. At one place he went to his meeting strongly guarded and by way of a secret pathway that led through gooseberry bushes and a cabbage patch to a back door. After the meeting he escaped through the same door and was solemnly guided along a path heavily laid with sawdust to deaden his footsteps, to a concealed motor car, where he sat until the crowd had all dispersed.

The other ministers had to resort to similar precautions. They lived under the constant protection of body-guards. Their meetings were policed in a manner without precedent. Of course no women were admitted to their meetings, but they got in just the same. Two women hid for twenty-five hours in the rafters of a hall in Louth where Mr. Lloyd-George spoke. They were arrested, but not until after they had made their demonstration. Two others hid under a platform for twenty-two hours in order to question the Prime Minister. I could continue this record almost indefinitely.

We had printed a wonderful poster showing the process of forcible feeding, and we used it on hoardings everywhere. We told the electors that the "Liberal Party," the people's friend, had imprisoned 450 women for the crime of asking for a vote. They were torturing women at that time in Holloway. It was splendid ammunition and it told. The Liberal Party was returned to power, but with their majority over all sections of the House of Commons swept away. The Asquith Government were dependent now for their very existence on the votes of the Labour Party and the Irish Nationalists.

CHAPTER VII

The first months of 1910 were occupied by the re-elected Government in a struggle to keep control of affairs. A coalition with the Irish party, the leaders of which agreed, if the Home Rule bill were advanced, to stand by the budget. No publicly announced coalition with the Labour Party was made at that time, Keir Hardie, at the annual conference of the party, announcing that they would continue to be independent of the Government. This was important to us because it meant that the Labour Party, instead of entering into an agreement to give general support to all Government measures, would be free to oppose the Government in the event of the continued withholding of a franchise bill. Other things combined to make us hopeful that the tide had turned in our favour. It was hinted to us that the Government were weary of our opposition and were ready to end the struggle in the only possible way, providing they could do so without appearing to yield to coercion. We therefore, early in February, declared a truce to all militancy.

Parliament met on February 15th and the King's speech was read on February 21st. No mention of women's suffrage was made in the speech nor was any private member successful in winning a place in the ballot for a suffrage bill. However, since the situation,

on account of the proposed abolition of the Lord's power of veto, was strained and abnormal, we decided to wait patiently for a while. It was confidently expected that another general election would have to be held before the contentions between the two Houses of Parliament were settled, and this event unquestionably would have occurred, not later than June, but for the unexpected death of King Edward VII. This interrupted the strained situation. The passing of the King served as an occasion for the temporary softening of animosities and produced a general disposition to compromise on all troubled issues. The question of women's enfranchisement was taken up again in this spirit, and in a manner altogether creditable to the members with whom the movement originated.

A strictly non-party committee on women's suffrage had been established in the House of Commons in 1887, mainly through the efforts of Miss Lydia Becker, whom I have mentioned before as the Susan B. Anthony of the English suffrage movement. In 1906, for reasons not necessary to enumerate, the original committee had been allowed to lapse, the Liberal supporters of women's suffrage forming a committee of their own. Now, in this period of good feeling, at the suggestion of certain members, led by Mr. H. N. Brailsford, not himself a member of Parliament, formed another non-party body which they called the Conciliation Committee. Its object was declared to be the bringing together of the full strength of suffragists of the House of Commons, regardless of party affiliation, and of framing a suffrage measure that could be passed by their united effort. The Earl of Lytton accepted the chairmanship of the committee and Mr. Brailsford was made its secretary. The committee consisted of twenty-five Liberals, seventeen Conservatives, six Irish Nationalists, and six members of the Labour Party. Under difficulties which I can hardly hope to make clear to American readers the committee laboured to frame a bill which should win the support of all sections of the House. The Conservatives insisted on a moderate bill, whilst the Liberals were concerned lest the terms of the bill should add to the power of the propertied classes. The original suffrage bill, drafted by my husband. Dr. Pankhurst, giving the vote to women on equal terms with men, was abandoned, and a bill was drawn up along the lines of the existing municipal franchise law. The basis of the municipal franchise is occupation, and the Conciliation Bill, as first drafted, proposed to extend the Parliamentary vote to women householders, and to women occupiers of business premises paying ten pounds rental and upwards. It was estimated that about ninety-five per cent. of the women who would be enfranchised under the bill were householders. This, in England, does not mean a person occupying a whole house. Any one who inhabits even a single room over which he or she exercises full control is a householder.

The text of the Conciliation Bill was submitted to all the suffrage societies and other women's organisations, and it was accepted by every one of them. Our official newspaper said editorially: "We of the Women's Social and Political Union are prepared to share in this united and peaceful action. The new bill does not give us all that we want, but we are for it if others are also for it."

It seemed certain that an overwhelming majority of the House of Commons were for the bill, and were prepared to vote it into law. Although we knew that it could not possibly pass unless the Government agreed that it should, we hoped that the leaders of all parties and the majority of their followers would unite in an agreement that the bill should pass. This settlement by consent is rare in the English Parliament, but some extremely important and hard fought measures have been carried thus. The extension of the franchise in 1867 is a case in point.

The Conciliation Bill was introduced into the House of Commons on June 14th, 1910, by Mr. D. J. Shackleton, and was received with the most extraordinary enthusiasm. The newspapers remarked on the feeling of reality which marked the attitude of the House towards the bill. It was plain that the members realised that here was no academic question upon which they were merely to debate and to register their opinions, but a measure which was intended to be carried through all its stages and to be written into English law. The enthusiasm of the House swept all over the Kingdom. The medical profession sent in a memorial in its favour, signed by more than three hundred of the most distinguished men and women in the profession. Memorials from writers, clergymen, social workers, artists, actors, musicians, were also sent. The Women's Liberal Federation met and unanimously resolved to ask the Prime Minister to give full facilities to the bill. Some advanced spirits in the Federation actually proposed to send then and there a deputation to the House of Commons with the resolution, but this proposal was rejected as savouring too much of militancy. A request for an interview was sent to Mr. Asquith, and he replied promising to receive, at an early day, representatives of both the Liberal Women's Federation and of the National Union of Women's Suffrage Societies.

The joint deputation was received by Mr. Asquith on June 21st, and Lady M'Laren, as a representative of the Women's Liberal Federation, spoke very directly to her party's leader. She said in part: "If you refuse our request we shall have to go to the country and say you, who are against the veto of the House of Lords, are placing a veto on the House of Commons by refusing to allow a second reading of this bill."

Mr. Asquith replied warily that he could not decide alone on such a serious matter, but would have to consult his Cabinet, the majority of whom, he admitted, were suffragists. Their decision, he said, would be given in the House of Commons.

[Illustration: OVER 1,000 WOMEN HAD BEEN IN PRISON--BROAD ARROWS IN THE 1910 PARADE]

The Women's Social and Political Union arranged a demonstration in support of the Conciliation Bill, the greatest that had, up to that time, been made. It was a national, indeed an inter-national affair in which all the suffrage groups took part, and its massed ranks were so great that the procession required an hour and a half to pass a given point. At the head marched six hundred and seventeen women, white clad and holding long silver staves tipped with the broad arrow. These were the women who had suffered imprisonment for the cause, and all along the line of march they received a tribute of cheers from the public. The immense Albert Hall, the largest hall in England, although it was packed from orchestra to the highest gallery, was not large enough to hold all the marchers. Amid great joy and enthusiasm Lord Lytton delivered a stirring address in which he confidently predicted the speedy advance of the bill. The women, he declared, had every reason to believe that their enfranchisement was actually at hand.

It was true that the time for passing a suffrage bill was ripe. Not in fifty years had the way been so clear, because the momentary absence of ordinary legislation left the field open for an electoral reform bill. Yet when the Prime Minister was asked in the House of Commons whether he would give the members an early opportunity for discussion, the answer was not encouraging. The Government, said Mr. Asquith, were prepared to give time before the close of the session for full debate and division on second reading, but they could not allow any further facilities. He stated frankly that he personally did not want the bill to pass, but the Government realised that the House of Commons ought to have an opportunity, if that was their deliberate desire, for effectively dealing with the whole question.

This cryptic utterance was taken by the majority of the suffragists, by the press and by the public generally to mean that the Government were preparing gracefully to yield to the undoubted desire of the House of Commons to pass the bill. But the Women's Social and Political Union were doubtful. Mr. Asquith's remark was ambiguous, and was capable of being interpreted in several ways. It could mean that he was prepared to accept the verdict of the majority and let the bill pass through all its stages. That of course would be the only way to allow the House opportunity effectively to deal with the whole question. On the other hand Mr. Asquith might be intending to let the bill pass through its debating stages and be afterwards smothered in committee. We feared treachery, but in view of the announcement that the Government had set apart July 11 and 12 for debate on the second reading, we preserved a spirit of waiting calm. July 26th had been fixed as the day for the adjournment of Parliament, and if the bill was voted on favourably on the 12th there would be ample time to take it through its final stages. When a bill passes its second reading it is normally sent upstairs to a Grand Committee which sits while the House of Commons is transacting other business, and thus the committee stage can proceed without special facilities. The bill does not go back to the House until the report stage is reached, at which time the third and last reading occurs. After that the bill goes to the House of Lords. A week at most is all that is required for this procedure. A bill may be referred to the Whole House, and in this case it cannot be brought up for its committee stage unless it is given special facilities. In our paper and in many public speeches we urged that the members vote to send the bill to a Grand Committee.

Some days before the bill reached its second reading it was rumoured that Mr. Lloyd-George was going to speak against it, but we refused to credit this. Unfair to women as Mr. Lloyd-George had shown himself in various ways, he had consistently posed as a staunch friend of women's suffrage, and we could not believe that he would turn against us at the eleventh hour. Mr. Winston Churchill, whose speech to the women of Dundee I quoted in a previous chapter, the promoters of the Bill also counted upon, as it was known that he had more than once expressed sympathy with its objects. But when the debates began we found both of these ardent suffragists arrayed against the bill. Mr. Churchill, after making a conventional anti-suffrage speech, in which he said that women did not need the ballot, and that they really had no grievances, attacked the Conciliation Bill because the class of women who would be enfranchised under it did not suit him. Some women, he conceded, ought to be enfranchised, and he thought the best plan would be to select "some of the best women of all classes" on considerations of property, education and earning capacity. These special franchises would be carefully balanced, "so as not on the whole to give undue advantage to the property vote against the wage earning vote." A more fantastic proposal and one less likely to find favour in the House of Commons could not possibly be imagined. Mr. Churchill's second objection to the bill was that it was anti-democratic! It seemed to us that anything was more democratic than his proposed "fancy" franchises.

Mr. Lloyd-George said that he agreed with everything Mr. Churchill had said "both relevant and irrelevant." He made the amazing assertion that the Conciliation Committee that had drafted the bill was a "committee of women meeting outside the House." And

that this committee said to the House of Commons not only that they must vote for a women's suffrage bill but "You must vote for the particular form upon which we agree, and we will not even allow you to deliberate upon any other form."

Of course these statements were wholly false. The Conciliation Bill was drafted by men, and it was introduced because the Government had refused to bring in a party measure. The suffragists would have been only too glad to have had the Government deliberate on a broader form of suffrage. Because they refused to deliberate on any form, this private bill was introduced.

This fact was brought forward in the course of Mr. Lloyd-George's speech. It had been urged, said he, that this bill was better than none at all, but why should that be the alternative? "What is the other?" called out a member, but Mr. Lloyd-George dodged the question with a careless "Well, I cannot say for the present."

Later on he said: "If the promoters of this bill say that they regard the second reading merely as an affirmation of the principle of women's suffrage, and if they promise that when they re-introduce the bill it will be in a form which will enable the House of Commons to move any amendment either for restriction or extension I shall be happy to vote for this bill."

Mr. Philip Snowden, replying to this, said: "We will withdraw this bill if the Right Honourable gentleman, on behalf of the Government, or the Prime Minister himself will undertake to give to this House the opportunity of discussing and carrying through its various stages another form of franchise bill. If we cannot get that, then we shall prosecute this bill."

The Government made no reply at all to this, and the debate proceeded. Thirty-nine speeches were made, the Prime Minister showing plainly in his speech that he intended to use all his power to prevent the bill becoming law. He began by saying that a franchise measure ought never to be sent to a Grand Committee, but to one of the Whole House. He said also that his conditions, that the majority of women should show beyond any doubt that they desired the franchise, and that the bill be democratic in its terms, had not been complied with.

When the division was taken it was seen that the Conciliation Bill had passed its second reading by a majority of 109, a larger majority than the Government's far famed budget or the House of Lords Resolution had received. In fact no measure during that Parliament had received so great a majority--299 members voted for it as against 190 opposed. Then the question arose as to which committee should deal with the bill. Mr. Asquith had said that all franchise bills should go to a Committee of the Whole House, so that in the division his words moved many sincere friends of the bill to send it there. Others understood that this was a mischievous course, but were afraid of incurring the anger of the Prime Minister. Of course all the anti-suffragists voted the same way, and thus the bill went to the Whole House.

Even then the bill could have been advanced to its final reading. The House had time on their hands, as virtually all important legislative work was halted because of the deadlock between the Lords and the Commons. Following the death of the King a conference of leaders of the Conservative and the Liberal Parties had been arranged to adjust the matters at issue, and this conference had not yet reported. Hence Parliament had little business on hand. The strongest possible pressure was brought to bear upon the Government to give facilities to the Conciliation Bill. A number of meetings were held in support of the bill. The Men's Political Union for Women's Enfranchisement, the Men's League for Women's Suffrage and the Conciliation Committee held a joint meeting in Hyde Park. Some of the old school of suffragists held another large meeting in Trafalgar Square. The Women's Social and Political Union, on July 23rd, which was the anniversary of the day in 1867 on which working men, agitating for their vote, had pulled down the Hyde Park railings, held another enormous demonstration there. A space of half a square mile was cleared, forty platforms erected, and two great processions marched from east and west to the meeting. Many other suffrage societies co-operated with us on this occasion. On the very day of that meeting Mr. Asquith wrote to Lord Lytton refusing to allow any more time for the bill during that session.

Those who still had faith that the Government could be induced to do justice to women set their hopes on the autumn session of Parliament. Resolutions urging the Government to give the bill facilities during the autumn were sent, not only by the suffrage associations but from many organisations of men. The Corporations of thirty-eight cities, including Liverpool, Manchester, Glasgow, Dublin and Cork, sent resolutions to this effect. Cabinet Ministers were besieged with requests to receive deputations of women, and since the country was on the verge of a general election, and the Liberal Party wanted the services of women, their requests could not altogether be ignored. Mr. Asquith, early in October, received a deputation of women from his own constituency of East Fife, but all he had to tell them was that the bill could not be advanced that year. "What about next year?" They asked, and he replied shortly: "Wait and see."

It had been exceedingly difficult, during these troublous days, to hold all the members of the W. S. P. U. to the truce, and when it became perfectly apparent that the Conciliation Bill was doomed, war was again declared. At a great meeting held in Albert Hall on November 10th, I myself threw down the gage of battle. I said, because I wanted the whole matter to be clearly understood by the public as well as by our members: "This is the last constitutional effort of the Women's Social and Political Union to secure the passage of the bill into law. If the Bill, in spite of our efforts, is killed by the Government, then first of all, I have to say there is an end of the truce. If we are met by the statement that there is no power to secure on the floor of the House of Commons time for our measure, then our first step is to say, 'We take it out of your hands, since you fail to help us, and we resume the direction of the campaign ourselves.'"

Another deputation, I declared, must go to the House of Commons to carry a petition to the Prime Minister. I myself would lead, and if no one cared to follow me I would go alone. Instantly, all over the hall, women sprang to their feet crying out, "Mrs. Pankhurst, I will go with you!" "I will go!" "I will go!" And I knew that our brave women were as ever ready to give themselves, their very lives, if need be, for the cause of freedom.

The autumn session convened on Friday, November 18th, and Mr. Asquith announced that Parliament would be adjourned on November 28th. While his speech was in progress, 450 women, in small groups, to keep within the strict letter of the law, were marching from Caxton Hall and from the headquarters of the Union.

[Illustration: THE HEAD OF THE DEPUTATION ON BLACK FRIDAY

November, 1910]

How to tell the story of that dreadful day, Black Friday, as it lives in our memory--how to describe what happened to English women at the behest of an English Government, is a difficult task. I will try to tell it as simply and as accurately as possible. The plain facts, baldly stated, I am aware will strain credulity.

Remember that the country was on the eve of a general election, and that the Liberal Party needed the help of Liberal women. This fact made the wholesale arrest and imprisonment of great numbers of women, who were demanding the passage of the Conciliation Bill, extremely undesirable from the Government's point of view. The Women's Liberal Federations also wanted the passage of the Conciliation Bill, although they were not ready to fight for it. What the Government feared, was that the Liberal women would be stirred by our sufferings into refraining from doing election work for the party. So the Government conceived a plan whereby the Suffragettes were to be punished, were to be turned back and defeated in their purpose of reaching the House, but would not be arrested. Orders were evidently given that the police were to be present in the streets, and that the women were to be thrown from one uniformed or ununiformed policeman to another, that they were to be so rudely treated that sheer terror would cause them to turn back. I say orders were given and as one proof of this I can first point out that on all previous occasions the police had first tried to turn back the deputations and when the women persisted in going forward, had arrested them. At times individual policemen had behaved with cruelty and malice toward us, but never anything like the unanimous and wholesale brutality that was shown on Black Friday.

The Government very likely hoped that the violence of the police towards the women would be emulated by the crowds, but instead the crowds proved remarkably friendly. They pushed and struggled to make a clear pathway for us, and in spite of the efforts of the police my small deputation actually succeeded in reaching the door of the Strangers' Entrance. We mounted the steps to the enthusiastic cheers of the multitudes that filled the streets, and we stood there for hours gazing down on a scene which I hope never to look upon again.

At intervals of two or three minutes small groups of women appeared in the square, trying to join us at the Strangers' Entrance. They carried little banners inscribed with various mottoes, "Asquith Has Vetoed Our Bill," "Where There's a Bill There's a Way," "Women's Will Beats Asquith's Won't," and the like. These banners the police seized and tore in pieces. Then they laid hands on the women and literally threw them from one man to another. Some of the police used their fists, striking the women in their faces, their breasts, their shoulders. One woman I saw thrown down with violence three or four times in rapid succession, until at last she lay only half conscious against the curb, and in a serious condition was carried away by kindly strangers. Every moment the struggle grew fiercer, as more and more women arrived on the scene. Women, many of them eminent in art, in medicine and science, women of European reputation, subjected to treatment that would not have been meted out to criminals, and all for the offence of insisting upon the right of peaceful petition.

[Illustration: FOR HOURS SCENES LIKE THIS WERE ENACTED ON BLACK FRIDAY

November, 1910]

This struggle lasted for about an hour, more and more women successfully pushing their way past the police and gaining the steps of the House. Then the mounted police were summoned to turn the women back. But, desperately determined, the women, fearing not the hoofs of the horses or the crushing violence of the police, did not swerve from their purpose. And now the crowds began to murmur. People began to demand why the women were being knocked about; why, if they were breaking the law, they were not arrested; why, if they were not breaking the law, they were not permitted to go on unmolested. For a long time, nearly five hours, the police continued to hustle and beat the women, the crowds becoming more and more turbulent in their defence. Then, at last the police were obliged to make arrests. One hundred and fifteen women and four men, most of them bruised and choked and otherwise injured, were arrested.

While all this was going on outside the House of Commons, the Prime Minister was obstinately refusing to listen to the counsels of some of the saner and more justice-loving members of the House. Keir Hardie, Sir Alfred Mondell and others urged Mr. Asquith to receive the deputation, and Lord Castlereagh went so far as to move as an amendment to a Government proposal, another proposal which would have compelled the Government to provide immediate facilities to the Conciliation Bill. We heard of what was going on, and I sent in for one and another friendly member and made every possible effort to influence them in favour of Lord Castlereagh's amendment. I pointed to the brutal struggle that was going on in the square, and I begged them to go back and tell the others that it must be stopped. But, distressed as some of them undoubtedly were, they assured me that there was not the slightest chance for the amendment.

"Is there not a single _man_ in the House of Commons," I cried, "one who will stand up for us, who will make the House see that the amendment must go forward?"

Well, perhaps there were men there, but all save fifty-two put their party loyalty before their manhood, and, because Lord Castlereagh's proposal would have meant censure of the Government, they refused to support it. This did not happen, however, until Mr. Asquith had resorted to his usual crafty device of a promise of future action. In this instance he promised to make a statement on behalf of the Government on the following Tuesday.

The next morning the suffrage prisoners were arraigned in police court. Or rather, they were kept waiting outside the court room while Mr. Muskett, who prosecuted on behalf of the Chief Commissioner of Police, explained to the astounded magistrate that he had received orders from the Home Secretary that the prisoners should all be discharged. Mr. Churchill it was declared, had had the matter under careful consideration, and had decided that "no public advantage would be gained by proceeding with the prosecution, and accordingly no evidence would be given against the prisoners."

Subdued laughter and, according to the newspapers, some contemptuous booing were raised in the court, and when order was restored the prisoners were brought in in batches and told that they were discharged.

On the following Tuesday the W. S. P. U. held another meeting of the Women's Parliament in Caxton Hall to hear the news from the House of Commons. Mr. Asquith said: "The Government will, if they are still in power, give facilities in the next Parliament for effectively proceeding with a franchise bill which is so framed as to admit of free amendment." He would not promise that this would be done during the first year of Parliament.

We had demanded facilities for the Conciliation Bill, and Mr. Asquith's promise was too vague and too ambiguous to please us. The Parliament now about to be dissolved had lasted a scant ten months. The next one might not last longer. Therefore, Mr. Asquith's promise, as usual, meant nothing at all. I said to the women, "I am going to Downing Street. Come along, all of you." And we went.

We found a small force of police in Downing Street, and we easily broke through their line and would have invaded the Prime Minister's residence had not reinforcements of police arrived on the scene. Mr. Asquith himself appeared unexpectedly, and as we thought, very opportunely. Before he could have realised what was happening he found himself surrounded by angry Suffragettes. He was well hooted and, it is said, well shaken, before he was rescued by the police. As his taxicab rushed away some object struck one of the windows, smashing it.

Another Cabinet Minister, Mr. Birrell, unwittingly got into the midst of the melee, and I am obliged to record that he was pretty thoroughly hustled. But it is not true that his leg was injured by the women. His haste to jump into a taxicab resulted in a slightly

sprained ankle.

That night and the following day windows were broken in the houses of Sir Edward Grey, Mr. Winston Churchill, Mr. Lewis Harcourt and Mr. John Burns; and also in the official residences of the Premier and the Chancellor of the Exchequer.

That week 160 Suffragettes were arrested, but all except those charged with window-breaking or assault were discharged. This amazing court action established two things: First, that when the Home Secretary stated that he had no responsibility for the prosecution and sentencing of Suffrage prisoners, he told a colossal falsehood; and second, that the Government fully realised that it was bad election tactics to be responsible for the imprisonment of women of good character who were struggling for citizenship.

CHAPTER VIII

Almost immediately after the events chronicled in the preceding chapter I sailed for my second tour through the United States. I was delighted to find a thoroughly alive and progressive suffrage movement, where before had existed with most people only an academic theory in favour of equal political rights between men and women. My first meeting, held in Brooklyn, was advertised by sandwich women walking through the principal streets of the city, quite like our militant suffragists at home. Street meetings, I found, were now daily occurrences in New York. The Women's Political Union had adopted an election policy, and throughout the country as far west as I travelled, I found women awakened to the necessity of political action instead of mere discussion of suffrage.

My second visit to America, like my first one, is clouded in my memory with sorrow. Very soon after my return to England a beloved sister, Mrs. Mary Clarke died. My sister, who was a most ardent suffragist and a valued worker in the Women's Social and Political Union, was one of the women who was shockingly maltreated in Parliament Square on Black Friday. She was also one of the women who, a few days later, registered their protest against the Government by throwing a stone through the window of an official residence. For this act she was sent to Holloway prison for a term of one month. Released on December 21st, it was plain to those who knew her best that her health had suffered seriously from the dreadful experience of Black Friday and the after experience of prison. She died suddenly on Christmas day, to the profound sorrow of all her associates. Hers was not the only life that was sacrificed as a result of that day. Other deaths occurred, mostly from hearts weakened by overstrain. Miss Henria Williams died on January 2nd, 1911, from heart failure. Miss Cecelia Wolseley Haig was another victim. Ill treatment on Black Friday resulted in her case in a painful illness which ended, after a year of intense suffering, in her death on December 21st, 1911.

It is not possible to publish a full list of all the women who have died or have been injured for life in the course of the suffrage agitation in England. In many cases the details have never been made public, and I do not feel at liberty to record them here. A very celebrated case, which is public property, is that of Lady Constance Lytton, sister of the Earl of Lytton, who acted as chairman of the Conciliation Committee. Lady Constance had twice in 1909 gone to prison as a result of suffrage activities, and on both occasions had been given special privileges on account of her rank and family influence. In spite of her protests and her earnest pleadings to be accorded the same treatment as other suffrage prisoners, the snobbish and cowardly authorities insisted in retaining Lady Constance in the hospital cells and discharging her before the expiration of her sentence. This was done on a plea of her ill health, and it was true that she suffered from a valvular disease of the heart.

[Illustration: RIOT SCENES ON BLACK FRIDAY

November, 1910]

Smarting under the sense of the injustice done her comrades in this discrimination, Lady Constance Lytton did one of the most heroic deeds to be recorded in the history of the suffrage movement. She cut off her beautiful hair and otherwise disguised herself, put on cheap and ugly clothing, and as "Jane Warton" took part in a demonstration at Newcastle, again suffering arrest and imprisonment. This time the authorities treated her as an ordinary prisoner. Without testing her heart or otherwise giving her an adequate medical examination, they subjected her to the horrors of forcible feeding. Owing to her fragile constitution she suffered frightful nausea each time, and when on one occasion the doctor's clothing was soiled, he struck her contemptuously on the cheek. This treatment was continued until the identity of the prisoner suddenly became known. She was, of course, immediately released, but she never recovered from the experience, and is now a hopeless invalid.[2]

I want to say right here, that those well-meaning friends on the outside who say that we have suffered these horrors of prison, of hunger strikes and forcible feeding, because we desired to martyrise ourselves for the cause, are absolutely and entirely mistaken.

We never went to prison in order to be martyrs. We went there in order that we might obtain the rights of citizenship. We were willing to break laws that we might force men to give us the right to make laws. That is the way men have earned their citizenship. Truly says Mazzini that the way to reform has always led through prison.

The result of the general election, which took place in January, 1911, was that the Liberal Party was again returned to power. Parliament met on January 31st, but the session formally opened on February 6th with the reading of the King's speech. The programme for the session included the Lords' veto measure, Home Rule, payment for members of Parliament, and the abolishment of plural voting. Invalid insurance was also mentioned and certain amendments to the old age pension bill. Women's suffrage was not mentioned. Nevertheless, we were singularly lucky, the first three places in the ballot being secured by members of the Conciliation Committee. Mr. Philips, an Irish member, drew the first place, but as the Irish party had decided not to introduce any bills that session, he yielded to Sir George Kemp, who announced that he would use his place for the purpose of taking a second reading debate on the new Conciliation Bill. The old bill had been entitled: "A Bill to give the Vote to Women Occupiers," a title that made amendment difficult. The new bill bore the more flexible title, "A Bill to Confer the Parliamentary Franchise on Women," thus doing away with one of Mr. Lloyd-George's most plausible objections to it. The L10 occupation clause was omitted, doing away with another objection, that of the possibility of "faggot voting," that is, of a rich man conferring the vote on a family of daughters by the simple expedient of making them tenants of slices of his own property. The Conciliation Bill now read: "1. Every woman possessed of a household qualification within the meaning of the Representation of the People Act (1884) shall be entitled to be registered as a voter, and when registered to vote in the county or borough in which the qualifying premises are situated.

"2. For the purposes of this Act a woman shall not be disqualified by marriage for being registered as a voter, provided that a husband and wife shall not both be registered as voters in the same Parliamentary borough or county division."

This bill met with even warmer approval than the first one, because it was believed that it would win votes from those members who felt that the original measure had fallen short of being truly democratic. Nevertheless, the Prime Minister showed from the first that he intended to oppose it, as he had all previous suffrage measures. He announced that all Fridays up to Easter and also all time on Tuesdays and Wednesdays usually allowed for private members' bills were to be occupied with consideration of Government measures. Hardly a Liberal voice was raised against this arbitrary ruling. The Irish members indeed were delighted with it, since it gave the Home Rule Bill an advantage. The Labour members seemed complacent, and the rest of the coalition were indifferent. One back bench Liberal went so far as to rise and thank the Prime Minister for the courtesy with which the gagging process was accomplished. There was some show of fight made by the Opposition, but Conservative indignation was tempered by the reflection that the precedent established might be followed to advantage when their party came into power.

Sir George Kemp then announced that he would take May 5th for the second reading of the Conciliation Bill, and the supporters of the bill, according to their various convictions, set to work to further its interests. The conviction of the W. S. P. U. was that Mr. Asquith's Government would never allow the bill to pass until they were actually forced to do so, and we adopted our own methods to secure a definite pledge from the Government that they would give facilities to the bill.

In April of that year the census was to be taken, and we organised a census resistance on the part of women. According to our law the census of the entire kingdom must be taken every ten years on a designated day. Our plan was to reduce the value of the census for statistical purposes by refusing to make the required returns. Two ways of resistance presented themselves. The first and most important was direct resistance by occupiers who should refuse to fill in the census papers. This laid the register open to a fine of L5 or a month's imprisonment, and thus required the exercise of considerable courage. The second means of resistance was evasion--staying away from home during the entire time that the enumerators were taking the census. We made the announcement of this plan and instantly there ensued a splendid response from women and a chorus of horrified disapproval from the conservative public. The _Times_ voiced this disapproval in a leading article, to which I replied, giving our reasons for the protest. "The Census," I wrote, "is a numbering of the people. Until women count as people for the purpose of representation in the councils of the nation as well as for purposes of taxation, we shall refuse to be numbered."

On the subject of laws made by men--without the assistance of women--for the protection of women and children, I have a very special feeling. From my experience as poor law guardian and as Registrar of Births and Deaths, I know how ridiculously, say rather how tragically, these laws fall short of protection. Take for instance the vaunted "Children's Charter" of 1906, the measure which spread Mr. Lloyd-George's fame throughout the world. A volume could be filled with the mistakes and the cruelties of that Act, the object of which is the preservation and improvement of child life. A distinguishing characteristic of the Act is that it puts most of the responsibility for neglect of children on the backs of the mothers, who, under the laws of England, have no rights as

parents. Two or three especially striking cases of this kind came into notice about this time, and gave the census resistance an additional justification.

The case of Annie Woolmore was a very pitiful one. She was arrested and sentenced to Holloway for six weeks for neglecting her children. The evidence showed that the woman lived with her husband and children in a miserable hovel, which would have been almost impossible to keep clean even if there had been water in the house. As it was the poor soul, who was in ill health and weakened by deprivation, had to carry all the water she used across a great distance. The children as well as the house were very dirty, it was true, but the children were well nourished and kindly treated. The husband, a labourer, out of work much of the time, testified that his wife "starved herself to feed the kids." Yet she had violated the terms of the "Children's Charter" and she went to prison. I am glad to say that owing to the efforts of suffragists she was pardoned and provided with a better home.

Another case was that of Helen Conroy, who was charged with living in one wretched room, with her husband and seven children, the youngest a month old. According to the law the mother was forbidden to have this infant in bed with her overnight, yet part of the charge against her was that the child was found sleeping in a box of damp straw. Doubtless she would have preferred a cradle, or even a box of dry straw. But direst poverty made the cradle impossible and the conditions of the tenement kept the straw damp. Both parents in this instance were sent to prison for three months at hard labour. The magistrate casually remarked that the house in which these poor people lived had been condemned two years before, but some respectable property owner was still collecting rents from it.

Another poor mother, evicted from her home because she could not pay the rent, took her four children out into the open country, and when found was sleeping with them in a gravel pit. She was sent to prison for a month and the children went to the workhouse.

These sorry mothers, logical results of the subjection of women, are enough in themselves to justify almost any defiance of a Government who deny the women the right to work out their destinies in freedom. No pledge having been secured from the Prime Minister by April 1st, we carried out, and most successfully, our census resistance. Many thousands of women all over the country refused or evaded the returns. I returned my census paper with the words "No vote no census" written across it, and other women followed that example with similar messages. One woman filled in the blank with full information about her one man servant, and added that there were many women but no more persons in her household. In Birmingham sixteen women of wealth packed their houses with women resisters. They slept on the floors, on chairs and tables, and even in the baths. The head of a large college threw open the building to 300 women. Many women in other cities held all night parties for friends who wished to remain away from home. In some places unoccupied houses were rented for the night by resisters, who lay on the bare boards. Some groups of women hired gipsy vans and spent the night on the moors.

In London we gave a great concert at Queen's Hall on Census night. Many of us walked about Trafalgar Square until midnight and then repaired to Aldwich skating rink, where we amused ourselves until morning. Some skated while others looked on, and enjoyed the admirable musical and theatrical entertainment that helped to pass the hours. We had with us a number of the brightest stars in the theatrical world, and they were generous in their contributions. It being Sunday night, the chairman had to call on each of the artists for a "speech" instead of a song or other turn. An all-night restaurant near at hand did a big business, and on the whole the resisters had a very good time. The Scala Theatre was the scene of another all-night entertainment.

There was a good deal of curiosity to see what the Government would devise in the way of a punishment for the rebellious women, but the Government realised the impossibility of taking punitive action, and Mr. John Burns, who, as head of the Local Government Board, was responsible for the census, announced that they had decided to treat the affair with magnanimity. The number of evasions, he declared, was insignificant. But every one knew that this was the exact reverse of the facts.

[Illustration: IN THIS MANNER THOUSANDS OF WOMEN THROUGHOUT THE KINGDOM SLEPT IN UNOCCUPIED HOUSES OVER CENSUS NIGHT]

The Conciliation Bill was debated on May 5th and passed its second reading by the enormous majority of 137. And now the public and a section of the press united in a strong demand that the Government yield to the undoubted will of the House and grant facilities to the bill. The Conciliation Committee sent a deputation of members to the Prime Minister to remind him of his pre-election promise that the House of Commons should have an opportunity of dealing with the whole question of woman suffrage, but they succeeded only in getting his assurance that he had the matter under consideration. Late in the month the announcement was made in the House that the Government would not grant facilities during that session, but, since the new bill fulfilled the conditions named by the Prime Minister, and was now capable of amendment, the Government recognised it to be their duty to grant facilities

in some session of the present Parliament. They would be prepared next session, when the bill had been again read for the second time, either as a result of obtaining a good place in the ballot, or (if that did not happen) by a grant of a Government day for the purpose, to give a week, which they understood to be the time suggested as reasonable by the promoters for its further stages.

This pledge was made in order to deter the W. S. P. U. from making a militant demonstration in connection with the coronation of the King.

Keir Hardie asked if the Government would, by means of a closure or otherwise, make certain that the bill would go through in the week, and the Prime Minister replied, "No, I cannot give an assurance of that kind. After all, it is a problem of the very greatest magnitude."

This reply seemed to make the Government's pledge practically worthless. The Conciliation Committee also realised the possibilities of the bill being talked out, and Lord Lytton wrote to Mr. Asquith and asked him for assurances that the facilities offered were intended not for academic discussion but for effective opportunity for carrying the bill. He also asked that the week offered should not be construed rigidly but that, providing the committee stage were got through in the time, additional days for the report and third reading stages might be forthcoming. Reasonable opportunity for making use of the closure was also asked. To Lord Lytton's letter the Prime Minister replied as follows:

My dear Lytton--In reply to your letter on the subject of the Women's Enfranchisement Bill, I would refer you to some observations recently made in a speech at the National Liberal Club by Sir Edward Grey, which accurately expresses the intention of the Government.

It follows (to answer your specific inquiries), that the "week" offered will be interpreted with reasonable elasticity, that the Government will interpose no reasonable obstacle to the proper use of the closure, and that if (as you suggest) the bill gets through committee in the time proposed, the extra days required for report and third reading will not be refused.

The Government, though divided in opinion on the merits of the bill, are unanimous in their determination to give effect, not only in the letter but in the spirit, to the promise in regard to facilities which I made on their behalf before the last general election. Yours etc., H. H. ASQUITH.

Sceptical up to this point, the W. S. P. U. was now convinced that the Government were sincere in their promise to give the bill full facilities in the following year. We held a joyful mass meeting in Queen's Hall and I again declared that warfare against the Government was at an end. Our new policy was the inauguration of a great holiday campaign, with the object of making victory in 1912 absolutely certain. Electors must be aroused, members of Parliament held to their allegiance. Women must be organised in order that questions that vitally affect the social welfare of the country might be placed before them. I chose Scotland and Wales as the scenes of my holiday labours.

I may say that our confidence was fully shared by the public at large. The belief in Mr. Asquith's pledge was accurately reflected in a leader published in _The Nation_, which said: "From the moment the Prime Minister signed the frank and ungrudging letter to Lord Lytton which appeared in last Saturday's newspapers, women became, in all but the legal formality, voters and citizens. For at least two years, if not for longer, nothing has been lacking save a full and fair opportunity for the House of Commons to translate its convictions into the precise language of a statute. That opportunity has been promised for next session and promised in terms and under conditions which ensure success."

The only thing, as we thought, that we had to fear were wrecking amendments to the bill, and in the new by-election policy which we adopted we worked against all candidates of every party who would refuse to promise, not only to support the Conciliation Committee to carry the bill, but also to vote against any amendment the committee thought dangerous. We believed that we had covered every possibility of disaster. But we had something yet to learn of the treachery of the Asquith Ministry and their capacity for cold-blooded lying.

Mr. Lloyd-George from the first was an open enemy of the bill, but since we had no doubt of the sincerity of the Prime Minister, we could only conclude that Mr. Lloyd-George had detached himself from the main body of the Government and had become the self-constituted leader of the opposition. In an address to a large Liberal group Mr. Lloyd-George advised that Liberal members be asked to ballot for a place for a "democratic measure," in order that such a measure might claim the Prime Minister's pledge for facilities next session. In one or two other speeches he made vague allusions to the possibilities of introducing another suffrage bill.

His own idea was to amend the bill to give a vote to wives of all electors--making married women voters in virtue of their husband's qualification. The inevitable effect of such an amendment would be to wreck the bill, since it would have enfranchised about 6,000,000 women in addition to the million and a half who would benefit by the original terms of the bill. Such a wholesale addition to the electorate was never known in England; the number enfranchised by the Reform Bill of 1832 being hardly more than half a million. The Reform Bill of 1867 admitted a million new voters, and that of 1884 perhaps two millions. The absurdity of Mr. Lloyd-George's proposition was such that we did not regard it seriously. We did not allow his opposition to give us serious alarm until a day in August when a Welsh member, Mr. Leif Jones, asked the Prime Minister from the floor of the House, whether he was aware that his promise for facilities for the Conciliation Bill in the next session was being claimed exclusively for that bill, and asked further for a statement that the promised facilities would be equally granted to any other suffrage bill that might secure a second reading and was capable of amendment. Mr. Lloyd-George, speaking for the Government, replied that they could not undertake to give facilities to more than one bill on the same subject, but that any bill which, satisfying these tests, secured a second reading, would be treated by them as falling within their engagements.

Astounded at this plain evasion of a sacred promise, Lord Lytton again wrote to the Prime Minister, reviewing the entire matter, and asking for another statement of the Government's intentions. The following is the text of Mr. Asquith's reply:

My dear Lytton--I have no hesitation in saying that the promises made by, and on behalf of the Government, in regard to giving facilities to the Conciliation Bill, will be strictly adhered to, both in letter and in spirit. Yours sincerely, H. H. ASQUITH. August 23, 1911.

Again we were reassured, and our confidence in the Premier's pledge remained unshaken throughout the campaign, although Mr. Lloyd-George continued to throw out hints that the promises of facilities for the bill were altogether illusory. We could not believe him, and when, two months later, I was asked in America: "When will English women vote?" I replied with perfect conviction, "Next year."

This was in Louisville, Kentucky, where I attended the 1911 Annual Convention of the National American Woman Suffrage Association.

I remember this third visit to the United States with especial pleasure. I was the guest in New York of Dr. and Mrs. John Winters Brannan, and through the courtesy of Dr. Brannan, who is at the head of all the city hospitals, I saw something of the penal system and the institutional life of America. We visited the workhouse and the penitentiary on Blackwell's Island, and although I am told that these places are not regarded as model institutions, I can assure my readers that they are infinitely superior to the English prisons where women are punished for trying to win their political freedom. In the American prisons, much as they lacked in some essentials, I saw no solitary confinement, no rule of silence, no deadly air of officialdom. The food was good and varied, and above all there was an air of kindness and good feeling between the officials and the prisoners that is almost wholly lacking in England.

But, after all, in the United States as in other countries, the problem of the relations between unfranchised women and the State remains unsolved and unsatisfactory. One night my friends took me to that sombre and terrible institution, the Night Court for Women. We sat on the bench with the magistrate, and he very courteously explained everything to us. The whole business was heart-breaking. All the women, with one exception--an old drunkard--were charged with solicitation. Most of them were of high type by nature. It all seemed so hopeless, and it was clear that they were victims of an evil system. Their conviction was a foregone conclusion.

The magistrate said that in most cases the reason for their coming there was economic. One case of a little cigar maker, who said very simply that she only went on the streets when out of work, and that when in work she earned $8 a week, was very tragic and touching. I could not keep the Night Court out of my speeches after that. The whole dreadful injustice of women's lives seemed mirrored in that place.

I went as far west as the Pacific Coast on this visit, spending Christmas day in Seattle, and for the first time seeing a community where women and men existed on terms of exact equality. It was a delightful experience. As I wrote home to our members, the men of the western States seemed to my eyes eager, earnest, rough men, building a great community in a great hurry, but never have I seen greater respect, courtesy and chivalry shown to women than in that one Suffrage State it has been my privilege to visit.

I am getting a little ahead of my story, however. It was in November, when I was in the city of Minneapolis, that a crushing blow descended on the English suffragists. I learned of this through cabled despatches in the newspapers and from private cables, and

was so staggered that I could scarcely command myself sufficiently to fill my immediate engagements. This was the news, that the Government had broken their plighted word and had deliberately destroyed the Conciliation Bill. My first wild thought, on hearing of this act of treachery, was to cancel all engagements and return to England, but my final decision to remain afterwards proved the right one, because the women at home, without a moment's loss of time, struck the answering blow, guided by that insight which has been characteristic of every act of the members of our Union. I did not return to England until January 11, 1912, and by that time great deeds had been done. Our movement had entered upon a new and more vigorous stage of militancy.

FOOTNOTE:

[2] Lady Constance Lytton's story has been thrillingly told in her book "Prisons and Prisoners," Heinemann.

BOOK III

THE WOMEN'S REVOLUTION

CHAPTER I

Parliament had reassembled on October 25th, 1911, and the first move on the part of the Government was, to say the least of it, rather unpropitious. The Prime Minister submitted two motions, the first one empowering them to take all the time of the House during the remainder of the session, and the second guillotining discussion on the Insurance Bill so as to force the measure through before Christmas. One day only was allotted to the clauses relating to women in that bill. These clauses were notoriously unfair; they provided for sickness insurance of about four million women and unemployment insurance of no women at all. Under the provision of the bill eleven million men were ensured against sickness and about two and a half million against unemployment. Women were given lower benefits for the same premium as men, and premiums paid out of the family income were credited solely to the men's account. The bill as drafted provided no form of insurance for wives, mothers and daughters who spent their lives at home working for the family. It penalised women for staying in the home, which most men agree is women's only legitimate sphere of action. The amended bill grudgingly allowed aside from maternity benefits, a small insurance, on rather difficult terms, for workingmen's wives.

Thus the re-elected Government's first utterance to women was one of contempt; and this was followed, on November 7th, by the almost incredible announcement that the Government intended, at the next session, to introduce a manhood suffrage bill. This announcement was not made in the House of Commons, but to a deputation of men from the People's Suffrage Federation, a small group of people who advocated universal adult suffrage. The deputation, which was very privately arranged for, was received by Mr. Asquith, and the then Master of Elibank (Chief Liberal Whip). The spokesman asked Mr. Asquith to bring in a Government measure for universal adult suffrage, including adult women. The Prime Minister replied that the Government had pledged facilities for the Conciliation Bill, which was as far as they were prepared to go in the matter of women's suffrage. But, he added, the Government intended in the next session to introduce and to pass through all its stages a genuine reform bill which would sweep away existing qualifications for the franchise, and substitute a single qualification of residence. The bill would apply to adult males only, but it would be so framed as to be open to a woman suffrage amendment in case the House of Commons desired to make that extension and amendment.

This portentous announcement came like a bolt from the blue, and there was strong condemnation of the Government's treachery to women. Said the _Saturday Review_:

With absolutely no demand, no ghost of a demand, for more votes for men, and with--beyond all cavil--a very strong demand for votes for women, the Government announce their Manhood Suffrage Bill and carefully evade the other question! For a naked, avowed plan of gerrymandering no Government surely ever did beat this one.

The _Daily Mail_ said that the "policy which Mr. Asquith proposes is absolutely indefensible." And the _Evening Standard and Globe_ said: "We are no friends of female suffrage, but anything more contemptible than the attitude assumed by the Government it is difficult to imagine."

If the Government hoped to deceive any one by their dishonest reference to the possibility of a woman suffrage amendment, they were disappointed. Said the _Evening News_:

Mr. Asquith's bombshell will blow the Conciliation Bill to smithereens, for it is impossible to have a manhood suffrage for men and a property qualification for women. True, the Premier consents to leave the question of women's suffrage to the House, but he knows well enough what the decision of the House will be. The Conciliation Bill had a chance, but the larger measure has none at all.

I have quoted these newspaper leaders to show you that our opinion of the Government's action was shared even by the press. Universal suffrage in a country where women are in a majority of one million is not likely to happen in the lifetime of any reader of this volume, and the Government's generous offer of a possible amendment was nothing more than a gratuitous insult to the suffragists.

The truce, naturally, came to an abrupt end. The W. S. P. U. wrote to the Prime Minister, saying that consternation had been aroused by the Government's announcement, and that it had been decided accordingly to send a deputation representing the Women's Social and Political Union to wait upon himself and the Chancellor of the Exchequer, on the evening of November 21st. The purpose of the deputation was to demand that the proposed manhood suffrage bill be abandoned, and that in its place should be introduced a Government measure giving equal franchise rights to men and women. A similar letter was despatched to Mr. Lloyd-George.

Six times before on occasions of crisis had the W. S. P. U. requested an interview with Mr. Asquith, and each time they had been refused. This time the Prime Minister replied that he had decided to receive a deputation of the various suffrage societies on November 17th, "including your own society, if you desire it." It was proposed that each society appoint four representatives as members of the deputation which would be received by the Prime Minister and the Chancellor of the Exchequer.

Nine suffrage societies sent representatives to the meeting, our own representatives being Christabel Pankhurst, Mrs. Pethick Lawrence, Miss Annie Kenney, Lady Constance Lytton and Miss Elizabeth Robins. Christabel and Mrs. Lawrence spoke for the Union, and they did not hesitate to accuse the two Ministers to their faces of having grossly tricked and falsely misled women. Mr. Asquith, in his reply to the deputation, resented these imputations.

He had kept his pledge, he insisted, in regard to the Conciliation Bill. He was perfectly willing to give facilities to the Bill, if the women preferred that to an amendment to his reform bill. Moreover, he denied that he had made any new announcement. As far back as 1908 he had distinctly declared that the Government regarded it as a sacred duty to bring forward a manhood suffrage bill before that Parliament came to an end. It was true that the Government did not carry out that binding obligation, and it was also true that until the present time nothing more was ever said about a manhood suffrage bill, but that was not the Government's fault. The crisis of the Lord's veto, had momentarily displaced the bill. Now he merely proposed to fulfil his promise made in 1908, and also his promise about giving facilities to the Conciliation Bill. He was ready to keep both promises. Well he knew that those promises were incompatible, that the fulfilment of both was therefore impossible, and Christabel told him so bluntly and fearlessly. "We are not satisfied," she warned him, and the Prime Minister said acidly: "I did not expect to satisfy _you_."

The reply of the W. S. P. U. was immediate and forceful. Led by Mrs. Pethick Lawrence, our women went out with stones and hammers and broke hundreds of windows in the Home Office, the War and Foreign Offices, the Board of Education, the Privy Council Office, the Board of Trade, the Treasury, Somerset House, the National Liberal Club, several post offices, the Old Banqueting Hall, the London and South Western Bank, and a dozen other buildings, including the residence of Lord Haldane and Mr. John Burns. Two hundred and twenty women were arrested and about 150 of them sent to prison for terms varying from a week to two months.

One individual protest deserves mention because of its prophetic character. In December Miss Emily Wilding Davison was arrested for attempting to set fire to a letter box at Parliament Street Post Office. In court Miss Davison said that she did it as a protest against the Government's treachery, and as a demand that women's suffrage be included in the King's speech. "The protest was meant to be serious," she said, "and so I adopted a serious course. In past agitation for reform the next step after window-breaking was incendiarism, in order to draw the attention of the private citizens to the fact that this question of reform was their concern as well as that of women."

Miss Davison received the severe sentence of six months' imprisonment for her deed.

To this state of affairs I returned from my American tour. I had the comfort of reflecting that my imprisoned comrades were being accorded better treatment than the early prisoners had known. Since early in 1910 some concessions had been granted, and some acknowledgment of the political character of our offences had been made. During the brief period when these scant concessions to

justice were allowed, the hunger strike was abandoned and prison was robbed of its worst horror, forcible feeding. The situation was bad enough, however, and I could see that it might easily become a great deal worse. We had reached a stage at which the mere sympathy of members of Parliament, however sincerely felt, was no longer of the slightest use. Reminding our members this, in the first speeches made after returning to England I asked them to prepare themselves for more action. If women's suffrage was not included in the next King's speech we should have to make it absolutely impossible for the Government to touch the question of the franchise.

The King's speech, when Parliament met in February, 1912, alluded to the franchise question in very general terms. Proposals, it was stated, would be brought forward for the amendment of the law with respect to the franchise and the registration of electors. This might be construed to mean that the Government were going to introduce a manhood suffrage bill or a bill for the abolition of plural voting, which had been suggested in some quarters as a substitute for the manhood suffrage bill. No precise statement of the Government's intentions was made, and the whole franchise question was left in a cloud of uncertainty. Mr. Agg Gardner, a Unionist member of the Conciliation Committee, drew the third place in the ballot, and he announced that he should reintroduce the Conciliation Bill. This interested us very slightly, for knowing its prospect of success to have been destroyed, for we were done with the Conciliation Bill forever. Nothing less than a Government measure would henceforth satisfy the W. S. P. U., because it had been clearly demonstrated that only a Government measure would be allowed to pass the House of Commons. With sublime faith, or rather with a deplorable lack of political insight, the Women's Liberal Federation and the National Union of Women's Suffrage Societies professed full confidence in the proposed amendment to a manhood suffrage bill, but we knew how futile was that hope. We saw that the only course to take was to offer determined opposition to any measure of suffrage that did not include as an integral part, equal suffrage for men and women.

On February 16th we held a large meeting of welcome to a number of released prisoners who had served two and three months for the window breaking demonstration that had taken place in the previous November. At this meeting we candidly surveyed the situation and agreed on a course of action which we believed would be sufficiently strong to prevent the Government from advancing their threatened franchise bill. I said on this occasion:

"We don't want to use any weapons that are unnecessarily strong. If the argument of the stone, that time-honoured official political argument, is sufficient, then we will never use any stronger argument. And that is the weapon and the argument that we are going to use next time. And so I say to every volunteer on our demonstration, 'Be prepared to use that argument.' I am taking charge of the demonstration, and that is the argument I am going to use. I am not going to use it for any sentimental reason, I am going to use it because it is the easiest and the most readily understood. Why should women go to Parliament Square and be battered about and insulted, and most important of all, produce less effect than when we throw stones? We tried it long enough. We submitted for years patiently to insult and assault. Women had their health injured. Women lost their lives. We should not have minded if that had succeeded, but that did not succeed, and we have made more progress with less hurt to ourselves by breaking glass than ever we made when we allowed them to break our bodies.

"After all, is not a woman's life, is not her health, are not her limbs more valuable than panes of glass? There is no doubt of that, but most important of all, does not the breaking of glass produce more effect upon the Government? If you are fighting a battle, that should dictate your choice of weapons. Well, then, we are going to try this time if mere stones will do it. I do not think it will ever be necessary for us to arm ourselves as Chinese women have done, but there are women who are prepared to do that if it should be necessary. In this Union we don't lose our heads. We only go as far as we are obliged to go in order to win, and we are going forward with this next protest demonstration in full faith that this plan of campaign, initiated by our friends whom we honour to-night, will on this next occasion prove effective."

Ever since militancy took on the form of destruction of property the public generally, both at home and abroad, has expressed curiosity as to the logical connection between acts such as breaking windows, firing pillar boxes, et cetera, and the vote. Only a complete lack of historical knowledge excuses that curiosity. For every advance of men's political freedom has been marked with violence and the destruction of property. Usually the advance has been marked by war, which is called glorious. Sometimes it has been marked by riotings, which are deemed less glorious but are at least effective. That speech of mine, just quoted, will probably strike the reader as one inciting to violence and illegal action, things as a rule and in ordinary circumstances quite inexcusable. Well, I will call the reader's attention to what was, in this connection, a rather singular coincidence. At the very hour when I was making that speech, advising my audience of the political necessity of physical revolt, a responsible member of the Government, in another hall, in another city, was telling his audience precisely the same thing. This Cabinet Minister, the right Honourable C. E. H. Hobhouse, addressing a large anti-suffrage meeting in his constituency of Bristol, said that the suffrage movement was not a

political issue because its adherents had failed to prove that behind this movement existed a large public demand. He declared that "In the case of the suffrage demand there has not been the kind of popular sentimental uprising which accounted for Nottingham Castle in 1832 or the Hyde Park railings in 1867. There has not been a great ebullition of popular feeling."

The "popular sentimental uprising" to which Mr. Hobhouse alluded was the burning to the ground of the castle of the anti-suffrage Duke of Newcastle, and of Colwick Castle, the country seat of another of the leaders of the opposition against the franchise bill. The militant men of that time did not select uninhabited buildings to be fired. They burned both these historic residences over their owners' heads. Indeed, the wife of the owner of Colwick Castle died as a result of shock and exposure on that occasion. No arrests were made, no men imprisoned. On the contrary the King sent for the Premier, and begged the Whig Ministers favourable to the franchise bill not to resign, and intimated that this was also the wish of the Lords who had thrown out the bill. Molesworth's History of England says:

These declarations were imperatively called for. The danger was imminent and the Ministers knew it and did all that lay in their power to tranquillise the people, and to assure them that the bill was only delayed and not finally defeated.

For a time the people believed this, but soon they lost patience, and seeing signs of a renewed activity on the part of the anti-suffragists, they became aggressive again. Bristol, the very city in which Mr. Hobhouse made his speech, was set on fire. The militant reformers burned the new gaol, the toll houses, the Bishop's Palace, both sides of Queen's Square, including the Mansion House, the custom house, the excise office, many warehouses, and other private property, the whole valued at over L100,000--five hundred thousand dollars. It was as a result of such violence, and in fear of more violence, that the reform bill was hurried through Parliament and became law in June, 1832.

Our demonstration, so mild by comparison with English men's political agitation, was announced for March 4th, and the announcement created much public alarm. Sir William Byles gave notice that he would "ask the Secretary of State for the Home Department whether his attention had been drawn to a speech by Mrs. Pankhurst last Friday night, openly and emphatically inciting her hearers to violent outrage and the destruction of property, and threatening the use of firearms if stones did not prove sufficiently effective; and what steps he proposes to take to protect Society from this outbreak of lawlessness."

The question was duly asked, and the Home Secretary replied that his attention had been called to the speech, but that it would not be desirable in the public interest to say more than this at present.

Whatever preparations the police department were making to prevent the demonstration, they failed because, while as usual, we were able to calculate exactly what the police department were going to do, they were utterly unable to calculate what we were going to do. We had planned a demonstration for March 4th, and this one we announced. We planned another demonstration for March 1st, but this one we did not announce. Late in the afternoon of Friday, March 1st, I drove in a taxicab, accompanied by the Hon. Secretary of the Union, Mrs. Tuke and another of our members, to No. 10 Downing Street, the official residence of the Prime Minister. It was exactly half past five when we alighted from the cab and threw our stones, four of them, through the window panes. As we expected we were promptly arrested and taken to Cannon Row police station. The hour that followed will long be remembered in London. At intervals of fifteen minutes relays of women who had volunteered for the demonstration did their work. The first smashing of glass occurred in the Haymarket and Piccadilly, and greatly startled and alarmed both pedestrians and police. A large number of the women were arrested, and everybody thought that this ended the affair. But before the excited populace and the frustrated shop owners' first exclamation had died down, before the police had reached the station with their prisoners, the ominous crashing and splintering of plate glass began again, this time along both sides of Regent Street and the Strand. A furious rush of police and people towards the second scene of action ensued. While their attention was being taken up with occurrences in this quarter, the third relay of women began breaking the windows in Oxford Circus and Bond Street. The demonstration ended for the day at half past six with the breaking of many windows in the Strand. The _Daily Mail_ gave this graphic account of the demonstration:

From every part of the crowded and brilliantly lighted streets came the crash of splintered glass. People started as a window shattered at their side; suddenly there was another crash in front of them; on the other side of the street; behind--everywhere. Scared shop assistants came running out to the pavements; traffic stopped; policemen sprang this way and that; five minutes later the streets were a procession of excited groups, each surrounding a woman wrecker being led in custody to the nearest police station. Meanwhile the shopping quarter of London had plunged itself into a sudden twilight. Shutters were hurriedly fitted; the rattle of iron curtains being drawn came from every side. Guards of commissionaires and shopmen were quickly mounted, and any

unaccompanied lady in sight, especially if she carried a hand bag, became an object of menacing suspicion.

At the hour when this demonstration was being made a conference was being held at Scotland Yard to determine what should be done to prevent the smashing of windows on the coming Monday night. But we had not announced the hour of our March 4th protest. I had in my speech simply invited women to assemble in Parliament Square on the evening of March 4th, and they accepted the invitation. Said the _Daily Telegraph_:

By six o'clock the neighbourhood Houses of Parliament were in a stage of siege. Shop keepers in almost every instance barricaded their premises, removed goods from the windows and prepared for the worst. A few minutes before six o'clock a huge force of police, amounting to nearly three thousand constables, was posted in Parliament Square, Whitehall, and streets adjoining, and large reserves were gathered in Westminster Hall and Scotland Yard. By half past eight Whitehall was packed from end to end with police and public. Mounted constables rode up and down Whitehall keeping the people on the move. At no time was there any sign of danger....

The demonstration had taken place in the morning, when a hundred or more women walked quietly into Knightsbridge and walking singly along the streets demolished nearly every pane of glass they passed. Taken by surprise the police arrested as many as they could reach, but most of the women escaped.

[Illustration: THE ARGUMENT OF THE BROKEN WINDOW PANE]

For that two days' work something like two hundred suffragettes were taken to the various police stations, and for days the long procession of women streamed through the courts. The dismayed magistrates found themselves facing, not only former rebels, but many new ones, in some cases, women whose names, like that of Dr. Ethel Smyth, the composer, were famous throughout Europe. These women, when arraigned, made clear and lucid statements of their positions and their motives, but magistrates are not schooled to examine motives. They are trained to think only of laws and mostly of laws protecting property. Their ears are not tuned to listen to words like those spoken by one of the prisoners, who said: "We have tried every means--processions and meetings--which were of no avail. We have tried demonstrations, and now at last we have to break windows. I wish I had broken more. I am not in the least repentant. Our women are working in far worse condition than the striking miners. I have seen widows struggling to bring up their children. Only two out of every five are fit to be soldiers. What is the good of a country like ours? England is absolutely on the wane. You only have one point of view, and that is the men's, and while men have done the best they could, they cannot go far without the women and the women's views. We believe the whole is in a muddle too horrible to think of."

The coal miners were at that time engaging in a terrible strike, and the Government, instead of arresting the leaders, were trying to come to terms of peace with them. I reminded the magistrate of this fact, and I told him that what the women had done was but a fleabite by comparison with the miners' violence. I said further: "I hope our demonstration will be enough to show the Government that the women's agitation is going on. If not, if you send me to prison, I will go further to show that women who have to help pay the salaries of Cabinet Ministers, and your salary too, sir, are going to have some voice in the making of the laws they have to obey."

I was sentenced to two months' imprisonment. Others received sentences ranging from one week to two months, while those who were accused of breaking glass above five pounds in value, were committed for trial in higher courts. They were sent to prison on remand, and when the last of us were behind the grim gates, not only Holloway but three other women's prisons were taxed to provide for so many extra inmates.

It was a stormy imprisonment for most of us. A great many of the women had received, in addition to their sentences, "hard labour," and this meant that the privileges at that time accorded to Suffragettes, as political offenders, were withheld. The women adopted the hunger strike as a protest, but as the hint was conveyed to me that the privileges would be restored, I advised a cessation of the strike. The remand prisoners demanded that I be allowed to exercise with them, and when this was not answered they broke the windows of their cells. The other suffrage prisoners, hearing the sound of shattered glass, and the singing of the Marseillaise, immediately broke their windows. The time had long gone by when the Suffragettes submitted meekly to prison discipline. And so passed the first days of my imprisonment.

CHAPTER II

The panic stricken Government did not rest content with the imprisonment of the window breakers. They sought, in a blind and blundering fashion, to perform the impossible feat of wrecking at a blow the entire militant movement. Governments have always tried to crush reform movements, to destroy ideas, to kill the thing that cannot die. Without regard to history, which shows that no Government have ever succeeded in doing this, they go on trying in the old, senseless way.

For days before the two demonstrations described in the last chapter our headquarters in Clement's Inn had been under constant observation by the police, and on the evening of March 5th an inspector of police and a large force of detectives suddenly descended on the place, with warrants for the arrest of Christabel Pankhurst and Mr. and Mrs. Pethick Lawrence, who with Mrs. Tuke and myself were charged with "conspiring to incite certain persons to commit malicious damage to property." When the officers entered they found Mr. Pethick Lawrence at work in his office, and Mrs. Pethick Lawrence in her flat upstairs. My daughter was not in the building. The Lawrences, after making brief preparations drove in a taxicab to Bow Street Station, where they spent the night. The police remained in possession of the offices, and detectives were despatched to find and arrest Christabel. But that arrest never took place. Christabel Pankhurst eluded the entire force of detectives and uniformed police, trained hunters of human prey.

Christabel had gone home, and at first, on hearing of the arrest of Mr. and Mrs. Pethick Lawrence, had taken her own arrest for granted. A little reflection however showed her the danger in which the Union would stand if completely deprived of its accustomed leadership, and seeing that it was her duty to avoid arrest, she quietly left the house. She spent that night with friends who, next morning, helped her to make the necessary arrangements and saw her safely away from London. The same night she reached Paris, where she has since remained. My relief, when I learned of her flight, was very great, because I knew that whatever happened to the Lawrences and myself, the movement would be wisely directed, this in spite of the fact that the police remained in full possession of headquarters.

The offices in Clement's Inn were thoroughly ransacked by the police, in a determined effort to secure evidence of conspiracy. They went through every desk, file and cabinet, taking away with them two cab loads of books and papers, including all my private papers, photographs of my children in infancy, and letters sent me by my husband long ago. Some of these I never saw again.

The police also terrorised the printer of our weekly newspaper, and although the paper came out as usual, about a third of its columns were left blank. The headlines, however, with the ensuing space mere white paper produced a most dramatic effect. "History Teaches" read one headline to a blank space, plainly indicating that the Government were not willing to let the public know some of the things that history teaches. "Women's Moderation" suggested that the destroyed paragraph called for comparison of the women's window breaking with men's greater violence in the past. Most eloquent of all was the editorial page, absolutely blank except for the headline, "A Challenge!" and the name at the foot of the last column, Christabel Pankhurst. What words could have breathed a prouder defiance, a more implacable resolve? Christabel was gone, out of the clutches of the Government, yet she remained in complete possession of the field. For weeks the search for her went relentlessly on. Police searched every railway station, every train, every sea port. The police of every city in the Kingdom were furnished with her portrait. Every amateur Sherlock Holmes in England joined with the police in finding her. She was reported in a dozen cities, including New York. But all the time she was living quietly in Paris, in daily communication with the workers in London, who within a few days were once more at their appointed tasks. My daughter has remained in France ever since.

Meanwhile, I found myself in the anomalous position of a convicted offender serving two months' prison sentence, and of a prisoner on remand waiting to be charged with a more serious offence. I was in very bad health, having been placed in a damp and unwarmed third division cell, the result being an acute attack of bronchitis. I addressed a letter to the Home Secretary, telling him of my condition, and urging the necessity of liberty to recover my health and to prepare my case for trial. I asked for release on bail, the plain right of a remand prisoner, and I offered if bail were granted now to serve the rest of my two months' sentence later on. The sole concessions granted me, however, were removal to a better cell and the right to see my secretary and my solicitor, but only in the presence of a wardress and a member of the prison clerical staff. On March 14th Mr. and Mrs. Pethick Lawrence, Mrs. Tuke and myself were brought up for preliminary hearing on the charge of having, on November 1, 1911, and on various other dates "conspired and combined together unlawfully and maliciously to commit damage, etc." The case opened on March 14th in a crowded courtroom in which I saw many friends. Mr. Bodkin, who appeared for the prosecution, made a very long address, in which he endeavoured to prove that the Women's Social and Political Union was a highly developed organisation of most sinister character. He produced much documentary evidence, some of it of such amusing character that the court rocked with stifled laughter, and the judge was obliged to conceal his smiles behind his hand. Mr. Bodkin cited our code book with the assistance of which we were able to communicate private messages. His voice sank to a scandalised half whisper as he stated the fact that we

had presumed to include the sacred persons of the Government in our private code. "We find," said Mr. Bodkin portentously, "that public men in the service of His Majesty as members of the Cabinet are tabulated here under code names. We find that the Cabinet collectively has its code word "Trees," and individual members of the Cabinet are designated by the name, sometimes of trees, but I am also bound to say the commonest weeds as well." Here a ripple of laughter interrupted. Mr. Bodkin frowned heavily, and continued: "There is one," he said solemnly, "called Pansy; another one--more complimentary--Roses, another, Violets, and so on." Each of the defendants was designated by a code letter. Thus Mrs. Pankhurst was identified by the letter F; Mrs. Pethick Lawrence, D; Miss Christabel Pankhurst, E. Every public building, including the House of Commons, had its code name. The deadly possibilities of the code were illustrated by a telegram found in one of the files. It read: "Silk, thistle, pansy, duck, wool, E. Q." Translated by the aid of the code book the telegram read: "Will you protest Asquith's public meeting to-morrow evening but don't get arrested unless success depends on it. Wire back to Christabel Pankhurst, Clements Inn."

More laughter followed these revelations, which after all proved no more than the business-like methods employed by the W. S. P. U. The laughter proved something a great deal more significant, for it was a plain indication that the old respect in which Cabinet Ministers had been held was no more. We had torn the veil from their sacro-sanct personalities and shown them for what they were, mean and scheming politicians. More serious from the point of view of prosecution was the evidence brought in by members of the police department in regard to the occurrences of March 1st and 4th. The policemen who arrested me and my two companions in Downing Street on March 1st, after we had broken the windows in the Premier's house, testified that following the arrest, we had handed him our reserve stock of stones, and that they were all alike, heavy flints. Other prisoners were found in possession of similar stones, tending to prove that the stones all came from one source. Other officers testified to the methodical manner in which the window breaking of March 1st and 4th was carried out, how systematically it had been planned and how soldierly had been the behaviour of the women. By twos and threes March 4th they had been seen to go to the headquarters at Clement's Inn, carrying handbags, which they deposited at headquarters, and had then gone on to a meeting at the Pavillion Music Hall. The police attended the meeting, which was the usual rally preceding a demonstration or a deputation. At five o'clock the meeting adjourned and the women went out, as if to go home. The police observed that many of them, still in groups of twos and threes, went to the Gardenia restaurant in Catherine Street, Strand, a place where many Suffragette breakfasts and teas had been held. The police thought that about one hundred and fifty women congregated there on March 4th. They remained until seven o'clock, and then, under the watching eyes of the police, they sauntered out and dispersed. A few minutes later, when there was no reason to expect such a thing, the noise was heard, in many streets, of wholesale window smashing. The police authorities made much of the fact that the women who had left their bags at headquarters and were afterwards arrested, were bailed out that night by Mr. Pethick Lawrence. The similarity of the stones used; the gathering of so many women in one building, prepared for arrest; the waiting at the Gardenia Restaurant; the apparent dispersal; the simultaneous destruction in many localities of plate glass, and the bailing of prisoners by a person connected with the headquarters mentioned, certainly showed a carefully worked out plan. Only a public trial of the defendants could establish whether or not the plan was a conspiracy.

On the second day of the Ministerial hearing, Mrs. Tuke, who had been in the prison infirmary for twenty days and had to be attended in court by a trained nurse, was admitted to bail. Mr. Pethick Lawrence made a strong plea for bail for himself and his wife, pointing out that they had been in prison on remand for two weeks and were entitled to bail. I also demanded the privileges of a prisoner on remand. Both of these pleas were denied by the court, but a few days later the Home Secretary wrote to my solicitor that the remainder of my sentence of two months would be remitted until after the conspiracy trail at Bow Street. Mr. and Mrs. Pethick Lawrence had already been admitted to bail. Public opinion forced the Home Secretary to make these concessions, as it is well known that it is next to impossible to prepare a defence while confined in prison. Aside from the terrible effect of prison on one's body and nerves, there is the difficulty of consulting documents and securing other necessary data to be considered.

On April 4th the Ministerial hearing ended in the acquittal of Mrs. Tuke, whose activities in the W. S. P. U. were shown to be purely secretarial. Mr. and Mrs. Pethick Lawrence and myself were committed for trial at the next session of the Central Criminal Court, beginning April 23rd. Because of the weak state of my health the judge was with great difficulty prevailed upon to postpone the trial two weeks and it was, therefore, not until May 15th that the case was opened.

The trial at Old Bailey is a thing that I shall never forget. The scene is clear before me as I write, the judge impressively bewigged and scarlet robed, dominating the crowded courtroom, the solicitors at their table, the jury, and looking very far away, the anxious pale faces of our friends who crowded the narrow galleries.

By the veriest irony of fate this judge, Lord Coleridge, was the son of Sir Charles Coleridge who, in the year 1867, appeared with my husband, Dr. Pankhurst, in the famous case of Chorlton v. Lings, and sought to establish that women were persons, and as

such were entitled to the Parliamentary vote. To make the irony still deeper the Attorney General, Sir Rufus Isaacs, who appeared as Counsel for the prosecution against women militants, himself had been guilty of remarkable speeches in corroboration of our point of view. In a speech made in 1910, in relation to the abolition of the Lords' veto, Sir Rufus made the statement that, although the agitation against privilege was being peacefully conducted, the indignation behind it was very intense. Said Sir Rufus: "Formerly when the great mass of the people were voteless they had to do something violent in order to show what they felt; to-day the elector's bullet is his ballot. Let no one be deceived, therefore, because in this present struggle everything is peaceful and orderly, in contrast to the disorderliness of other great struggles of the past." We wondered if the man who said these words could fail to realise that voteless women, deprived of every constitutional means of righting their grievances, were also obliged to do something violent in order to show how they felt. His opening address removed all doubt on that score.

Sir Rufus Isaacs has a clear-cut, hawk-like face, deep eyes, and a somewhat world worn air. The first words he spoke were so astoundingly unfair that I could hardly believe that I heard them aright. He began his address to the jury by telling them that they must not, on any account, connect the act of the defendants with any political agitation.

"I am very anxious to impress upon you," he said, "from the moment we begin to deal with the facts of this case, that all questions of whether a woman is entitled to the Parliamentary franchise, whether she should have the same right of franchise as a man, are questions which are in no sense involved in the trial of this issue.... Therefore, I ask you to discard altogether from the consideration of the matters which will be placed before you any viewpoint you may have on this no doubt very important political issue."

Nevertheless Sir Rufus added in the course of his remarks that he feared that it would not be possible to keep out of the conduct of the case various references to political events, and of course the entire trial, from beginning to end, showed clearly that the case was what Mr. Tim Healey, Mrs. Pethick Lawrence's counsel, called it, a great State Trial.

Proceeding, the Attorney General described the W. S. P. U., which he said he thought had been in existence since 1907, and had used what were known as militant methods. In 1911 the association had become annoyed by the Prime Minister because he would not make women's suffrage what was called a Government question. In November, 1911, the Prime Minister announced the introduction of a manhood suffrage bill. From that time on the defendants set to work to carry out a campaign which would have meant nothing less than anarchy. Women were to be induced to act together at a given time, in different given places, in such numbers that the police should be paralysed by the number of persons breaking the law, in order, to use the defendant's own words, "to bring the Government to its knees."

After designating the respective positions held by the four defendants in the W. S. P. U., Sir Rufus went on to relate the events which resulted in the smashing of plate glass windows valued at some two thousand pounds, and the imprisonment of over two hundred women who were incited to their deeds by the conspirators in the dock. He entirely ignored the motive of the acts in question, and he treated the whole affair as if the women had been burglars. This inverted statement of the matter, though accurate enough as to facts, was such as might have been given by King John of the signing of Magna Charta.

A very great number of witnesses were examined, a large number of them being policemen, and their testimony, and our cross examination disclosed the startling fact that there exists in England a special band of secret police entirely engaged in political work. These men, seventy-five in number, form what is known as the political branch of the Criminal Investigation Department of the Police. They go about in disguise, and their sole duty is to shadow Suffragettes and other political workers. They follow certain political workers from their homes to their places of business, to their social pleasures, into tea rooms and restaurants, even to the theatre. They pursue unsuspecting people in taxicabs, sit beside them in omnibuses. Above all they take down speeches. In fact the system is exactly like the secret police system of Russia.

Mr. Pethick Lawrence and I spoke in our own defence, and Mr. Healey M. P. defended Mrs. Pethick Lawrence. I cannot give our speeches in full, but I should like to include as much of them as will serve to make the entire situation clear to the reader.

Mr. Lawrence spoke first at the opening of the case. He began by giving an account of the suffrage movement and why he felt the enfranchisement of women appeared to him a question so grave that it warranted strong measures in its pursuit. He sketched briefly the history of the Women's Social and Political Union, from the time when Christabel Pankhurst and Annie Kenney were thrown out of Sir Edward Grey's meeting and imprisoned for asking a political question, to the torpedoing of the Conciliation Bill. "The case that I have to put before you," he said, "is that neither the conspiracy nor the incitement is ours; but that the conspiracy is a conspiracy of the Cabinet who are responsible for the Government of this country; and that the incitement is the incitement of the Ministers of the Crown." And he did this most effectually not only by telling of the disgraceful trickery and deceit with which the

Government had misled the suffragists in the matter of suffrage bills, but by giving the plain words in which members of the Cabinet had advised the women that they would never get the vote until they had learned to fight for it as men had fought in the past.

When it came my turn to speak, realising that the average man is profoundly ignorant of the history of the women's movement--because the press has never adequately or truthfully chronicled the movement--I told the jury, as briefly as I could, the story of the forty years' peaceful agitation before my daughters and I resolved that we would give our lives to the work of getting the vote for women, and that we should use whatever means of getting the vote that were necessary to success.

"We founded the Women's Social and Political Union," I said, "in 1903. Our first intention was to try and influence the particular political Party, which was then coming into power, to make this question of the enfranchisement of women their own question and to push it. It took some little time to convince us--and I need not weary you with the history of all that has happened--but it took some little time to convince us that that was no use; that we could not secure things in that way. Then in 1905 we faced the hard facts. We realised that there was a Press boycott against Women's Suffrage. Our speeches at public meetings were not reported, our letters to the editors, were not published, even if we implored the editors; even the things relating to Women's Suffrage in Parliament were not recorded. They said the subject was not of sufficient public interest to be reported in the Press, and they were not prepared to report it. Then with regard to the men politicians in 1905: we realised how shadowy were the fine phrases about democracy, about human equality, used by the gentlemen who were then coming into power. They meant to ignore the women--there was no doubt whatever about that. For in the official documents coming from the Liberal party on the eve of the 1905 election, there were sentences like this: 'What the country wants is a simple measure of Manhood Suffrage.' There was no room for the inclusion of women. We knew perfectly well that if there was to be franchise reform at all, the Liberal party which was then coming into power did not mean Votes for Women, in spite of all the pledges of members; in spite of the fact that a majority of the House of Commons, especially on the Liberal side, were pledged to it--it did not mean that they were going to put it into practice. And so we found some way of forcing their attention to this question.

"Now I come to the facts with regard to militancy. We realised that the plans we had in our minds would involve great sacrifice on our part, that it might cost us all we had. We were at that time a little organisation, composed in the main of working women, the wives and daughters of working men. And my daughters and I took a leading part, naturally, because we thought the thing out, and, to a certain extent, because we were of better social position than most of our members, and we felt a sense of responsibility."

I described the events that marked the first days of our work, the scene in Free Trade Hall, Manchester, when my daughter and her companion were arrested for the crime of asking a question of a politician, and I continued:

"What did they do next? (I want you to realise that no step we have taken forward has been taken until after some act of repression on the part of our enemy, the Government--because it is the Government that is our enemy; it is not the Members of Parliament, it is not the men in the country; it is the Government in power alone that can give us the vote. It is the Government alone that we regard as our enemy, and the whole of our agitation is directed to bringing just as much pressure as necessary upon those people who can deal with our grievance.) The next step the women took was to ask questions during the course of meetings, because, as I told you, these gentlemen gave them no opportunity of asking them afterwards. And then began the interjections of which we have heard, the interference with the right to hold public meetings, the interference with the right of free speech, of which we have heard, for which these women, these hooligan women, as they have been called--have been denounced. I ask you, gentlemen, to imagine the amount of courage which it needs for a woman to undertake that kind of work. When men come to interrupt women's meetings, they come in gangs, with noisy instruments, and sing and shout together, and stamp their feet. But when women have gone to Cabinet Ministers' meetings--only to interrupt Cabinet Ministers and nobody else--they have gone singly. And it has become increasingly difficult for them to get in, because as a result of the women's methods there has developed the system of admission by ticket and the exclusion of women--a thing which in my Liberal days would have been thought a very disgraceful thing at Liberal meetings. But this ticket system developed, and so the women could only get in with very great difficulty. Women have concealed themselves for thirty-six hours in dangerous positions, under the platforms, in the organs, wherever they could get a vantage point. They waited starving in the cold, sometimes on the roof exposed to a winter's night, just to get a chance of saying in the course of a Cabinet Minister's speech, 'When is the Liberal Government going to put its promises into practice?' That has been the form militancy took in its further development."

I went over the whole matter of our peaceful deputations, and of the violence with which they were invariably met; of our arrests and the farcical police court trials, where the mere evidence of policemen's unsupported statements sent us to prison for long terms; of the falsehoods told of us in the House of Commons by responsible members of the Government--tales of women scratching and

biting policemen and using hatpins--and I accused the Government of making these attacks against women who were powerless to defend themselves because they feared the women and desired to crush the agitation represented by our organisation.

"Now it has been stated in this Court," I said, "that it is not the Women's Social and Political Union that is in the Court, but that it is certain defendants. The action of the Government, gentlemen, is certainly against the defendants who are before you here to-day, but it is also against the Women's Social and Political Union. The intention is to crush that organisation. And this intention apparently was arrived at after I had been sent to prison for two months for breaking a pane of glass worth, I am told, 2s. 3d., the punishment which I accepted because I was a leader of this movement, though it was an extraordinary punishment to inflict for so small an act of damages as I had committed. I accepted it as the punishment for a leader of an agitation disagreeable to the Government; and while I was there this prosecution started. They thought they would make a clean sweep of the people who they considered were the political brains of the movement. We have got many false friends in the Cabinet--people who by their words appear to be well-meaning towards the cause of Women's Suffrage. And they thought that if they could get the leaders of the Union out of the way, it would result in the indefinite postponement and settlement of the question in this country. Well, they have not succeeded in their design, and even if they had got all the so-called leaders of this movement out of their way they would not have succeeded even then. Now why have they not put the Union in the dock? We have a democratic Government, so-called. This Women's Social and Political Union is not a collection of hysterical and unimportant wild women, as has been suggested to you, but it is an important organisation, which numbers amongst its membership very important people. It is composed of women of all classes of the community, women who have influence in their particular organisations as working women; women who have influence in professional organisations as professional women; women of social importance; women even of Royal rank are amongst the members of this organisation, and so it would not pay a democratic Government to deal with this organisation as a whole.

"They hoped that by taking away the people that they thought guided the political fortunes of the organisation they would break the organisation down. They thought that if they put out of the way the influential members of the organisation they, as one member of the Cabinet, I believe, said, would crush the movement and get it 'on the run.' Well, Governments have many times been mistaken, gentlemen, and I venture to suggest to you that Governments are mistaken again. I think the answer to the Government was given at the Albert Hall meeting held immediately after our arrest. Within a few minutes, without the eloquence of Mrs. Pethick Lawrence, without the appeals of the people who have been called the leaders of this movement, in a very few minutes L10,000 was subscribed for the carrying on of this movement.

"Now a movement like that, supported like that, is not a wild, hysterical movement. It is not a movement of misguided people. It is a very serious movement. Women, I submit, like our members, and women, I venture to say, like the two women, and like the man who are in the dock to-day, are not people to undertake a thing like this lightly. May I just try to make you feel what it is that has made this movement the gigantic size it is from the very small beginnings it had? It is one of the biggest movements of modern times. A movement which is not only an influence, perhaps not yet recognised, in this country, but is influencing the women's movement all over the world. Is there anything more marvellous in modern times than the kind of spontaneous outburst in every country of this woman's movement? Even in China--and I think it somewhat of a disgrace to Englishmen--even in China women have won the vote, as an outcome of a successful revolution, with which, I dare say, members of his Majesty's Government sympathise--a bloody revolution.

"One more word on that point. When I was in prison the second time, for three months as a common criminal for no greater offence than the issue of a handbill--less inflammatory in its terms than some of the speeches of members of the Government who prosecute us here--during that time, through the efforts of a member of Parliament, there was secured for me permission to have the daily paper in prison, and the first thing I read in the daily Press was this: that the Government was at that moment feting the members of the Young Turkish Revolutionary Party, gentlemen who had invaded the privacy of the Sultan's home--we used to hear a great deal about invading the privacy of Mr. Asquith's residence when we ventured to ring his door bell--gentlemen who had killed and slain, and had been successful in their revolution, while we women had never thrown a stone--for none of us was imprisoned for stone throwing, but merely for taking the part we had then taken in this organisation. There we were imprisoned while these political murderers were being feted by the very Government who imprisoned us, and were being congratulated on the success of their revolution. Now I ask you, was it to be wondered at that women said to themselves: 'Perhaps it is that we have not done enough. Perhaps it is that these gentlemen do not understand womenfolk. Perhaps they do not realise women's ways, and because we have not done the things that men have done, they may think we are not in earnest.'

"And then we come down to this last business of all, when we have responsible statesmen like Mr. Hobhouse saying that there had never been any sentimental uprising, no expression of feeling like that which led to the burning down of Nottingham Castle. Can you wonder, then, that we decided we should have to nerve ourselves to do more, and can you understand why we cast about to find a way, as women will, that would not involve loss of human life and the maiming of human beings, because women care more about human life than men, and I think it is quite natural that we should, for we know what life costs. We risk our lives when men are born. Now, I want to say this deliberately as a leader of this movement. We have tried to hold it back, we have tried to keep it from going beyond bounds, and I have never felt a prouder woman than I did one night when a police constable said to me, after one of these demonstrations, 'Had this been a man's demonstration, there would have been bloodshed long ago.' Well, my lord, there has not been any bloodshed except on the part of the women themselves--these so-called militant women. Violence has been done to us, and I who stand before you in this dock have lost a dear sister in the course of this agitation. She died within three days of coming out of prison, a little more than a year ago. These are things which, wherever we are, we do not say very much about. We cannot keep cheery, we cannot keep cheerful, we cannot keep the right kind of spirit, which means success, if we dwell too much upon the hard part of our agitation. But I do say this, gentlemen, that whatever in future you may think of us, you will say this about us, that whatever our enemies may say, we have always put up an honourable fight, and taken no unfair means of defeating our opponents, although they have not always been people who have acted so honourably towards us.

"We have assaulted no one; we have done no hurt to any one; and it was not until 'Black Friday'--and what happened on 'Black Friday' is that we had a new Home Secretary, and there appeared to be new orders given to the police, because the police on that occasion showed a kind of ferocity in dealing with the women that they had never done before, and the women came to us and said: 'We cannot bear this'--it was not until then we felt this new form of repression should compel us to take another step. That is the question of 'Black Friday,' and I want to say here and now that every effort was made after 'Black Friday' to get an open public judicial inquiry into the doings of 'Black Friday,' as to the instructions given to the police. That inquiry was refused; but an informal inquiry was held by a man, whose name will carry conviction as to his status and moral integrity on the one side of the great political parties, and a man of equal standing on the Liberal side. These two men were Lord Robert Cecil and Mr. Ellis Griffith. They held a private inquiry, had women before them, took their evidence, examined that evidence, and after hearing it said that they believed what the women had told them was substantially true, and that they thought there was good cause for that inquiry to be held. That was embodied in a report. To show you our difficulties, Lord Robert Cecil, in a speech at the Criterion Restaurant, spoke on this question. He called upon the Government to hold this inquiry, and not one word of that speech was reported in any morning paper. That is the sort of thing we have had to face, and I welcome standing here, if only for the purpose of getting these facts out, and I challenge the Attorney General to institute an inquiry into these proceedings--not that kind of inquiry of sending their inspectors to Holloway and accepting what they are told by the officials--but to open a public inquiry, with a jury, if he likes, to deal with our grievances against the Government and the methods of this agitation.

"I say it is not the defendants who have conspired, but the Government who have conspired against us to crush this agitation; but however the matter may be decided, we are content to abide by the verdict of posterity. We are not the kind of people who like to brag a lot; we are not the kind of people who would bring ourselves into this position unless we were convinced that it was the only way. I have tried--all my life I have worked for this question--I have tried arguments, I have tried persuasion. I have addressed a greater number of public meetings, perhaps, than any person in this court, and I have never addressed one meeting where substantially the opinion of the meeting--not a ticket meeting, but an open meeting, for I have never addressed any other kind of a meeting--has not been that where women bear burdens and share responsibilities like men they should be given the privileges that men enjoy. I am convinced that public opinion is with us--that it has been stifled--wilfully stifled--so that in a public Court of Justice one is glad of being allowed to speak on this question."

The Attorney General's summing up for the prosecution was very largely a defence of the Liberal Party and its course in regard to woman suffrage legislation. Therefore, Mr. Tim Healey, in his defence of Mrs. Pethick Lawrence, did well to lay stress on the political character of the conspiracy charge and trial. He said:

"It is no doubt a very useful thing when you have political opponents to be able to set the law in motion against them. I have not the smallest doubt it would be a very convenient thing, if they had the courage to do it, to shut up the whole of His Majesty's Opposition while the present Government is in office--to lock up all the men of lustre and distinction in our public forum and on our public platforms--all the Carsons, F. E. Smiths, Bonar Laws, and so on. It would be a most convenient thing to end the whole thing, as it would be to end women's agitation in the form of the indictment. Gentlemen of the jury, whatever words have been spoken by mutual opponents, whatever instructions have been addressed, not to feeble females, but to men who boast of drilling and of arms,

they have not had the courage to prosecute anybody, except women, by means of an indictment. Yet the Government of my learned friend have selected two dates as cardinal dates, and they ask you to pass judgment upon the prisoners at the bar, and to say that, without rhyme or reason, taking the course suggested without provocation, these responsible, well-bred, educated, University people, have suddenly, in the words of the indictment, wickedly and with malice aforethought engaged in these criminal designs.

"Gentlemen of the jury, the first thing I would ask in that connection is this: What is there in the course of this demand put forward by women which should have excited the treatment at the hands of His Majesty's Ministers which this movement, according to the documents which are in evidence before me, has received? I should suppose that the essence of all government is the smooth conduct of affairs, so that those who enjoy high station, great emoluments, should not be parties against whom the accusation of provoking civic strife and breeding public turmoil should be brought. What do we find? We find that, in regard to the treatment of the demand which had always been put forward humbly, respectably, respectfully, in its origin, by those who have received trade unionists, anti-vaccinators, deceased wife's sisters, and all other forms of political demand, and who have received them humbly and yielded to them, we find that when these people advocating this particular form of civic reform request an audience, request admission, request even to have their petitions respectfully received, they have met, judicially, at all events, with a flat and solemn negative. That is the beginning of this unhappy spirit bred in the minds of persons like the defendants, persons like those against whom evidence has been tendered--which has led to your being empanelled in that box to-day. And I put it to you when you are considering whether it is the incitement of my clients or the conduct of Ministers that have led to these events--whether I cannot ask you to say that even a fair apportionment of blame should not rest upon more responsible shoulders, and whether you should go out of your way to say that these persons in the dock alone are guilty."

In closing Mr. Healey reverted to the political character of the trial. "The Government have undertaken this prosecution," he declared, "to seclude for a considerable period their chief opponents. They hope there will be at public meetings which they attend no more inconvenient cries of 'Votes for Women.' I cannot conceive any other object which they could have in bringing the prosecution. I have expressed my regret at the loss which the shopkeepers, tradesmen and others have suffered. I regret it deeply. I regret that any person should bring loss or suffering upon innocent people. But I ask you to say that the law has already been sufficiently vindicated by the punishment of the immediate authors of the deed. What can be gained? Does justice gain?

"I almost hesitate to treat this as a legal inquiry. I regard it as a vindictive political act. Of all the astonishing acts that have ever been brought into a public court against a prisoner I cannot help feeling the charge against Mr. Pethick Lawrence is the most astonishing. He ventured to attend at some police courts and gave bail for women who had been arrested in endeavouring, as I understand, to present petitions to Parliament or to have resort to violence. I do not complain of the way in which my learned friend has conducted the prosecution, but I do complain of the police methods--inquiring into the homes and the domestic circumstances of the prisoners, obtaining their papers, taking their newspaper, going into their banking account, bringing up their bankers here to say what is their balance; and I do say that in none of the prosecutions of the past have smaller methods belittled a great State trial, because, look at it as you will, you cannot get away from it that this is a great State trial. It is not the women who are on trial. It is the men. It is the system of Government which is upon its trial. It is this method of rolling the dice by fifty-four counts in an indictment without showing to what any bit of evidence is fairly attributable; the system is on its trial--a system whereby every innocent act in public life is sought to be enmeshed in a conspiracy."

The jury was absent for more than an hour, showing that they had some difficulty in agreeing upon a verdict. When they returned it was plain from their strained countenances that they were labouring under deep feeling. The foreman's voice shook as he pronounced the verdict, guilty as charged, and he had hard work to control his emotion as he added: "Your Lordship, we unanimously desire to express the hope that, taking into consideration the undoubtedly pure motives that underlie the agitation that has led to this trouble, you will be pleased to exercise the utmost clemency and leniency in dealing with the case."

A burst of applause followed this plea. Then Mr. Pethick Lawrence arose and asked to say a few words before sentence was pronounced. He said that it must be evident, aside from the jury's recommendation, that we had been actuated by political motives, and that we were in fact political offenders. It had been decided in English Courts that political offenders were different from ordinary offenders, and Mr. Lawrence cited the case of a Swiss subject whose extradition was refused because of the political character of his offence. The Court on that occasion had declared that even if the crime were murder committed with a political motive it was a political crime. Mr. Lawrence also reminded the judge of the case of the late Mr. W. T. Stead, convicted of a crime, yet because of the unusual motive behind the crime, was allowed first division treatment and full freedom to receive his family and friends. Last of all the case of Dr. Jameson was cited. Although his raid resulted in the death of twenty-one persons and the

wounding of forty-six more, the political character of his offence was taken into account and he was made a first division prisoner.

They were men, fighting in a man's war. We of the W. S. P. U. were women, fighting in a woman's war. Lord Coleridge, therefore, saw in us only reckless and criminal defiers of law. Lord Coleridge said: "You have been convicted of a crime for which the law would sanction, if I chose to impose it, a sentence of two years' imprisonment with hard labour. There are circumstances connected with your case which the jury have very properly brought to my attention, and I have been asked by you all three to treat you as first class misdemeanants. If, in the course of this case, I had observed any contrition or disavowal of the acts you have committed, or any hope that you would avoid repetition of them in future, I should have been very much prevailed upon by the arguments that have been advanced to me."

No contrition having been expressed by us, the sentence of the Court was that we were to suffer imprisonment, in the second division, for the term of nine months, and that we were to pay the costs of the prosecution.

CHAPTER III

The sentence of nine months astonished us beyond measure, especially in view of certain very recent events, one of these being the case of some sailors who had mutinied in order to call attention to something which they considered a peril to themselves and to all seafarers. They were tried and found technically guilty, but because of the motive behind their mutiny, were discharged without punishment. Perhaps more nearly like our case than this was the case of the labour leader, Tom Mann, who, shortly before, had written a pamphlet calling upon His Majesty's soldiers not to fire upon strikers when commanded to do so by their superior officers. From the Government's point of view this was a much more serious kind of inciting than ours, because if it had been responded to the authorities would have been absolutely crippled in maintaining order. Besides, soldiers who refuse to obey orders are liable to the death penalty. Tom Mann was given a sentence of six months, but this was received, on the part of the Liberal Press and Liberal politicians, with so much clamour and protest that the prisoner was released at the end of two months. So, even on our way to prison, we told one another that our sentences could not stand. Public opinion would never permit the Government to keep us in prison for nine months, or in the second division for any part of our term. We agreed to wait seven Parliamentary days before we began a hunger strike protest.

It was very dreary waiting, those seven Parliamentary days, because we could not know what was happening outside, or what was being talked of in the House. We could know nothing of the protests and memorials that were pouring in, on our behalf, from Oxford and Cambridge Universities, from members of learned societies, and from distinguished men and women of all professions, not only in England but in every country of Europe, from the United States and Canada, and even from India. An international memorial asking that we be treated as political prisoners was signed by such great men and women as Prof. Paul Milyoukoff, leader of the Constitutional Democrats in the Duma; Signor Enrico Ferri, of the Italian Chamber of Deputies; Edward Bernstein, of the German Reichstag; George Brandes, Edward Westermarck, Madame Curie, Ellen Key, Maurice Maeterlinck, and many others. The greatest indignation was expressed in the House, Keir Hardie and Mr. George Lansbury leading in the demand for a drastic revision of our sentences and our immediate transference to the first division. So much pressure was brought to bear that within a few days the Home Secretary announced that he felt it his duty to examine into the circumstances of the case without delay. He explained that the prisoners had not at any time been forced to wear prison clothes. Ultimately, which in this case means shortly before the expiration of the seven Parliamentary days, we were all three placed in the first division. Mrs. Pethick Lawrence was given the cell formerly occupied by Dr. Jameson and I had the cell adjoining. Mr. Pethick Lawrence, in Brixton Gaol, was similarly accommodated. We all had the privilege of furnishing our cells with comfortable chairs, tables, our own bedding, towels, and so on. We had meals sent in from the outside; we wore our own clothing and had what books, newspapers and writing materials we required. We were not permitted to write or receive letters or to see our friends except in the ordinary two weeks' routine. Still we had gained our point that suffrage prisoners were politicals.

We had gained it, but, as it turned out, only for ourselves. When we made the inquiry, "Are all our women now transferred to the first division?" the answer was that the order for transference referred only to Mr. and Mrs. Pethick Lawrence and myself. Needless to say, we immediately refused to accept this unfair advantage, and after we had exhausted every means in our power to induce the Home Secretary to give the other suffrage prisoners the same justice that we had received, we adopted the protest of the hunger strike. The word flew swiftly through Holloway, and in some mysterious way travelled to Brixton, to Aylesbury, and Winson Green, and at once all the other suffrage prisoners followed our lead. The Government then had over eighty hunger strikers on their hands, and, as before, had ready only the argument of force, which means that disgusting and cruel process of forcible feeding.

Holloway became a place of horror and torment. Sickening scenes of violence took place almost every hour of the day, as the doctors went from cell to cell performing their hideous office. One of the men did his work in such brutal fashion that the very sight of him provoked cries of horror and anguish. I shall never while I live forget the suffering I experienced during the days when those cries were ringing in my ears. In her frenzy of pain one woman threw herself from the gallery on which her cell opened. A wire netting eight feet below broke her fall to the iron staircase beneath, else she must inevitably have been killed. As it was she was frightfully hurt.

The wholesale hunger strike created a tremendous stir throughout England, and every day in the House the Ministers were harassed with questions. The climax was reached on the third or fourth day of the strike, when a stormy scene took place in the House of Commons. The Under Home Secretary, Mr. Ellis Griffith, had been mercilessly questioned as to conditions under which the forcible feeding was being done, and as soon as this was over one of the suffragist members made a moving appeal to the Prime Minister himself to order the release of all the prisoners. Mr. Asquith, forced against his will to take part in the controversy, rose and said that it was not for him to interfere with the actions of his colleague, Mr. McKenna, and he added, in his own suave, mendacious manner: "I must point out this, that there is not one single prisoner who cannot go out of prison this afternoon on giving the undertaking asked for by the Home Secretary." Meaning an undertaking to refrain henceforth from militancy.

Instantly Mr. George Lansbury sprang to his feet and exclaimed: "You know they cannot! It is perfectly disgraceful that the Prime Minister of England should make such a statement."

Mr. Asquith glanced carelessly at the indignant Lansbury, but sank into his seat without deigning to reply. Shocked to the depths of his soul by the insult thrown at our women, Mr. Lansbury strode up to the Ministerial bench and confronted the Prime Minister, saying again: "That was a disgraceful thing for you to say, Sir. You are beneath contempt, you and your colleagues. You call yourselves gentlemen, and you forcibly feed and murder women in this fashion. You ought to be driven out of office. Talk about protesting. It is the most disgraceful thing that ever happened in the history of England. You will go down to history as the men who tortured innocent women."

By this time the House was seething, and the indignant Labour member had to shout at the top of his big voice in order to be heard over the din. Mr. Asquith's pompous order that Mr. Lansbury leave the House for the day was probably known to very few until it appeared in print next day. At all events Mr. Lansbury continued his protest for five minutes longer. "You murder, torture and drive women mad," he cried, "and then you tell them they can walk out. You ought to be ashamed of yourself. You talk about principle--you talk about fighting in Ulster--you, too--" turning to the Unionist benches--"You ought to be driven out of public life. These women are showing you what principle is. You ought to honour them for standing up for their womanhood. I tell you, Commons of England, you ought to be ashamed of yourselves."

The Speaker came to Mr. Asquith's rescue at last and adjured Mr. Lansbury that he must obey the Prime Minister's order to leave the House, saying that such disorderly conduct would cause the House to lose respect. "Sir," exclaimed Mr. Lansbury, in a final burst of righteous rage, "it has lost it already."

This unprecedented explosion of wrath and scorn against the Government was the sensation of the hour, and it was felt on all sides that the release of the prisoners, or at least cessation of forcible feeding, which amounted to the same thing, would be ordered. Every day the Suffragettes marched in great crowds to Holloway, serenading the prisoners and holding protest meetings to immense crowds. The music and the cheering, faintly wafted to our straining ears, was inexpressibly sweet. Yet it was while listening to one of these serenades that the most dreadful moment of my imprisonment occurred. I was lying in bed, very weak from starvation, when I heard a sudden scream from Mrs. Lawrence's cell, then the sound of a prolonged and very violent struggle, and I knew that they had dared to carry their brutal business to our doors. I sprang out of bed and, shaking with weakness and with anger, I set my back against the wall and waited for what might come. In a few moments they had finished with Mrs. Lawrence and had flung open the door of my cell. On the threshold I saw the doctors, and back of them a large group of wardresses. "Mrs. Pankhurst," began the doctor. Instantly I caught up a heavy earthenware water jug from a table hard by, and with hands that now felt no weakness I swung the jug head high.

"If any of you dares so much as to take one step inside this cell I shall defend myself," I cried. Nobody moved or spoke for a few seconds, and then the doctor confusedly muttered something about to-morrow morning doing as well, and they all retreated.

I demanded to be admitted to Mrs. Lawrence's cell, where I found my companion in a desperate state. She is a strong woman, and a very determined one, and it had required the united strength of nine wardresses to overcome her. They had rushed into the cell

without any warning, and had seized her unawares, else they might not have succeeded at all. As it was she resisted so violently that the doctors could not apply the stethoscope, and they had very great difficulty in getting the tube down. After the wretched affair was over Mrs. Lawrence fainted, and for hours afterwards was very ill.

This was the last attempt made to forcibly feed either Mrs. Lawrence or myself, and two days later we were ordered released on medical grounds. The other hunger strikers were released in batches, as every day a few more triumphant rebels approached the point where the Government stood in danger of committing actual murder. Mr. Lawrence, who was forcibly fed twice a day for more than ten days, was released in a state of complete collapse on July 1st. Within a few days after that the last of the prisoners were at liberty.

As soon as I was sufficiently recovered I went to Paris and had the joy of seeing again my daughter Christabel, who, during all the days of strife and misery, had kept her personal anxiety in the background and had kept staunchly at her work of leadership. The absence of Mr. and Mrs. Pethick Lawrence had thrown the entire responsibility of the editorship of our paper, _Votes for Women_, on her shoulders, but as she has invariably risen to meet new responsibility, she conducted the paper with skill and discretion.

We had much to talk about and to consider, because it was evident that militancy, instead of being dropped, as the other suffrage societies were constantly suggesting, must go on very much more vigorously than before. The struggle had been too long drawn out. We had to seek ways to shorten it, to bring it to such a climax that the Government would acknowledge that something had to be done. We had already demonstrated that our forces were impregnable. We could not be conquered, we could not be terrified, we could not even be kept in prison. Therefore, since the Government had their war lost in advance, our task was merely to hasten the surrender.

The situation in Parliament, as far as the suffrage question was concerned, was clean swept and barren. The third Conciliation Bill had failed to pass its second reading, the majority against it being fourteen.

Many Liberal members were afraid to vote for the bill because Mr. Lloyd-George and Mr. Lewis Harcourt had persistently spread the rumour that its passage, at that time, would result in splitting the Cabinet. The Irish Nationalist members had become hostile to the bill because their leader, Mr. Redmond, was an anti-suffragist, and had refused to include a woman suffrage clause in the Home Rule Bill. Our erstwhile friends, the Labour members, were so apathetic, or so fearful for certain of their own measures, that most of them stayed away from the House on the day the bill reached its second reading. So it was lost, and the Militants were blamed for its loss! In June the Government announced that Mr. Asquith's manhood suffrage bill would soon be introduced, and very soon after this the bill did appear. It simplified the registration machinery, reduced the qualifying period of residence to six months, and abolished property qualifications, plural voting and University representation. In a word, it gave the Parliamentary franchise to every man above the age of twenty-one and it denied it to all women. Never in the history of the suffrage movement had such an affront been offered to women, and never in the history of England had such a blow been aimed at women's liberties. It is true that the Prime Minister had pledged himself to introduce a bill capable of being amended to include women's suffrage, and to permit any amendment that passed its second reading to become a part of the bill. But we had no faith in an amendment, nor in any bill that was not from its inception an official Government measure. Mr. Asquith had broken every pledge he had ever made the women, and this new pledge impressed us not at all. Well we knew that he had given it only to cover his treachery in torpedoing the Conciliation Bill, and in the hope of placating the suffragists, perhaps securing another truce to militancy.

If this last was his hope he was most grievously disappointed. Signs were constantly appearing to indicate that women would no longer be contented with the symbolic militancy involved in window breaking. For example, traces were found in the Home Secretary's office at Whitehall of an attempt at arson. On the doorstep of another Cabinet Minister similar traces were found. Had the Government acted upon these warnings, by giving women the vote, all the serious acts of militancy that have occurred since would have been averted. But like the heart of Pharaoh, the heart of the Government hardened, and militant acts followed one another in rapid succession. In July the W. S. P. U. issued a manifesto which set forth our intentions in that regard. The manifesto read in part as follows:

"The leaders of the Women's Social and Political Union have so often warned the Government that unless the vote were granted to women in response to the mild militancy of the past, a fiercer spirit of revolt would be awakened which it would be impossible to control. The Government have blindly disregarded the warning, and now they are reaping the harvest of their unstatesmanlike folly."

This was issued immediately after a visit paid by Mr. Asquith to Dublin. The occasion had been intended to be one of great pomp and circumstance, a huge popular demonstration in honour of the sponsor of Home Rule, but the Suffragettes turned it into the most lamentable fiasco imaginable. From the hour of Mr. Asquith's attempted secret departure from London until his return he lived and moved in momentary dread of Suffragettes. Every time he entered or left a railway carriage or a steamer he was confronted by women. Every time he rose to speak he was interrupted by women. Every public appearance he made was turned into a riot by women. As he left Dublin a woman threw a hatchet into his motor car, without, however, doing him any injury. As a final protest against his reception by Irishmen, the Theatre Royal was set on fire by two women. The theatre was practically empty at the time, the performance having been completed, and the damage done was comparatively small, yet the two women chiefly concerned, Mrs. Leigh and Miss Evans, were given the barbarous sentences of five years each in prison. These were the first women sentenced to penal servitude in the history of our movement. Of course they did not serve their sentences. On entering Mountjoy Prison they put in the usual claim for first division treatment, and this being refused, they immediately adopted the hunger strike. A number of Irish Suffragettes were in Mountjoy at this time for a protest made against the exclusion of women from the Home Rule Bill. They were in the first division, and they were almost on the eve of their release, but such is the indomitable spirit of militancy that these women entered upon a sympathetic hunger strike. They were released, but the Government forbade the release of Mrs. Leigh and Miss Evans, that is, they ordered the authorities to retain the women as long as they could, by forcible feeding, be kept alive. After a struggle which, for fierceness and cruelty, is almost unparalleled in our annals, the two women fought their way out.

All during that summer militancy surged up and down throughout the Kingdom. A series of attacks on golf links was instituted, not at all in a spirit of wanton mischief, but with the direct and very practical object of reminding the dull and self-satisfied English public that when the liberties of English women were being stolen from them was no time to think of sports. The women selected country clubs where prominent Liberal politicians were wont to take their week-end pleasures, and with acids they burned great patches of turf, rendering the golf greens useless for the time being. They burned the words, Votes for Women, in some cases, and always they left behind them reminders that women were warring for their freedom. On one occasion when the Court was at Balmoral Castle in Scotland, the Suffragettes invaded the Royal golf links, and when Sunday morning dawned all the marking flags were found to have been replaced by W. S. P. U. flags hearing inscriptions such as "Votes for Women means peace for Ministers," "Forcible feeding must be stopped," and the like. The golf links were frequently visited by Suffragettes in order to question recreant ministers. Two women followed the Prime Minister to Inverness, where he was playing golf with Mr. McKenna. Approaching the men one Suffragette exclaimed: "Mr. Asquith, you must stop forcible feeding--" She got no farther, for Mr. Asquith, turning pale with rage--perhaps--retreated behind the Home Secretary, who, quite forgetting his manners, seized the Suffragette, crying out that he was going to throw her into the pond. "Then we will take you with us," the two retorted, after which a very lively scuffle ensued, and the women were not thrown into the pond.

[Illustration: A SUFFRAGETTE THROWING A BAG OF FLOUR AT MR. ASQUITH IN CHESTER]

This golf green activity really aroused more hostility against us than all the window-breaking. The papers published appeals to us not to interfere with a game that helped weary politicians to think clearly, but our reply to this was that it had not had any such effect on the Prime Minister or Mr. Lloyd-George. We had undertaken to spoil their sport and that of a large class of comfortable men in order that they should be obliged to think clearly about women, and women's firm determination to get justice.

I made my return to active work in the autumn by speaking at a great meeting of the W. S. P. U., held in the Albert Hall. At that meeting I had the announcement to make that the six years' association of Mr. and Mrs. Pethick Lawrence with the W. S. P. U. had ended.

Since personal dissensions have never been dwelt upon in the W. S. P. U., have never been allowed to halt the movement or to interfere for an hour with its progress, I shall not here say any more about this important dissension than I said at our first large meeting in Albert Hall after the holiday, on October 17th. That day a new paper was sold on the streets. It was called _The Suffragette_, it was edited by Christabel Pankhurst, and was henceforth to be the official organ of the Union. Both in this new paper and in _Votes for Women_, the following announcement appeared:

GRAVE STATEMENT BY THE LEADERS

At the first reunion of the leaders after the enforced holiday, Mrs. Pankhurst and Miss Christabel Pankhurst outlined a new militant policy which Mr. and Mrs. Pethick Lawrence found themselves altogether unable to approve.

Mrs. Pankhurst and Miss Christabel Pankhurst indicated that they were not prepared to modify their intentions, and recommended that Mr. and Mrs. Pethick Lawrence should resume control of the Paper, _Votes for Women_, and should leave the Women's Social and Political Union.

Rather than make schism in the ranks of the Union Mr. and Mrs. Pethick Lawrence consented to take this course.

This was signed by all four. That night at the meeting I further explained to the members that, hard as partings from old friends and comrades unquestionably were, we must remember that we were fighting in an army, and that unity of purpose and unity of policy are absolutely necessary, because without them the army is hopelessly weakened. "It is better," I said, "that those who cannot agree, cannot see eye to eye as to policy, should set themselves free, should part, and should be free to continue their policy as they see it in their own way, unfettered by those with whom they can no longer agree."

Continuing I said: "I give place to none in appreciation and gratitude to Mr. and Mrs. Pethick Lawrence for the incalculable services that they have rendered the militant movement for Woman Suffrage, and I firmly believe that the women's movement will be strengthened by their being free to work for woman suffrage in the future as they think best, while we of the Women's Social and Political Union shall continue the militant agitation for Woman Suffrage initiated by my daughter and myself and a handful of women more than six years ago."

I then went on to survey the situation in which the W. S. P. U. now stood and to outline the new militant policy which he had decided upon. This policy, to begin with, was relentless opposition, not only to the party in power, the Liberal Party, but to all parties in the coalition. I reminded the women that the Government that had tricked and betrayed us and was now plotting to make our progress towards citizenship doubly difficult, was kept in office through the coalition of three parties. There was the Liberal Party, nominally the governing party, but they could not live another day without the coalition of the Nationalist and the Labour parties. So we should say, not only to the Liberal Party but to the Nationalist Party and the Labour Party, "So long as you keep in office an anti-suffrage Government, you are parties to their guilt, and from henceforth we offer you the same opposition which we give to the people whom you are keeping in power with your support." I said further: "We have summoned the Labour Party to do their duty by their own programme, and to go into opposition to the Government on every question until the Government do justice to women. They apparently are not willing to do that. Some of them tell us that other things are more important than the liberty of women--than the liberty of working women. We say, 'Then, gentlemen, we must teach you the value of your own principles, and until you are prepared to stand for the right of women to decide their lives and the laws under which they shall live, you, with Mr. Asquith and company, are equally responsible for all that has happened and is happening to women in this struggle for emancipation.'"

Outlining further our new and stronger policy of aggression, I said: "There is a great deal of criticism, ladies and gentlemen, of this movement. It always seems to me when the anti-suffrage members of the Government criticise militancy in women that it is very like beasts of prey reproaching the gentler animals who turn in desperate resistance when at the point of death. Criticism from gentlemen who do not hesitate to order out armies to kill and slay their opponents, who do not hesitate to encourage party mobs to attack defenceless women in public meetings--criticism from them hardly rings true. Then I get letters from people who tell me that they are ardent suffragists but who say that they do not like the recent developments in the militant movement, and implore me to urge the members not to be reckless with human life. Ladies and gentlemen, the only recklessness the militant suffragists have shown about human life has been about their own lives and not about the lives of others, and I say here and now that it has never been and never will be the policy of the Women's Social and Political Union recklessly to endanger human life. We leave that to the enemy. We leave that to the men in their warfare. It is not the method of women. No, even from the point of view of public policy, militancy affecting the security of human life would be out of place. _There is something that governments care far more for than human life, and that is the security of property, and so it is through property that we shall strike the enemy._ From henceforward the women who agree with me will say, 'We disregard your laws, gentlemen, we set the liberty and the dignity and the welfare of women above all such considerations, and we shall continue this war, as we have done in the past; and what sacrifice of property, or what injury to property accrues will not be our fault. It will be the fault of that Government who admit the justice of our demands, but refuses to concede them without the evidence, so they have told us, afforded to governments of the past, that those who asked for liberty were in earnest in their demands!"

I called upon the women of the meeting to join me in this new militancy, and I reminded them anew that the women who were fighting in the Suffragette army had a great mission, the greatest mission the world has ever known--the freeing of one-half the human race, and through that freedom the saving of the other half. I said to them: "Be militant each in your own way. Those of you who can express your militancy by going to the House of Commons and refusing to leave without satisfaction, as we did in the early

days--do so. Those of you who can express militancy by facing party mobs at Cabinet Ministers' meetings, when you remind them of their falseness to principle--do so. Those of you who can express your militancy by joining us in our anti-Government by-election policy--do so. Those of you who can break windows--break them. Those of you who can still further attack the secret idol of property, so as to make the Government realise that property is as greatly endangered by women's suffrage as it was by the Chartists of old--do so. And my last word is to the Government: I incite this meeting to rebellion. I say to the Government: You have not dared to take the leaders of Ulster for their incitement to rebellion. Take me if you dare, but if you dare I tell you this, that so long as those who incited to armed rebellion and the destruction of human life in Ulster are at liberty, you will not keep me in prison. So long as men rebels--and voters--are at liberty, we will not remain in prison, first division or no first division."

I ask my readers, some of whom no doubt will be shocked and displeased at these words of mine that I have so frankly set down, to put themselves in the place of those women who for years had given their lives entirely and unstintingly to the work of securing political freedom for women; who had converted so great a proportion of the electorate that, had the House of Commons been a free body, we should have won that freedom years before; who had seen their freedom withheld from them through treachery and misuse of power. I ask you to consider that we had used, in our agitation, only peaceful means until we saw clearly that peaceful means were absolutely of no avail, and then for years we had used only the mildest militancy, until we were taunted by Cabinet Ministers, and told that we should never get the vote until we employed the same violence that men had used in their agitation for suffrage. After that we had used stronger militancy, but even that, by comparison with the militancy of men in labour disputes, could not possibly be counted as violent. Through all these stages of our agitation we had been punished with the greatest severity, sent to prison like common criminals, and of late years tortured as no criminals have been tortured for a century in civilised countries of the world. And during all these years we had seen disastrous strikes that had caused suffering and death, to say nothing at all of the enormous economic waste, and we had never seen a single strike leader punished as we had been. We, who had suffered sentences of nine months' imprisonment for inciting women to mild rebellion, had seen a labour leader who had done his best to incite an army to mutiny released from prison in two months by the Government. And now we had come to a point where we saw civil war threatened, where we read in the papers every day reports of speeches a thousand times more incendiary than anything we had ever said. We heard prominent members of Parliament openly declaring that if the Home Rule Bill was passed Ulster would fight, and Ulster would be right. None of these men were arrested. Instead they were applauded. Lord Selborne, one of our sternest critics, referring to the fact that Ulstermen were drilling under arms, said publicly: "The method which the people of Ulster are adopting to show the depths of their convictions and the intensity of their feelings will impress the imagination of the whole country." But Lord Selborne was not arrested. Neither were the mutinous officers who resigned their commissions when ordered to report for duty against the men of Ulster who were actually preparing for civil war.

What does all this mean? Why is it that men's blood-shedding militancy is applauded and women's symbolic militancy punished with a prison cell and the forcible feeding horror? It means simply this, that men's double standard of sex morals, whereby the victims of their lust are counted as outcasts, while the men themselves escape all social censure, really applies to morals in all departments of life. Men make the moral code and they expect women to accept it. They have decided that it is entirely right and proper for men to fight for their liberties and their rights, but that it is not right and proper for women to fight for theirs.[3]

They have decided that for men to remain silently quiescent while tyrannical rulers impose bonds of slavery upon them is cowardly and dishonourable, but that for women to do that same thing is not cowardly and dishonourable, but merely respectable. Well, the Suffragettes absolutely repudiate that double standard of morals. If it is right for men to fight for their freedom, and God knows what the human race would be like to-day if men had not, since time began, fought for their freedom, then it is right for women to fight for their freedom and the freedom of the children they bear. On this declaration of faith the militant women of England rest their case.

FOOTNOTE:

[3] There is no question that a great deal of the animus directed against us during 1913 and 1914 by the Government was due to sex bitterness stirred up by a series of articles written by Christabel Pankhurst and published in _The Suffragette_. These articles, a fearless and authoritative expose of the evils of sexual immoralities and their blasting effect on innocent wives and children, have since been published in a book called "The Great Scourge, and how to end it," issued by David Nutt, New Oxford Street, London W. C.

CHAPTER IV

I had called upon women to join me in striking at the Government through the only thing that governments are really very much concerned about--property--and the response was immediate. Within a few days the newspapers rang with the story of the attack made on letter boxes in London, Liverpool, Birmingham, Bristol, and half a dozen other cities. In some cases the boxes, when opened by postmen, mysteriously burst into flame; in others the letters were destroyed by corrosive chemicals; in still others the addresses were rendered illegible by black fluids. Altogether it was estimated that over 5,000 letters were completely destroyed and many thousands more were delayed in transit.

It was with a deep sense of their gravity that these letter-burning protests were undertaken, but we felt that something drastic must be done in order to destroy the apathy of the men of England who view with indifference the suffering of women oppressed by unjust laws. As we pointed out, letters, precious though they may be, are less precious than human bodies and souls. This fact was universally realised at the sinking of the _Titanic_. Letters and valuables disappeared forever, but their loss was forgotten in the far more terrible loss of the multitude of human lives. And so, in order to call attention to greater crimes against human beings, our letter burnings continued.

In only a few cases were the offenders apprehended, and one of the few women arrested was a helpless cripple, a woman who could move about only in a wheeled chair. She received a sentence of eight months in the first division, and, resolutely hunger striking, was forcibly fed with unusual brutality, the prison doctor deliberately breaking one of her teeth in order to insert a gag. In spite of her disabilities and her weakness the crippled girl persisted in her hunger strike and her resistance to prison rules, and within a short time had to be released. The excessive sentences of the other pillar box destroyers resolved themselves into very short terms because of the resistance of the prisoners, every one of whom adopted the hunger strike.

Having shown the Government that we were in deadly earnest when we declared that we would adopt guerrilla warfare, and also that we would not remain in prison, we announced a truce in order that the Government might have full opportunity to fulfil their pledge in regard to a woman suffrage amendment to the Franchise Bill. We did not, for one moment, believe that Mr. Asquith would willingly keep his word. We knew that he would break it if he could, but there was a bare chance that he would not find this possible. However, our principal reason for declaring the truce was that we believed that the Prime Minister would find a way of evading his promise, and we were determined that the blame should be placed, not on militancy, but on the shoulders of the real traitor. We reviewed the history of past suffrage bills: In 1908 the bill had passed its second reading by a majority of 179; and then Mr. Asquith had refused to allow it to go on; in 1910 the Conciliation Bill passed its second reading by a majority of 110, and again Mr. Asquith blocked its progress, pledging himself that if the bill were reintroduced in 1911, in a form rendering it capable of free amendment, it would be given full facilities for becoming law; these conditions were met in 1911, and we saw how the bill, after receiving the increased majority of 167 votes, was torpedoed by the introduction of a Government manhood suffrage bill. Mr. Asquith this time had pledged himself that the bill would be so framed that a woman suffrage amendment could be added, and he further pledged that in case such an amendment was carried through its second reading, he would allow it to become a part of the bill. Just exactly how the Government would manage to wriggle out of their promise was a matter of excited speculation.

All sorts of rumours were flying about, some hinting at the resignation of the Prime Minister, some suggesting the possibility of a general election, others that the amended bill would carry with it a forced referendum on women's suffrage. It was also said that the intention of the Government was to delay the bill so long that, after it was passed in the House, it would be excluded from the benefits of the Parliament Acts, according to which a bill, delayed of passage beyond the first two years of the life of a Parliament, has no chance of being considered by the Lords. In order to become a law without the sanction of the House of Lords, a bill must pass three times through the House of Commons. The prospect of a woman suffrage bill doing that was practically nil.

To none of the rumours would Mr. Asquith give specific denial, and in fact the only positive utterance he made on the subject of the Franchise Bill was that he considered it highly improbable that the House would pass a woman suffrage amendment. In order to discourage woman suffrage sentiment in the House, Mr. Lloyd-George and Mr. Lewis Harcourt again busied themselves with spreading pessimistic prophecies of a Cabinet split in case an amendment was carried. No other threat, they well knew, would so terrorize the timid back bench Liberals, who, in addition to their blind party loyalty, stood in fear of losing their seats in the general election which would follow such a split. Rather than risk their political jobs they would have sacrificed any principle. Of course the hint of a Cabinet split was pure buncombe, and it deceived few of the members. But it established very clearly one thing, and this was that Mr. Asquith's promise that the House should be left absolutely free to decide the suffrage issue, and that the Cabinet stood ready to bow to the decision of the House was never meant to be fulfilled.

The Franchise Bill unamended, by its very wording, specifically denied the right of any woman to vote. Sir Edward Grey moved an amendment deleting from the bill the word male, thus leaving room for a women's suffrage amendment. Two such amendments were moved, one providing for adult suffrage for men and women, and the other providing full suffrage for women householders and wives of householders. The latter postponed the voting age of women to twenty-five years, instead of the men's twenty-one. On January 24th, 1913, debate on the first of the amendments was begun. A day and a half had been allotted to consideration of Sir Edward Grey's amendment, which if carried would leave the way clear for consideration of the other two, to each of which one-third of a day was allotted.

We had arranged for huge meetings to be held every day during the debates, and on the day before they were to open we sent a deputation of working women, led by Mrs. Drummond and Miss Annie Kenney, to interview Mr. Lloyd-George and Sir Edward Grey. We had asked Mr. Asquith to receive the deputation, but, as usual, he refused. The deputation consisted of the two leaders, four cotton mill operatives from Lancashire, four workers in sweated trades of London, two pit brow lassies, two teachers, two trained nurses, one shop assistant, one laundress, one boot and shoe worker and one domestic worker, twenty in all, the exact number specified by Mr. Lloyd-George. Some hundreds of working women escorted the deputation to the official residence of the Chancellor of the Exchequer and waited anxiously in the street to hear the result of the audience.

The result was, of course, barren. Mr. Lloyd-George glibly repeated his confidence in the "great opportunity" afforded by the Franchise Bill, and Sir Edward Grey, reminding the women of the divergence of view held by the members of Cabinet on the suffrage question, assured them that their best opportunity for success lay in an amendment to the present bill. The women spoke with the greatest candour to the two ministers and questioned them sharply as to the integrity of the Prime Minister's pledge to accept the amendments, if passed. To such depth of infamy had English politics sunk that it was possible for women openly to question the plighted word of the King's chief Minister! Mrs. Drummond, who stands in awe of no human being, in plain words invited the slippery Mr. Lloyd-George to clear his own character from obloquy. In the closing words of her speech she put the whole matter clearly up to him, saying: "Now, Mr. Lloyd-George, you have doggedly stuck to your old age pensions, and the insurance act, and secured them, and what you have done for these measures you can do also for the women."

The House met on the following afternoon to debate Sir Edward Grey's permissive amendment, but no sooner had the discussion opened than a veritable bombshell was cast into the situation. Mr. Bonar Law arose and asked for a ruling on the constitutionality of a woman's suffrage amendment to the bill as framed. The Speaker, who, besides acting as the presiding officer of the House, is its official parliamentarian, replied that, in his opinion, such an amendment would make a huge difference in the bill, and that he would be obliged, at a later stage of the debates, to consider carefully whether, if carried, any woman suffrage amendment would not so materially alter the bill that it would have to be withdrawn. In spite of this sinister pronouncement, the House continued to debate the Grey amendment, which was ably supported by Lord Hugh Cecil, Sir John Rolleston, and others.

During the intervening week-end holiday two Cabinet councils were held, and when the House met on Monday the Prime Minister called upon the Speaker for his ruling. The Speaker declared that, in his opinion, the passage of any one of the woman suffrage amendments would so alter the scope of the Franchise Bill as practically to create a new bill, because the measure, as it was framed, did not have for its main object the bestowal of the franchise on a hitherto excluded class. Had it been so framed a woman suffrage amendment would have been entirely proper. But the main object of the bill was to alter the qualification, or the basis of registration for a Parliamentary vote. It would increase the male electorate, but only as an indirect result of the changed qualifications. An amendment to the bill removing the sex barrier from the election laws was not, in the Speaker's opinion, a proper one.

The Prime Minister then announced the intentions of the Cabinet, which were to withdraw the Franchise Bill and to refrain from introducing, during that session, a plural voting bill. Mr. Asquith blandly admitted that his pledge in regard to women's suffrage had been rendered incapable of fulfilment, and he said that he felt constrained to give a new pledge to take its place. There were only two that could be given. The first was that the Government should bring in a bill to enfranchise women, and this the Government would not do. The second was that the Government agree to give full facilities as to time, during the next session of Parliament, to a private member's bill, so drafted as to be capable of free amendment. This was the course that the Government had decided to adopt. Mr. Asquith had the effrontery to say in conclusion that he thought that the House would agree that he had striven and had succeeded in giving effect, both in letter and in spirit, to every undertaking which the Government had given.

Two members only, Mr. Henderson and Mr. Keir Hardie had the courage to stand up on the floor of the House and denounce the Government's treachery, for treachery it unquestionably was. Mr. Asquith had pledged his sacred honour to introduce a bill that

would be capable of an amendment to include women's suffrage, and he had framed a bill that could not be so amended. Whether he had done the thing deliberately, with the plain intention of selling out the women, or whether ignorance of Parliamentary rules accounted for the failure of the bill was immaterial. The bill need not have been drawn in ignorance. The fount of wisdom represented by Mr. Speaker could have been consulted at the time the bill was under construction quite as easily as when it had reached the debating stage. Our paper said editorially, representing and perfectly expressing our member's views: "Either the Government are so ignorant of Parliamentary procedure that they are unfit to occupy any position of responsibility, or else they are scoundrels of the worst kind."

I am inclined to think that the verdict of posterity will lean towards the later conclusion. If Mr. Asquith had been a man of honour he would have reframed the Franchise Bill in such a way that it could have included a suffrage amendment, or else he would have made amends for his stupendous blunder--if it was a blunder--by introducing a Government measure for women's suffrage. He did neither, but disposed of the matter by promising facilities for a private member's bill which he knew, and which everybody knew, could not possibly pass.

There was no chance for a private member's bill, even with facilities, because of a number of reasons, but principally because the torpedoing of the Conciliation Bill had destroyed utterly the spirit of conciliation in which Conservatives, Liberals and Radicals in the House of Commons, and militant and non-militant women throughout the Kingdom had set aside their differences of opinion and agreed to come together on a compromise measure. When the second Conciliation Bill, of 1911, was under discussion, Lord Lytton had said: "If this bill does not go through, the woman suffrage movement will not be stopped, but the spirit of conciliation of which this bill is an expression will be destroyed, and there will he war throughout the country, raging, tearing, fierce, bitter strife, though nobody wants it."

Lord Lytton's words were prophetic. At this last brazen piece of trickery on the part of the Government the country blazed with bitter wrath. All the suffrage societies united in calling for a Government measure for women's suffrage to be introduced without delay. The idle promise of facilities for a private member's bill was rejected with contumely and scorn. The Liberal women's executive committee met, and a strong effort was made to pass a resolution threatening the withdrawal from party work of the entire federation, but this failed and the executive merely passed a feeble resolution of regret.

The membership of the Women's Liberal Federation was, at that time, close to 200,000, and if the executive had passed the strong resolution, refusing to do any more work for the party until a Government measure had been introduced, the Government would have been forced to yield. They could not have faced the country without the support of the women. But these women, many of them, were wives of men in the service, the paid service of the Liberal Party. Many of them were wives of Liberal members. They lacked the courage, or the intelligence, or the insight, to declare war as a body on the Government. A large number of women, and also many men, did resign from the Liberal Party, but the defections were not serious enough to affect the Government.

The militants declared, and proceeded instantly to carry out, unrelenting warfare. We announced that either we must have a Government measure, or a Cabinet split--those men in the Cabinet calling themselves suffragists going out--or we would take up the sword again, never to lay it down until the enfranchisement of the women of England was won.

It was at this time, February, 1913, less than two years ago as I write these words, that militancy, as it is now generally understood by the public began--militancy in the sense of continued, destructive, guerilla warfare against the Government through injury to private property. Some property had been destroyed before this time, but the attacks were sporadic, and were meant to be in the nature of a warning as to what might become a settled policy. Now we indeed lighted the torch, and we did it with the absolute conviction that no other course was open to us. We had tried every other measure, as I am sure that I have demonstrated to my readers, and our years of work and suffering and sacrifice had taught us that the Government would not yield to right and justice, what the majority of members of the House of Commons admitted was right and justice, but that the Government would, as other governments invariably do, yield to expediency. Now our task was to show the Government that it was expedient to yield to the women's just demands. In order to do that we had to make England and every department of English life insecure and unsafe. We had to make English law a failure and the courts farce comedy theatres; we had to discredit the Government and Parliament in the eyes of the world; we had to spoil English sports, hurt business, destroy valuable property, demoralise the world of society, shame the churches, upset the whole orderly conduct of life--

That is, we had to do as much of this guerilla warfare as the people of England would tolerate. When they came to the point of saying to the Government: "Stop this, in the only way it can be stopped, by giving the women of England representation," then we

should extinguish our torch.

Americans, of all people, ought to see the logic of our reasoning. There is one piece of American oratory, beloved of schoolboys, which has often been quoted from militant platforms. In a speech now included among the classics of the English language your great statesman, Patrick Henry, summed up the causes that led to the American Revolution. He said: "We have petitioned, we have remonstrated, we have supplicated, we have prostrated ourselves at the foot of the throne, and it has all been in vain. We must fight--I repeat it, sir, we must fight."

Patrick Henry, remember, was advocating killing people, as well as destroying private property, as the proper means of securing the political freedom of men. The Suffragettes have not done that, and they never will. In fact the moving spirit of militancy is deep and abiding reverence for human life. In the latter course of our agitation I have been called upon to discuss our policies with many eminent men, politicians, literary men, barristers, scientists, clergymen. One of the last named, a high dignitary of the Church of England, told me that while he was a convinced suffragist, he found it impossible to justify our doing wrong that right might follow. I said to him: "We are not doing wrong--we are doing right in our use of revolutionary methods against private property. It is our work to restore thereby true values, to emphasise the value of human rights against property rights. You are well aware, sir, that property has assumed a value in the eyes of men, and in the eyes of the law, that it ought never to claim. It is placed above all human values. The lives and health and happiness, and even the virtue of women and children--that is to say, the race itself--are being ruthlessly sacrificed to the god of property every day of the world."

To this my reverend friend agreed, and I said: "If we women are wrong in destroying private property in order that human values may be restored, then I say, in all reverence, that it was wrong for the Founder of Christianity to destroy private property, as He did when He lashed the money changers out of the Temple and when He drove the Gaderene swine into the sea."

It was absolutely in this spirit that our women went forth to war. In the first month of guerilla warfare an enormous amount of property was damaged and destroyed. On January 31st a number of putting greens were burned with acids; on February 7th and 8th telegraph and telephone wires were cut in several places and for some hours all communication between London and Glasgow were suspended; a few days later windows in various of London's smartest clubs were broken, and the orchid houses at Kew were wrecked and many valuable blooms destroyed by cold. The jewel room at the Tower of London was invaded and a showcase broken. The residence of H. R. H. Prince Christian and Lambeth Palace, seat of the Archbishop of Canterbury, were visited and had windows broken. The refreshment house in Regents Park was burned to the ground on February 12th and on February 18th a country house which was being built at Walton-on-the-Hill for Mr. Lloyd-George was partially destroyed, a bomb having been exploded in the early morning before the arrival of the workmen. A hat pin and a hair pin picked up near the house--coupled with the fact that care had been taken not to endanger any lives--led the police to believe that the deed had been done by women enemies of Mr. Lloyd-George. Four days later I was arrested and brought up in Epsom police court, where I was charged with having "counselled and procured" the persons who did the damage. Admitted to bail for the night, I appeared next morning in court, where the case was fully reviewed. Speeches of mine were read, one speech, made at a meeting held on January 22nd, in which I called for volunteers to act with me in a particular engagement; and another, made the day after the explosion, in which I publicly accepted responsibility for all militant acts done in the past, and even for what had been done at Walton. At the conclusion of the hearing I was committed for trial at the May Assizes at Guildford. Bail would be allowed, it was stated, if I would agree to give the usual undertaking to refrain from all militancy or incitement to militancy.

I asked that the case be set for speedy trial at the Assizes then in progress. I was entirely willing, I said, to give an undertaking for a short period, for a week, or even two weeks, but I could not possibly do so for a much longer period, looking at the fact that a new session of Parliament began in March, and was vitally concerned with the interests of women. The request was refused, and I was ordered to be taken to Holloway. I warned the magistrate that I should at once adopt the hunger strike, and I told him that if I lived at all until the summer it would be a dying woman who would come up for trial.

Arriving at Holloway I carried out my intention, but within twenty-four hours I heard that the authorities had arranged that my trial should take place on April 1st, instead of at the end of June, and at the Central Criminal Court, London, instead of the Guildford Court. I then gave the required under-takings and was immediately released on bail.

CHAPTER V

When I entered Old Bailey on that memorable Wednesday, April 2nd, 1913, to be tried for inciting to commit a felony, the court was packed with women. A great crowd of women who could not obtain the necessary tickets remained in the streets below for hours waiting news of the trial. A large number of detectives from Scotland Yard, and a still larger number of uniformed police were on duty both inside and outside the court. I could not imagine why it was considered necessary to have such a regiment of police on hand, for I had not, at that time, realised the state of terror into which the militant movement, in its new development, had thrown the authorities.

Mr. Bodkin and Mr. Travers Humphreys appeared to prosecute on behalf of the Crown, and I conducted my own case, in consultation with my solicitor, Mr. Marshall. The Judge, Mr. Justice Lush, having taken his seat I entered the dock and listened to the reading of the indictment. I pled "not guilty," not because I wished to evade responsibility for the explosion,--I had already assumed that responsibility--but because the indictment accused me of having wickedly and maliciously incited women to crime. What I had done was not wicked of purpose, but quite the opposite of wicked. I could not therefore truthfully plead guilty. The trial having opened the Judge courteously asked me if I would like to sit down. I thanked him, and asked if I might also have a small table on which to place my papers. By orders of the Judge a table was brought me.

Mr. Bodkin opened the case by explaining the "Malicious Damages to Property Act" of 1861, under which I was charged, and after describing the explosion which had damaged the Lloyd-George house at Walton, said that I was accused of being in the affair an accessory before the fact. It was not suggested, he said, that I was present when the crime was committed, but it was charged that I had moved and incited, counselled and procured women whose names were unknown to carry out that crime. It would be for the jury to decide, after the evidence had been presented, whether the facts did not point most clearly to the conclusion that women, probably two in number, who committed the crime were members of the Women's Social and Political Union, which had its office in Kingsway in London, and of which the defendant was the head, moving spirit and recognised leader.

The blowing up of Mr. Lloyd-George's house was then described in detail. That the damage was intended as an act against Mr. Lloyd-George was clear, Mr. Bodkin said, from the malicious statements made against him by the prisoner. He produced a private letter written by me to a friend in which I had defended militancy, and said that not only had it become a duty but in the circumstances it had also become a political necessity. Said Mr. Bodkin:

"A letter of that kind proves very clearly several things. It shows that she is the leader. It shows her influence over the emotional members of this organisation. It shows that according to her, militancy can be withheld for a time and let loose upon society at another time. And it further shows that any person or any woman who wants to indulge in militancy, which is only a picturesque expression for committing crimes against society, has to communicate with her, and with her alone, by word of mouth or by letter. That is the Proclamation which went out to the members of this organisation. The plain language of that letter is, 'If we don't get what we want, the Government and their members will be responsible, and the Government and the public will be bullied into giving us what we want.'"

Many extracts from my speeches made in January and February were read, and the final speech made just before my arrest at Chelsea. But before they were read I said:

"I wish to lodge an objection now to the police reports of my speeches. They have been supplied to me, and the only report I accept is that of the journalist of Cardiff who is one of the witnesses. He has furnished a fairly accurate report of what I said in that town. The police reports I do not accept. They are grossly inaccurate and ignorant and ungrammatical, and they convey an absolutely wrong impression of what I said in many respects."

Witnesses were then examined; the carter who heard and reported the explosion; the foreman in charge of the damaged house, who told the cost of the damages, and described the explosives, etc., found on the premises; several police officers who told of finding hairpins and a woman's rubber golosh in the house, and so on. Absolutely nothing was brought out that tended to show that the Suffragettes had anything to do with the affair. The Judge noted this for he said to Mr. Bodkin:

"I am not quite sure how you present this case. There are two ways of looking at it. Do you only ask the jury to say that the defendant specifically counselled the perpetration of this crime, or do you also say that, looking at her speeches that you read--assuming you prove that they were uttered--that the language used being a general incitement to damage property, any one who acted on this invitation and perpetrated this outrage would be incited by her to do it?"

Mr. Bodkin replied that the latter assumption was correct.

"I say that the speeches generally are incitement to all kinds of acts of violence against property, and that they present evidence of attacks against property and a particular individual, and that there is evidence in the speeches which have been read, and which will be proved, of admissions by Mrs. Pankhurst of having been connected with the particular outrage in a way which makes her in law an accessory before the fact."

"But you do not confine the case to the latter way of putting it?"

"No," replied Mr. Bodkin.

"Even if the jury are satisfied," said the Judge, "that Mrs. Pankhurst was not directly connected with this outrage by counselling it, you still ask the jury to say that by counselling, as you say she had in the speeches, the destruction of property, especially that belonging to a particular gentleman, anybody who acted on that and committed this outrage would have been incited by her to do it?"

"Yes, my lord."

"I think, Mrs. Pankhurst, you now understand the way it is put?" asked the Judge.

"I understand it quite well, my lord," I replied.

Proceedings were resumed on the following day, and the examination of witnesses for the prosecution went on. At the close of the examination, the Judge inquired whether I desired to call any witnesses. I replied:

"I do not desire to give evidence or to call any witnesses, but I desire to address your Lordship."

I began by objecting to some of the things Mr. Bodkin had said in his speech which concerned me personally. He had referred to me--or at least his words conveyed the suggestion--that I was a woman riding about in my motor car inciting other women to do acts which entail imprisonment and great suffering, while I, perhaps indulging in some curious form of pleasure, was protected, or thought myself protected, from serious consequences. I said that Mr. Bodkin knew perfectly well that I shared all the dangers the other women faced, that I had been in prison three times, serving two of the sentences in full, and being treated like an ordinary felon--searched, put in prison clothes, eating prison fare, given solitary confinement and conforming to all the abominable rules imposed upon women who commit crimes in England. I thought I owed it to myself, especially as the same suggestions--in regard to the luxury in which I lived, supported by the members of the W. S. P. U.--had been made, not only by Mr. Bodkin in court, but by members of the Government in the House of Commons--I thought I owed it to myself to say that I owned no motor car and never had owned one. The car in which I occasionally rode was owned by the organisation and was used for general propaganda work. In that car, and in cars owned by friends I had gone about my work as a speaker in the Woman Suffrage movement. It was equally untrue, I said, that some of us were making incomes of L1,000 to L1,500 a year out of the suffrage movement, as had actually been alleged in the debates in the House in which members of Parliament were trying to decide how to crush militancy. No woman in our organisation was making any such income, or anything remotely like it. Myself, I had sacrificed a considerable portion of my income because I had to surrender a very important part of it in order to be free to do what I thought was my duty in the movement.

Addressing myself to my defence I told the Court that it was a very serious condition of things when a large number of respectable and naturally law abiding people, people of upright lives, came to hold the law in contempt, came seriously to making up their minds that they were justified in breaking the law.

"The whole of good government," I said, "rests upon acceptance of the law, upon respect of the law, and I say to you seriously, my lord, and gentlemen of the jury, that women of intelligence, women of training, women of upright life, have for many years ceased to respect the laws of this country. It is an absolute fact, and when you look at the laws of this country as they effect women it is not to be wondered at."

At some length I went over these laws, laws that made it possible for the Judge to send me, if found guilty, to prison for fourteen years, while the maximum penalty for offences of the most revolting kind against little girls was only two years' imprisonment. The laws of inheritance, the laws of divorce, the laws of guardianship of children--all so scandalously unjust to women, I sketched briefly, and I said that not only these laws and others, but the administration of the laws fell so far short of adequacy that women felt that they must be permitted to share the work of cleaning up the entire situation. I tried here to tell of certain dreadful things that I had learned as the wife of a barrister, things about some of the men in high places who are entrusted with the administration of the law, of a judge of Assizes where many hideous crimes against women were tried, this judge himself being found dead one morning

in a brothel, but the Court would not allow me to go into personalities, as he called it, with regard to "distinguished people," and told me that the sole question before the jury was whether or not I was guilty as charged. I must speak on that subject and on no other.

After a hard fight to be allowed to tell the jury the reasons why women had lost respect for the law, and were making such a struggle in order to become law makers themselves, I closed my speech by saying:

"Over one thousand women have gone to prison in the course of this agitation, have suffered their imprisonment, have come out of prison injured in health, weakened in body, but not in spirit. I come to stand my trial from the bedside of one of my daughters, who has come out of Holloway Prison, sent there for two months' hard labour for participating with four other people in breaking a small pane of glass. She has hunger-struck in prison. She submitted herself for more than five weeks to the horrible ordeal of feeding by force, and she has come out of prison having lost nearly two stone in weight. She is so weak that she cannot get out of her bed. And I say to you, gentlemen, that is the kind of punishment you are inflicting upon me or any other woman who may be brought before you. I ask you if you are prepared to send an incalculable number of women to prison--I speak to you as representing others in the same position--if you are prepared to go on doing that kind of thing indefinitely, because that is what is going to happen. There is absolutely no doubt about it. I think you have seen enough even in this present case to convince you that we are not women who are notoriety hunters. We could get that, heaven knows, much more cheaply if we sought it. We are women, rightly or wrongly, convinced that this is the only way in which we can win power to alter what for us are intolerable conditions, absolutely intolerable conditions. A London clergyman only the other day said that 60 per cent. of the married women in his parish were breadwinners, supporting their husbands as well as their children. When you think of the wages women earn, when you think of what this means to the future of the children of this country, I ask you to take this question very, very seriously. Only this morning I have had information brought to me which could be supported by sworn affidavits, that there is in this country, in this very city of London of ours, a regulated traffic, not only in women of full age, but in little children; that they are being purchased, that they are being entrapped, and that they are being trained to minister to the vicious pleasures of persons who ought to know better in their positions of life.

"Well, these are the things that have made us women determined to go on, determined to face everything, determined to see this thing out to the end, let it cost us what it may. And if you convict me, gentlemen, if you find me guilty, I tell you quite honestly and quite frankly, that whether the sentence is a long sentence, whether the sentence is a short sentence, I shall not submit to it. I shall, the moment I leave this court, if I am sent to prison, whether to penal servitude or to the lighter form of imprisonment--because I am not sufficiently versed in the law to know what his lordship may decide; but whatever my sentence is, from the moment I leave this court I shall quite deliberately refuse to eat food--I shall join the women who are already in Holloway on the hunger strike. I shall come out of prison, dead or alive, at the earliest possible moment; and once out again, as soon as I am physically fit I shall enter into this fight again. Life is very dear to all of us. I am not seeking, as was said by the Home Secretary, to commit suicide. I do not want to commit suicide. I want to see the women of this country enfranchised, and I want to live until that is done. Those are the feelings by which we are animated. We offer ourselves as sacrifices, just as your forefathers did in the past, in this cause, and I would ask you all to put this question to yourselves:--Have you the right, as human beings, to condemn another human being to death--because that is what it amounts to? Can you throw the first stone? Have you the right to judge women?

"You have not the right in human justice, not the right by the constitution of this country, if rightly interpreted, to judge me, because you are not my peers. You know, every one of you, that I should not be standing here, that I should not break one single law--if I had the rights that you possess, if I had a share in electing those who make the laws I have to obey; if I had a voice in controlling the taxes I am called upon to pay, I should not be standing here. And I say to you it is a very serious state of things. I say to you, my lord, it is a very serious situation, that women of upright life, women who have devoted the best of their years to the public weal, that women who are engaged in trying to undo some of the terrible mistakes that men in their government of the country have made, because after all, in the last resort, men are responsible for the present state of affairs--I put it to you that it is a very serious situation. You are not accustomed to deal with people like me in the ordinary discharge of your duties; but you are called upon to deal with people who break the law from selfish motives. I break the law from no selfish motive. I have no personal end to serve, neither have any of the other women who have gone through this court during the past few weeks, like sheep to the slaughter. Not one of these women would, if women were free, be law-breakers. They are women who seriously believe that this hard path that they are treading is the only path to their enfranchisement. They seriously believe that the welfare of humanity demands this sacrifice; they believe that the horrible evils which are ravaging our civilisation will never be removed until women get the vote. They know that the very fount of life is being poisoned; they know that homes are being destroyed; that because of bad education, because of the unequal standard of morals, even the mothers and children are destroyed by one of the vilest and most horrible

diseases that ravage humanity.

"There is only one way to put a stop to this agitation; there is only one way to break down this agitation. It is not by deporting us, it is not by locking us up in gaol; it is by doing us justice. And so I appeal to you gentlemen, in this case of mine, to give a verdict, not only on my case, but upon the whole of this agitation. I ask you to find me not guilty of malicious incitement to a breach of the law.

"These are my last words. My incitement is not malicious. If I had power to deal with these things, I would be in absolute obedience to the law. I would say to women, 'You have a constitutional means of getting redress for your grievances; use your votes, convince your fellow-voters of the righteousness of your demands. That is the way to obtain justice.' I am not guilty of malicious incitement, and I appeal to you, for the welfare of the country, for the welfare of the race, to return a verdict of not guilty in this case that you are called upon to try."

After recapitulating the charge the Judge, in summing up, said:

"It is scarcely necessary for me to tell you that the topics urged by the defendant in her address to you with regard to provocation by the laws of the country and the injustice done to women because they are not given the vote as men are, have no bearing upon the question you have to decide.

"The motive at the back of her mind, or at the back of the minds of those who actually did put the gunpowder there, would afford no defence to this indictment. I am quite sure you will deal with this case upon the evidence, and the evidence alone, without regard to any question as to whether you think the law is just or unjust. It has nothing to do with the case. I should think you will probably have no doubt that this defendant, if she did these things charged against her, is not actuated by the ordinary selfish motive that leads most of the criminals who are in this dock to commit the crimes that they do commit. She is none the less guilty if she did these things which are charged against her, although she believes that by means of this kind the condition of society will be altered."

The jury retired, and soon after the afternoon session of the court opened they filed in, and in reply to the usual question asked by the clerk of arraigns, said that they had agreed upon a verdict. Said the clerk:

"Do you find Mrs. Pankhurst guilty or not guilty?"

"Guilty," said the foreman, "with a strong recommendation to mercy."

I spoke once more to the Judge.

"The jury have found me guilty, with a strong recommendation to mercy, and I do not see, since motive is not taken into account in human laws, that they could do otherwise after your summing up. But since motive is not taken into account in human laws, and since I, whose motives are not ordinary motives, am about to be sentenced by you to the punishment which is accorded to people whose motives are selfish motives, I have only this to say: If it was impossible for a different verdict to be found; if it is your duty to sentence me, as it will be presently, then I want to say to you, as a private citizen, and to the jury as private citizens, that I, standing here, found guilty by the laws of my country, I say to you it is your duty, as private citizens, to do what you can to put an end to this intolerable state of affairs. I put that duty upon you. And I want to say, _whatever the sentence you pass upon me, I shall do what is humanly possible to terminate that sentence at the earliest possible moment. I have no sense of guilt. I feel I have done my duty. I look upon myself as a prisoner of war. I am under no moral obligation to conform to, or in any way accept, the sentence imposed upon me._ I shall take the desperate remedy that other women have taken. It is obvious to you that the struggle will be an unequal one, but I shall make it--I shall make it as long as I have an ounce of strength left in me, or any life left in me.

"I shall fight, I shall fight, I shall fight, from the moment I enter prison to struggle against overwhelming odds; I shall resist the doctors if they attempt to feed me. I was sentenced last May in this court to nine months' imprisonment. I remained in prison six weeks. There are people who have laughed at the ordeal of hunger-striking and forcible feeding. All I can say is, and the doctors can bear me out, that I was released because, had I remained there much longer, I should have been a dead woman.

"I know what it is because I have gone through it. My own daughter[4] has only just left it. There are women there still facing that ordeal, facing it twice a day. Think of it, my lord, twice a day this fight is gone through. Twice a day a weak woman resisting overwhelming force, fights and fights as long as she has strength left; fights against women and even against men, resisting with her tongue, with her teeth, this ordeal. Last night in the House of Commons some alternative was discussed, or rather, some additional punishment. Is it not a strange thing, my lord, that laws which have sufficed to restrain men throughout the history of this

country do not suffice now to restrain women--decent women, honourable women?

"Well, my lord, I do want you to realise it. I am not whining about my punishment, I invited it. I deliberately broke the law, not hysterically or emotionally, but of set serious purpose, because I honestly feel it is the only way. Now, I put the responsibility of what is to follow upon you, my lord, as a private citizen, and upon the gentlemen of the jury, as private citizens, and upon all the men in this court--what are you, with your political powers, going to do to end this intolerable situation?

"_To the women I have represented, to the women who, in response to my incitement, have faced these terrible consequences, have broken laws, to them, I want to say I am not going to fail them, but to face it as they face it, to go through with it, and I know that they will go on with the fight whether I live or whether I die._

"_This movement will go on and on until we have the rights of citizens in this country, as women have in our Colonies, as they will have throughout the civilised world before this woman's war is ended._

"That is all I have to say."

Mr. Justice Lush, in passing sentence, said: "It is my duty, Mrs. Emmeline Pankhurst, and a very painful duty it is, to pass what, in my opinion, is a suitable and adequate sentence for the crime of which you have been most properly convicted, having regard to the strong recommendation to mercy by the jury. I quite recognise, as I have already said, that the motives that have actuated you in committing this crime are not the selfish motives that actuate most of the persons who stand in your position, but although you blind your eyes to it, I cannot help pointing out to you that the crime of which you have been convicted is not only a very serious one, but, in spite of your motives, it is, in fact, a wicked one. It is wicked because it not only leads to the destruction of property of persons who have done you no wrong, but in spite of your calculations, it may expose other people to the danger of being maimed or even killed. It is wicked because you are, and have been, luring other people--young women, it may be--to engage in such crimes, possibly to their own ruin; and it is wicked, because you cannot help being alive to it if you would only think.

"You are setting an example to other persons who may have other grievances that they legitimately want to have put right by embarking on a similar scheme to yours, and trying to effect their object by attacking the property, if not the lives, of other people. I know, unfortunately--at least, I feel sure--you will pay no heed to what I say. I only beg of you to think of these things."

"I have thought of them," I interjected.

"Think, if only for one short hour, dispassionately," continued the majesty of law, "I can only say that, although the sentence I am going to pass must be a severe one, must be adequate to the crime of which you have been found guilty, if you would only realise the wrong you are doing, and the mistake you are making, and would see the error you have committed, and undertake to amend matters by using your influence in a right direction, I would be the first to use all my best endeavours to bring about a mitigation of the sentence I am about to pass.

"I cannot, and I will not, regard your crime as a merely trivial one. It is not. It is a most serious one, and, whatever you may think, it is a wicked one. I have paid regard to the recommendation of the jury. You yourself have stated the maximum sentence which this particular offence is by the legislature thought to deserve. The least sentence I can pass upon you is a sentence of three years' penal servitude."

As soon as the sentence was pronounced the intense silence which had reigned throughout the trial was broken, and an absolute pandemonium broke out among the spectators. At first it was merely a confused and angry murmur of "Shame!" "Shame!" The murmurs quickly swelled into loud and indignant cries, and then from gallery and court there arose a great chorus uttered with the utmost intensity and passion. "Shame!" "Shame!" The women sprang to their feet, in many instances stood on their seats, shouting "Shame!" "Shame!" as I was conducted out of the dock in charge of two wardresses. "Keep the flag flying!" shouted a woman's voice, and the response came in a chorus: "We will!" "Bravo!" "Three cheers for Mrs. Pankhurst!" That was the last I heard of the courtroom protest.

Afterwards I heard that the noise and confusion was kept up for several minutes longer, the Judge and the police being quite powerless to obtain order. Then the women filed out singing the Women's Marseillaise--

"March on, march on, Face to the dawn, The dawn of liberty."

The Judge flung after their retreating forms the dire threat of prison for any woman who dared repeat such a scene. Threat of prison--to Suffragettes! The women's song only swelled the louder and the corridors of Old Bailey reverberated with their shouts. Certainly that venerable building had never in its checkered history witnessed such a scene. The great crowd of detectives and police who were on duty seemed actually paralysed by the audacity of the protest, for they made no attempt to intervene.

At three o'clock, when I left the court by a side entrance in Newgate Street, I found a crowd of women waiting to cheer me. With the two wardresses I entered a four wheeler and was driven to Holloway to begin my hunger strike. Scores of women followed in taxicabs, and when I arrived at the prison gates there was another protest of cheers for the cause and boos for the law. In the midst of all this intense excitement I passed through the grim gates into the twilight of prison, now become a battle-ground.

FOOTNOTE:

[4] Sylvia Pankhurst, who was forcibly fed for five weeks, during an original sentence of two months imposed for breaking one window.

CHAPTER VI

Prison had indeed been for us a battle-ground ever since the time when we had solemnly resolved that, as a matter of principle, we would not submit to the rules that bound ordinary offenders against the law. But when I entered Holloway on that April day in 1913, it was with full knowledge that I had before me a far more prolonged struggle than any that the militant suffragists had hitherto faced. I have described the hunger strike, that terrible weapon with which we had repeatedly broken our prison bars. The Government, at their wits' end to cope with the hunger strikers, and to overcome a situation which had brought the laws of England into such scandalous disrepute, had had recourse to a measure, surely the most savagely devised ever brought before a modern Parliament.

In March of that year, while I was waiting trial on the charge of conspiring to destroy Mr. Lloyd-George's country house, a bill was introduced into the House of Commons by the Home Secretary, Mr. Reginald McKenna, a bill which had for its avowed object the breaking down of the hunger strike. This measure, now universally known as the "Cat and Mouse Act," provided that when a hunger striking suffrage prisoner (the law was frankly admitted to apply only to suffrage prisoners) was certified by the prison doctors to be in danger of death, she could be ordered released on a sort of a ticket of leave for the purpose of regaining strength enough to undergo the remainder of her sentence. Released, she was still a prisoner, the prisoner, or the patient, or the victim, as you may choose to call her, being kept under constant police surveillance. According to the terms of the bill the prisoner was released for a specified number of days, at the expiration of which she was supposed to return to prison on her own account. Says the Act:

"The period of temporary discharge may, if the Secretary of State thinks fit, be extended on a representation of the prisoner that the state of her health renders her unfit to return to prison. If such representation be made, the prisoner shall submit herself, if so required, for medical examination by the medical officer of the above mentioned prison, or other registered medical practitioner appointed by the Secretary of State.

The prisoner shall notify to the Commissioner of Police of the Metropolis the place of residence to which she goes on her discharge. She shall not change her residence without giving one clear day's notice in writing to the Commissioner, specifying the residence to which she is going and she shall not be temporarily absent from her residence for more than twelve hours without giving a like notice," etc.

The idea of militant suffragists respecting a law of this order is almost humorous, and yet the smile dies before the pity one feels for the Minister whose confession of failure is embodied in such a measure. Here was a mighty Government weakly resolved that justice to women it would not grant, knowing that submission of women it could not force, and so was willing to compromise with a piece of class legislation absolutely contrary to all of its avowed principles. Said Mr. McKenna, pleading in the House for the advancement of his odious measure: "At the present time I cannot make these prisoners undergo their sentences without serious risk of death and I want to have power to enable me to compel a prisoner to undergo the sentence, and I want that power in all cases where the prisoner adopts the system of the hunger strike. At the present moment, although I have the power of release, I cannot release a prisoner without a pardon, and I have to discharge them for good. I want the power of releasing a prisoner without a pardon, with the sentence remaining alive.... I want to enforce the Law, and I want, if I can, to enforce it without forcible feeding,

and without undergoing the risk of some one else's life."

Interrogated by several members, Mr. McKenna admitted that the "Cat and Mouse" bill, if passed, would not inevitably do away with forcible feeding, but he promised that the hateful and disgusting process would be resorted to only when "absolutely necessary." We shall see later how hypocritical this representation was.

Parliament, which had never had time to consider, beyond its initial stages, a women's suffrage measure, passed the Cat and Mouse Act through both houses within the limits of a few days. It was already law when I entered Holloway on April 3rd, 1913, and I grieve to state that many members of the Labour Party, pledged to support woman suffrage, helped to make it into law.

Of course the Act was, from its inception, treated by the suffragists with the utmost contempt. We had not the slightest intention of assisting Mr. McKenna in enforcing unjust sentences against soldiers in the army of freedom, and when the prison doors closed behind me I adopted the hunger strike exactly as though I expected it to prove, as formerly, a means of gaining my liberty.

That struggle is not a pleasant one to recall. Every possible means of breaking down my resolution was resorted to. The daintiest and most tempting food was placed in my cell. All sorts of arguments were brought to bear against me--the futility of resisting the Cat and Mouse Act, the wickedness of risking suicide--I shall not attempt to record all the arguments. They fell against a blank wall of consciousness, for my thoughts were all very far away from Holloway and all its torments. I knew, what afterwards I learned as a fact, that my imprisonment was followed by the greatest revolutionary outbreak that had been witnessed in England since 1832. From one end of the island to the other the beacons of the women's revolution blazed night and day. Many country houses--all unoccupied--were fired, the grand stand of Ayr race course was burned to the ground, a bomb was exploded in Oxted Station, London, blowing out walls and windows, some empty railroad carriages were blown up, the glass of thirteen famous paintings in the Manchester Art Gallery were smashed with hammers--these are simply random specimens of the general outbreak of secret guerilla warfare waged by women to whose liberties every other approach had been barricaded by the Liberal Government of free England. The only answer of the Government was the closing of the British Museum, the National Gallery, Windsor Castle, and other tourist resorts. As for the result on the people of England, that was exactly what we had anticipated. The public were thrown into a state of emotion of insecurity and frightened expectancy. Not yet did they show themselves ready to demand of the Government that the outrages be stopped in the only way they could be stopped--by giving votes to women. I knew that it would be so. Lying in my lonely cell in Holloway, racked with pain, oppressed with increasing weakness, depressed with the heavy responsibility of unknown happenings, I was sadly aware that we were but approaching a far goal. The end, though certain, was still distant. Patience, and still more patience, faith and still more faith, well, we had called upon these souls' help before and it was certain that they would not fail us at this greatest crisis of all.

Thus in great anguish of mind and body passed nine terrible days, each one longer and more acutely miserable than the preceding. Towards the last, I was mercifully half unconscious of my surroundings. A curious indifference took possession of my over-wrought mind, and it was almost without emotion that I heard, on the morning of the tenth day, that I was to be released temporarily in order to recover my health. The Governor came to my cell and read me my licence, which commanded me to return to Holloway in fifteen days, and meanwhile to observe all the obsequious terms as to informing the police of my movements. With what strength my hands retained I tore the document in strips and dropped it on the floor of the cell. "I have no intention," I said, "of obeying this infamous law. You release me knowing perfectly well that I shall never voluntarily return to any of your prisons."

They sent me away, sitting bolt upright in a cab, unmindful of the fact that I was in a dangerous condition of weakness, having lost two stone in weight and suffered seriously from irregularities of heart action. As I left the prison I was gratefully aware of groups of our women standing bravely at the gates, as though enduring a long vigil. As a matter of fact, relays of women had picketed the place night and day during the whole term of my imprisonment. The first pickets were arrested, but as others constantly arrived to fill their places the police finally gave in and allowed the women to march up and down before the prison carrying the flag.

At the nursing home to which I was conveyed I learned that Annie Kenney, Mrs. Drummond, and our staunch friend, Mr. George Lansbury,[5] had been arrested during my imprisonment, and that all three had adopted the hunger strike. I also learned on my own account how desperately the Government were striving to make their Cat and Mouse Act--the last stand in their losing campaign--a success. Without regard to the extra expense laid on the unfortunate tax payers of the country, the Government employed a large extra force of police especially for this purpose. As I lay in bed, being assisted by every medical resource to return to life and health, these special police, colloquially termed "Cats," guarded the nursing home as if it were a besieged castle. In the street under my windows two detectives and a constable stood on guard night and day. In a house at right angles to my refuge three more

detectives kept constant watch. In the mews at the rear of the house were more detectives, and diligently patrolling the road, as if in expectation of a rescuing regiment, two taxicabs, each with its quota of detectives, guarded the highways.

All this made recovery slow and difficult. But worse was to come. On April 30th, just as I was beginning to rally somewhat, came the news that the police had swooped down on our headquarters in Kingsway and had arrested the entire official force. Miss Barrett, associate editor of _The Suffragette_; Miss Lennox, the sub-editor; Miss Lake, business manager; Miss Kerr, office manager, and Mrs. Sanders, financial secretary of the Union, were arrested, although not one of them had ever appeared in any militant action. Mr. E. G. Clayton, a chemist, was also arrested, accused of furnishing the W. S. P. U. with explosive materials. The offices were thoroughly searched, and, as on a former occasion, stripped of all books and papers. While this was being done another party of police, armed with a special warrant, proceeded to the printing office where our paper, _The Suffragette_, was published. The printer, Mr. Drew, was placed under arrest and the material for the paper, which was to appear on the following day, was seized. By one o'clock in the afternoon the entire plant and the headquarters of the Union were in the hands of the police, and to all appearances the militant movement--temporarily at least--was brought to a full stop. In my state of semi-prostration it at first seemed to me best to let the week's issue of the paper lapse, but on second thought I decided that even the appearance of surrender was not to be thought of. How we managed it need not here be told, but we actually did, overnight, with hardly any material, except Christabel's leading article, and with hastily summoned helpers, get out the paper as usual, and side by side with the morning journals which bore front page stories of the suppression of the Suffragette organ, our paper sellers sold _The Suffragette_. The front page bore, instead of the usual cartoon, the single word in bold faced type--

"RAIDED,"

the full story of the police search and the arrests being related in the other pages. Our headquarters, I may say in passing, remained closed less than forty-eight hours. We are so organised that the arrest of leaders does not seriously cripple us. Every one has an understudy, and when one leader drops out her substitute is ready instantly to take her place.

In this emergency there appeared as chief organiser in Miss Kenney's place, Miss Grace Roe, one of the young Suffragettes of whom I, as belonging to the older generation, am so proud. Faced by difficulties as great as the Government could make them, Miss Roe at once showed herself to be equal to the situation, and to have the gift of unswerving loyalty combined with a strong and rapid judgment of things and people. Aiding her was Mrs. Dacre Fox, who surprised us all by her amazing ability to act as assistant editor of _The Suffragette_, manage a host of affairs in the office, and preside at our weekly meetings. Another member of the Union who came prominently to the front at the time of this crisis was Mrs. Mansel.

In two days' time the office was open and running quite as usual, no outward sign showing the grief and indignation felt for our imprisoned comrades. Most of them refused bail and instantly hunger struck appearing in court for trial three days later in a pitiful state. Mrs. Drummond was so obviously ill and in need of medical attention that she was discharged and was very soon afterwards operated upon. Mr. Drew, the printer, was forced to sign an undertaking not to publish the paper again. The others were sentenced to terms varying from six to eighteen months. Mr. Clayton was sentenced to twenty-one months, and after desperate resistance, during which he was forcibly fed many times, escaped his prison. The others, following the same example, starved their way to liberty, and have ever since been pursued at intervals and rearrested under the Cat and Mouse Act.

After my discharge, April 12th, I remained in the nursing home until partially restored, then, under the eyes of the police, I motored out to Woking, the country home of my friend, Dr. Ethel Smyth. This house, like the nursing home, was guarded by a small army of police. I never went to the window, I never took the air in the garden without being conscious of watching eyes. The situation became intolerable, and I determined to end it. On May 26th there was a great meeting at the London Pavillion, and I gave notice that I would attend it. Supported by Dr. Flora Murray, Dr. Ethel Smyth and my devoted Nurse Pine, I walked downstairs, to be confronted at the door by a detective, who demanded to know where I was going. I was in a weak state, much weaker than I had imagined, and in refusing the right of a man to question my movements I exhausted the last remnant of my strength and sank fainting in the arms of my friends. As soon as I recovered I got into the motor car. The detective instantly took his place beside me and told the chauffeur to drive to Bow Street Station. The chauffeur replied that he took his orders only from Mrs. Pankhurst, whereupon the detective summoned a taxicab and, placing me under arrest, took me to Bow Street.

Under the Cat and Mouse Act a paroled prisoner can be thus arrested without the formality of a warrant, nor does the time she has spent at liberty, in regaining her health, count off from her prison sentence. The magistrate at Bow Street was therefore quite within his legal rights when he ordered me returned to Holloway. I felt it my duty, nevertheless, to point out to him the inhumanity of his

act. I said to him: "I was released from Holloway on account of my health. Since then I have been treated exactly as if I were in prison. It has become absolutely impossible for any one to recover health under such conditions, and this morning I decided to make this protest against a state of affairs unparalleled in a civilised country."

[Illustration: RE-ARREST OF MRS. PANKHURST AT WOKING

May 26, 1913]

The magistrate replied formally: "You quite understand what the position is. You have been arrested on this warrant and all I have to do is to make an order recommending you to prison."

"I think" I said, "that you should do so, with a full sense of responsibility. If I am taken to Holloway on your warrant I shall resume the protest I made before which led to my release, and I shall go on indefinitely until I die, or until the Government decide, since they have taken upon themselves to employ you and other people to administer the laws, that they must recognise women as citizens and give them some control over the laws of this country."

It was a five days' hunger strike this time, because the extreme weakness of my condition made it impossible for me to endure a longer term. I was released on May 30th on a seven days' licence, and in a half-alive state was again carried to a nursing home. Less than a week later, while I was still bed-ridden, a terrible event occurred, one that should have shaken the stolid British public into a realisation of the seriousness of the situation precipitated by the Government. Emily Wilding Davison, who had been associated with the militant movement since 1906, gave up her life for the women's cause by throwing herself in the path of the thing, next to property, held most sacred to Englishmen--sport. Miss Davison went to the races at Epsom, and breaking through the barriers which separated the vast crowds from the race course, rushed in the path of the galloping horses and caught the bridle of the King's horse, which was leading all the others. The horse fell, throwing his jockey and crushing Miss Davison in such shocking fashion that she was carried from the course in a dying condition. Everything possible was done to save her life. The great surgeon, Mr. Mansell Moullin, put everything aside and devoted himself to her case, but though he operated most skilfully, the injuries she had received were so frightful that she died four days later without once having recovered consciousness. Members of the Union were beside her when she breathed her last, on June 8th, and on June 14th they gave her a great public funeral in London. Crowds lined the streets as the funeral car, followed by thousands of women, passed slowly and sadly to St. George's Church, Bloomsbury, where the memorial services were held.

Emily Wilding Davison was a character almost inevitably developed by a struggle such as ours. She was a B. A. of London University, and had taken first class honours at Oxford in English Language and Literature. Yet the women's cause made such an appeal to her reason and her sympathies that she put every intellectual and social appeal aside and devoted herself untiringly and fearlessly to the work of the Union. She had suffered many imprisonments, had been forcibly fed and most brutally treated. On one occasion when she had barricaded her cell against the prison doctors, a hose pipe was turned on her from the window and she was drenched and all but drowned in the icy water while workmen were breaking down her cell door. Miss Davison, after this experience, expressed to several of her friends the deep conviction that now, as in days called uncivilised, the conscience of the people would awaken only to the sacrifice of a human life. At one time in prison she tried to kill herself by throwing herself head-long from one of the upper galleries, but she succeeded only in sustaining cruel injuries. Ever after that time she clung to her conviction that one great tragedy, the deliberate throwing into the breach of a human life, would put an end to the intolerable torture of women. And so she threw herself at the King's horse, in full view of the King and Queen and a great multitude of their Majesties' subjects, offering up her life as a petition to the King, praying for the release of suffering women throughout England and the world. No one can possibly doubt that that prayer can forever remain unanswered, for she took it straight to the Throne of the King of all the worlds.

The death of Miss Davison was a great shock to me and a very great grief as well, and although I was scarcely able to leave my bed I determined to risk everything to attend her funeral. This was not to be, however, for as I left the house I was again arrested by detectives who lay in waiting. Again the farce of trying to make me serve a three years' sentence was undertaken. But now the militant women had discovered a new and more terrible weapon with which to defy the unjust laws of England, and this weapon--the thirst strike--I turned against my gaolers with such effect that they were forced within three days to release me.

The hunger strike I have described as a dreadful ordeal, but it is a mild experience compared with the thirst strike, which is from beginning to end simple and unmitigated torture. Hunger striking reduces a prisoner's weight very quickly, but thirst striking reduces weight so alarmingly fast that prison doctors were at first thrown into absolute panic of fright. Later they became somewhat

hardened, but even now they regard the thirst strike with terror. I am not sure that I can convey to the reader the effect of days spent without a single drop of water taken into the system. The body cannot endure loss of moisture. It cries out in protest with every nerve. The muscles waste, the skin becomes shrunken and flabby, the facial appearance alters horribly, all these outward symptoms being eloquent of the acute suffering of the entire physical being. Every natural function is, of course, suspended, and the poisons which are unable to pass out of the body are retained and absorbed. The body becomes cold and shivery, there is constant headache and nausea, and sometimes there is fever. The mouth and tongue become coated and swollen, the throat thickens and the voice sinks to a thready whisper.

When, at the end of the third day of my first thirst strike, I was sent home I was in a condition of jaundice from which I have never completely recovered. So badly was I affected that the prison authorities made no attempt to arrest me for nearly a month after my release. On July 13th I felt strong enough once more to protest against the odious Cat and Mouse Act, and, with Miss Annie Kenney, who was also at liberty "on medical grounds," I went to a meeting at the London Pavillion. At the close of the meeting, during which Miss Kenney's prison licence was auctioned off for L12, we attempted for the first time the open escape which we have so frequently since effected. Miss Kenney, from the platform, announced that we should openly leave the hall, and she forthwith walked coolly down into the audience. The police rushed in in overwhelming numbers, and after a desperate fight, succeeded in capturing her. Other detectives and policemen hurried to the side door of the hall to intercept me, but I disappointed them by leaving by the front door and escaping to a friend's house in a cab.

The police soon traced me to the house of my friend, the distinguished scientist, Mrs. Hertha Ayrton, and the place straightway became a besieged fortress. Day and night the house was surrounded, not only by police, but by crowds of women sympathisers. On the Saturday following my appearance at the Pavillion we gave the police a bit of excitement of a kind they do not relish. A cab drove up to Mrs. Ayrton's door, and several well-known members of the Union alighted and hurried indoors. At once the word was circulated that a rescue was being attempted, and the police drew resolutely around the cab. Soon a veiled woman appeared in the doorway, surrounded by Suffragettes, who, when the veiled lady attempted to get into the cab, resisted with all their strength the efforts of the police to lay hands upon her. The cry went up from all sides: "They are arresting Mrs. Pankhurst!" Something very like a free fight ensued, occupying all the attention of the police who were not in the immediate vicinity of the cab. The men surrounding that rocking vehicle succeeded in tearing the veiled figure from the arms of the other women and piling into the cab ordered the chauffeur to drive full speed to Bow Street. Before they reached their destination, however, the veiled lady raised her veil--alas, it was not Mrs. Pankhurst, who by that time was speeding away in another taxicab in quite another direction.

Our ruse infuriated the police, and they determined to arrest me at my first public appearance, which was at the Pavillion on the Monday following the episode just related. When I reached the Pavillion I found it literally surrounded by police, hundreds of them. I managed to slip past the outside cordon, but Scotland Yard had its best men inside the hall, and I was not permitted to reach the platform. Surrounded by plain clothes men, batons drawn, I could not escape, but I called out to the women that I was being taken, and so valiantly did they rush to the rescue that the police had their hands full for nearly half an hour before they got me into a taxicab bound for Holloway. Six women were arrested that day, and many more than six policemen were temporarily incapacitated for duty.

By this time I had made up my mind that I would not only resist staying in prison, I would resist to the utmost of my ability going to prison. Therefore, when we reached Holloway I refused to get out of the cab, declaring to my captors that I would no longer acquiesce in the slow judicial murder to which the Government were subjecting women. I was lifted out and carried into a cell in the convicted hospital wing of the gaol. The wardresses who were on duty there spoke with some kindness to me, suggesting that, as I was very apparently exhausted and ill, I should do well to undress and go to bed. "No," I replied, "I shall not go to bed, not once while I am kept here. I am weary of this brutal game, and I intend to end it."

Without undressing, I lay down on the outside of the bed. Later in the evening the prison doctor visited me, but I refused to be examined. In the morning he came again, and with him the Governor and the head wardress. As I had taken neither food nor water since the previous day my appearance had become altered to such an extent that the doctor was plainly perturbed. He begged me, "as a small concession," to allow him to feel my pulse, but I shook my head, and they left me alone for the day. That night I was so ill that I felt some alarm for my own condition, but I knew of nothing that could be done except to wait. On Wednesday morning the Governor came again and asked me with an assumption of carelessness if it were true that I was refusing both food and water. "It is true," I said, and he replied brutally: "You are very cheap to keep." Then, as if the thing were not a ridiculous farce, he announced that I was sentenced to close confinement for three days, with deprivation of all privileges, after which he left my cell.

Twice that day the doctor visited me, but I would not allow him to touch me. Later came a medical officer from the Home Office, to which I had complained, as I had complained to the Governor and the prison doctor, of the pain I still suffered from the rough treatment I had received at the Pavillion. Both of the medical men insisted that I allow them to examine me, but I said: "I will not be examined by you because your intention is not to help me as a patient, but merely to ascertain how much longer it will be possible to keep me alive in prison. I am not prepared to assist you or the Government in any such way. I am not prepared to relieve you of any responsibility in this matter." I added that it must be quite obvious that I was very ill and unfit to be confined in prison. They hesitated for a moment or two, then left me.

Wednesday night was a long nightmare of suffering, and by Thursday morning I must have presented an almost mummified appearance. From the faces of the Governor and the doctor when they came into my cell and looked at me I thought that they would at once arrange for my release. But the hours passed and no order for release came. I decided that I must force my release, and I got up from the bed where I had been lying and began to stagger up and down the cell. When all strength failed me and I could keep my feet no longer I lay down on the stone floor, and there, at four in the afternoon, they found me, gasping and half unconscious. And then they sent me away. I was in a very weakened condition this time, and had to be treated with saline solutions to save my life. I felt, however, that I had broken my prison walls for a time at least, and so this proved. It was on July 24th that I was released. A few days later I was borne in an invalid's chair to the platform of the London Pavillion. I could not speak, but I was there, as I had promised to be. My licence, which by this time I had ceased to tear up because it had an auction value, was sold to an American present for the sum of one hundred pounds. I had told the Governor on leaving that I intended to sell the licence and to spend the money for militant purposes, but I had not expected to raise such a splendid sum as one hundred pounds. I shall always remember the generosity of that unknown American friend.

A great medical congress was being held in London in the summer of 1913, and on August 11th we held a large meeting at Kingsway Hall, which was attended by hundreds of visiting doctors. I addressed this meeting, at which a ringing resolution against forcible feeding was passed, and I was allowed to go home without police interference. It was, as a matter of fact, the second time during that month that I had spoken in public without molestation. The presence of so many distinguished medical men in London may have suggested to the authorities that I had better be left alone for the time being. At all events I was left alone, and late in the month I went, quite publicly, to Paris, to see my daughter Christabel and plan with her the campaign for the coming autumn. I needed rest after the struggles of the past five months, during which I had served, of my three years' prison sentence, not quite three weeks.

FOOTNOTE:

[5] Mr. Lansbury shortly before this had resigned his seat in Parliament and had gone to his constituents on the question of women's suffrage. Both the Liberal and the Conservative parties had united against him, with the result that a Unionist candidate was returned in his place. Mr. Lloyd-George publicly rejoiced in the result of this election, saying that Mr. Marsh, the Conservative candidate, had been his man. The Labour Party, in Parliament and out, meekly accepted this piece of Liberal chicanery without protest.

CHAPTER VII

The two months of the summer of 1913 which were spent with my daughter in Paris were almost the last days of peace and rest I have been destined since to enjoy. I spent the days, or some hours of them, in the initial preparation of this volume, because it seemed to me that I had a duty to perform in giving to the world my own plain statement of the events which have led up to the women's revolution in England. Other histories of the militant movement will undoubtedly be written; in times to come when in all constitutional countries of the world, women's votes will be as universally accepted as men's votes are now; when men and women occupy the world of industry on equal terms, as co-workers rather than as cut-throat competitors; when, in a word, all the dreadful and criminal discriminations which exist now between the sexes are abolished, as they must one day be abolished, the historian will be able to sit down in leisurely fashion and do full justice to the strange story of how the women of England took up arms against the blind and obstinate Government of England and fought their way to political freedom. I should like to live long enough to read such a history, calmly considered, carefully analysed, conscientiously set forth. It will be a better book to read than this one, written, as it were, in camp between battles. But perhaps this one, hastily prepared as it has been, will give the reader of the future a clearer impression of the strenuousness and the desperation of the conflict, and also something of the heretofore undreamed of courage and fighting strength of women, who, having learned the joy of battle, lose all sense of fear and continue their struggle up to and

past the gates of death, never flinching at any step of the way.

Every step since that meeting in October, 1912, when we definitely declared war on the peace of England, has been beset with danger and difficulty, often unexpected and undeclared. In October, 1913, I sailed in the French liner, _La Provence_, for my third visit to the United States. My intention was published in the public press of England, France and America. No attempt at concealment of my purpose was made, and in fact, my departure was witnessed by two men from Scotland Yard. Some hints had reached my ears that an attempt would be made by the Immigration Officers at the port of New York to exclude me as an undesirable alien, but I gave little credit to these reports. American friends wrote and cabled encouraging words, and so I passed my time aboard ship quite peacefully, working part of the time, resting also against the fatigue always attendant on a lecture tour.

[Illustration: MRS. PANKHURST AND CHRISTABEL IN THE GARDEN OF CHRISTABEL'S HOME IN PARIS]

We came to anchor in the harbour of New York on October 26th, and there, to my astonishment, the Immigration authorities notified me that I was ordered to Ellis Island to appear before a Board of Special Inquiry. The officers who served the order of detention did so with all courtesy, even with a certain air of reluctance. They allowed my American travelling companion, Mrs. Rheta Childe Dorr, to accompany me to the Island, but no one, not even the solicitor sent by Mrs. O. H. P. Belmont to defend me, was permitted to attend me before the Board of Special Inquiry. I went before these three men quite alone, as many a poor, friendless woman, without any of my resources, has had to appear. The moment of my entrance to the room I knew that extraordinary means had been employed against me, for on the desk behind which the Board sat I saw a complete _dossier_ of my case in English legal papers. These papers may have been supplied by Scotland Yard, or they may have been supplied by the Government. I cannot tell, of course. They sufficed to convince the Board of Special Inquiry that I was a person of doubtful character, to say the least of it, and I was informed that I should have to be detained until the higher authorities at Washington examined my case. Everything was done to make me comfortable, the rooms of the Commissioner of Immigration being turned over to me and my companion. The very men who found me guilty of moral obloquy--something of which no British jury has ever yet accused me--put themselves out in a number of ways to make my detention agreeable. I was escorted all over the Island and through the quarters assigned detained immigrants, whose right to land in the United States is in question. The huge dining-rooms, the spotless kitchens and the admirably varied bill of fare interested and impressed me. Nothing like them exists in any English institution.

I remained at Ellis Island two and a half days, long enough for the Commissioner of Immigration at Washington to take my case to the President who instantly ordered my release. Whoever was responsible for my detention entirely overlooked the advertising value of the incident. My lecture tour was made much more successful for it and I embarked for England late in November with a very generous American contribution to our war chest, a contribution, alas, that I was not permitted to deliver in person.

The night before the White Star liner _Majestic_ reached Plymouth a wireless message from headquarters informed me that the Government had decided to arrest me on my arrival. The arrest was made, under very dramatic conditions, the next day shortly before noon. The steamer came to anchor in the outer harbour, and we saw at once that the bay, usually so animated with passing vessels, had been cleared of all craft. Far in the distance the tender, which on other occasions had always met the steamer, rested at anchor between two huge grey warships. For a moment or two the scene halted, the passengers crowding to the deckrails in speechless curiosity to see what was to happen next. Suddenly a fisherman's dory, power driven, dashed across the harbour, directly under the noses of the grim war vessels. Two women, spray drenched, stood up in the boat, and as it ploughed swiftly past our steamer the women called out to me: "The Cats are here, Mrs. Pankhurst! They're close on you--" Their voices trailed away into the mist and we heard no more. Within a minute or two a frightened ship's boy appeared on deck and delivered a message from the purser asking me to step down to his office. I answered that I would certainly do nothing of the kind, and next the police swarmed out on deck and I heard, for the fifth time that I was arrested under the Cat and Mouse Act. They had sent five men from Scotland Yard, two men from Plymouth and a wardress from Holloway, a sufficient number, it will be allowed, to take one woman from a ship anchored two miles out at sea.

Following my firm resolve not to assist in any way the enforcing of the infamous law, I refused to go with the men, who thereupon picked me up and carried me to the waiting police tender. We steamed some miles up the Cornish coast, the police refusing absolutely to tell me whither they were conveying me, and finally disembarked at Bull Point, a Government landing-stage, closed to the general public. Here a motor car was waiting, and accompanied by my bodyguard from Scotland Yard and Holloway, I was driven across Dartmoor to Exeter, where I had a not unendurable imprisonment and hunger strike of four days. Everyone from the Governor of the prison to the wardresses were openly sympathetic and kind, and I was told by one confidential official that they kept me only because they had orders to do so until after the great meeting at Empress Theatre, Earls Court, London, which had

been arranged as a welcome home for me. The meeting was held on the Sunday night following my arrest, and the great sum of L15,000 was poured into the coffers of militancy. This included the L4,500 which had been collected during my American tour.

Several days after my release from Exeter I went openly to Paris to confer with my daughter on matters relating to the campaign about to open, returning to attend a W. S. P. U. meeting on the day before my license expired. Nevertheless the boat train carriage in which I travelled with my doctor and nurse was invaded at Dover town by two detectives who told me to consider myself under arrest. We were making tea when the men entered, but this we immediately threw out of the window, because a hunger strike always began at the instant of arrest. We never compromised at all, but resisted from the very first moment of attack.

The reason for this uncalled for arrest at Dover was the fear on the part of the police of the body guard of women, just then organised for the expressed purpose of resisting attempts to arrest me. That the police, as well as the Government were afraid to risk encountering women who were not afraid to fight we had had abundant testimony. We certainly had it on this occasion, for knowing that the body guard was waiting at Victoria Station, the authorities had cut off all approaches to the arrival platform and the place was guarded by battalions of police. Not a passenger was permitted to leave a carriage until I had been carried across the arrival platform between a double line of police and detectives and thrown into a forty horse power motor car, guarded within by two plain clothes men and a wardress, and without by three more policemen. Around this motor car were twelve taxi-cabs filled with plain clothes men, four to each vehicle, and three guarding the outside, not to mention the driver, who was also in the employ of the police department. Detectives on motor cycles were on guard at various points ready to follow any rescuing taxicab.

Arrived at Holloway I was again lifted from the car and taken to the reception room and placed on the floor in a state of great exhaustion. When the doctor came in and told me curtly to stand up I was obliged to tell him that I could not stand. I utterly refused to be examined, saying that I was resolved to make the Government assume full responsibility for my condition. "I refuse to be examined by you or any prison doctor," I declared, "and I do this as a protest against my sentence, and against my being here at all. I no longer recognise a prison doctor as a medical man in the proper sense of the word. I have withdrawn my consent to be governed by the rules of prison; I refuse to recognise the authority of any prison official, and I therefore make it impossible for the Government to carry out the sentence they have imposed upon me."

Wardresses were summoned, I was placed in an invalid chair and so carried up three flights of stairs and put into an unwarmed cell with a concrete floor. Refusing to leave the chair I was lifted out and placed on the bed, where I lay all night without removing my coat or loosening my garments. It was on a Saturday that the arrest had been made, and I was kept in prison until the following Wednesday morning. During all that time no food or water passed my lips, and I added to this the sleep strike, which means that as far as was humanly possible I refused all sleep and rest. For two nights I sat or lay on the concrete floor, resolutely refusing the oft repeated offers of medical examination. "You are not a doctor," I told the man. "You are a Government torturer, and all you want to do is to satisfy yourself that I am not quite ready to die." The doctor, a new man since my last imprisonment, flushed and looked extremely unhappy. "I suppose you do think that," he mumbled.

On Tuesday morning the Governor came to look at me, and no doubt I presented by that time a fairly bad appearance. At least I gathered as much from the alarmed expression of the wardress who accompanied him. To the Governor I made the simple announcement that I was ready to leave prison and that I intended to leave very soon, dead or alive. I told him that from that moment I should not even rest on the concrete floor, but should walk my cell until I was released or until I died from exhaustion. All day I kept to this resolution, pacing up and down the narrow cell, many times stumbling and falling, until the doctor came in at evening to tell me that I was ordered released on the following morning. Then I loosened my gown and lay down, absolutely spent, and fell almost instantly into a death-like sleep. The next morning a motor ambulance took me to the Kingsway headquarters where a hospital room had been arranged for my reception. The two imprisonments in less than ten days had made terrible drafts on my strength, and the coldness of the Holloway cell had brought on a painful neuralgia. It was many days before I recovered even a tithe of my usual health.

These two arrests resulted exactly as the Government should have known that they would result, in a great outbreak of fresh militancy. As soon as the news spread that I had been taken at Plymouth a huge fire broke out in the timber yards at Richmond Walk, Devenport, and an acre and a half of timber, beside a pleasure fair and a scenic railway adjacent, to the value of thousands of pounds was destroyed. No one ever discovered the cause of the fire, the greatest that ever occurred in the neighbourhood, but tied to one of the railings was a copy of the _Suffragette_ and to another railing two cards, on one of which was written a message to the Government: "How dare you arrest Mrs. Pankhurst and allow Sir Edward Carson and Mr. Bonar Law to go free?" The second card bore the words: "Our reply to the torture of Mrs. Pankhurst, and her cowardly arrest at Plymouth."

Besides this fire, which waged fiercely from midnight until dawn, a large unoccupied house at Bristol was destroyed by fire; a fine residence in Scotland, also unoccupied, was badly damaged by fire; St. Anne's Church in a suburb of Liverpool was partly destroyed; and many pillar boxes in London, Edinburgh, Derby and other cities were fired. In churches all over the Kingdom our women created consternation by interpolating into the services reverently spoken prayers for prisoners who were suffering for conscience' sake. The reader no doubt has heard of these interruptions, and if so he has read of brawling, shrieking women, breaking into the sanctity of religious services, and creating riot in the House of God. I think the reader should know exactly what does happen when militants, who are usually religious women, interrupt church services. On the Sunday when I was in Holloway, following my arrest at Dover, certain women attending the afternoon service at Westminster Abbey, chanted in concert the following prayer: "God save Emmeline Pankhurst, help us with Thy love and strength to guard her, spare those who suffer for conscience' sake. Hear us when we pray to Thee." They had hardly finished this prayer when vergers fell upon them and with great violence hustled them out of the Abbey. One kneeling man, who happened to be near one of the women, forgot his Christian intercessions long enough to beat her in the face with his fists before the vergers came.

Similar scenes have taken place in churches and cathedrals throughout England and Scotland, and in many instances the women have been most barbarously treated by vergers and members of the congregations. In other cases the women not only have been left unmolested, but have been allowed to finish their prayers amid deep and sympathetic silence. Some clergymen have even been brave enough to add a reverent amen to these prayers for women in prison, and it has happened that clergymen have voluntarily offered prayers for us. The Church as a whole, however, has undoubtedly failed to live up to its obligation to demand justice for women, and to protest against the torture of forcible feeding. During the year just closing we sent many deputations to Church authorities, the Bishops, one after another having been visited in this manner. Some of the Bishops, including the reactionary Archbishop of Canterbury, refused to accord the desired interview, and when that happened, the answer of the deputation was to sit on the doorstep of the episcopal residence until surrender followed--as it invariably did.

As Holloway Gaol is within his diocese, the Bishop of London was visited by the W. S. P. U. and the demand was made that the Bishop himself should witness forcible feeding in order to realise the horror of the proceeding. He did visit two of the tortured women, but he did not see them forcibly fed, and when he came out he gave the public an account of his interview with them which was in effect the Government's version of the facts. The W. S. P. U. was naturally indignant, while all the Government's friends hailed the Bishop as a supporter of the policy of torture. Only those who have suffered the pain and agony, not to speak of the moral humiliation of forcible feeding can realise the depths of the iniquity which the Bishop of London was manoeuvred by the Govern

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PART VIII.

THE AQUEDUCTS.

THE ARCHÆOLOGY OF ROME,

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THE AQUEDUCTS.

=OXFORD:= JAMES PARKER AND CO. =LONDON:= JOHN MURRAY, ALBEMARLE-STREET. 1876.

[Illustration]

THE AQUEDUCTS.

PREFACE TO THE AQUEDUCTS.

It is impossible to understand the archæology of Rome without studying the Aqueducts. In every part of the City, and of the country round it, there are remains of them; they are frequently mistaken for something else, and called by other names, misleading those who have not given attention to the subject. They are necessarily mixed up with the _Thermæ_, for most of the aqueducts were made to bring water to those great establishments. There was also a reservoir of water supplied by the aqueducts under each of the palaces, larger houses and villas, as may be seen in many parts of the Palatine, under the palaces of the Cæsars. In their original state the Aqueducts must have been among the grandest objects in Rome, and the most conspicuous in all directions. The principal approach from the east passed between two fine arcades of the aqueducts, one carrying three of them, the other two. These two fine arcades were not more than a hundred yards apart; all the great roads from the eastern side were brought into this space, and certainly, for the last mile into Rome, must have had one of these arcades on either hand: to the left, or south, the Claudian arcade, fifty feet high; to the right, the Marcian, thirty feet high.

For the last half-mile, the Claudian arcade was also the boundary of the palace gardens of the Sessorium, the residence first of the Kings and afterwards of one branch of the imperial family (that of Verus or Varius), who resided there for more than a century. That portion of the arcade still exists for a considerable extent, forming the northern wall of that garden, and at the same time part of the wall of the city, Aurelian having adopted it, and incorporated it with his great wall. This portion is thoroughly shewn in my Photographs, as it is a very important part of the antiquities of Rome, and illustrates many points. It was the place where the principal aqueducts entered Rome, and the whole ground is full of remains of them with their reservoirs and filtering-places. The inner side of the wall is the part necessarily shewn, because the outer side is concealed by the arcade of the Aqua Felice, excepting in places where the _specus_ of the Claudia and the Anio Novus appear above it. Just outside of this garden, at the west end of it, is the great foss which separated the Sessorium, or fortified palace, from the other fortifications of the City, and in it are remains of the two great reservoirs that were probably the Gemelli or Twins of Frontinus, made originally for the Appia and the Anio Vetus side by side, and used afterwards to receive the surplus water of the later aqueducts on a higher level. We then have a considerable number of the Arches of Nero, following a straight line for another mile to the west end of the Cœlian Hill; where remains of the great reservoir are on a level with the _specus_ carried on the top of this arcade, fifty feet above the ground in that high situation, from which the water was distributed in all directions, first on other arcades, three of which branched off from this point, and afterwards in metal pipes when it was sub-divided; but for the main supply no metal pipes then to be had were large and

strong enough to bear the pressure of a stream of water four feet deep and two feet wide, running at the rate of five or six miles an hour, if not more. The direct line went on over the Palatine to the Capitol, passing over the Forum Romanum on the bridge of Caligula, of which, also, some remains are shewn in my Photographs; the other two branches from the great reservoir over the Arch of Dolabella, went one to the right to the Colosseum (to supply the Stagna there), the other to the left to the Aventine, to supply the private house of Trajan and the Thermæ of Sura.

The Porta Maggiore stood at the end of the long vista between the two great aqueducts, and was itself made out of two of the arches of the Claudian arcade, in the last of the angles that occurred at every half-mile. The penultimate one was at the eastern end of the Sessorium palace gardens, where this water entered Rome, and then, after passing the angle to the north, with the usual _piscina_ and _castellum aquæ_, or reservoir and filtering-place, turned again to the west, as far as that gate where the Claudian arcade terminated. From this point the Marcian turned to the north upon the great bank of earth which formed the outer defence of Rome in that part, and continued along it for another half-mile, as far as the Porta di S. Lorenzo, and beyond it to the Prætorian Camp; then turning again to the west, it went across the great inner foss between the outer bank, the great _agger_ of Servius Tullius, which formed the inner line, where remains of it were found near the railway station in 1871, with inscriptions on two of the _cippi_, stating that the three aqueducts passed there. It is not quite correct to say that the _arcades_ were carried there, because where the ground is high the _specus_ are carried underground. This is the case between the Porta Maggiore (the Porta Esquilina of Frontinus) and the Porta di S. Lorenzo (the Porta Viminalis of the same). The _specus_ is seen on arches close to each of the gates; but, between the two, it passed underground through a sort of hillock, about midway between the two gates, as is mentioned by Frontinus. The ground is high again near the Porta Chiusa at the Prætorian Camp, and in the great bank or _agger_ of Servius Tullius.

These two great arcades are those chiefly known to visitors to Rome as THE AQUEDUCTS; but the underground aqueducts are at least equally interesting when understood. The Anio Vetus being near the surface can be traced all over Rome; the Appia being very deep, is not so easily traced, and can only be seen with certainty near its source and its mouth. There are other arcades nearly as fine as these; but, as they do not come so near Rome, they are less known; in the parts nearest to the City they are either underground or destroyed. One of them is that called Alexandrina by Fabretti; but the original parts of it are of the time of Hadrian and Trajan. This runs from the source near Gabii and Labicum, now la Colonna, to the place called _Cento-Celle_. Possibly some of the hundred cells or vaults found there and supposed to have been all tombs, were really reservoirs of water. At every great villa there are always remains of these great cisterns for the supply of water, and this is about three miles from Rome, where a great villa of Hadrian was situated. This arcade extends for miles across the country between the two great roads, one from Gabii, the other from Preneste (now Palestrina). Another fine arcade is seen on the road to Albano, at the Tor di Mezza Via (or half-way house). This has been ascertained to be the Aqua Aurelia, which goes to the villa of the Quintilii on the Via Appia, and from thence into Rome to supply the Thermæ of Commodus and Severus, of which also remains have been found; the latter part of its course is chiefly underground.

It was very difficult at first to ascertain to which of the aqueducts each of the remains belonged that were seen on all sides; and I found it necessary to follow each aqueduct up to its source, and then down to its mouth, in order to ascertain this. This work has taken me some years, in connection with the other branches of the general subject of the Archæology of Rome. It has now been done, with one exception,—the aqueduct made to bring water to the Thermæ of Diocletian on the Viminal,—which has not been traced; but there is great probability that it was a branch from one of the older aqueducts, probably brought across from the great reservoir where the Nymphæum of Alexander Severus was situated, on which the Trophies of Marius were hung. This is on high ground, and at a short distance only, so that it would be very convenient for the purpose. We see that there are several branches from that point, and one of them probably supplied these great Thermæ, for which purpose more than one aqueduct would be tapped. It may be that the curious sort of tower reservoir—long supposed to have been a tomb, a short distance to the south of the Trophies of Marius—was the one for these Thermæ; in either case, these reservoirs were supplied from the great old aqueducts.

I may almost say that wherever the aqueducts are visible, they can now be seen in my Photographs, and in some places the remains have been destroyed since these were taken, during what is called the _Restoration_ of the City Walls. Perhaps the finest and most interesting part of the Aqueducts are the great cascades at the source of the Anio Novus above Subiaco, in the bed of that river, situated in some of the finest scenery in the world. Among later works the ingenious manner in which the bed of the small river Almo is made use of to carry the water of two other mountain streams, the Aqua Crabra and the Marrana, the water of which never fails; and the manner in which the tunnel of the Aqua Julia has been used again in the twelfth century, are the most curious and interesting. This had hitherto escaped observation, and was not easily traced. The Aqua Felice was unfortunately carried out in

a very rude manner; the plan of the Pope was a good one, but was spoiled by the ignorance of the engineer.

The new aqueduct, the Aqua Marcia-Pia, restoring the celebrated Aqua Marcia to use in Rome, is a work deserving of high commendation. It is much to be regretted that my lamented friend the late Mr. Shepherd, to whose energy and perseverance we are chiefly indebted for this, did not live to see the completion of his work. Much credit is also due to Signor Moraldi, the originator of the scheme, to whom the Company still pay a premium, which he well deserves. His map[1] of the Aqua Marcia, of which he kindly gave me a photograph, was of great service to me, as far as it went; but I saw it was necessary to go further, and include all the Aqueducts on the eastern side of Rome. I was fortunate in meeting with Dr. Fabio Gori, who is a native of Subiaco, and has been interested in the Aqueducts from his boyhood. He shewed me that Signor Moraldi had not gone quite far enough, and that the real spring of the Marcia is about a mile further from Rome than the one he supposed to be so, which was a subsidiary spring, though of equally good water. At the original source the stone _specus_ was found, having been long concealed by being a foot or two under water. I saw it, and stood upon it, and had a photograph made, so that there could be no mistake, and the engineer of the company also saw it, and carried his aqueduct to that point; so that the real ancient Aqua Marcia now comes into Rome again, and is getting rapidly into general use, being much the best drinking water. The water supply of ancient Rome has long been a subject of interest, and can now be more perfectly understood than it ever could before. The series of Photographs of them are a thorough illustration of their history, such as could not have been made before that art was invented.

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and the Piazza della Navicella, to the Aventine, the Palatine, and the Colosseum.

Map of the Aqueducts on the Eastern side of Rome, from their Sources above Subiaco, and on the bank of the river Anio, to Rome, and their mouths in the Tiber.

—— Western side of Rome, from their Sources in the lakes on the hills, called Alseatina and Sabatina, or Anguillara.

CHAPTER IV. PART I.

THE AQUEDUCTS.

In treating of the Aqueducts we have a trustworthy guide in a writer who flourished in the time of the Emperors Nerva and Trajan, namely, SEXTUS JULIUS FRONTINUS[2]. While he informs us of what improvements he made during the time he had the charge of these important public works, he also gives in his treatise a historical account of the several changes which had been from time to time made in the means of supply of water to the Imperial City, which kept pace with the growing wealth and population of Rome. When he died they had probably reached perfection, and were justly the admiration and surprise of all travellers[3].

His treatise is well worth examination, not only from an archæological point of view, but as suggesting also many curious enquiries as to the engineering abilities which the Romans possessed, compared with those exhibited at the present day. In elucidating, however, the architectural antiquities of the city of Rome, it will be necessary, as far as possible, to limit the extracts from his treatise _De Aquæductibus_, to those portions which refer either directly to existing remains, or which indirectly explain them, by pointing out the principle on which the several Roman aqueducts seem to have succeeded each other.

Frontinus tells us in his fourth chapter, that for 441 years after the building of the city, or until B.C. 312, the people were content with the water which they could draw from the Tiber, or from wells[4] or from springs, of some of which the memory was in his time still held sacred and honoured, for they were thought to afford health to the sick[5].

Passing to his own time, he says, “there now flow into the city:”—

I. Aqua Appia. II. Anio Vetus. III. Aqua Marcia. IV. ” Tepula. V. ” Julia. VI. Aqua Virgo. VII. ” Alsietina (which is also called Augusta[6]). VIII. ” Claudia. IX. Anio Novus.

Frontinus describes the above nine aqueducts in order, giving details as to the source of the water in each, the quantity, and the distribution. Such extracts as are calculated to throw light upon the existing remains, are given in the course of the following remarks. Seven other Aqueducts were added after the time of Frontinus at different periods, of which an account will also be found in the second part of this Chapter.

I. THE AQUA APPIA (A.U.C. 441, B.C. 312).

“The _Aqua Appia_ was brought into Rome by the censor Appius Claudius Crassus, afterwards called _Cæcus_ (the blind), who also caused the Via Appia to be constructed from the Porta Capena to the city of Capua[7].”

“The Appian stream rises in the Lucullan fields on the Via Prænestina, between the seventh and eighth milestone, and about 780 paces (or about ¾ of a mile) off on the left-hand side. The channel from its source to the ‘_Salinæ_,’ which is a spot near the Porta Trigemina, measures 11 miles, 190 paces (about 300 yards) in length. For 11 miles, 130 paces, (about 200 yards,) the channel runs underground, and for 60 paces (about 100 yards) it is carried above ground on a substructure and arcade (in the part) nearest to the Porta Capena[8]. At the ‘_Spes (Specus) Vetus_,’ (the old _specus_ or conduit,) on the confines of the Torquatian and Pallantian gardens, a branch called the _Augustan_ was added to it by Augustus as supplementary, whence it received the name of ‘Gemelli[9]’....”

“The distribution of the Appian water begins at the bottom of the _Clivus Publicii_ at the Porta Trigemina[10]; the stream having passed beneath the Cœlian and Aventine Hills.”

“... The measure at the head of this could not be obtained because it consists of two channels. At the Gemelli, however, which is under[11] the _Spem (Specum) Veterem_, (the old conduit,) where it joined with the Augustan branch, I found the height or depth of the water to be 5 ft., the width 1 ft. 9 in., which makes the area 8 ft. 9 in.: ... it should be noticed that the water in many parts of the City was observed to be lost, that is, by trickling away. Moreover we found some of it intercepted by illegal pipes within the City;

without the City, owing to the pressure, that which was underground (at the head 50 ft.), received no injury[12].”

The Lucullan fields, in which are the sources of the Aqua Appia, are nearly due east from Rome, on the bank of the river Anio, at about six miles from the present gates of Rome, and three quarters of a mile off the Via Collatina, now a cart-road. This is the old Via Prænestina, which went through Collatia, now called Lunghezza, about two miles higher up the river Anio, at the point where the smaller river Osa falls into it. In this part the old paved road remains for some distance in use, both before and after the entrance to Collatia, and was the more direct road; the present carriage-road, now called Prænestina, was the Via Gabina, and went through or near to Gabii, but was not so direct a line to Præneste or Palestrina as the one through Collatia. The old road passes close in front of the ancient stone quarries, on the bank of the Anio, in which one of the springs or reservoirs of the Aqua Appia is situated; the pavement of it remains, and is now used as a foot-path only.

There are several springs or sources for this aqueduct, and also several ponds to collect the rain-water, made in the clay, the water from all of which was collected into a central reservoir cut in the rock, with a large well over it. There are also seventeen wells visible in two lines, eight in one and nine in the other, converging and meeting in the central reservoir. The soil is clay upon stone. The _specus_ is here a large tunnel cut in the rock, and the wells descend into it. They may be distinguished from above by the bramble-bushes which grow over and cover each of the openings, and do not grow on the other part of the field; each well is also protected by a wooden rail, to hinder cattle from falling into it. The water still runs through in some parts. Near to this reservoir is a tomb of very early character, similar to what are usually called Etruscan[13] tombs, cut out of the rock.

As the length of its course was rather more than eleven miles, while the distance by the Via Prænestina direct was only between seven and eight, it is clear that it did not follow that road. It was carried to the south towards the Via Labicana by a winding course, according to the levels of the ground. The Aqua Virgo, whose source is in the same Lucullan fields as the Appia, is carried to the north by another winding course of a greater length, to supply the northern parts of the city.

The course of _the old Via Prænestina_[14] has undergone but little change, and the 7th milestone is soon measured. A little beyond it, and 780 paces off on the left of the road (i.e. on the northern side), we are brought to a point[15] where the sources of the Aqua Appia are still to be seen in caves formed by ancient stone quarries, near a tenement called _La Rustica_. One cave is of a triple form, with three springs, and the soil above the stone is much mixed with clay. These three springs meet at the mouth of the cave in one stream, which runs in the old _specus_ cut in the rock, but open at the top, and having the appearance of a mere country ditch, half hid by the grass and weeds in the winter, and in the summer months entirely concealed by them. This _specus_ runs across a low meadow for about a quarter of a mile. It crosses the line of the Aqua Virgo, the respirators of which cross this meadow in an opposite direction; the sources of the Virgo are about a mile further from Rome, on the same road. It then enters the rock again in a tunnel, and at this point is the first _castellum_ or reservoir, with a large circular well cut out of the rock, which forms the vault over it. There are the grooves for sluices at each end of the reservoir, and an opening has been made into the tunnel a little beyond this reservoir. The course of the aqueduct is then in a tunnel entirely underground, in the direction of a series of ancient caves, through which, or by which, it must pass, but being underground it cannot be seen. These caves are evidently an ancient stone quarry, but of later character than the one first mentioned. In the earliest one, at the source, the stone has been split off the rock, not cut; in the other caves, the stone has been well cut, and of these many are to be seen, the openings being large square apertures like doorways, but side by side in the face of the scarped cliff, not following each other: a practice common in quarrying, where the circumstances require it, down to the present day. Between the chambers are massive square or oblong piers, left to support the vault and the earth above. At the bottom of one of these chambers is water running from another spring, and the shepherds state that there is an opening from it to the _specus_ of the aqueduct; but as the bottom is filled up to the depth of several feet with broken stone, it cannot be seen. Some of the chambers of this ancient quarry have been used as a burying-place, probably for the neighbouring town of Collatia. The graves are cut out in the side of the walls, like the _loculi_, and there are also chambers like the _cubicula_ of a catacomb. The tombs of this necropolis of Collatia are very ancient, perhaps anterior to the Kings of Rome, and certainly not posterior to the Republic. This stone has been cut out in large square or oblong blocks, such as are usual in work of the time of the Kings; it is probable that Appius Claudius made use of a quarry which he found, and that the ground was not excavated for the purpose of the aqueduct only.

From this point the course was entirely underground, therefore no traces are visible without some difficulty. Incidentally, as we have seen, Frontinus notes, that at the head the water ran as much as fifty feet below the surface, and was thus protected from being fraudulently diverted. It could not have taken a very direct line, as the levels of the crossing valleys must have necessitated here and there a circuitous course; and moreover this is clearly implied by Frontinus, who says that the total length from the source to the “Salinæ” was more than eleven miles, while the distance in a direct line is less than nine miles. As it had no _piscina_[16], it

flowed on in an uninterrupted course to the spot where it was distributed for the public service.

One branch seems to have entered Rome under the line of the Claudian arcade, near the Porta Maggiore[17], and its course within the city is not difficult to follow, since for certain purposes access has been made in more than one place into the old _specus_, part of which is used to carry the lead pipes of the Aqua Felice to the Hospital of the Lateran and other places. From the surface where one of the shafts is situated to the bottom of the channel, is a depth of twenty-five feet. No water runs along it at present, except in the metal pipes from the Aqua Felice, belonging to the modern system.

The direction of this channel, after it enters Rome, happens to be easily seen above, as it is marked throughout its course, from the eastern end of the Cœlian to the Arch of Dolabella, by the fine arches of the Neronian branch from the Claudian Aqueduct erected almost over it. It is very probable that one of the laws (referred to by Frontinus as having been in existence long before his time) respecting aqueducts was in force from the commencement, namely, that there should be no buildings of any kind within ten feet on either side of the aqueducts; thus an open space was probably existing at the time when Nero wished to carry water to his magnificent reservoir at the north-western end of the Cœlian, and of this he availed himself in rearing the splendid arcade which is called by his name. It will be remarked, however, that the brick buttresses actually came down to the flat roof of the original _specus_ of the Appian. The top of that _specus_ was raised to a greater height by the engineers of Sixtus V., and in this enlargement the underground supports of the Neronian arches are cut through to give headway to the _aquarii_ passing along the channel. They have however to stoop their heads as they pass under each buttress.

The old tunnel _specus_ was discovered in the time of Sixtus V., (Felice Peretti), filled up by clay deposit to the depth of three feet, or half the height of the _specus_, as in other places, and the builders found it easier to raise it, for the _aquarii_ to go along it, than to clear it out. They therefore knocked away the flat tile-covering of the time of Nero, and raised a vault of rubble-stone three feet higher.

From the great subterranean reservoir, still in use for the water of a spring, near the Arch of Dolabella, to the edge of the western cliff of the Cœlian is but a short distance, and here the _specus_ seems to run in a bank dividing the vineyard or garden of the Villa Mattei from that of the monks of S. Gregory, on which a wall has been built. At this point subsequent alterations, and especially those under the Emperors Nerva and Trajan, have buried to a great depth the actual remains of the original aqueduct; but this later work occupies the same line, and must be described. We first come to a large _piscina_ or filtering-place on the cliff of the Cœlian, immediately above the Porta Capena. This _piscina_ is divided into two parts, one above the other; but both are below the top of the cliff, and are faced with brick and reticulated work of the time of Trajan. There are remains of two _specus_ running along against the face of the cliff; of the upper one the lower part, or pavement, of _Opus Signinum_, only remains, and this runs down in a sloping direction from the upper reservoir to a lower one, a little to the south of it, which is very extensive. This lower reservoir consists of several parallel chambers, through which, or rather in front of which, another _specus_ runs at a lower level; this appears to be horizontal. This _specus_ goes on in the direction of the ruins of a building of various periods, possibly the remains of the Ædes Camenarum, and passes then to the south in the direction of the Thermæ of Severus and Commodus.

Another branch was evidently afterwards made from the upper reservoir going towards the north for a very short distance, merely for one of the usual angles; then, turning again to the west, in the valley below, there is another large _castellum aquæ_, or reservoir of five chambers, all as usual oblong and side by side. This is on lower ground, and is built upon the wall of Servius Tullius, where it crosses the valley; the upper part of this reservoir has been made into a house for the gardener. The underground part of the chamber nearest to the Cœlian is built of the large square blocks of tufa usual in the time of the Kings, and belongs to the fortifications of the Porta Capena, over the Via Appia, which here passed close under the Cœlian; the other chambers appear, from the bricks, to be of the time of Trajan. From this point to the Piscina Publica, the line of tall brick piers of Trajan can be distinctly traced by the existing remains, passing across to the other side of the road and of the stream here close to it[18]. The ruins of the Piscina Publica, as rebuilt by Trajan, remain visible under the corner of the Pseudo-Aventine, near S. Balbina, and from this the water was again distributed in different branches. At this point, let it be observed, and only at this point, is the valley which divides the Cœlian from the Aventine sufficiently narrow to admit of agreement with the direct and clear assertion of Frontinus, that here alone, throughout the whole course, was it carried on a substructure and on arches for a distance of one hundred yards.

Although there are no remains of the _specus_ now visible at this spot, because the gate has been destroyed, there can be little doubt that the channel for the water was carried _over_ the southern gate of _the city_ according to its extent at that time. This gate was called the Porta Capena; and as the Appian aqueduct was allowed to fall into decay, it gave rise to the descriptions both of Martial and Juvenal, who describe it as wet or moist[19].

The excavations made in 1868 and 1869 under the direction of Mr. Parker, with the help of the British Archæological Society of Rome and the Roman Exploration Fund, have clearly shewn the _specus_ of the Aqua Appia and those of two other aqueducts carried upon the _agger_ of Servius Tullius across the valley from the Cœlian to the Aventine, with branches to the left running into the subterranean chambers of the Piscina Publica. These underground chambers are of the time of the Republic, the walls are built of rubble stone as usual at that period, and there are small openings through these walls for the circulation of the water, although the upper part has been rebuilt in the time of Trajan, as the remains of the wall are faced with the brickwork usual in his time. The lowest _specus_ is cut out of tufa rock _under_ the wall of Servius Tullius, which is built of the usual large blocks of tufa.

The principal branch went underground to the cave reservoir at its mouth, on the level of the quay of the Marmorata between that and the Salaria, just outside of the old Porta Trigemina; the old _agger_ in which that gate was situated still forms the southern or lower boundary of the wharf of the Salaria. Part of the course of this earliest _specus_, that of the Appia, can be traced and seen in a subterranean stone quarry nearly under S. Sabba. The _specus_ is six feet high and two feet wide, and it is filled up to nearly half its height by solid clay, evidently the deposit left by the water. The old _specus_, long after it had been out of use, seems to have been employed by the quarrymen: as it was a tunnel in the tufa rock just high and wide enough for a man to walk in, by cutting away one side they made it wide enough for a horse and cart to carry the stone, and they raised the vault as high as was convenient for the purpose of making an entrance into the quarry. The series of wells descending into the old _specus_ from the gardens above remain at intervals, with notches for steps cut in the rock to enable a man to go up and down when required. The course of the _specus_ is cut off by the road to the Porta Ostiensis, but probably that road was originally carried over it[20] at the crossing; it then passed through another large subterranean quarry nearly under S. Prisca, to the cave reservoir at its mouth[21].

Before arriving at the two large reservoirs just outside of the garden of the Sessorium, now Sante Croce, the _specus_ of the Appia must have passed by another smaller reservoir at the same low level, near the ruins of the apse of a hall, miscalled the temple of Venus and Cupid. This seems likely to have been the point at which the branch _specus_, coming from the north, entered Rome, and it was then carried on to the two large reservoirs outside this garden, supposed to have been the _Gemelli_[22].

Below the “Salinæ” or salt warehouses on the bank of the Tiber, and near the “Porta Trigemina,” the water was “distributed.” This was also close under the Clivus Publicii, or the slanting zig-zag road leading up from the wharf to the top of the hill.

So far the general course can be traced; but the exact point of entrance into Rome could not be fixed without excavations, which have not as yet been made. There are, however, some _data_ given by Frontinus which should not be overlooked, as they bear incidentally upon the course of some other of the aqueducts.

First, it should be remarked, that the water of the Appia was augmented by an additional stream. This was not accomplished till the time of Augustus. The source of this latter[23] was on the same side of the Via Prænestina, but a little nearer to Rome (near the sixth milestone) we are told, and its course was, like the main stream, entirely underground. It was more direct, as its length was less than six miles and a-half, while the original stream, by its windings, required about eleven miles to complete the same distance[24].

It joined, however, the Appia _at the “Spes (Specus) Vetus,”_ and at the Gemelli[25], which was _under (infra) the “Old Specus,”_ it could be measured. This is an important landmark; it is well at once to observe that the usual interpretation of the passage as referring to a “Temple of Spes,” and the statement that a temple occupied the site of some ruins which are marked thus in a few maps, (in most, _Templum Veneris et Cupidinis_) does not seem to fit the circumstances. It is proposed to read in both these two instances “Specus Vetus.” The expression occurs, altogether, five times in Frontinus, and it will be most satisfactory therefore to consider the passages together, which will be done more conveniently in connection with the next aqueduct described.

The Torquatian and Plautian, or Pallantian gardens, seem by the context to have occupied a spot on either side of the point of junction of the two streams. The Torquatian gardens are not mentioned elsewhere, and with respect to the Plautian[26] (which is only conjectural, and has the authority of neither of the early MSS.), it has been suggested to read _Pallantian_, which gardens are mentioned twice elsewhere by Frontinus in connection with the Specus Vetus, besides once in such a way as to imply the same[27].

The Torquatian gardens probably occupied the space between the outer wall and the modern “Via di Porta Maggiore,” and were probably those of Titus Manlius Torquatus, a member of an important patrician family; Livy mentions at least three generations of that name. This ground shews numerous remains of aqueducts and reservoirs, and here also is the fine building of the third century called the Minerva Medica, which was probably the _nymphæum_ of some _thermæ_ of that period[28]. The Pallantian gardens is

a natural name for those belonging to the Sessorium, or the Sessorian fortified Camp and Palace[29], and occupied the low ground near it. They would therefore be to the south of, but adjoining to, the Torquatian gardens.

II. THE ANIO VETUS (B.C. 272).

“Forty years after the Appian aqueduct had been completed, and in the year A.U.C. 481 (B.C. 272), Marcus Curius Dentatus, who bore the office of censor with Lucius Papirius Cursor, contracted to bring into the city the water of the Anio, which is now called the Anio Vetus, from the spoils taken of Pyrrhus[30].

“The Anio Vetus takes its rise beyond Tibur (now called Tivoli), outside the gate, at the twentieth milestone, where it parts with some of its water for the use of Tibur. Its course has in length, in consequence of the difficulties caused by the levels, 43 miles. Of this for 42 miles and 779 paces, the stream is underground, and for 221 paces (about 350 yards) on a substructure above ground.

“Near the fourth milestone within the new road (_infra novum_) the Anio Vetus crosses between the arches from the Via Latina into the Via Lavicana, and has (there?) a _reservoir_ (or _piscina_). Thence just within the second milestone it gives a part of its water into the _specus_, which is called the Octavian, and this comes in the direction of the New Road to the Asinian Gardens, whence it is distributed through that neighbourhood; but its direct channel, following the _specus_ (or conduit) coming within the Porta Esquilina, _along_ the _Spes (Specus?) Vetus_, is drawn off for distribution in the city, through the high channels[31].

“It held the sixth place in height, but would have been sufficient for even the higher parts of the city, if it had been carried across the valleys and the low ground, where requisite, upon substructure, arches, and buttresses[32].”

Passing on to the second aqueduct, namely, the stream taken from the River ANIO (and which was called the ANIO VETUS to distinguish it from a later diversion from the same river), we find that Frontinus is also very distinct in many of his details; a few only he leaves to conjecture.

The point where a branch was taken from the river Anio can be traced[33]. There was a reservoir by the side of the river, of which some ruins remain; but it was nearly destroyed a few years since by some peasants in their ignorant and too eager search after hidden treasure which they expected to find there. The _specus_ is cut in the rock as a tunnel in the cliff of the valley of the Anio, just below the level of the road; it follows the line of the cliff, of the river, and of the road: for they are all the same, the only opening through the rocky mountains of limestone in this part, obviously made by the river itself. It follows this line as far as the valley called the “Valle degli Arci,” or of the Arches, where three later aqueducts cross the river on arcades about two miles above Tivoli. At this point several aqueducts are visible crossing the valley on arcades, each on a separate arcade, not three on one arcade and two on another, as near Rome. The one nearest to Tivoli is the Marcian, and at the foot of one of the piers of the arch, which here crosses the road, the _specus_ of the Anio Vetus is visible, partly underground, but the upper part above ground, on the right-hand side of the road in going from Tivoli. It then is carried in a tunnel through the hill, but appears again on the other side with a large reservoir, and runs gradually downwards in a winding course round part of the hill.

It is not easy to distinguish to which of the aqueducts belongs any one of the numerous reservoirs, the ruins of which are conspicuous objects on the roads up to Tivoli on the other side towards Rome, especially along both sides of that called the “Promenade of Carciano,” for the distance of about three miles from Tivoli. The _specus_ and reservoir of the Anio Novus are on a natural terrace above that road, and the Marcia below it; these have passed through Tivoli, winding round that end of the hill. The Claudia passed upon a great arcade the valley of the Arci, and another valley in the direction of Gerocomio. The Anio Vetus was carried in a tunnel through the hill, and appears on the other side near Tivoli, at a considerably lower level than the others. The road passes across the _specus_, and is made upon the surface of the vault, which is visible about four miles and a-half from Tivoli. A little further on there are two large reservoirs belonging to it, near a modern villa called Gerocomio, built by the Cardinal Santacroce in the year 1579, now a farm-house only, but on the site of an ancient villa, of which some remains are built into the walls. One of these reservoirs or _piscinæ_ (?) appears to be unaltered, the buttresses remain and apparently the vault; but it is covered with herbage and shrubs, which conceal it. The other has been turned into a cottage or an out-house of the villa, and this is of later date than the other. The Anio Vetus, the Marcian, the Claudian, and the Anio Novus, all have to be conveyed down this lofty hill from the high ground on which the remains above mentioned are situated, to the valley below. The river Anio itself rushes straight down the celebrated cascades by a fall of about a hundred feet; but the channels of the aqueducts follow a winding course, which allowed of the descent towards Rome being very gradual.

This road or promenade of Carciano is rather high on the side of the hill above the villa of Hadrian, looking towards Rome. The dome of S. Peter's is distinctly visible from it. The road is on a ledge on the side of the cliff, and the aqueducts run along the steep side of the hill or cliff, until they come to the valley of a small stream winding down to the Anio; along the cliff of this they are then carried. The Anio Vetus being at a considerably lower level, is more difficult to trace than the others; but it seems clear that after the later aqueducts had arrived at the point where the Anio Vetus emerges from the hill, they all followed the same line, winding along with the small stream, and their _specus_ or channels cut in the cliffs as far as they could be made available. The Anio Vetus has been discovered at the left hand of the modern road to Rome, and to the right of the promenade of Carciano. It passed, upon a lofty bridge called the Ponte di S. Antonio, over a torrent, with the Marcia. Afterwards upon another bridge called Ponte delle Mole di S. Giovanni, and over the Ponte Lupo it went with the others. Near Gallicano (or the ancient Pedum) are two _cippi_ of Augustus in two wells of his _specus_; one is in the country called Le Sette, and another at Obrego[34] dell' Ermito. The others have all been followed, and an account of them will be found under their respective heads.

In order to avoid the many small valleys occupied by streams which run parallel to each other from the hilly ground on the south, down to the river Anio on the north, (the general course of which river is west and east,) the course was kept along the higher ground, and in fact wound round the heads of those valleys in order to retain a level, gradually becoming more and more depressed, till, by the time it reached Rome, the base of the _specus_ (according to the computation of Piranesi), was 55 ft. above that of the Appian[35]. The whole course is underground, as has been said, except for 221 paces (about 360 yards); for this short distance it was carried on a substructure above ground. It is reasonable to suppose that this exception to the subterranean course was, as in the case of the Appian, within the present boundary of the city.

Before it reached Rome, two circumstances have especially to be noted. Just within the fourth milestone we are told it had a reservoir and _piscina_ or filtering-place, and at the second milestone it parted[36] with some of its water, which was conveyed to Rome in a separate channel.

This fourth milestone was clearly on the Via Latina, as Frontinus in the previous paragraph had referred to some _piscinæ_ at the seventh milestone on the same road; and it appears, although the sentence is exceedingly corrupt, that the course of the Aqueduct left the Via Latina at this point, and crossed towards the Via Labicana "amongst the arches[37]" at the fourth milestone. The _specus_ is here visible, and appears to be perfect; it is very near to the Torre Fiscale[38], between that and the Osteria, called the Tavolato (which itself appears to be made out of another, but a later, reservoir belonging to the aqueducts, as many of the houses in the Campagna have been). The vault of the old _castellum aquæ_ or _piscina_ is now covered with turf, but the side of it forms a sort of cliff like the edge of a quarry.

This place, where the Anio Vetus leaves the Via Latina, is near the great junction and crossing of the aqueducts, over which the tall medieval tower called the Torre Fiscale has been built. Here six aqueducts meet and cross each other. The Marcian arcade, with three of these, makes one of its many angles, and the lofty Claudian arcade, with two more, is carried over it. The expression that it passed amongst the arches is a very natural one, to any person who knows the locality, as there are many arches at this point. It then goes on to another angle and crossing of the great aqueducts, where there is a gate called Porta Furba, about two miles and a-half from the Porta Maggiore. There is a _castellum aquæ_ of the time of Nero, with an ancient _piscina_ under it, and a fountain of Sixtus V. by the side of it. At the second milestone it parted with some of its water into the _specus_ called the _Octavian_, which enters Rome at the Asinian gardens, following the direction of the new road.

By referring to the maps it will be seen that the original line of the Via Latina united with the Via Appia within the outer wall and before reaching the old southern entrance of the city (the Porta Capena); but, in joining this latter road (the most convenient course to pursue in the then state of the fortifications), the Via Latina swerved rapidly to the south-west. Had it been continued in a direct line, it would have reached the Cœlian Hill, near the Porta Asinaria, as the Via Appia Nova still does, following the line of the old Via Asinaria.

At this second milestone also is another _castellum aquæ_[39], mentioned by Frontinus as two miles from Rome. This is near the Porta Furba; it is entirely buried, but the vault of it is not many feet underground. In the spring of 1871, some excavations were made under my direction in a large vineyard hard by, and another subterranean reservoir was found near the road to Tusculum and Frascati, with a _specus_ cut in the rock going in the direction of that road, and apparently passing under it, on the line of a cross-way to the Via Appia Nova, a short distance only. On the other side of that is the "Albergo dei Spiriti," near the junction with the Via Latina; and, in the garden at the back of that house, a _specus_ was found in a stone quarry, the vault of which had fallen in and brought the _specus_ to view. It seems to have passed underground along the southern side of that ancient Via for a short

distance, and then crossed it to a _piscina_, of which there are remains at the foot of the bank on which the road runs in that part. It then goes along the edge of some higher ground, and for a short distance underground again towards a by-lane (_diverticulum_), parallel to the Via Latina; remains of a brick arcade can be seen on the bank of that lane, which is a deep foss-way, and goes on to Rome about a mile distant. It is cut by the railway before it arrives at the wall of Rome. It then passes through that wall and underground again as far as the arch of Drusus, over which it passes; and thence on an arcade, part of which only remains, to the great _piscinæ_ at the back of the _thermæ_ of Caracalla[40].

The Via Appia Nova was probably made in the time of Frontinus, and is the road which he calls Via Nova. The part nearest to Rome was previously called the Via Asinaria, and extended from the Porta Asinaria to the junction with the Via Latina, at three miles from Rome, which name was then dropped. The new road continues parallel to the Via Appia Antiqua as far as the eleventh milestone, and there forms a junction with it. Both of these roads are now open. The railway to Capua and Naples passes near to this point of junction. The short Via Lateranensis, going out of the Porta Lateranensis (excavated in 1868), ran into the Via Asinaria, and so joined the Via Appia Nova, which has tombs of the first century along the line, and none of any other period. Those which were of stone have been used as a quarry by the farmers to build the low walls that line the road on both sides, the foundations only being left in the banks; but those which were built of concrete faced with brick, would not pay for the trouble of destroying them, and have therefore been left standing in their places. One of these, a very fine one, faced with brick of the time of Trajan, with moulded pilasters, remains nearly perfect near the seventh mile, just where a path turns off to the left across the fields to the _piscinæ_, which are near the line of the old Via Latina in this part, about half-a-mile from the Via Appia Nova, and forming the carriage-road to Albano through Marino. It left Rome by the Porta Asinaria as it now does by the modern Porta S. Giovanni, which is close to the old gate, but at a much higher level. The Via Latina crosses it in a diagonal line, and runs nearly parallel to it as far as the Torre Fiscale, that is, for about a mile gradually diverging from it.

Wherever the exterior of the _specus_ of the Anio Vetus is visible, it is faced with _Opus Reticulatum_. The reservoirs of this Aqueduct are of the same construction, and this may serve to distinguish those on the slope of the hill at Tivoli from the other aqueducts there.

“The water of this straight branch,” says Frontinus, “coming within the _Porta Esquilina_ along the _Spes [specus] Vetus_, was carried down into the city in the high streams[41].”

This _specus_ is on the high bank of the Tarquins, the outer and lofty line of defence on the eastern side of Rome. On this the wall of Aurelian was afterwards built. After its entry into Rome, the Anio Vetus was divided into several branches, in the same manner as the later aqueducts were.

The right-hand branch, in crossing the Campagna, appears to have run nearly under the Marcian arcade, which was afterwards built on the same line and nearly over it. As we approach near to Rome, there are remains of a reservoir built of large stones a little way down the road, about a hundred yards from the Porta Maggiore. It enters Rome under the wall, almost on the level of the ground; the upper part of the _specus_ was visible in 1868, but in 1869 was studiously concealed by a modern brick wall. It is visible again inside the wall, on the other side of the road, going into the vineyard in which the Minerva Medica stands, while one branch went to the great reservoir near to it, westward of the gate.

Another branch passes along the bank under the wall of Aurelian, and is not visible again until it reaches the Prætorian Camp, where a portion of it was excavated in May, 1868, built of large stones of tufa, under the Porta Chiusa. It may then be traced all round the three sides of the Prætorian Camp, and near the north-east corner there was, in 1868, an opening into it, now closed by a modern wall. It is distinctly visible in several places, especially on the north side of the Camp, where the wall of Tiberius remains perfect, faced with the fine brickwork of his period, whereas the _specus_ under it is faced with _Opus Reticulatum_, probably of the time of the Republic. The wall of Tiberius distinctly stands on the old _specus_. There was an opening into it here also in 1868; but this was also carefully walled up in 1869 under the influence of the Garibaldian panic, which had a bad effect upon the Roman authorities at that period. Remains of a reservoir or _castellum aquæ_ were also found on the surface of the ground on the bank near the Porta Chiusa, with the present wall of Rome built right across it, but this part of the wall has been rebuilt of old materials, and is not exactly in the same line. There are remains of several other reservoirs on the bank at intervals outside the wall in the modern road, and in many places all along the eastern and southern sides of Rome.

Beyond this, near the Porta Nomentana, are the ruins of another reservoir or _piscina_ on the surface of the ground, against the wall. From near the Porta Chiusa another branch went along the old road, which passed through that gate across the inner foss to

the Thermæ of Diocletian, where a part of the _specus_ and two _cippi_, with two inscriptions upon them, naming this aqueduct the Anio Vetus, were found in the year 1861, when the railway was made[42]. These _cippi_ are now in the Vatican Museum.

Another branch went from the reservoir near the Porta Maggiore before mentioned, across the road into the bank on which the arches of Nero stand, near the Lateran, and passed under them apparently into the old _specus_ of the Appia, which runs parallel to and nearly under the arches on the other side. Two small _specus_ or stone pipes can be still seen (in 1872) passing obliquely into that bank; and, as they came from this large reservoir and _piscina_, (or from this direction,) they seem to have belonged to two aqueducts at different levels. A branch of the Marcian may have been brought to the same filtering-place for distribution, and the surplus water carried into the old _specus_ at the lowest level, which was evidently used for receiving and carrying off the surplus water of all the other aqueducts in the same line.

The fifty yards outside the wall added to the three hundred yards between the Cœlian and the Aventine, make up the three-hundred-and-fifty yards above ground, mentioned by Frontinus. In this valley we found it again, in 1869, parallel to the Appia, sometimes on the _agger_ or bank of Servius Tullius, which was used as a substructure for it, in other places on an arcade built up against the tufa wall of Servius Tullius, and faced with reticulated-work.

APPENDIX.

ON SP■ OR SPC■.

For the supposed Temple of Spes, the ruins of an apse in the gardens of S. Croce, of “Venus and Cupid,” (as it is marked in most maps, and as “Speranza Vecchia” in others,) was fixed upon by Piranesi, who carefully examined all that he could with a view of mapping out his aqueducts, according to the knowledge possessed in his time. This building was no doubt a hall belonging to the Sessorian Palace. Others, again, have suggested the so-called temple of Minerva Medica, but this again is a _nymphæum_, or _pantheum_, and not a temple at all. Besides, a further difficulty lies in one being too far south, while the other is too far north.

Canina, in his account of the results of the excavations at the Porta Maggiore[43], and of the tomb of Eurysaces the baker there discovered, just outside of the gate, gives a plan in which he inserts a temple just inside the gate on the southern side, which he calls the Temple of Spes[44]. It is quite possible that this was a Temple of Spes. There certainly was a temple on the site indicated, where the modern guard-house stands; and during excavations carried on there, fragments of a temple of the time of the early Empire were found, consisting chiefly of a fine cornice of travertine.

When, however, the words of Frontinus have to be applied, the difficulties of the theory of his referring to a temple are increased. In the case of the expression last referred to, “_following the specus (spes)_, or, according to one manuscript, _the old specus_, which is obviously the sense,” it is very difficult to imagine what circumstances there were in connection with a temple which could warrant the use of such words; and even in the instance mentioned, where we were noticing the Appian aqueduct, “the expression, the Gemelli, which is a place under the _old specus_ (Spe■s■ Vetus),” is somewhat singular. Granting that a temple once existed just within the wall of the city (which, from the context, must have been its position if any) it is singular that he should use it as a landmark when describing the junction of two streams of water. The remaining three expressions are simply “at the _old specus_ (Spe■s■ Vetus[45]).”

With these difficulties to contend with, it has been thought well to seek a different solution, and this is found in the reading of “Specum Veterem” for “Spe■m■ Veterem,” i.e., the “old _specus_.” With this reading, it naturally follows that it would refer to the old _specus_, or the _specus_ of the Appia and the Anio Vetus; and it is singular that the first time it occurs in Frontinus, the Codex Urbinas[46], only second in authority to the Codex Cassinensis, has the reading “Anienem Veterem,” instead of “Spem Veterem.” What was the true reading of the Codex or Codices from which these two copies were made, it is impossible to say; they are the earliest we have, and it is clear from several other instances that the scribes did not copy with much knowledge of the matter in question: then it was easy to mistake _Spc■_ for _Sp■_. That it was the Specus Vetus which was meant, must rest therefore upon the circumstances which allow of its application to the passages named, and it remains to shew that this is the case.

In the instance under discussion, the water of the Anio is said to flow along its own _specus_, and therefore it would not be probably possible to find an interpretation more suitable as far as this case is concerned. The conduit of the water of the Anio Vetus had “emerged,” as the other aqueducts emerge, near the Porta S. Lorenzo, from the higher ground between the Porta Maggiore and that gate: it must consequently have been carried on a substructure from that point on the outer bank of the original fortifications of Rome, that is, on the high bank on which the aqueducts were carried, and on which the wall of Aurelian was

afterwards built, to the inner bank, on lower ground faced with the tufa wall of Servius Tullius. The names of the gates are matters of dispute, and are quite immaterial; the levels of the ground decide the question[47].

In another place, Frontinus says[48] that several streams of water, and first the Marcia, were carried to the Aventine from the _specus_ (_a spe-cu_), that is from the old _specus_ he had before mentioned on the Cœlian, and obviously from the west end of the Cœlian. The Temple of Spes of Canina and others at the Porta Maggiore, is at least a mile from the Aventine. The only way of giving an intelligible meaning of the passage is that the author refers to the old _specus_ he had before mentioned, as leading along the Cœlian to the Porta Capena. In the excavations made in 1868 and 1869, on the line of the wall of Servius Tullius from the Cœlian to the Aventine, the conduits of three _specus_ were found, two of which must have passed over the arch of the Porta Capena, in order to cross the Via Appia, there a deep foss-way. Two conduits were seen in each of the pits that were dug at intervals along the line, and at the junction with the Piscina Publica under the Aventine they were all three perfect; the lowest one is there cut in the tufa rock under the wall, the other two are on the wall, and partly cut out of it.

Piranesi has preserved a sketch of the _specus_ of the aqueduct, which he supposed to be the Anio Vetus upon its substructure; but he gives no clue as to the exact spot whence that sketch was taken[49]. In its character the masonry is very similar to that of the Marcian, but there are minor differences sufficient to shew that it belongs to an earlier age.

Those who have paid attention to the manner in which ancient books have been transmitted to modern times before the invention of printing, and who are familiar with the use of records and of other medieval manuscripts or transcripts, well know how full of abbreviations they are, and how difficult it often is for the editor to fill up these abbreviations, if he does not happen to know the word intended. The name of _specus_ for the conduit of an aqueduct was essentially a technical word. The first transcribers of the text of Frontinus were not Romans, and did not know the term: hence they filled up the abbreviation _sp■_, or perhaps originally _spc■_, with _spem_ or _spei_, instead of _specum_ or _specûs_. The same thing may have occurred in the text of Lampridius (as mentioned in a note on a preceding page).

The Abbot of the monastery on Monte Cassino (now a public school and public library) has kindly given me tracings of all the passages in that manuscript in which this abbreviation occurs, and I have had them reproduced by photography and phototype on the page annexed. Opposite to this the same passages are given in the Italic characters, and a few words that are necessary to complete the sense in Roman characters. This is followed by an English translation of these passages, and by some extracts from Livy and other authors in explanation.

[Illustration: FACSIMILE FROM THE MANUSCRIPT AT MONTE CASSINO[50].]

FRONTINUS DE AQUÆDUCTIBUS.

EXTRACTS REFERRING TO THE ABBREVIATION SPE■S■ FOR SPECUS.

I. _iungitur ei ad s .. em ueterem[51] in confinio ortorum torquatianorum_ et ... novum ramus Augustae, hac tres ... ad Viminalem usque portam deveniunt. I. 5.

II. _ibi rursus emer_ _gunt prius tamen pars julie ad sp■ ... veterem excepta, castelli celii_ _montis diffunditur._ I. 19.

III. _partem tamen sui claudia prius_ _in arcus que vocantur neroniani ad sp■ ueterem transfert_ hi directe per Caelium montem juxta templum divi Claudii terminantur. I. 20.

IV. _rectus vero ductus secundum_ _sp■ veniens intra portam exquelinam in altos rivos per urbem diducitur._ I. 21.

V. _ad gemellos tamen que locus infra sp■ ueterem_, ubi jungitur cum ramo Augustae. II. 64.

VI. _sed postquam nero im_ _perator claudiam opere arcuato ascus[52] (?) excepta usque ad templum_ _divi claudii perduxit_, ut inde distribuetur. II. 76.

VII. _quibus nunc plures aque et imprimis_ _marcia reddita amplo opere a sp■ in auentinum usque perducitur._ II. 87.

Translation of the Extracts from the Treatise of Frontinus on the Aqueducts, containing all the passages in which the abbreviation Sp■ occurs.

I. [The Augustan branch] is joined to it [the Aqua Appia] at the old _Specus_ [or old Spes (?), temple of Hope], in the border of the Torquatian gardens[53]. I. 5.

II. [The three, Marcia, Tepula, Julia] there emerge again; first, however, part (of the water) intercepted from the Julia is poured at the old _Specus_ (or at the old temple of Spes[54]), and so into the reservoirs on the Cœlian Hill, near the temple of the divine Claudius. I. 19.

III. First, however, the Claudia transfers part of its [water] into the old Specus [or at the temple of Spes], on the arches called Neronian[55]. I. 20.

IV. But the direct conduit [of the Marcia, &c.], passing by the old Specus (?) of the Appia (at a higher level, or following the old Hope?)[56], coming within the Porta Esquilina, [the water] is drawn off in the high streams through the City. I. 21.

V. [The Aqua Appia], however, at the _Gemelli_[57], which place is below the old _Specus_ [or below the old temple of Hope (?)], is joined with the Augustan branch. II. 64.

VI. But after the Emperor Nero had carried the Claudian (water), which he diverted, on arched work to the temple of Claudius [or the Claudium], at the _specus_[58] (or at the Temple of Hope?), that it might be distributed thence. II. 76.

VII. By which many waters, especially the Marcia, being supplied in great abundance, are conducted from the _specus_[59] (or from the temple of Hope?) on to the Aventine. II. 87.

Passages in which the Temple of Spes occurs in Livy.

“At the time when this disaster happened, Caius Horatius and Titus Menenius were in the Consulship. Menenius was immediately sent against the Etruscans, elated with their victory. He also was worsted in battle, and the enemy took possession of the Janiculum; nor would the City, which besides the war was distressed also by scarcity, have escaped a siege (the Etruscans _having passed the Tiber_), had not the Consul Horatius been recalled from the country of the Volscians. So near indeed did the enemy approach to the walls, that first the engagement was at _the temple of Spes_, in which little was gained on either side; again at the Porta Collina, in which the Romans gained some small advantage, and this, though far from decisive, yet by restoring to the soldiers their former courage, qualified them the better to contend with the enemy in future[60].”

“At Rome a dreadful fire raged during two nights and one day; everything between the Salinæ (or salt wharf) and the Porta Carmentalis was levelled to the ground, as were the Æquimælian and the Jugarian streets. The fire catching the _temples_ of Fortuna, of mater Matuta and _of Spes_, on the outside of the gate, and spreading to a vast extent, consumed a great number of buildings, both religious and private[61].”

“After this, in pursuance of a decree of the Senate, and an order of the people, an assembly of election was held by the city prætor, in which were created five commissioners for repairing the walls and towers, and two sets of triumvirs: one to search for the effects belonging to the temples, to register the offerings; the other to repair the _temples_ of Fortuna and mater Matuta within the Porta Carmentalis, and likewise _that of Spes_ on the outside of the gate, which had been consumed by fire the year before[62].”

“He agreed with contractors for building a theatre near the Temple of Apollo, and for embellishing the Temple of Jupiter in the Capitol, and the columns around it; he also removed from those columns the statues that stood incommodiously before them, and took down the shields and military ensigns of all sorts which were hung upon them. Marcus Fulvius made contracts for more numerous and more useful works—a haven on the Tiber, and piers for a bridge across it, on which piers Publius Scipio Africanus and Lucius Mummius, censors, many years after, caused the arches to be erected; a court of justice behind the new bankers’ houses, and a fish-market, surrounded with shops for private sales; also a forum and porticus, on the outside of the Porta Trigemina; another porticus behind the dockyard, and one at the _Temple of_ Hercules; also a temple of Apollo Medicus, behind that _of Spes_, near the bank of the Tiber[63].”

It will be observed that all these passages apply to the well-known Temple of Spes near the bank of the Tiber, of which there are considerable remains now in the church of S. Nicolas in Carcere, and do not apply to a Temple of Spes at the Porta Maggiore.

The word _specus_ is used by Vitruvius in the sense of a covered water-course:—

“But if there should be mounds in the middle between the walls and the fountain-head, it must be so contrived that the water-channel (_specus_) be dug under the earth, and poised on the top[64].”

And at a later period by Hirtius:—

“Alexandria is almost wholly undermined with water-courses, and has a _specus_ extending to the Nile, by which water is conveyed into private houses[65].”

III. THE AQUA MARCIA (B.C. 145).

“127 years afterwards, that is, from the building of Rome 608 years, when Servius Sulpicius Galba and Aurelius Cotta were consuls, as the aqueducts or conduits (_ductus_) of the Appian and Anio were much decayed by age, (and also intercepted fraudulently for private purposes,) the business of repairing and reclaiming the said aqueducts was entrusted by the senate to Marcius, who was then acting as Prætor. And because the increase of the population of the city seemed to demand a more ample supply of water, instructions were given to him by the senate that he should carefully examine how far there were other streams which he might be able to bring into the city[66].

“He therefore restored the two old conduits, and introduced a third, _which he caused to be erected with ‘squared stones,’ and larger aqueducts, and carried through them the water which he had obtained for the public service_[67]. Hence it received the name of the ‘Marcian’ from himself, as the author of it.

“The Aqua Marcia has its origin on the Via Valeria at the thirty-sixth milestone, three miles off in the _diverticulum_ (or cross-road), on the right-hand to those going from Rome. On the road to Sublacum, now called Subiaco (_Via Sublacensis_) also (which was paved for the first time under the Emperor Nero), at the thirty-eighth milestone, for the space of two hundred paces on the left-hand side the water lies like a pond, bubbling up in innumerable springs from beneath the stony hollows, and is very green in colour.

“The length of the course from its head to the city is 61 miles, 710 paces;—by an underground channel 54 miles, 247½ paces, on structure above ground 7 miles, 463 paces. Out of this, in many parts away from the city, in the upper part of the valleys, it is carried on arched substructure for 473 paces; nearer the city, from the seventh milestone, on a substructure for 528 paces. In the rest of the work it is carried on an arcade for 6 miles, 472 paces[68].”

“The Marcian ranks fifth in height, and is at its head even in level with the Claudian[69].”

“In the year of the building of the city, 719 (i.e. B.C. 44), Agrippa repaired the three aqueducts—the Appian, the Anio Vetus, and Marcian—and took care to supply the city with many fountains[70].”

“[Temp. Nervæ, (A.D. 96)] the Marcian having been enlarged was carried across from the Cœlian [i.e. its _specus_] to the Aventine[71].”

IV. THE AQUA TEPULA (B.C. 126).

“In the year 627,” writes Frontinus, “after the building of the city, when Plautius Hypsæus and Fulvius Flaccus were consuls, the censors, Cneius Servilius Cæpio and Lucius Cassius Longinus, took care to bring into Rome and the Capitol the stream called the Tepulan, from the Lucullan Fields (which some call the Tusculan[72]).

“The Tepula has its source on the Via Latina at the tenth milestone, two miles off on the right of those going from Rome. Thence it was brought by a separate channel into the city[73].”

V. THE AQUA JULIA (B.C. 34).

“Afterwards Marcus Agrippa collected the natural waters of another stream, at 12 miles from the city on the Via Latina, (2 miles off on the right of those going from Rome,) and so intercepted the stream of the Tepula. To the newly-acquired water the name of Julia was given, from the finder of it; nevertheless the distribution was so divided that the name of Tepula was retained[74].

“The course of the Julia runs for the length of 15 miles, 426½ yards. In work above ground 7 miles; out of this in parts nearest to the city from the seventh milestone (it is carried) on a substructure for 528 yards; the rest on arched work for 6 miles, 472 yards[75].”

III., IV., V. THE AQUÆ MARCIA, TEPULA, AND JULIA.

“Of these [Aquæ], six within the seventh mile, on the Via Latina, are taken up into covered _piscinæ_, where, as though breathing again after their course, they deposit mud. The Julia, the Marcia, and the Tepula, are joined there; of these, the Tepula, (which had been intercepted, and joined to the stream of the Julia,) now receives from the reservoir of the same Julia its proper quantity, and flows out in its own channel, and under its own name.

“These three are carried from the reservoirs on the same arcade.

“The highest of them is the Julia, lower the Tepula, then the Marcia. These come down towards the Viminal, running together beneath the ground, on the same level as the Collis Viminalis, as far as the gate. There they again emerge.

“First, however, a part of the Julia is, at the _Spes Vetus_, taken out and distributed in the _castella_ on the Cœlian Hill; but the Marcia, after the Pallantian Gardens, throws off part of its water into a stream called the Herculanean. This conduit through the Cœlian, being of no use for the houses on the hill because at too low a level, comes to an end above the Porta Capena[76].”

THE PISCINÆ.

To this point, Frontinus tells us, the three aqueducts tend[77], while from this they are carried on the same arcade into Rome. The ruins of these remain visible. Some of them are situated a little way off the south side of the Via Latina, others on the east side of the Via Appia Nova. Of these, two belonging to the Claudia and Anio Novus are subterranean, and are now only to be distinguished as mounds of earth, looking like tumuli. Others are above ground, near that part of the Via Latina [now the road to Frascati and Tusculum], and close to the _Torre di mezza via_, or half-way house from Rome to Frascati, just beyond the sixth milestone of the modern road. Others are at or near the Villa of the time of Hadrian, called _Sette Bassi_ (which is supposed to be a corruption of Septimius Bassus), near the same point. All of these are between seven and eight miles from the City; they are the chief landmarks in tracing the course of the three aqueducts now to be explained, and each of the three comes from its own separate source. The Marcia, the lowest on the arcade, has its origin at the greatest distance from Rome. The Tepula and Julia have their sources comparatively close to the city. The Marcia takes its rise from the Simbrivine Hills, as far removed beyond Tibur to the east as Tibur is from the city, while the latter two find their way from springs in the volcanic region around the lake of Albano.

III. MARCIA.

The source of the Marcia is plainly visible, the exact description of Frontinus pointing to the spot without leaving room for doubt. In one of the numerous little valleys which run down on the north side of the River Anio, feeding this stream with their rivulets, the Marcian has its rise. The lake of S. Lucia[78] in that valley is so called from a small village situated some distance up the slope; along the bottom of this valley the Via Valeria passes. This lake is usually, but erroneously, considered as the source of the Aqua Marcia.

The exact position of the source is about two miles from the village of Marano, but on the other side of the river, on the right of the valley to one looking towards the mountains, and there are still at times pools of water forming here from the springs which emanate from the overhanging hills. The water now falls into two or three rivulets, which run at the bottom of the valley into the river Anio.

The aqueduct, however, when it reached the high road from Rome to Subiaco, along the north bank of the Anio, turned abruptly to the west, followed the course of the road back towards the city, chiefly passing the further or hill side of it, but winding somewhat according to the nature of the ground. After following the road for some seven or eight miles, it crossed the river (close to the monastery of S. Cosimato) and then pursued for some six or seven miles the southern or right bank of the river Anio. Here, at a spot scarcely more than a mile from Tivoli (_Tibur_), the course of the aqueduct left the line of the river, and wound its way in a south-westerly direction towards the _piscinæ_ before referred to; at times on a substructure, and in a few places, where the valleys were deep, on arches, but for by far the greater distance beneath the surface.

The line of the Marcia can be clearly traced along its whole length. The principal source, called Acqua Serena, is a beautiful spring gushing out from the mountain under the present carriage-road, about seven miles and a-half before arriving at Subiaco, clear as crystal and very abundant; it forms a small lake in the valley, and fully realizes the description of Martial. The old _specus_, which had long been concealed by being a foot or two under water and overgrown with weeds, was brought to light in 1869 by the engineer of the Aqua Marcia Pia, in making his new works for the restoration of this beautiful water to use in Rome. He drained the lake a little, and by that means made the _specus_ visible[79]: this _specus_ is then carried to the cliff of the valley of the Anio (into

which the water from the small lake falls), and then follows the course of the valley and the river, until it comes to the monastery of S. Cosimato, a mile from Vico-Varo: here it crosses the river on an arcade of brick. It there leaves the present road, and then is carried in the cliff on the other side of the river until it arrives within two miles of Tivoli, where it again crosses the river (here a deep ravine) on a fine arcade parallel to that of the Anio Novus, and at a very short distance from it. There are very fine and picturesque ruins of both these arcades in the valley called the Valley of the Arches. It then continued in the cliff by the side of the present road, which is on a ledge of the rock or hill overlooking the Anio, as far as the old town of Tibur and the Cascades, behind the present town of Tivoli: to avoid these it follows a serpentine course, winding round the end of the hill, and has a fine reservoir about half a mile beyond the town, on the side towards Rome, below the level of the Promenade of Carciano, by the side of which are considerable remains of a large reservoir or _piscina_, with the _specus_ running into it and from it. This large building is divided down the middle by an arcade, into two nearly equal parts. Some of it is faced with _Opus Reticulatum_ of a peculiar pattern. On the exterior, there are remains of niches and fountains, a villa of some importance having been built at this spot to take advantage of the abundant supply of excellent water[80]. The _specus_ then runs near the cliff below the level of the road to another extensive reservoir and _piscina_ about a mile further on. There are considerable remains of a large building erected on a steep slope just under the cliff, with no upper wall, as the cliff itself supplied its place; but there is on the lower side a fine wall of considerable extent and height, built of large square or oblong stones of the construction called Cyclopean Masonry[81], in this instance differing little from that of the Walls of the Kings in Rome, except that the stones are rather larger, the building-material being not tufa, but a kind of calcareous stone of the country, dug on the spot. This wall has been supposed to be a portion of the fortifications of the ancient city of Tibur, but for this there does not appear to be the slightest evidence or probability. It is simply the natural construction of the material at hand, and therefore the cheapest wall that could be built for the purpose. No cement is used, because none was required; these large blocks of stone require none, and some chippings are used to fill up interstices, as usual when no cement is used. Again the wall turns the corner at both ends; it is not part of a large wall but is complete in itself, as the facing of one side of the reservoir and filtering-place, the interior of which is built of the usual concrete of rough stone and mortar, and lined with cement of the kind which holds water, _Opus Signinum_, used for all the aqueducts. The end is faced with _Opus Reticulatum_, and there are remains of niches against the wall at intervals. It was also more ornamented, because it was intended to be the one seen chiefly; the other side, being near the edge of a precipice, would only appear from a distance, and the large stones were therefore more effective in that situation. There is no reason to doubt that the whole was built together at the time that the Marcian Aqueduct was made, and it was probably restored by Augustus. It may be doubtful whether some caves in the cliff, which formed part of the reservoir, were natural or were cut, and the stone dug out from them. It is altogether a very picturesque and interesting structure. There may be a question also whether there was not a branch from this reservoir to the Villa of Hadrian at the foot of the hill, perhaps a mile lower down.

The _specus_ of the Marcia is visible at the Ponte di S. Antonio over that of the Anio Vetus; and again, but alone, at the Ponte di S. Pietro, and it passes the Ponte Lupo with the Anio Novus, Claudia and Anio Vetus. It then continues, chiefly underground, to the great _piscinæ_ before mentioned, and thence on the arcade into Rome.

After reaching the City, the branch mentioned by Frontinus, c. 87, as being carried across the valley from the Cœlian to the Aventine in the time of Nerva, seems to be the one found during the excavation in 1868, passing over the Porta Capena at a higher level than the Appia, but still at a much lower level than the lofty arcade of Trajan, of which only the bases of the series of piers crossing the valley now remain. The aqueducts following this line had all to cross the Via Appia, here a foss-way, on the arch of the Porta Capena. This southern branch of the Aqua Marcia is probably the one that can be traced along the side of the cliff of the Pseudo-Aventine, after it had been repaired and brought again into use, for it must be remembered that at one time, as Frontinus says, it ended at the Porta Capena.

The conduit and arcade were rebuilt by Augustus, as recorded on the inscription on his arch at the Porta S. Lorenzo, and in the sixth decree of the Senate, on the subject of the aqueducts. This branch arcade of Augustus is there expressly named as distinct from the others, all needing repairs at the time of this edict. The consuls are charged to see to “the repairs, at the expense of the city, of the streams, conduits, and arches, of the Julia, Marcia, Tepula, Anio; also of those streams and arcades which Augustus Cæsar had rebuilt.”

A branch of the Marcian aqueduct was carried along the _agger_ into the Prætorian Camp. Some leaden pipes were found there in 1742, with an inscription upon them, recording that they were of the time of the Emperor Macrinus (A.D. 217). This probably indicates either a renewal of the pipes, or an additional supply of water. The garrison in that camp was twelve thousand men, and a large supply of water must have been required for their use[82].

The excellent qualities of the Marcian water are mentioned by several of the classical authors, and were celebrated for a long period; they were known in England in the time of Shakespeare, as appears from the following passage in CORIOLANUS, _Act_ ii. _Sc._ 3—

Brutus loquitur.—"What stock he springs of, The noble house of the Marcians; from whence came That Ancus Marcius, Numa's daughter's son, Who, after great Hostilius, here was king: Of the same house Publius and Quintus were, That our best water brought by conduits hither; And Censorinus, darling of the people, And nobly named so, being censor twice, Was his great ancestor."

There is a slight anachronism here. Coriolanus lived in B.C. 489, and the Marcian aqueduct was constructed in B.C. 145, more than three hundred years after his death. Marcius Censorinus also, who was twice Censor (the only Roman who filled that office twice), lived B.C. 294.

In the thirteenth century, the church of S. Bibiana is incidentally mentioned as being near the arcade of the Marcian aqueduct[83]. In some excavations made in the year 1871, a portion of the Marcian arcade, built of the usual large squared stones, was shewn, passing under some high ground to the north of the Porta Maggiore, within the wall of Aurelian, in a direction to join the bank on which that wall is built, and passing between the Minerva Medica and the wall in that part. This is very near the church of S. Bibiana.

IV. TEPULA.

The sources of the Tepula and the Julia are in the valleys on either side of the promontory on which the modern town of Marino stands, the ancient Castrimœnium (under the village of Rocca di Papa). That of the Julia is on the south side, and almost close under the crater now the Alban Lake. The Tepula rises near the bottom of the valley which comes down from the hills in the neighbourhood of Grottaferrata, and along which the Via Latina passes. This lies somewhat nearer to Rome than the source of the Julia; but the Julia joined it before it had advanced far, and thus the expression of Frontinus, "Marcus Agrippa intercepted the Tepula[84]," is explained. The waters, therefore, flow into the same series of reservoirs and cisterns which received the Marcian after they enter Rome.

Under the account of the Julia, the _Aqua Crabra_ is mentioned. This is the little stream into which the water of the Julia and Tepula falls; which is united at the foot of the hill on which the town of Marino stands, to another stream called the Marrana, and the united water is now generally called by the latter name only[85]. Frontinus mentions several reasons why it was not made use of for supplying the city with water; but it was brought into Rome in the twelfth century as a small mill-stream.

Frontinus also says that the Tepula had its source at ten miles from Rome on the Via Latina, with two more miles to the right on a cross-road[86]. Ten miles on the Via Latina brings us near to Tusculum, at the tenth mile is the Casino de Ciampino, from which starts a cross-road to the right; and at two miles from that point we arrive at the springs called Fontanaccio, before reaching Grotta Ferrata, but close under that village. It follows that the source of the Tepula was at this place, now called Fontanaccio. The spring comes out under a cliff of the rock of lava near the road, and has a modern washing-cistern in front of it; but behind this the ancient work can be seen, with openings into a reservoir in the cliff. This is probably contemporaneous with the time that the conduit of the Tepula was made. The supply of water is small, but of good quality.

As the Aqua Tepula supplied only the Regiones in the northern part of the city, it seems to have passed into the _castellum_, the remains of which may still be seen in the city wall near the Porta S. Lorenzo, evidently built upon an old _agger_ before the Aurelian wall was erected[87]. It, however, has been a house as well, the lower part only being used as the reservoir for the water, and the upper part, which is large and important, for chambers. The front of this house, or _castellum aquæ_, still forms part of the city wall. It has been much disfigured, and the old drains walled up during the _restorations_ (!) of 1869.

On the level of the first floor, in which is part of the reservoir, is a row of corbels to carry a wooden gallery or _hourd_, probably an external passage for the use of the Aquarii, behind which the _specus_ runs at the same level. Immediately above the line of the corbels which carried the floor of the gallery or balcony, is a row of large arches; but these are merely the arches of construction found in most walls of the period. At the south end of this line of corbels, which mark the extent of the _castellum_ in that direction, there is an angle, and the wall recedes a few feet. In this angle is the _specus_, corresponding in form and dimensions with that of the Aqua Tepula in other parts; it can be seen entering into the reservoir behind the line of corbels. Within the wall are the usual marks of a reservoir of water: the tartar deposit remains visible in the corners of the chambers cut through by the wall of Aurelian, or

by the engineers of the Acqua Felice, whose _specus_ runs behind it on the bank within the wall which formed the front of the house. The _specus_ of the Acqua Felice is here at rather a higher level than the Marcian arcade, with the three _specus_ upon it, although at the “Sette Bassi,” five miles from Rome, and near the _piscinæ_, it is at a lower level. On the bank just above the level of the ground are the water-drains (hidden by the restorers in 1869) for carrying off the superfluous water into a large subterranean drain which runs under the gateway, and which is still in use for purposes of irrigation.

V. JULIA.

Frontinus states that the source of the Julia was at twelve miles on the Via Latina, with two more miles added on a cross-road to the right[88]. The twelfth mile is at Frascati; from thence, by a cross-road to the right, we arrive at the bridge of the Squaricarelli, and at the copious springs called the Fontanile, exactly two miles from the starting-point at Frascati. This must, therefore, be the source of the Aqua Julia.

The swampy ground in which the source of the Angelosa or Aqua Julia is found, is full of springs, like the Lucullan fields, from which flow the Appia and the Virgo, and from it run also the streams called di Monte Fiore and la Marrana di Marino.

This ground is on a high level on the Monte Fiore e dell Aglio (the Mons Algidus of the ancients), or “The hill of flowers or of garlic;” and the springs come from the gardens of the modern Villa Aldobrandini, at Frascati. Canina cleared out the ancient _specus_, which had a curved vault, almost oval (_a capanna_).

This source of the Julia is on the left-hand side of the road from Grotta Ferrata to Marino, about a mile above the former, and nearly the same distance below the latter. The water gushes out from the foot of the rock and passes under the road to a _lavacrum_, or washing-place, at a lower level on the opposite side of the road, and then falls into the Aqua Crabra, which passes at the foot of the cliff many feet lower down. A part of the water of the Julia, before it goes into the _lavacrum_, is carried to the right in a _specus_ to Grotta Ferrata. This is ancient, but has been restored to use, so that it looks modern. Below Grotta Ferrata, the _specus_ has been destroyed in many parts; but remains of it may be seen close to the ancient fortified villages called Pagus Lemonius (on the maps Castellaccio, a small castle). It is ten miles on a branch of the ancient Via Latina, and between the present roads to Frascati and Grotta Ferrata. In a part of the fortifications of this village is a _castellum aquæ_, or reservoir of the Julia, and near it part of the _specus_, on an arcade on the brow of the hill. This _specus_ is built of rough stone, and faced with a rude early kind of _Opus Reticulatum_, more rude indeed than might have been expected at its date (B.C. 34), and not nearly such good work as the Muro Torto, but more like the Emporium. The reservoir is of the same character, but part of the _specus_ in the fortifications is carried on brick arches which agree with that date; the brickwork is not of the time of Nero, to whom it has been attributed. A _specus_ of rough stone follows the line of the hill to the Marrana, after the junction of that stream with the Aqua Crabra, close to the point where the water from that stream enters a tunnel of the Aqua Julia. After it emerges from this tunnel, it arrives at the _castellum_ or _piscina_ in which the water of the Julia was received before it was carried on the Marcian arcade. This _piscina_ is about two miles nearer to Rome, close to the point of junction between the roads to Frascati and Marino, through Grotta Ferrata, and near to the other _piscinæ_.

Frontinus says that the AQUA CRABRA flowed past the head of the Julia, but was excluded from it by Agrippa[89]. We find this stream coming from that part of the hill on which the village called Rocca di Papa is situated, passing near the head of the Julia at Fontanile, now Angelosa, and sometimes mixing with the springs there. It has one of its sources in the grounds of the Villa Torlonia, at Frascati. All these three streams now fall into the river Anio.

Near Rocca di Papa an arcade, or bridge of ten arches, of silex or flint, covered with brick, passes over the Aqua Crabra to carry some aqueduct, probably a part of the Julia. This arcade is called Arcioni, [‘the arches.’]

There are some remains of another reservoir within the wall of Rome, on the bank between this and the Porta di S. Lorenzo, which seems to have belonged to the Julia: the _specus_ of the Marcia, with that of the Tepula and remains of that of the Julia over it, are visible on an arcade a little beyond, close to the gate. The lower part of a fine brick wall with bold buttresses, of the usual character of a _piscina_ or _castellum aquæ_, are visible, and this faces the present Wall of Rome, almost touching it, so that this has been built since the _piscina_, but that not being exactly in the same line it could not be used. The _piscina_ of the Tepula being on the outer side of the bank or _mœnia_ came into the line of defence of Aurelian, and was used as part of his wall; that of the Julia, being on the inner side of the bank, was too much within the line to be used.

The Castellum Aquæ Juliæ, or chief reservoir of the Julian Aqueduct, is usually, but erroneously, said to have been the one situated on high ground near the church of S. Maria Maggiore, where the picturesque ruins stand, usually called the “Trophies of Marius,” because those trophies were hung under two of the arches there, until they were removed to the Capitol. A lofty arcade carrying a _specus_ at a high level passes across the valley, from the reservoir near the Porta S. Lorenzo to this point. This arcade is of the first century, built of the fine brickwork usual at that period, and agrees with the time of Frontinus; but the only aqueduct that was high enough to have carried water to that spot was the Anio Novus.

This great reservoir was rebuilt by Alexander Severus, and called a Nymphæum, being given as such on one of his coins. This name is rather a vague one; but it is evident, from some excavations made in 1871, that there were extensive _thermæ_ of the Emperors of the third century near this place.

From this lofty reservoir the distributing channels may be seen branching off in different directions, one going to the Thermæ of Titus, towards the reservoir called the Sette Sale, another going in a different direction.

This Nymphæum (?) is on lower ground than the outer wall, though still on ground so high that the only water that could reach it was that of the Claudia and Anio Novus, of which part of the arcade remains between it and the reservoir on the high bank. From that point the ground descends gradually and gently along the line of the _agger_ of Servius Tullius either way, and still more towards the interior of the city. The aqueduct, therefore, could not pass underground and then _emerge_ in this part. The Porta Esquilina of the inner wall was on the same level, or nearly so. The Porta Tiburtina of the inner wall was near the _thermæ_ of Diocletian, with a gradual and gentle descent to it along the line of the _agger_. The only possible explanation of the text of Frontinus is that the same names of the gates in the inner wall were applied to those in the outer wall on the same roads.

A piece of leaden pipe, with an inscription upon it, was found at the Porta S. Lorenzo, which gives the names of Dolabella and Silanus as Consuls; this fixes the date at A.D. 10, and shews that the Marcian water was conveyed in leaden pipes at that point in the time of Augustus. The stone _specus_ was carried over the gate, as we see by the remains of it in the wall, and the inscription upon it recording repairs by Augustus. The one upon the leaden pipe is given by Gruter[90].

Another leaden pipe was found by Panvinius on the site of the Prætorian Camp, with an inscription, given by Gruter[91], which records that it conveyed the Marcian water to that point.

Three aqueducts are mentioned in other inscriptions found during the excavations near the railway station in 1869[92]; the _three_ aqueducts intended can hardly be other than the Marcia, Tepula, and Julia. The upper one only was excavated; but if the noble Roman princes who conducted this excavation had dug a little deeper, they would probably have found the other two _under_ the one that they had discovered. These three _specus_ must have been carried along and in the _agger_ of Servius Tullius.

To reach that part of it on the side of which these _cippi_ are found, they probably went along the side of the road that passed on the south side of the Prætorian Camp, on which was the gate called Porta Chiusa. Close to this gate remains of a large reservoir were found in the researches of 1869 on the bank, with the Wall of Rome carried right across it; but this part of the wall is medieval, built of old materials, and it is probable that, originally, the front wall of this reservoir was included as part of the wall of the city, in the same manner as that of the Tepula near the Porta S. Lorenzo. This reservoir, with the Porta Chiusa by the side of it, and the road from it to the _agger_, at the place where the _cippi_ were found, is now in the garden of the Baron Grazioli.

VI. AQUA VIRGO (B.C. 21).

This Aqueduct was made by Marcus Vipsanius Agrippa to supply water to his Thermæ, on the south side of the Pantheon, which was the hall of entrance to them.

Frontinus writes:—

“The same (M. Agrippa) when he had been consul for the third time, and when C. Sentius and Quintus Lucretius were consuls, that is, thirteen years after he had brought down the Julia, he brought the ‘VIRGO’ also, the water of which was collected in the Lucullan fields[93].

“The Virgo begins on the Via Collatia, at the eighth milestone, in some marshy places: a cemented wall [_signino[94] circumjecto_] being placed round it, to retain the bubbling waters; the source was increased by many other additional supplies. It comes for a length of 14 miles and 105 paces. Out of this,—by a subterranean stream 12 miles, 865 paces; above ground for 1 mile, 240 paces, of which it runs on a substructure in several places for a distance altogether of 540 paces; on arched work 700 paces. The

channels of the additional supplies of the subterranean stream make 1 mile, 405 paces[95].”

The Virgo has no reservoir, i.e. Piscina ... “The arches of the Virgo have their commencement beneath the Lucilian (or Lucullan?) gardens. They end in the Campus Martius, along the front of the Septa[96].”

The Virgo was the seventh in height as to level (c. 18).

The road now called Via Collatia, or Collatina, where the Aqua Virgo has its origin, is between the present roads to Tivoli and Palestrina; it turns off to the left or north of the highway now called Via Prænestina, just beyond the ruins called Torre de’ Scavi or de’ Schiavi, about three miles from the city. But this is an alteration; the old road from Rome to this point in a foss-way may be traced _behind_ the tower in the meadows, with the subterranean aqueduct running under and in the southern bank of it, as traced by the respirators or ventilating shafts. There are remains of very ancient tombs at intervals all along the line of this old road, which goes straight towards a postern-gate midway between the Porta Maggiore and the Porta di S. Lorenzo. This must be the Via Collatia of Frontinus.

Close to this road, at eight miles from Rome, near the ruins of Collatia, there are several springs in marshy ground, from which the water is collected in a series of reservoirs, just below the level of the ground, the vaults over them being sometimes above ground; from these small reservoirs separate short conduits run to the same point, the great central _castellum aquæ_, part of which is a cave in a rock, with a larger semicircular basin built out in front of it, over which passes the cross-road from the Via Collatia to Salone.

The line of the _specus_ can be distinctly traced from this reservoir near its source to the city by the respirators over the wells. The smaller _castella_, or cisterns, at the sources are also still in use.

About four miles from Rome, on the road now called Via Collatia, or Collatina, a portion of the Aqueduct was rebuilt under Benedict XIV. in 1753, as stated on an inscription upon it. It is here carried across a shallow valley, on an _agger_ built of rough concrete faced with brick, for about a quarter of a mile. At the further end is a conduit-head, or a modern _castellum aquæ_. This is a small oblong building with a semicircular head erected under Pius VI. in 1788, by Joseph Vai; and the conduit was continued by him for the length of 175 feet, also stated in an inscription upon it[97].

From this point there is a branch to the south for a short distance, with two respirators visible in the field; but this, though appearing like an additional source, is only a branch leading to an old fountain of a villa.

The main line comes from the north along the bank of the Via Collatia, as shewn by the respirators, at regular intervals of about a hundred yards. These are mostly round masses of concrete with round heads; but some are dwarf pyramids, one of which, numbered “40,” has been rebuilt in 1866. The surplus water is carried into a brook which runs by it, and receives its chief supply from it.

The _specus_ or conduit of the Aqua Virgo passes along the line of the old road in a direct line west, towards the Porta Maggiore, until within about half a mile from that gate; then it makes a great detour to the north, passing under the modern Via Tiburtina, and eventually enters Rome through the Pincian Hill a little to the north of the Spanish steps, and there is a reservoir for it at the end of a short street called the Via del Bottino. It then goes to the present fountain of _Trevi_, passing at the back of the houses in the Via del Nazareno, where it may be seen in several of the courtyards. In one of these, on the left hand of the street, is an inscription recording its repair by Claudius[98]; in another, on the right, is an ancient lavatory below the level of the street. A branch passes under the Via dei Condotti carried in leaden pipes, enclosed in a brick _specus_; this branch is the one that led to the Thermæ of Alexander Severus, which were situated to the north of the Pantheon. The main line supplied those of Agrippa, for which this aqueduct was made. The Aqua Virgo chiefly supplies the fountains and houses in the Campus Martius, or lower city, and the main stream terminated originally in front of the Septa[99], considerably to the south-west of that fountain. In some excavations made in the summer of 1871, a portion of it was found in the Piazza di S. Ignazio. This original termination was at the north end of the Septa, very near the Pantheon.

This aqueduct was restored by Pope Hadrian I., A.D. 772-795, after it had been damaged by the Goths. It was afterwards repaired by several subsequent pontiffs, especially by Boniface IX., A.D. 1389, and by Nicholas V. in the fifteenth century. It now supplies the fountains in the Piazza Colonna, erected in 1574; at the Pantheon, restored in 1711; several others of the seventeenth century; and that of the _Trevi_, erected by Benedict XIV. in 1730.

Near the source of the Virgo passes an abundant stream, also called Marrana; but this has mineral properties, and was therefore carefully avoided in forming the aqueduct for the Virgo. Pliny says[100] that there was a stream which was abhorred by the Virgo, and for that reason the water was called the Virgin. This stream was called by him _Rivus Herculaneus_, some say for its salubrious qualities, because Hercules was the god of health; others because it was a strong stream. There is little doubt that this is the stream here described. The same name of Herculanean is given by Frontinus to the stream now called Marrana[101] in two places, because it was also a strong stream.

VII. THE ALSIETINA (A.D. 10), AFTERWARDS MADE THE AQUA PAOLA.

Frontinus says of this water, “What could have induced Augustus, that most careful of emperors, to bring in the water of the ALSIETINA (which is called Augusta) I do not well know; for it is not pleasant to the taste, and therefore of no use for the people. It may be, however, that when the work of the Naumachia approached completion, in order not to divert the more wholesome water, he introduced this for the special purpose, and gave the surplus to the adjacent gardens and territories.

“It is the custom, however, in the Transtiberine Regio, when the bridges require mending, and there is no water forthcoming from the city side, to make use of this for supplying the public springs, as a matter of necessity.

“It begins in the Alsietine lake on the Via Claudia, at the fourteenth milestone, about six miles and a-half off on the right hand. Its course is in length 22 miles, 172 paces, and over arched work 358 paces[102].”

“It is the lowest of all as regards the level, supplying only the Transtiberine Regio, and the places adjacent[103].”

“The manner of beginning the Alsietine aqueduct is not described in the commentaries, nor can it now be found with certainty; it begins from the Alsietine lake, and then about the _Cariæ_ receives water from the Sabatine lake also, as the Aquarii regulate. The Alsietine gives 392 quinariæ[104].”

The lake formerly called “Lacus Alsietina,” now called Lago di Martignano, is situated on the hills on the western side of Rome, between the Via Aurelia and the Via Claudia, (not far from the old carriage-road from Florence to Rome). It is about 679 ft. above the level of the sea; and as Rome is only 204 ft. at the Porta Maggiore, the lake is 475 ft. above the level of Rome at that high point. There is another small lake about a quarter of a mile from, and a little above the level of, the Alsietina, called Strachia Capra, which has recently been drained by a tunnel in imitation of the _emissario_ from the lake of Albano. The water in the Lacus Alsietina has also been very much lowered in the same manner[105]. In consequence of this reducing of the level of the water, the _specus_ of the aqueducts are now brought to view, being on the bank and above the present level of the water, so that they can distinctly be seen and entered into[106].

To begin with the highest, the _specus_ of the Aqua Paola begins in the upper lake, and forms a junction with the water from the Alsietina Lake, near the bank of the latter, at the south end of that lake. The _specus_ of the Alsietina of Augustus is a tunnel cut in the rock[107]. The Lacus Sabatina[108] is at the elevation of about 523 ft., and therefore 156 ft. below the Alsietina. Augustus drew an additional supply of water from this lake, and this portion only of the aqueduct of Augustus was restored by Trajan. The water for this was not drawn from the lake itself, but from the springs that supply the lake on the western shore, the side most distant from Rome. Some of the work of the time of Trajan is visible there. The _specus_ of the Alsietina has been traced to the point of junction with the Aqua Paola (this water having been restored to use by Pope Paul III., A.D. 1540), and it still supplies the district of the Trastevere. It does not appear that Trajan used the water of the Alsietina at all, but the engineers of Pope Paul evidently did so; a tunnel, or _specus_, from that lake having been made in the time of Pope Paul, the entrance to which remains, with the grooves for a flood-gate[109]. After the junction with the Aqua Paola, the old wells can no longer be traced; their place is supplied by the constructions called _respirators_, each of which is a small square structure surmounted by a pyramid. These are evidently built over the wells, and very rudely constructed of the stone of the country, worked rough. When we arrive at the Osteria Nuova,—which is near the site of the ancient city of Cariæ[110], mentioned by Frontinus, and the old village of S. Maria in Celsano, the point of junction of the Alsietina and Sabatina,—there are evident marks of another junction of aqueducts there. The house itself, now used as an _osteria_ or hostelry (_auberge_), is made out of an ancient Castellum Aquæ, as is frequently the case with similar houses in the country round Rome, and sometimes even within the walls. At about half a mile from this _osteria_, in a hollow, is a white house called Casale Bianco; and close to this is a fountain, supplied by a spring which runs into a _specus_. This water, being one of the sources of the Aqua Paola, passes through the hill at a considerable depth. At about half the distance between this and the _osteria_ is a remarkable passage for the Aquarii into the tunnel by a very steep descent, passing sideways across the _specus_ of the Aqua Paola, and going on to a much greater depth to the Aqua Alsietina[111]. This passage is 150 ft. in

length from the surface of the hill, and 70 ft. in perpendicular depth, with ninety steps, of which only a few at the top are visible; the others are covered with earth. The water still runs through the upper _specus_, and is still in use, but not through the lower one[112].

From the valley beneath the sloping passage for the Aquarii, near the Osteria Nuova, Nibby[113] traced the Alsietina as a tunnel cut in the tufa rock, a part of which he saw near an oil mill. The _specus_ then followed the low ground from the tenements of S. Niccola, Porcareccina, Maglianella, and from the Villa Panfili, to the principal gate of the monastery of _S. Cosimato_ (or SS. Cosmas and Damian in the Trastevere), where it is stated by Cassio[114] that the _specus_ was found in 1720, about thirty feet underground. The Naumachia of Augustus is said to have been near this monastery.

The complaints of Frontinus appear to have been listened to by the Emperor, and great changes and improvements were made in this aqueduct under his direction, in the time of Trajan; this is in fact the same as the Aqua Trajana (see X.), and the water still comes from the Lacus Sabatina, but not from the Alsietina. In going from Rome, the respirators can be followed across Monte Mario, and near the high road that passes over Ponte Molli, to the point of junction about ten miles on the road to the Cariæ [now Osteria Nuova]. Here the respirators cease; but their place is supplied by a line of old wells descending into the subterranean _specus_, which follows the line of the _old road_. This is not always the same as the new one. The other branch, which supplied the Naumachia, was the only one made in the time of Augustus. Paul V. repaired this aqueduct along the whole line, restored it to use, and put up in various places inscriptions recording this, in which he calls it the Aqua Alsietina[115]. The last of these is on his fountain at the mouth of the aqueduct, where the water still gushes out in great abundance, as it did in the sixth century, when it was observed by Procopius; this is on the Janiculum, above S. Pietro in Montorio, the highest ground in Rome.

VIII., IX. THE CLAUDIA AND ANIO NOVUS (A.D. 52).

“Afterwards Caius Cæsar, (Caligula,) who succeeded Tiberius, considered seven aqueducts scarcely sufficient for public purposes and private amusements, and began two new aqueducts in the second year of his rule as Emperor, when Aquilius Julianus and P. Nonius Asprenas were consuls (i.e. A.D. 38), in the year of Rome 789, which work Claudius in a most splendid manner finished and dedicated, on the calends of August, in the year of the city 803 (i.e. A.D. 52), when Sulla and Titianus were consuls[116].

“To one, which was brought from the springs of Cæruleus and Curtius, the name of _Claudia_ was given. This one is next in order of excellence to the Marcian.

“The other, because two streams of the Anio had begun to flow into the city, so that they should be more easily distinguished by their names, began to be called _Anio Novus_. It ruins all the others[117]. To the former Anio the cognomen of _Vetus_ was added[118].

“The Anio Novus and Claudia are carried from the _piscinæ_ upon higher[119] arches, so that the Anio is the highest of the two. Their arches come to an end after the Pallantian Gardens, and thence they are carried down in pipes for the use of the city.

“But first of all the Claudia transfers a part of its water on to the arches which are called the Neronian, at the _Spes (Specus) Vetus_. These, being continued in a direct line along the Mons Cœlius, are terminated close to the temple of Claudius. They disperse the quantity which they had received either about the ‘Mons Cœlius’ itself, or in the Palatine, in the Aventine and the Transtiberine Region[120].”

VIII. THE CLAUDIA.

“The Claudia begins on the Via Sublacensis[121], at the thirty-eighth milestone, about 300 yards off the road towards the left. There are two very large and beautiful springs, one called Cæruleus, from its blue appearance, the other Curtius[122]. It receives also the spring which is called Albudinus, of such excellence, that when there is need of adding it to the Marcia, the latter loses none of its quality by the addition. The spring of the Aqua Augusta, because the Marcian seemed to be sufficient for itself, was turned aside into the Claudian; nevertheless it was retained as a protection for the Marcian, but so that the Augustan might be added to the Claudian, if the channel of the Marcian was not capable of receiving it[123].

“The channel of the Claudia is 46 miles, 406 paces in length; of this, 36 miles, 230 paces is by a subterranean course: on work above ground 10 miles, 176 paces, and out of this on arched work, in many places in the upper part, 3 miles, 76 paces; and near the city from the seventh milestone, by a substructure of channels for 609 paces, on arched work 6 miles, 491 paces[124].

“The Claudian was the second in height as to level[125].”

IX. THE ANIO NOVUS.

“The Anio Novus, at the forty-second milestone, on the _Via Sublacensis_, at _Simbruinum_[126], is taken out of the river, which, since it has about it cultivated land in a rich territory, and so very loose banks, flows muddy and turbid even when uninfluenced by violent rains; and therefore at the very entrance of the channel is placed a cistern for the mud (_piscina limaria_), so that the water on its way from the river to the _specus_ should settle and become clear. From this cause also when heavy showers come down, the water flows into the city in a muddy state.

“There is joined to it the _Rivus Herculaneus_[127] which rises on the same road at the thirty-eighth milestone, in the same neighbourhood as the springs of the Claudian, on the other side of the river and the road. This is very pure by nature, but when mixed it loses the advantage of its freshness.

“The channel of the Anio Novus is in length 58 miles, 700 paces. Out of this 49 miles, 300 paces is by a subterranean channel;—on work above ground 9 miles, 400 paces; out of this on substructure or on arched work in several places in the upper part 2 miles, 300 paces, and nearer the city, from the seventh milestone, on a substructure of channels 609 paces, on arched work 6 miles, 491 paces. These are the highest arches, elevated in some places 109 feet[128].

“Nor was it enough for our Emperor [Nerva] to have restored an abundant and pleasant supply of water in the other aqueducts; he thought he saw his way to getting rid of the bad qualities _even of the Anio Novus_, he therefore ordered the _source to be changed from the river_, which was now left alone, and taken instead _from the lock in which_ the water was most pure, and which _is situated above Nero’s villa on the lake_ (_super villam Neronianam Sublaquensem_[129]);” i.e. at Subiaco, now a medieval castle and a modern town.

“But the water of the Anio Novus often spoilt the rest, for since it was the highest as to level, and held the first rank as to abundance, it was most often made use of to help the others when they failed. The stupidity, indeed, of the Aquarii was such that they introduced this water into the channels of several others where there was no need, and spoilt water which was flowing in abundance without it. This was the case especially as regards the Claudia, which came all the way for many miles in its own channel perfectly pure, but when it reached Rome, and was mixed with the Anio, lost all its purity. And thus it happened that most of the streams were not in fact helped at all by the addition of the extra water, through the want of care on the part of those who distributed it[130].”

THE NERONIAN ARCHES.

“Amongst those abuses which seemed to require reform, may be mentioned what took place regarding the supply to the Cœlian and Aventine hills. These hills, before the Claudian was supplied to them, were accustomed to use the Marcian and Julian; nevertheless, when the Emperor Nero gave them the Claudian raised to a greater height on the series of arches extending to the Temple of Claudius, where it was distributed, the older streams, instead of yielding an increased supply, were lost altogether. He made no new castella [for the Claudian], but used those which were there, and which retained their names, although the water brought to them was different[131].”

THE RIVER ANIO.

The highest source of the river Anio, or Aniene, is in a gorge in the highest part of Mount Cantaro, about 63 miles from Rome. This spring never fails in the hottest and driest weather, and is always cool; it is situated in the close or (_serra_) of St. Antonio, and is called _La Canala_, or the canal at the gate of the small castle or fortified village of Filettino. Pliny says[132] that it rises in the territory of Treba[133]. In going from Filettino towards Trevi the road has an ancient pavement, and on the left-hand side is a magnificent substructure of Cyclopean character called _Mura Saracine_, against the cliff. In 1857 Signor Gori saw some of the large stones of this fine ancient substructure thrown down to the banks of the stream, to make the foundations of a small bridge across it. The stream receives several accessions from other springs in its course, two from a cave called Pertusu, the small limpid stream called Suria, on the hill of Trevi, and another called Capo d’Acqua. The Anio thus augmented falls in two cataracts, or cascades, near Pertusu, and passes under the Ponte delle Tartare with much violence. This bridge is a natural arch of rock formed by the force of the water piercing it. The river then passes on through a gorge in the mountain-pass in small waterfalls, especially at a place called Pendema, where in 1855 an ancient mosaic pavement and a wall of reticulated masonry were found.

At the two bridges of Communacchio (_comune acqua_), where an amphitheatre of mountains and the castle of Valle-pietra are situated, another stream coming from the mountains of the Trinitá and Autore, the highest in that district, joins the Anio.

In the basin of Valle-Pietra, two fine cascades fall over the massive rocks and unite in a single stream. From the bridge of Communacchio a road leads to Arcinazzo, situated in a large plain, surrounded by the mountains, with several roads leading into it. One of these from Palestrina, passing by Piglio, is an ancient paved road, and some persons consider that an arcade of Cyclopean masonry, near Guarcino, carried an aqueduct to the _thermæ_ there. On the south-west side of this plain are the ruins of an imperial villa, commonly called of Nero; but two inscriptions found there upon leaden pipes in 1860, shew that it was of Trajan[134]. Great quantities of marble were dug up here in the time of Pius VI., A.D. 1795.

The river passes below the monastery of S. Benedict, called the Sacro Speco, and a little lower down, the monastery of S. Scholastica, both of which stand on the brink of a precipice, over which the Anio makes a large and picturesque waterfall, and passes under the bridge of S. Mauro or Piedilago, where the rocks approach so closely as to leave only a narrow passage, which was formerly closed by a gigantic wall, forming a long lake or lock. The stream now passes through the ruins of the wall, the demolition of which was caused in 1305 by two ignorant monks, who pierced a hole at the foot of the wall, the result being that the whole country was inundated up to the walls of Rome, and serious mischief done, as recorded in the anonymous chronicle of the monastery[135].

On the banks of the lake are the ruins of a villa of early character, called Casa de' Saraceni and Carceri, with a _nymphæum_ and baths. At Pianigliu, are other ruins on an enormous scale.

Subiaco is more than two thousand feet above the level of Rome, and all the foregoing description applies to the part of the river above Subiaco. In all this upper part of the stream, the river Anio has very much the character of a large mountain-torrent rushing through the rocks with great violence. It usually appears to be a clear stream of beautiful water, excepting in time of floods, when the clayey soil is brought down into the stream and makes it muddy. To guard against this evil, Nero made his great lakes, which do not correspond at all to the usual English idea of a lake, by which is commonly understood a considerable sheet of water, like the Swiss lakes or the lakes of Westmoreland, Scotland, and Wales. The Roman word _lacus_, and the modern Italian _lago_, may mean a lake of this description also; but it includes a reservoir of water of any kind. We are expressly told in the _Breviarium_, at the end of the Catalogue of the Regionaries, that a _lacus_ is a well, _puteus_, and the numerous _lacus_ of that Catalogue are the same as the _castella aquarum_ of Frontinus, within the walls of Rome. These justly-celebrated lakes of Nero are in fact portions of the river Anio, intercepted in a gorge of the rocks about a mile above Subiaco, and are formed by cutting away some large pieces of the rock on each side in large masses, and with these building a great high and massive wall across the stream, forming an effectual barricade or dam to stop the water and raise it to the level of the top of this great wall. There were three of these walls across the stream, over each of which the river fell in tremendous cascades. The first loch (_lacus_) commenced at the Mola di Ienne, where the first great wall of enclosure is situated. The second at the cascade of the river, under the great monastery of S. Benedict, and called "the Sacred Specus," from a cave in which the saint is said to have lived, extends to the bridge called Ponte di S. Mauro, where the _specus_ of Trajan commenced. The third is from the Ponte di S. Mauro, through a gorge, where the wall of enclosure is visible. Here was the Piscina Limaria of Claudius, and the _specus_ of the Anio Novus originally commenced at the Emissarium, restored by Cardinal Barberini. This was made by Claudius, but was abandoned by Trajan, because the earth from the adjoining fields had fallen between the river and the _specus_.

The Villa Sublacensis of Nero was below the level of the upper lake or loch, as mentioned by Frontinus. This was just above the present bridge called S. Mauro or Piè-di-lago, which seems to be made upon the two ends of the dam. This dam, wall, or barricade, was quite 150 feet above the surface of the water in ordinary times. The bridge is still 144 feet above the water by measurement, and the _specus_ is nearly ten feet higher. This _specus_ or conduit is cut in the rock of the cliff on the side of the valley, at the level at which the water originally stood in this lake or loch; the wall was a few feet higher, in order to force a portion of the water to pass through the _specus_ before the rest fell over the cascade. There are ruins of the _piscinæ_ on the bank where the _specus_ began, and of the villa of Trajan on both sides of the loch, with the well-known brickwork and _Opus Reticulatum_ as facings for the walls. These magnificent cascades still remain, being a natural formation; but as the bed of the river is very deep, they are much concealed by the banks, and the shrubs upon them. The great walls or dams of Nero and Trajan being brought out to the edge, the cascades falling over them must have had a much finer effect, although the natural site is extremely grand and most picturesque; in fact it is celebrated among all the landscape painters of Italy, the scenery about Subiaco being among the finest of its kind of river and mountain scenery that is known. The enormous reservoirs or lakes, or lochs of Caligula and Claudius (commonly called of Nero), cover the space between the natural cascade and the outer wall of rock artificially constructed, over which the water was

made to fall. When the ignorant monks in the fourteenth century made an aperture in the great wall or dam, the force of the water soon enlarged it, and washed the whole structure away, leaving the great masses of stone or rock, of which it had been built, scattered in the stream below as if they were natural rocks, where they still remain. The object of the monks was to release their fields adjoining to the monastery above the falls from a temporary flood.

The _specus_ is nearly six feet high, and only sixteen inches wide; the men must have cut it standing sideways. There are apertures into it at intervals now open, and there probably always were such openings for the use of the _aquarii_ to keep the course clear. The _specus_ which Frontinus calls _subterraneus_, although that is _literally_ true, does not mean exactly what we now call a tunnel; but this _specus_ is cut in the rock of the cliff, with a few feet of stone only as an outer wall to it, and in this manner it is continued along the edge of the valley of the river Anio for many miles, always on the left side of the river in going towards Rome. An old road runs by the side of it, not now used for carriages, but remaining as a cart-road only; this must be the Via Sublacensis of Frontinus. Another road runs along the right-hand side of the valley, and is the one now in use: this is the Via Sublacensis Neroniana of the time of the Empire. The valley varies in width very much, in some parts it is three or four miles wide; this is the case where the springs of the Marcia and the Cerulean Lake gush out from the rock under the _diverticulum_ of the Via Valeria or present carriage-road, on the right-hand side of the valley.

The lowest of the three lakes of Claudius above Subiaco was circular, the rock being cut away to a half circle on each side of the stream; into this great basin the grand cascade fell from the second lake. The lowest lake or loch was comparatively not very deep. It seems most probable that the lowest reservoir was intended to serve for the Aqua Claudia. The _specus_ has not at present been traced quite so far; but it is found a little lower down, above the modern paper-mill. This is more than a hundred feet below the level of the Anio Novus. It may be that this was one of the springs that fell into the Anio, and was intercepted for the aqueduct. It is probable that the same was the case with the Anio Vetus, as we know it was with the Marcia; but as the water from the springs sometimes ran short in dry seasons, the Anio Novus was taken from the river itself, a part of which was turned into it from the great lake or loch. For this reason that water was always more abundant than all the rest, and was used to supply the deficiency in case of need, as Frontinus tells us. This _specus_ can be entered and examined; it is here a tunnel made in a rock of soft stone, with fissures filled with clay. The _specus_ is lined with brick, and covered with large flat tiles, placed at an angle, so as to form a roof sloping down to the two sides from the ridge in the middle. There are inscriptions recording repairs by Cardinal Barberini, nephew of Urban VIII. This _specus_ is that of the Anio Novus, constructed by Claudius; that of Trajan is about half-a-mile above the town of Subiaco, and on the right-hand side of the river Anio, not on the left, as the Anio Novus is.

The thirty-eighth milestone on the Via Sublacensis was found by Fabretti _in situ_, and the thirty-eighth milestone in the Via Valeria, now at Arsoli, is said by Gruter[136] to have been formerly at _La Sonnoletta_, or _ad fontem Somnulæ_: so that the two sources of the Claudian water, called Cæruleus and Curtius, were at the lake now called S. Lucia, in the territory of Arsoli; and the source called Albudinus is the _first_ of the four springs now called _Acque Serene_, while the other springs of the same name formed the _Aqua Marcia_.

The _Piscina Limaria_, referred to by Frontinus as erected by Claudius for filtering the stream, at the entrance of the Anio Novus, at the forty-_second_ mile[137] on the Via Sublacensis, is visible at the _Parata della Cartiera_ of Subiaco. This _piscina_ is not covered over, but open at the top, and is excavated in the rock of the bed of the river Anio, with a great declivity and with four cascades to throw down the sand, wood, and weeds brought down the river, and so to purify the water; but as it was still liable to become muddy in the time of floods, Trajan, according to Frontinus, excavated another _specus_ in the rock of the mountain near the Ponte di S. Mauro, where the great wall of the lake was situated[138].

The _specus_ of the Claudia seems to have been carried on the right-hand side of the valley as far as Vicovaro, about half-way to Tivoli, and then across the valley on an arcade, and carried on under the Anio Novus, and above the Marcia and Anio Vetus. All of these seem to be at different elevations on the side of the hill to the left of the valley, until they arrive at another valley crossing this, called the Valley of the Arches, about two miles from Tivoli, where they were carried across upon arcades. On these ancient arcades, or out of the materials of them, modern bridges have been made, both at Vicovaro and in the Valley of the Arches. The ruins of these splendid arcades are among the finest and most picturesque ruins of the Roman empire.

After passing the bridges across the valley of the Anio, the Anio Novus, Marcia, and Anio Vetus are continued along the side of the hill in what may still be called the cliff of the valley of the Anio, to _near_ the cascades at Tivoli, at different levels, the Anio Novus considerably higher than the others. To avoid the cascades here the aqueducts wind round the end of the hill. In going out of Tivoli to the promenade of Carciano, on the side towards Rome, there is a large college of the Jesuits on the left hand, the _specus_ of

the Anio Novus passing under this, and through a wine-cellar. About a quarter of a mile out of the town, two _specus_ are visible on the side of the hill above the road or promenade, and these may be traced at short intervals for miles, with openings into them in several places. The lower one is the Marcian, passing in a more direct line, and further from Tivoli, and is generally cut in the rock as a tunnel; the upper one is the Anio Novus, and is in some places faced with brick or with _Opus Reticulatum_, where it has to cross an opening. The Aqua Marcia here passes at a lower level below the road, with reservoirs at intervals, as already described.

At about three miles below Tivoli, and half-a-mile after passing one of the great reservoirs of the Marcia at the lower level, the Anio Novus is carried on an arcade across a valley and a small stream, at a place called after the arcade Arcinelli. The great Villa of Hadrian is nearly under this at the foot of the hill, perhaps a mile lower down. This was supplied with water by branches from the aqueducts, but without interfering with the main streams, which went on at the high level still at least five hundred feet above the level of Rome. From this high level the aqueducts led gradually down in a serpentine course, crossing several narrow valleys or gullies through the hills, along which some mountain-stream flows far below. At two important points, the aqueducts have to be carried across such valleys or gullies on fine arcades or bridges. The one nearest to Tivoli is called the bridge of S. Antony, from a small chapel made in the Middle Ages, probably in the fourteenth century, out of a portion of the _specus_ of the Marcia, in one of the chambers of a _castellum aquæ_ belonging to it, the rest of which has been destroyed. The _specus_ of the Anio Vetus under it has also been destroyed, but the arcade is preserved for the use of horses and foot-passengers. This bridge is about eight miles from Tivoli. There is no carriage-road to it, but a tolerable path for horses or donkeys; it is one of the finest and most picturesque objects on the whole line of the Aqueducts, and is about 100 ft. above the water in the stream below which is called the _fosse_ of S. Antony. This valley or gorge in the mountain, with the bridge across it, is not easily seen from any distance; but the site may be indicated by a medieval castle with a tall square brick tower, which is a conspicuous object for miles. This is distinctly seen from the bridge, and as it stands at the mouth of the valley, that object must be seen from thence on looking up the valley. This bridge is a really grand work; it is 373 ft. long, 16 ft. wide, and about 104 English feet high. The dome of S. Peter's at Rome is visible at a long distance from the hill above the medieval castle.

Following the direction of the aqueducts towards Rome for about a mile, along a very rough cross-country path, we arrive at a good carriage-road from Rome to Poli, and about a mile beyond that is another magnificent structure, as fine and more perfect than the last, called Ponte Lupo, one of the greatest works of all the Roman aqueducts. There are not so many open arches as at the bridge of S. Antony, but a greater extent of substructure and wall at each end, and the height above the mountain-stream is even greater. Several of the arches seem to have been filled up for greater strength, at an early period; it is all work of the first century. Here the two _specus_ of the Claudian and the Anio Novus are perfect, one upon the other, and serve as a lofty parapet to the road for horses, which passes across the valley along the side of them, the _specus_ occupying about one-third of the width of the bridge. The two _specus_ seem to have been first brought together at this point, and afterwards continue one upon the other for the rest of their course into Rome, interrupted only by the _piscinæ_ and _castella aquarum_ at intervals.

There are ruins of another arcade across the valley at a lower level by the side of this grand bridge, only a few yards from it, which can only be that of the Marcia. The Anio Vetus appears to be carried across under the Claudia and Anio Novus at a much lower level, and it is probably for this reason that the arches are closed instead of being left open. They pass upon four other bridges over the streams of S. Gregory and of the Inferno, before they arrive at the _piscinæ_. They all four meet at this point, and then diverge again for miles. This splendid work is about ten miles from Tivoli, half-a-mile from the carriage-road, five or six miles from the Villa of Hadrian, and out of the line of the direct road to Rome, but very near the road from Rome to Poli. After passing these great works, the aqueducts are continued at their respective levels in the direction of La Colonna and of the _piscinæ_, and are carried in tunnels through the hill, but these tunnels do not appear to be of any great length; they merely pass through part of one side of the hill. They bring us to the _piscinæ_, which are about six miles from Rome, where the arcades begin, and from this point the Marrana follows the same direction in the bed of the Almo, winding about but never very distant from the arcades, and always receiving the surplus water. This stream is here divided into two branches, one of which goes through Rome and into the Tiber at the Pulchrum Littus; the other passes through the valley of the Caffarella, and falls into the Tiber near the church of S. Paul beyond the walls, as is explained under the head of the Aqua Crabra and the Marrana.

The _specus_ of the Anio Novus is always faced with brick or with _Opus Reticulatum_; it is carried _upon_ the Claudian arcade, and the one _specus_ always rests upon the other: what applies to one applies to both after the first junction. The aqueduct of Claudius has a stone _specus_ carried on a stone arcade for the last five miles into the city. It was begun by Caligula, and carried on by his successor; this portion was completed in fourteen years, a very short period for so enormous an undertaking. The Anio Novus was the most abundant of all the aqueducts, as stated by Frontinus[139].

The arches of aqueducts, stretching for miles across the open country and entering Rome at the eastern angle, are the first objects to attract the attention of strangers on approaching the city. These are the arches of the Claudian aqueduct, built of large square stones, with the angles chamfered off, and carrying the streams of the Aqua Claudia and of the Anio Novus.

Of the _Piscinæ_ mentioned by Frontinus, the ruins of one remain at the place now called Porta Furba, where the aqueducts just mentioned meet again about two miles from the city. The lofty Claudian arcade passes over the Marcian arcade at this point, at one of the numerous angles, as it had previously done at the Torre Fiscale. From the Porta Furba to Rome, the Aqua Felice is carried against the side of the Claudian, or on the piers of the Marcian, as most convenient, frequently crossing from one to the other on arches over the road. The _specus_ of the Felice is built in the roughest manner of old materials taken from the other two arcades. The Anio Vetus also passes underground at the Porta Furba. Immediately after the entrance of the Claudian _specus_ into Rome at the extreme east end, in the gardens of the Sessorian Palace (now S. Croce), there are remains of at least four reservoirs or _castella aquarum_ before it reaches the Porta Maggiore[140].

Nero was the immediate successor of Claudius, A.D. 54-69, and carried on the conduit into the city, on what are still called the arches of Nero, which are faced entirely with brick, and some of the most beautiful brickwork in the world. So gigantic a work as these aqueducts could not have been completed in the lifetime of a single emperor, however large the number of slaves he may have employed upon it.

THE NERONIAN ARCADE.

The arcade of Caligula and Claudius, which is entirely of stone, terminates at the Porta Maggiore, the Esquilina of Frontinus. The work of Nero includes the arches within the city from the wall close to the Porta Maggiore to the great _castellum_ on the Cœlian, over the arch of Dolabella. The _specus_ of the Anio Novus is easily distinguished from the _specus_ of the Claudia, as the latter is of squared stone.

The arcade of the Claudia has been considerably repaired with brick, and the arches filled up in several places with brickwork of the time of Septimius Severus and Caracalla, A.D. 193-217. This may be distinctly seen in that part of the arcade which is between two and three miles from the city, near the Porta Furba. It was again repaired by Pope Hadrian I. in 780, and several times by other Popes.

The remains of these two aqueducts, one above the other, are admirably seen in their course along the top of the Porta Maggiore; and at this spot their relative levels with regard to the Marcia, Tepula, and Julia, are also clearly exhibited, the latter entering the wall close to the gate, and almost at right angles to it. Thus, at one view, we are able to see the _specus_ of five out of the nine aqueducts, mentioned by Frontinus, actually remaining. A sixth, the Anio Vetus, also passes under the Walls of Rome at the same point; the _specus_ is half underground, and now concealed by the _restorations_ made in 1869.

An inscription upon the face of the _specus_ itself in the wall of the city over the archway, records that Claudius the son of Drusus, caused to be brought into the city the water of the Claudian conduit, from the springs called Cæruleus and Curtius, from 45 miles distance; also the water of the Anio Novus, from 62 miles, at his own expense[141]. These dates here given correspond with the year 798 of Rome, or A.D. 45. Great repairs were made by Vespasian and Titus to the Claudian aqueduct. The distance from which the Anio Novus is brought, according to this inscription[142], is 62 miles, which agrees with Frontinus[143].

The architect of the Claudian is believed to have been Claudius Annius Bassus, mentioned by Tacitus as chief engineer at Carthage under Marcus Silanus, the father-in-law of Caligula. The remains of the tomb of Bassus may be seen near Vicovaro. The tomb of another architect and his family, on the side of the _agger_ upon which the arcade of Nero stands, near the Porta Maggiore, was excavated in 1865. From its situation immediately under the _Neronian Arcade_ against the bank on which it stands, there seems no doubt that this Tiberius Claudius Vitalis, whose name is inserted on the front of the tomb, was the architect of the arcade; and it does infinite credit to him, for it is one of the finest pieces of brickwork in the world.

This arcade, commonly called the Arches of Nero, carried the _specus_ of the Claudia[144] and Anio Novus combined. It first crosses the foss on a double arcade, one upon the other, to give more height across this wide and deep inner trench; it is then carried on a high bank, and therefore on a single arcade only to the Lateran, and on another bank across the foss between the Lateran and the City to the Cœlian, and along the north side of S. Stefano Rotondo to the reservoir and _piscina_ over the arch of Dolabella. This arch was the principal entrance to that part of the Cœlian in which the _Claudium_, or courts and temple of Claudius, were situated. There are magnificent ruins of a large _castellum aquæ_ over this arch, faced with the beautiful brickwork

of Nero; in part of this the small church of S. Thomas in Formis has been made.

Another large subterranean reservoir remains perfect on the west side of this lofty brick _castellum_ of Nero. This consists of three large vaulted chambers under the garden between the church of the twelfth century and the small monastery of the Redemptorists, now (1872) all belonging to the Villa Mattei, or Celimontana. There is, through the crown of each of the vaults, a circular opening, or well, closed by a stone, which can be moved at pleasure for letting down buckets into the water; it is still used for the purpose of irrigation. From the low level of this reservoir, it must have belonged to the Aqua Appia. By the side of the garden over this, and above ground, in a line with the Arch of Dolabella, is a wall of the first century, faced with reticulated masonry, probably part of the _castellum_ of that period, as new reservoirs have been built there for each successive aqueduct that came to this point. The highest, being that of Nero, was 50 feet above the level of the ground.

Thence the water was distributed in different directions, one branch to the Claudium[145], and thence again to the _stagnum_ or pool originally of Nero, but afterwards retained under the Colosseum; a second to the Palatine, passing down the western side of the Clivus Scauri opposite to the church of SS. John and Paul. Then, after making one of the usual angles, it was carried across the valley on the arches attributed to Nero, but in this part really after his time, the lower portions of some of which remain. The third branch was to the Aventine. The plan for this was not carried out until the time of Trajan, when a lofty arcade was made across the valley from the Cœlian to the Aventine, passing over the Porta Capena above the Aqua Appia, which had previously been made in the same line, and with new reservoirs for it, generally by the side of the old subterranean ones. One great reservoir under the Cœlian occupies a considerable part of the space between the cliff and the present road, and is now turned into a gardener's house. The excavations made there in 1868 have been described in the account of the Appia; the piers of the tall brick arcade of Trajan remain on both sides of the road leading direct to the north end of the ruins of the Piscina Publica, on the other side of the Marrana, under S. Balbina; the upper part of this great building is of the time of Trajan. On the side of the Cœlian are remains of another large _castellum_, of two stories, of the same period. There are also remains of this aqueduct on the brow of the Aventine Hill, near the church of S. Prisca, in front of the monastery, now in a vineyard opposite to the Palatine, and overlooking the Circus Maximus.

The water both of the Anio Vetus and of the Anio Novus was of inferior quality, and was used chiefly for watering gardens, and for the more common purposes in the city; the Anio Novus, being higher than any of the others, and the water very abundant, assisted all the rest. Trajan endeavoured to improve the quality of the water by excluding the more turbid sources, and using only the most pure, as we learn from Frontinus, who was the person charged with the execution of the work[146]; and this inscription was put up, IMPERATOR CAESAR NERVA TRAJANVS AVGVSTVS.

The waters of the Claudian and Anio Novus are stated by Frontinus[147] to have been united after their entrance into the city, and then distributed to all the fourteen Regiones. Several subdivisions must therefore have been made at different points, and, wherever a division or a junction took place, a _castellum aquæ_ was required. The union of the two streams was probably made in the large reservoir at the angle of the Sessorian gardens and City wall near the Porta Maggiore. Another great division was over the Arch of Dolabella; one branch was afterwards carried on by Domitian to the Palatine upon the lofty arches, some of which still remain, and into his reservoir at the south-west corner of the Palatine Hill, part of the baths or _thermæ_ of his palace. The branch over the Via Appia to the Piscina Publica and the Aventine was not made until the time of Trajan and Hadrian. A great deal of work was done to the aqueducts at that period. The amazement of the people at seeing copious streams of water pouring over the arid heights and slopes of the Aventine, is recorded by a contemporary author. This was the branch of which a portion remains near Santa Prisca. The branch from the Palatine to the Capitol, of which two of the tall piers remain[148], was made by Caligula; this is sometimes called a bridge across the Forum. To convey the water to the other Regiones, the older conduits or _specus_ were probably used.

In the fourth century, there were great complaints of the stealing of the Aqua Claudia by the farmers through whose lands it passed, and several strenuous decrees against this practice were issued by the Emperors Arcadius and Honorius, A.D. 400. Similar edicts were issued repeatedly by these Emperors, and by Constantine[149].

The springs called Cæruleus and Curtius, to which (when united in this aqueduct) the name of Claudia[150] was given, as Frontinus tells us, are situated in a valley on the south side of the river Anio, thirty-eight miles from Rome, and eight miles below Subiaco (which is forty-six miles from Rome), and not more than half a mile from the source of the Marcia. Several streams issue from the rock under the present carriage-road, a _diverticulum_ or branch of the ancient Via Valeria, and form a beautiful small lake of very clear water having a distinctly bluish tint. Another of these springs, the Albudinus, is still considered as equally good with the

Marcia, or nearly so. The Anio here flows at the opposite end of this small valley, and both the lakes are now emptied into it. This valley is in the territory of Arsoli, so called from a neighbouring village on a height overlooking it, and the lake of S. Lucia. The spring called Curtius is another of these streams.

This valley is admirably calculated for the sources of aqueducts; the ground is full of springs of beautiful water, and the watery meadows have only to be dammed up a little to form lakes or reservoirs. Probably the water from these springs, which now runs into the river, was entirely intercepted and carried into Rome in the aqueducts. The Anio is in general such an abundant stream, that these additional springs would scarcely be missed, although in time of severe drought the water did sometimes run short[151].

The _piscinæ_, mentioned by Frontinus, were large subterranean reservoirs and filtering-places, at seven miles from the old City or from the inner gates, and six from the outer gates: the portion of Rome outside of the walls of _the city_ was considered as the suburbs only, until the time of Aurelian, when the City was made to extend to the outer wall, then newly raised and fortified, but this was long after the aqueducts were made. The present appearance of these two _piscinæ_ of the Claudia and the Anio Novus is merely that of earthen mounds or tumuli. They are situated about midway between the old Via Latina, which now in this part is made into a carriage-road to Frascati, and the Via Appia Nova. The distance from one road to the other is about a mile, and the _piscinæ_ are about half-a-mile from each. The stream, which was originally a branch of the Almo, and now conveys the water of the Marrana and the Aqua Crabra united, runs near them, and received the surplus water from all the aqueducts on this line. It is divided into two parts near the _piscinæ_, one branch going through the valley called the Caffarella, and falling into the Tiber near the church of S. Paul's outside of the walls; the other keeps near the arcades and reservoirs, and coming through Rome, passes on the south side of the Cœlian. This branch had come from the _piscinæ_ nearly parallel to the aqueducts; it winds about a good deal, but is never distant from the line of the latter, now on one side and then on the other. A further account of this will be found under the head of the Marrana, in the second part of this chapter.

APPENDIX TO CHAPTER IV. PART I.

THE NINE AQUEDUCTS IN THE TIME OF FRONTINUS.

Having sketched the general history of each one of these aqueducts, and the circumstances under which they were erected, it remains to refer briefly to some of those details which Frontinus has handed down to us, of the mode of management of the water. These details apply equally to the whole series. First of all, the position which he and his predecessors in office held was a very important and honourable one. He had the entire responsibility of the water supply, and the absolute control of seven hundred men employed to attend to their proper working, to clean the _piscinæ_, and to repair the channels and pipes when needed. Of these, 240 were appointed by the City, and the remaining 460 by the Emperor. The channels in which the main stream of water was carried, and the reservoirs (_castella_), and the _piscinæ_, were always lined with a particular kind of cement, called _Opus Signinum_.

It has also been observed that the base of the channel is constantly broken up by inequalities, or dips, if they may be termed so, as if purposely introduced to agitate the water in its course, and, consequently, to aërate it. No doubt also the inequalities, provided they were rugged, would tend to check the passage of any earthen matter held in solution by the water. Of most importance, however, and shewing still more remarkably the engineering qualities of the builders of the Aqueducts, were the ventilating-shafts which were introduced at proper intervals. Such shafts were often used as wells also, to let buckets down for water, and steps were cut on the sides for the _aquarii_ to descend and remove obstructions. At about every half-mile the _specus_ forms an angle to break the force of the water, and at such points there is usually a reservoir also. Advantage was taken of these angles for the later aqueducts to be carried over the older ones, as at the Torre Fiscale and the Porta Maggiore. These precautions, combined with the system of _Piscinæ_, rendered the water constantly fresh, pure, and wholesome.

From some considerable remains of the _Piscinæ_, the system can be clearly made out. The building consisted of four chambers, two beneath and two above. Supposing, for the sake of illustration, in the annexed diagram, the letters [Illustration: A B C D] represent the four chambers. The channel of the aqueduct, coming at a tolerably high level, enters the chamber A. Thence the water passed (possibly over a large waste-pipe) into the chamber beneath, B. Between B. and C. there were small holes communicating through the wall (possibly provided with fine grating). Through the roof of C. there was a hole, and the water passed upwards, of course finding the same level in D. at its exit, as in A. at its entrance; on leaving the _piscina_ the water was carried off into another _specus_. By the aid of sluice-gates the water could be transferred direct from chamber A. to chamber D. Access was obtained by an opening to the chambers beneath, and the mud was from time to time cleaned out. Curious details of the sluices,

&c., have been found; but it is not easy to determine their age, as the aqueducts have undergone so many repeated alterations.

As a typical example of the size of the _specus_, or channel of the Aqueducts, the Marcian may be taken, which measures in the opening five Roman feet in height, two and a-half in breadth, and the thickness of the wall on each of the two sides one foot. The roof of the Marcian being surmounted by the Tepulan and Julian, no great solidity was needed; but so far as can be ascertained, the roofs were generally of considerable thickness, to prevent, as much as possible, the heat of the sun spoiling the coolness of the water. The channels and general structure of the Anio Novus and Claudian were larger in every respect, those of the Tepulan and Julian somewhat smaller, as shewn by the accompanying diagrams.

It will be seen that the period of the construction of the nine aqueducts which have been described, embraces some four centuries, as Frontinus was employed in surveying them towards the close of the first century after Christ, and the first aqueduct was commenced more than three centuries before the Christian era. If we omit the Alsietina, which was on the other side of the river, and which ought scarcely therefore to be taken into account, the order of level follows almost exactly the order of construction, the only exception being that of the Virgo. This increase of height of level as each new aqueduct was added, is pointed out by Frontinus in his eighteenth chapter.

It will be perhaps convenient to have the several aqueducts already described represented in a tabular form, shewing the dates when they were made, and the order as to level, together with the distances which they traversed.

The aqueducts, especially those which were mostly underground, it will be observed, made long detours, as compared with the direct line of road; as, for instance, in the first on the list, the distance by road was but eight Roman miles, but that by the channel of the aqueduct was eleven miles. The total length of all the channels of the aqueducts, constructed in less than four centuries, was upwards of 285.610 Roman miles, of which 242.697 miles were cut beneath the surface, and 42.918 miles carried on substructure, arched or not, as the case required, above the surface of the ground.

| LENGTH OF CHANNEL.[152] Order as | Above Under DATE. No. to Level. NAME. | ground. ground. ----------+-------+--------+----------------+------------+------------- | | | _m._ _p._ | _m._ _p._ B.C. 312 | I. | 8th | AQUA APPIA | 0 60 | 11 130 | | | | | ” 263 | II. | 6th | ANIO VETUS | 0 221 | 42 779 | | | | | ” 145 | III. | 5th | AQUA MARCIA | 7 463 | 54 247½ | | | | | ” 126 | IV. | 4th | ” TEPULA | 7 0 | 6 0 | | | | | ” 34 | V. | 3rd | ” JULIA | 7 0 | 8 426½ | | | | | ” 21 | VI. | 7th | ” VIRGO | 1 240 | 12 865 | | | | | ” _c._ 10 | VII. | 9th | ” ALSIETINA | 0 358 | 21 714 | | | | ? in channel | | | | A.D. 33 | VIII. | 2nd | ” CLAUDIA | 10 176 | 36 230 | | | | | ” 33 | IX. | 1st | ANIO NOVUS | 9 400 | 49 300 ----------+-------+--------+----------------+------------+------------- _Totals according to computation of Frontinus_ 42 918 242 692 ----------

Of the above, six are carried to Piscinæ on the Via Latina.

{ V. JULIA } The three { IV. TEPULA } carried from the same reservoir { III. MARCIA } on the same series of arches.

The two { IX. Anio Novus } carried on higher arches, which end { VIII. Aqua Claudia } after the Pallantian gardens.

The one II. Anio Vetus, has a reservoir on the Via Latina.—(_Fron._, c. 19.)

SUPPLY.

As given in the Measured No. Commentaries. at the head. ----------+------------+------------+ | _quin._ | _quin._ | I. APPIAN | 841 | 1825 | | | | II. ANIO VET. | 1541 | 4398 | | | | III. MARCIAN | 2162 | 4690 | | | | IV. TEPULAN | 400 | 445 | | | | V. JULIAN | 649 | 1206 | | | | VI. VIRGO | 652 | 2504 | | | | VII. ALSIETINE | —— | —— | | | | VIII. CLAUDIAN | 2855 | 4607 | | | | IX. ANIO NOV. | 3263 | 4738 | | | | ----------+------------+------------+ 12,363 24,413

SUMMARY OF DISTRIBUTION.

Outside Inside No. of No. City. the City. Regiones served. Castella. ----------+---------+---------+-------------------------+--------- | _quin._ | _quin._ | | I. APPIAN | 5 | 699 | II. VIII. IX. XI. XII. | 20 | | | XIII. XIV. | | | | | II. ANIO VET. | 573 | 1508½ | I. III. IV. V. VI. VII. | 35 | | | VIII. IX. XII. XIV. | | | | | III. MARCIAN | 261½ | 1472 | I. III. IV. V. VI. VII. | 51 | | | VIII. IX. X. XII. XIV. | | | | | IV. TEPULAN | 114 | 331 | IV. V. VI. VII. | 14 | | | | V. JULIAN | 206 | 548 | II. III. V. VI. VIII. | 17 | | | X. XII. | | | | | VI. VIRGO | 200 | 2304 | VII. IX. XIV. | 18 | | | | VII. ALSIETINE | 392 | —— | { Outside the city and | — | | | { the XIV. in the | | | | { Naumachia. | | | | | VIII. CLAUDIAN | 685 | | { United within the | | | 3498 | { city, and distributed | 92 | | | { throughout the XIV. | IX. ANIO NOV. | 728 | | { Regiones. | | | | | ----------+---------+---------+-------------------------+--------- 3164½ 10,360½ 247

| DETAILS OF DISTRIBUTION. | | Imperial. Private. Public. -------+----------+---------+--------- | _quin._ | _quin._ | _quin._ I. | 151 | 194 | 354 II. | 66½ | 490 | 503 III. | 116 | 543 | 439 IV. | 42 | 237 | 50 V. | 18 | 196 | 383 VI. | 509 | 338 | 1167 VII. | 354 | 138 | — VIII. }| 1793 | 1506 | 1012 IX. }| | | -------+----------+---------+--------- 3049½ 3642 3908

| DETAILS OF THE PUBLIC SERVICE. | | Castra. Public Works. Munera. Laous. -------+----+---------+----+---------+----+---------+-----+--------- | | _quin._ | | _quin._ | | _quin._ | | _quin._ I. | 1 | 4 | 14 | 123 | 1 | 2 | 92 | 226 II. | 1 | 50 | 19 | 196 | 9 | 88 | 94 | 218 III. | 4 | 41 | 15 | 41 | 12 | 104 | 113 | 253 IV. | 1 | 12 | 3 | 7 | — | — | 13 | 32 V. | 3 | 69 | 10 | 181 | 3 | 67 | 28 | 65 VI. | — | — | 16 | 1380 | 2 | 26 | 25 | 51 VII. | — | — | — | — | — | — | — | — VIII. }| 9 | 149 | 18 | 384 | 12 | 107 | 226 | 482 IX. }| | | | | | | -------+----+---------+----+---------+----+---------+-----+--------- 19 325 95 2312 39 394 591 1327

Buecheler, in his edition of Frontinus, pp. xi., xii., xiii., explains the mathematical part of chap. 78 differently from Poleni and Dederich[153].

In order to regulate these several aqueducts, so that deflection in any part should be easily ascertained, means were provided for estimating the abundance of the water, and in this respect for its minuteness and clearness the treatise of Frontinus stands unrivalled, when compared with any work of ancient or even modern times. The mode of measurement is to take the area of a vertical section of the water flowing along the _specus_,—the object being to test each aqueduct by itself, and to see whether its proper supply was given or not. Had he been called upon to estimate the actual supply of the water, and not the relative, other points would have had to be taken into account, namely, the average fall of the aqueduct, from which to gather its velocity. On this, however, he does not touch. It must be borne in mind, also, that when Frontinus was appointed, the system had been long in force, and he had to follow the traditions and rules of his office. He made no revolution, he was simply a reformer. He tells us that in examining the books belonging to the office, he found certain measures given to certain aqueducts; these he had to verify, and a great part of his work is taken up in the account of his operations. To begin with, he is much troubled as to the measures employed. The _digitorum modulus_ (i.e. a pipe with a given measured orifice) is uncertain. There is the square digit and the round digit (in other words, a square pipe of which each side is one digit, and the round pipe of which the _diameter_ is one digit). As an instance of his accurate and clear expression, it may be worth while to quote his words on this point[154]:—

“The measurement of the _Moduli_ is taken either by digits or inches. In Campania and in many places in Italy, the digit is used; in Apulia, the inch[155]. The digit, as all agree, is the sixteenth part of a foot; the inch, a twelfth part. But just as there is a different usage of inches and digits, so also there is no uniformity in the simple computation of the digit itself. There is one which is called the square digit, another the round digit. The square digit is _three-fourteenths greater_ than the round; the round is _three-elevenths smaller_ than the square, because the angles are taken off.”

In this we obtain a key to most of his calculations[156], because they depend throughout upon the computation of the area of the circle.

The base measure chosen was the “quinary,” so called (according to the most natural derivation) because its diameter was five quarter-digits. And to this basis are reduced some twenty different _moduli_, to which the names were given of senary, septenary, octonary, denary, duodenary, and so on up to centenary. The reduction of these seems to be tolerably accurate according to the system which he pursues, and making allowance for transcribers’ errors. But either the relation of the circumference to the diameter of a circle had not been worked out to the same extent to which it has been in later times, or Frontinus considered the ratio adopted sufficient for his purpose. One of his calculations stands thus: he is measuring the Appian at a point where it is joined by a later branch; it had been assigned in the register as giving 841 quinaries: he says—

“I found the depth of the water five feet, and its breadth one foot and three quarters, which gives an area of eight feet and three quarters. This is equal to twenty-two _centenaries_ and a _quadragenary_, which make 1,825 _quinaries_, or 984 quinaries more than is given in the Commentaries[157].”

Each centenary is shewn elsewhere to contain 81 quinaries and a fraction, and therefore 22 would give 1,792 in quinaries and a fraction. The quadragenary is marked to contain 32 quinaries and a fraction. Together, therefore, the 1,825. Now the area of each quinary, according to the system of Frontinus, would be the square of its diameter (i.e. 1¼ digit), multiplied by ¹¹⁄■■ (the ratio already ascertained). This equals ²■■/■■■, which, multiplied by 1,825, produces 2,240½ digits (nearly). Finally, the area of 8¾ square feet, reduced to square digits, gives 2,240[158].

This calculation illustrates his mode of computation from absolute measure of the water; but the ordinary way was to affix the _moduli_, which were of brass, or rather of bronze, to certain openings. Provided the _modulus_ was placed perfectly level, the water flowed at its ordinary rate; and when the _moduli_ were sufficient to prevent the water rising in the reservoir or channel, and, on the other hand, not too numerous or too large to reduce the mean level of the water, the sum of them represented the amount of water.

We next come to the question of distribution. On examining the registers, Frontinus says that he found that there were assigned to the nine aqueducts 12,755 quinaries; but it appeared that the distribution amounted to 13,470 quinaries. To account for this discrepancy, the whole were re-measured. In the annexed table the measures of each aqueduct are given separately, and by adding together the results of each, as calculated from the data which Frontinus gives of the water measured at the head, the total, as the table shews, comes to 24,413 quinaries. The fact was that in process of time some of the channels had fallen into decay, and the water was wasted. In other and more numerous cases, it had been abstracted by persons for their own use without authority; in addition to which there were no doubt errors in the computation, which had crept into the books, and if we are to believe Frontinus, these errors had been turned to the profit of his predecessors.

In the table of distribution will be seen the number of quinaries distributed outside the wall of the city; next, the Regiones which they serve within the city; thirdly, the measure of water so distributed within the city, and the number of _castella_, or reservoirs, used for that purpose. These reservoirs, at least such as remain, will be described in the several Regiones in which they occur. That over the arch of Dolabella on the Cœlian Hill, and the so-called Castellum Aquæ Juliæ on the Esquiline, are the most prominent. Many, no doubt, were of much smaller size, and merely large cisterns, as the total number was 247.

The supply of 13,470 quinaries is thus accounted for. Outside Rome 3,164 quinaries were distributed, inside 10,306; of that outside Rome 1,718 quinaries were used “in the name of the Emperor,” that is, to supply the imperial villas and gardens, &c., while 2,345 were charged to private persons. Inside Rome 1,707 were charged to the Emperor for his palaces, &c., while private persons used 3,847 quinaries, leaving 4,401 quinaries, which were for the “Public Service.” These, together, account for the 9,955 distributed within Rome.

In the details of the distribution, we learn how much water was employed in the palaces, &c., in the service of the Emperor and his household (_nomine Cæsaris_), how much was carried into houses for the use of private persons, and how much was used in public buildings and the public reservoirs or fountains which were established in all convenient positions, and generally accessible to the population.

It may, perhaps, be interesting to examine more carefully the distribution for the “Public Service.” We have four classes of recipients, and we know from Frontinus how much was served to each class from each aqueduct. There were first of all 19 _castra_ or barracks, in which the army were kept when not out on service, and in which also the guards were stationed. These required in all 279 quinaries. There were next, 95 different Public Establishments which used 2,401 quinaries, and 39 theatres and places of entertainment (_munera_) which used 386 more. Lastly, there were 591 open reservoirs (_lacus_) for the service of all comers, using 1,335 quinaries. These reservoirs were what we usually speak of as fountains, and some hundreds are in use to this day, many probably on the site of the older ones. There were very stringent laws respecting their use. Heavy penalties were inflicted upon anyone dipping a dirty bucket or other vessel into the reservoir; there were also laws respecting the “overflow,” as the fountains of course were constantly running. These were the most important to keep in order, as all the poorer classes depended entirely upon them for their supply of water.

The more wealthy had water brought into their own private reservoir in the court, with buckets and windlasses for drawing the water to the upper story, and this is the case to the present day[159].

These details, while giving us an insight into the social state of the city, go to shew how thoroughly the supply of the water was under control. The pipes supplying every one of these 744 points of distribution were all registered, and their sizes being known, the system of computation, as explained by Frontinus, was brought into play: thus every part was checked, and any irregularity could be traced to its source.

It may be asked what amount of supply, in gallons, would the water represent, in order that a comparison can be made between the supply of towns at the present time, and that of Rome at the time at which Frontinus wrote. The answer is not easy. As said before, we have not sufficient data for an accurate determination; still we may attempt an approximate estimate. It is easy to compute the section of water given by the 24,805 quinaries. This being just upon 120 square feet, we can form some notion of the vast quantity,

if we picture to ourselves a stream twenty feet wide by six feet deep, constantly pouring into Rome at a fall six times as rapid as that of the river Thames. It has been computed by a French engineer that, together with one or two additional aqueducts which were added between the time of Trajan and Aurelian, the supply of water to Rome was 332,306,624 gallons _daily_. If we assume the population to have been a million souls—and it is scarcely probable that there were more—we find that the rate was 332 gallons per diem for each person. In our own day we consider 40 gallons sufficient, and many think this excessive, including the use of water in manufactures, &c. No wonder, with the facilities for drainage which the rapid Tiber afforded, and with this plentiful supply of really good water, the great city was rendered, in spite of overcrowding and an unhealthy situation as regards its neighbourhood, comparatively free from those epidemics which are so fatal in all densely-populated towns.

One part of the system which Frontinus seems to have been the first to adopt was this: he had 247 _castella_, or main reservoirs, from which the pipes were carried to the smaller cisterns and fountains, and he so arranged the supply of water to these that the several aqueducts could be interchanged. A net-work was established, so that when one channel, from whatever cause, failed, whether from requiring to be cleansed or repaired, another could supply its place. But this was not all. He tells us, cap. 87, that many of the parts of the city which were dependent on one source for their supply, were, by careful distribution of the water, able to avail themselves of a second in case of need; and he gives as an instance that the Marcian was made available in the Aventine, by being carried across from the Cœlian[160]. He also speaks of the improvements which were made in keeping the water pure. Hitherto a very slight shower had made many of the streams muddy, although at their source they were pure[161].

The least pure, however, before the time of Trajan, were the Anio Vetus and Anio Novus. This arose from the banks which, being soft, gave way, and the stream, even in fair weather, thus became muddy. He points out that hitherto, by the mixture of the waters which had been adopted to prevent failure in supply, proper skill had not been shewn, and these new streams were allowed to destroy the purity of others[162]. His object, therefore, was to keep the pure streams separate, and in addition to that, arrange that they should be used for drinking purposes only; while the water which was less grateful to the taste, and which was subject to be at times muddy, should be used for cleansing the city, or watering the gardens, or other ordinary purposes, which it might fulfil equally with the fresher and purer water. In considering the supply of water to our large towns, which is one of the great problems which at the present time has to be solved, it is not too much to say that—the plan adopted by the Emperor Trajan, by the advice of Frontinus, the head of the _aquarii_, and of that department of the government of Rome which had charge of the aqueducts, the importance of which in that climate can hardly be over-estimated—is worthy of more attention than it has received[163].

THE CURATOR AQUARUM.

The care of the aqueducts was assigned by Augustus to a Curator Aquarum, of whom Marcus Agrippa was the first, and held the office for life. Frontinus, to whom we are indebted (as we have seen) for nearly all that we know respecting the early history of the aqueducts, held this office under Domitian, A.D. 94; he remained in office under Nerva, wrote his treatise at that time, and died under Trajan, A.D. 107. The office continued to exist till the third century, in the time of Diocletian, when it was superseded by the magistrates called _Consulares Aquarum_, a title changed in the fifth century into _Comes Formarum Urbis_. These several magistrates had 700 servants, charged with the superintendence, repair, and distribution of the water from the aqueducts, divided into _familia publica_ and _familia Cæsaris_; the former, comprising 240 persons paid by the State; the latter, 460 paid by the Emperor. Agrippa supplied the city with 700 _lacus_, 105 fountains, 130 _castella_ for distributing waters, and 170 gratuitous baths for public use. These structures were adorned with 400 marble columns, and 300 statues of marble or bronze. After the devastations caused in the Gothic wars, under Vitiges and Totila, only the most important aqueducts were restored, either by Belisarius or Narses. Ruin and neglect again undid much of what had then been restored to use. At the beginning of the ninth century, the only aqueducts supplying water were the Appian [I.], and Marcian [XII.], then called Jobia or Iopia, by corruption from “Jovius,” the name assumed by Diocletian.

During both the eighth and ninth centuries, indeed, various repairs for maintaining the aqueduct of Trajan [X.], which carried water from the lake Sabatinus (di Bracciano, Acqua Paola), are mentioned by Anastasius; and in 786 the “Jovia” aqueduct was restored by Hadrian I. In the twelfth century, the Aqua Lateranensis is mentioned as still in use, being that part of the Claudian aqueduct carried upon the arcade called the Arches of Nero near the Lateran, where the _specus_ is very conspicuous. The aqueduct of Trajan [X.], and that of Agrippa [VI.], continued to supply water, though but scantily, for about two centuries later. The Appia [I.] has long been supposed to have been gradually stopped up by the deposit of clay, and thus rendered useless[164]; and so total was the failure of all these waters in the fourteenth century, that the population (said to have been not more than 17,000 during the absence of the Papal Court at Avignon) were without any supply of running water, except from the Tiber[165]. The first restoration,

in the fifteenth century, was that of Agrippa [VI.], by Nicholas V., whose aims and efforts were renewed by Sixtus IV., and by later Pontiffs. Sixtus V. [Felice Peretti] determined to restore to Rome the water then supposed to be the Marcia, but really of Hadrian [XIII.] The arcade of the Claudian [VIII.] and Anio Novus [IX.], was the most magnificent of all, and conveyed its several streams along a distance of forty-six miles. This had been restored by Vespasian and Titus, by Trajan, Septimius Severus and Constantine; but, in the greater part, especially within the first few miles from Rome, the existing stone arcade is of the time of Claudius, with repairs in the brickwork of the Flavian emperors. At the beginning of the ninth century, it was certainly still serviceable, and was known by the name Forma Claudiana. The piers of this arcade were used by the engineers of Felice to carry that _specus_ on the part near Rome; but the greater part of the Marcian arcade, and considerable parts of the Claudian, near Rome, were used as a stone-quarry by them. The channels through which the Anio and the other streams flowed, were the first, 9 ft. in height and nearly 3 in breadth, the second 6 ft. by 3, as seen in their ruins at the Porta Maggiore. The more ancient portion is not in brickwork, but of enormous squared blocks of tufa and peperino.

The popular notion that all these aqueducts were a mere waste of money, arising from the ignorance of the ancient Romans of the simple fact that water will rise to its level, is altogether erroneous. Vitruvius gives directions for taking the levels for carrying water through valleys, where, he says, there should be standing or upright pipes (_columnaria_,), now called respirators, to let off the confined air (_spiritus_[166]), and explains how to bring the water on by earthenware, lead, and even leather pipes.

Within the last few years a large leaden pipe of great antiquity, not less than two feet in diameter, was found under the Via de' Condotti, encased in ancient brickwork, evidently shewing that they were afraid to trust to the strength of the lead. The force of the water running in a strong current from such great distances, required to be broken at frequent intervals, by being turned at a sharp angle, and then allowed to return again to its course by another angle. This arrangement occurs continually along the line of the aqueducts, generally at each half mile, with a _piscina_ or a _castellum_, or both filtering-place and reservoir, at each of these angles. The great object of constructing these magnificent aqueducts was to bring the water to the highest levels in the city, from which it descended by a succession of reservoirs (_castella aquarum_), some with _piscinæ_ or filters, others with fountains, each one below the level of the preceding one. The lower town along the valley, or Campus Martius, was also supplied by other aqueducts at a much lower level. The ancient Romans had abundance of leaden pipes to convey the water to the baths or _thermæ_, and bronze stop-cocks, as may be seen at Pompeii, and silver ones for the emperor; but they had no pumps. From each _castellum_ there were pipes to supply the neighbouring baths or palaces, with moderate pressure; also wells or cisterns in the courtyard of each house, which had frequently a fountain. On the Janiculum, the water of the aqueduct passing from one _castellum_ to another, has sufficient force to turn several mill-wheels.

A letter of King Theodoric, printed in Cassiodorus[167], addressed to the Roman Senate, enjoins them to assist Joannes in his enquiries after those who have diverted the water from the aqueducts for their own uses, and those who have stolen the brass and lead, or those who have helped them. This proves that they were not destroyed by the Goths, and that they were in use in the sixth century.

CHAPTER IV., PART II.

THE LATER AQUEDUCTS.

X. SABATINA, A.D. 110; TRAJANA AND PAOLA, A.D. 1540.

The Aqua Sabatina came from the springs which supply the lake Sabatinus, now called di Bracciano (in the Middle Ages it was, and is still often called, Anguillara), on the side opposite to Rome, about twenty-four miles from the city, in a tunnel at a considerable depth. It arrives at the line of the tunnel of the Aqua Alsietina in about three miles. (See Aqueduct VII.)

The line of this aqueduct, which is chiefly subterranean, can be traced backwards by the respirators of Paul V., who repaired it, from his fountain on the Janiculum in Rome across Monte Mario to La Storta, and a little beyond it to the junction of the roads from Viterbo and Bracciano. Here the present road follows a winding course for the sake of better gradients, but the old one (_Clodia_) followed a more direct line in a cutting through the hill, to the left of the present road, as may be seen by the old paving-stones at intervals; and here, instead of the clumsy respirators of Paul V., are wells only, one of which is near the present road at the junction. The respirators are built over old wells, and serve to shew that Paul V. restored the _specus_ from La Storta to Rome only in this part. There are no respirators beyond that point for some distance, but the _specus_ may still be traced by the wells descending into it. About two miles further on, this _specus_ is carried on an arcade across a valley, and it may be traced from thence to the

point where Nibby explored it in 1826, near the lake of Bracciano. From the Osteria Nuova (fifteen miles from Rome) to La Storta (ten miles from Rome), the rough pyramids continue along the line of the aqueduct, and at the Osteria itself there are two of different dimensions close together at the end of the house or _castellum aquæ_; one is nearly double the size of the other, and both are of very rough construction. Probably one of these is of the time of Trajan, the other of the time of Pope Paul; these wells, with the smaller pyramids over them, are continued to near La Storta; here a change takes place, and the respirators are modern, as has been said.

Procopius expresses his amazement at the quantity of water thus brought to the top of the Janiculum, and poured in torrents over the whole of the region of the Trastevere. This is still the case, and the fountains in front of St. Peter's and in the gardens of the Vatican, are also supplied from this aqueduct. The water is so abundant that it is even brought over the bridge and supplies a fountain on the other side.

Paul V. also mentions (in his inscription at the fountain above S. Pietro in Montorio) that it had been previously restored by one of his predecessors, Hadrian I., A.D. 774. This was after it had been damaged by the Lombards under Astulfus, as recorded in the Pontifical Registers of Stephen III., Hadrian I., and Gregory IV., in whose time (A.D. 830) the work was completed. The Saracens again destroyed it in 846, and it was again restored by Nicholas I. (A.D. 860). It continued in use in the fifteenth century; but in the sixteenth it was much out of repair, and the branch to the Janiculum almost entirely failed. That to the Vatican continued to flow in 1561, and was repaired by Pius IV., as recorded on an inscription in the garden of the Vatican. In 1618, it had become almost entirely ruined, and was restored in a more thorough manner at great expense by Paul V., a member of the wealthy Borghese family, from whom it is now commonly called the Aqua Paola. The Orsini family, to whom the lake Bracciano belonged, contributed 2,000 ounces of water daily from that lake. Hadrian I., who had made the first great restoration of this water-course, was a Colonna, so that three of the greatest medieval families of Rome have contributed towards it.

The cascade which now falls down the face of the Janiculum, in a _specus_, turns the water-wheels of three mills in its course; this is mentioned by Procopius, they having been destroyed by the Goths, and their place supplied by other mills made in the Tiber by Belisarius, which continued in use for a long period. The ruins still visible in the river, opposite the mouth of the Cloaca Maxima, are supposed by some to have belonged to these mills. They were of wood only[168], and may have been built on the stone foundations; but these ruins in the river more probably belonged to the fortifications at the head of the Port of Rome, where there was a chain across the river to prevent boats from being carried down by the rapid stream into the Port[169].

Immediately outside of the Porta S. Pancrazio the _specus_ forms the boundary of the beautiful garden of the Villa Pamphili-Doria, on the northern side, for about a mile. It is faced with fine reticulated work of the time of Trajan, excepting where it has been clumsily repaired with brick in the time of Paul V., and it has a wall built upon it. Shortly after passing the limits of the garden, it arrives at the old junction or fork where the stream was divided into two branches, one going to the fountains in front of S. Peter's and the Vatican, the other to the great fountain rebuilt by Paul V. above S. Pietro in Montorio, as before mentioned. In this part the _specus_, being above ground, had been much mutilated, and the engineers of Paul V. found it more convenient to change its course and make a new _specus_ for a short distance, than to repair the old one. The ancient reservoir and the fork in the _specus_ were abandoned, and new ones made about a hundred yards off, on rather a higher level. The old reservoir or _castellum aquæ_ was turned into a farm-house, by piercing the walls with windows and doors, and putting on a new roof. The original arrangement for the separation of the great stream into two smaller ones may still be seen in the farm-yard. The old _specus_ is here just below the level of the ground, with its reservoir, but there is an opening into it. A portion of it can also be seen under the Villa Spada, just within the Porta di S. Pancrazio. From the point of junction, or rather of division, to La Storta, and nearly all the way to the lakes, the _specus_ is underground; but the line of the branch added by Trajan can be traced by the respirators as far as the junction, ten miles from Rome, where, in the year 1830, an inscription[170] was found on the Via Claudia, near the tavern of La Storta, stating that Trajan had carried this water into the city at his own expense in A.D. 109. In the inscriptions put up by Paul V. after his repairs, A.D. 1611[171], the Alsietina, Sabatina, and Trajana are all considered as the same.

XI. TRAJANA OR HADRIANA[172] (?), (A.D. 120).

"In the time of the Emperor Nerva the health of the eternal city was sensibly improved by the increased number of castella, public works and buildings, and cisterns. Nor was his generosity less for the benefit of private individuals, so that those who had previously timidly obtained water in an unlawful manner were now allowed to do so by his favour. Lest some of the waters should perish uselessly great cleanliness was adopted, and there was better ventilation, and the causes of the bad climate for which the city was formerly infamous were removed. I must not pass by the necessity for a new distribution of the waters; but this, with the

increased quantity we have added, can easily be arranged, that is, when the work is completed[173].”

These and other passages in the work of Frontinus shew that great works were carrying on under his direction, not then completed, their object being to improve the quality of the water, and to supply an additional quantity in case any of the existing aqueducts should fail, as they did occasionally, and to increase the power of distributing it, with a view to improving the climate. This is a proof that Malaria existed at that time[174], and that the best remedy for it was an abundant supply of water in the hot weather, for which the subterranean aqueducts were most useful. The improvement of the Aqua Alsietina, and the addition of the Sabatina, were not sufficient for both these purposes; and, as they supplied the district of the Trastevere only, this could not be all that was intended by Frontinus in describing the great works begun by him under Nerva, carried on by Trajan, and completed by Hadrian. The only work which will correspond to this account is the great aqueduct called by modern writers the Aqua Alexandrina, and erroneously attributed to Alexander Severus only.

The sources of this aqueduct are about three miles from Gabii in a watery meadow, nearly under La Colonna, the ancient Labicum. The reservoir of the Aqua Felice is in the same meadow, very near that of Hadrian. Several of the springs that supplied that of Hadrian were intercepted by the engineers of the Aqua Felice, who mistook these springs for those of the Aqua Marcia, shewing their ignorance of the line of the aqueducts. One of the streams, which is rapid and has a considerable body of water, is not used, because the water is of bad quality, and is so full of chalk that it is a petrifying stream. The first central _castellum_ and _piscina_ of Hadrian remains nearly intact, lined with the usual brickwork of that period, but much disguised in outward appearance. It is divided in the inside by a rough stone wall, as was frequently the case; the upper chamber to it has an external staircase added, and windows pierced in it, giving it now the appearance of a mere farm-house. Here the _specus_ is perfect, and from hence it goes at first on a substructure, then on an arcade across the fields, and along the line of arcade to the Cento Celle. The part near the reservoir is destroyed, as is the opposite end near that place, but great part of the arcade in the intervening portion remains nearly perfect, and is one of the finest arcades of the aqueducts, extending for miles across the country between the Via Gabina and the Via Labicana. In some places it is double, one arcade over another, to cross a low valley or a stream. At about a quarter of a mile from the source, the _specus_ is open in two places, so that a man can walk along it, being nearly six feet high and three wide. Small openings have been left on the sides of the _specus_ at regular intervals to let the chalky water escape; and in falling from above it has left the marks of a small cascade in each place, in the form of stalactite, a solid deposit of chalk or lime or tartar against the side of the piers, down which it ran. These petrifactions continue all along the line as far as Cento Celle, and near that point there is a part where the stones and bricks of the arcade have been carried away for building-materials, and the masses of hard chalk remain standing up from the ground, in small pyramids, having very much the appearance of concrete respirators belonging to a subterranean aqueduct; but this appearance is deceitful. There is no pipe in them; they are merely petrifactions formed by the deposit of the chalk from the water.

By the side of the line there are some fine _piscinæ_ and reservoirs, of _Opus Reticulatum_, at intervals, belonging to the time of Trajan or Hadrian. Some of the arches near the sources seem to be earlier. The brickwork is so fine that it appears more like the work of Nero; but most of the work agrees well with the time of Hadrian, and Visconti states that an inscription of Hadrian[175] was found at the reservoir in his time, towards the end of the eighteenth century, and given up to the Borghese family, the proprietors of the ground, who also drained the lake of Gabii, with the aid of Canina the architect. This inscription is believed to have been sold to the French, with other things.

The character of the construction of the _castella_, or reservoirs, does not agree with the time of Alexander Severus, but suits perfectly well with those of Nerva, Trajan, and Hadrian, whose works are so well known. It is work of the first or second century, not of the third. It does not follow the line of the Via Gabina, but is carried at once to the south of it, towards the Via Labicana, and passes nearly parallel to it between those two roads until it crosses the Via Labicana at five miles from Rome, at the place called Cento Celle.

The bad effect of the petrifying stream was noticed by the engineers of the Aqua Felice, and, as that stream was carefully excluded by them, it now runs to waste through the meadows. This discovery was probably made before the third century, and the _specus_ being then found to be choked up with stalactite, was restored to use on a higher level by Alexander Severus. Although the _castella_, or reservoirs, are all of the time of Trajan and Hadrian, the _specus_ and the arcade to carry it is of two periods, the later portion of it being of the third century. The principal intention of this aqueduct has been originally to supply the great villa of Hadrian at Cento-Celle, but a branch of it does appear to have been brought into Rome. Although it is very difficult to trace it for the last two miles, this may arise from the general use of all the aqueducts near Rome as quarries, by the engineers of the Aqua Felice. In the excavations made in 1871, in the high ground near the Minerva Medica, between the Porta Maggiore and the Porta di San

Lorenzo, by the side of that portion of the Marcian arcade that has been mentioned as found there, was also part of another arcade of an aqueduct of the third century, which may have belonged to this, and it was in that neighbourhood that the inscription belonging to the aqueduct of Severus was found.

About a mile nearer to Rome, at the Torre Pignattara[176], or Mausoleum of S. Helena, there is a branch from the Marrana, passing under the Aqua Marcia, apparently to convey water to an imperial villa. The construction of the arcade of this branch to the south of the road is not of the same period as that of the other arcade on the other side to the north. It is usual for modern topographers, following Fabretti, to consider this branch a continuation of the Aqua Alexandrina; but as the water from the Marrana, which is at a considerably lower level than the Aqua Marcia, runs _down_ the gentle incline of this arcade towards the road and the Mausoleum of S. Helena called Torre Pignattara, this is impossible. The construction is chiefly of the fourth century. The Mausoleum of S. Helena is on lower ground than this part of the Marrana.

Constantine is said to have built a villa for his mother near her tomb; but there are no remains of an imperial villa nearer than those called the Cento Celle, a mile further along the road, or the one called “Torre de’ Schiavi[177],” i.e. Tower of the Slaves, about a mile across country, on another road, but on the same level. A milestone for the third mile, found opposite this mausoleum, with an inscription of the time of Maxentius, has been published by Ciampini. This indicates that some works were going on there at the end of the third century, and the arcade may be of that period.

A large and a very remarkable reservoir of the time of Trajan or Hadrian remains a little to the west of the mausoleum, and on rather higher ground. This was probably to receive the water for a branch to the imperial villa, afterwards taken possession of by the Gordiani, who built at that place their great family mausoleum, on which a tall medieval tower was afterwards erected; of this, very picturesque ruins remain, under the title of Torre de’ Schiavi. There are at the same place other large reservoirs of the time of the Gordiani, shewing that the great imperial villa was still supplied with water from the Marcian aqueduct in the third century.

No water under the name of Hadrian is mentioned in the Regionary Catalogue of the fourth century, it is therefore evident that this great aqueduct was not called then after that emperor, although we are told in his life by Spartianus, that many were made in his time, and were at first called after him (as we have said[178]). At the first reservoir, the starting-point, there was an inscription of Hadrian, and the other reservoirs belonging to it are also constructions of the same period. It may be that this water did not come into Rome at all, but that the aqueduct was made to supply the great villa in the place now called “Cento-Celle,” to which it leads in a direct line, and where it appears to terminate. If any alterations were made, these may have been done in the time of Alexander Severus, and this may now represent the so-called Aqua Alexandrina, as Fabretti thought, although he was certainly mistaken in one part of his account of it. The branch which went by the Mausoleum of S. Helena, and which apparently ran underground to the Villa of the Gordiani, was not a branch of the aqueduct to convey water into Rome, but a branch from the great aqueduct for the villa or villas, as it now does from the Marrana at a lower level. This short arcade is of the time of Constantine. The great and long one that leads to the Cento-Celle is of two periods, the earlier part of the time of Hadrian, the latter of the third century. It is quite possible that the original _specus_ had become choked up with stalactite in the course of a century, and that it was restored to use for a time by Alexander Severus, and so called after him.

THE BRANCH OF TRAJAN ON THE AVENTINE.

It has been mentioned in the account of the Anio Novus (IX.) that, after the main conduit reached the great reservoir at the arch of Dolabella, it was divided into three branches, and that one of these was not completed until the time of Trajan and Hadrian. This important branch was carried over the valley between the Cœlian and the Aventine on a lofty arcade, built upon the _agger_ of Servius Tullius, and over the Aqua Appia, also passing over the Via Appia upon the arch of the Porta Capena to the Piscina Publica. It then ran along the edge of the cliff to the north of S. Balbina, and crossed again the valley between the Pseudo-Aventine and the Aventine itself, a little further to the west, by the side of the road which goes down the hill towards S. Prisca. In the vineyard of S. Prisca a portion of the _specus_ remains perfect, at a very high level[179]. From thence it was carried across the hill to the cliff above the Tiber, where the monastery and garden of S. Sabina are now placed. These are on the site of a palace of the time of the early Empire. Some extensive and important excavations were made there in 1855-57, by the Dominican monks of S. Sabina, and among the discoveries then made were an extensive series of conduits, with a _piscina_ and a _nymphæum_ of the same period,—of the end of the first and the beginning of the second century of the Christian era. A cascade _specus_ served to conduct the surplus water down to the more ancient cave reservoir at the mouth of the Aqua Appia, at the Salaria. An account of these excavations was drawn up by M. Descemet[180], and published in the Memoirs of the Institute of France, with an excellent plan and section. Several brick-stamps, of which the words are given in that work, with the names of the consuls, and some terra cotta

water-pipes, with the name of Trajan, were also found here. Others were discovered on the Aventine and near the same spot by Fabretti, who was puzzled by them, because they did not agree with his theories about the aqueducts. Donatus also mentions some of the same facts as known in his time. Some of the bricks were made at the kiln (_figlina_) of Annius Verus, said to have been on the Aventine, near the Salaria; and, if this is correct, that was the spot where they were found. Others have the stamp of Trajan himself. Another is the work of an Arabian servant of Q. Servilius Pudens, A.D. 139, when the Emperor Antoninus Pius and C. Bruttius Præsens were consuls. A piece of leaden pipe, with an inscription upon it, AQVA TRAIANA, was also found on the Aventine.

XII. AURELIA, A.D. 185, AND XIII. SEVERIANA, A.D. 190.

The Aqua Aurelia of the Regionary Catalogue must be the one made by Marcus Aurelius to convey water to his villa on the Via Appia, usually called the Villa de' Quintilii, where a brick-stamp of the time of Marcus Aurelius (A.D. 162) was found on the aqueduct itself by Fea in the eighteenth century[181]. This water was afterwards conveyed to Rome by his successors, Ælius Aurelius Commodus and Septimius Severus, to supply the great _thermæ_ begun by Commodus and finished by Septimius Severus, which were in the first Regio just inside of the Porta Latina, and must have been begun about A.D. 185[182].

The Aurelia was an important aqueduct, and there are slight remains of its _piscina_ just outside of the Porta Latina on the southern side: its _specus_ was traced nearly to that point in the excavations made in 1871. The modern road is cut through this old _piscina_, forming a foss-way in this portion: the aqueduct there passes underground, and has been destroyed or is not visible in this part; but, about a mile from Rome, it can be seen on the bank in the western cliff of the valley of the Caffarella. The _specus_ remains as a tunnel for a short distance, and this was laid open at both ends in 1872 under my direction; it had been concealed and covered over with Pozzolana sand, which had fallen over it from the cliff above, but it can now be seen again. The greater part of the _specus_ has been destroyed, and used for building the large modern farm-house on the opposite side of the valley, the building material having been good brick. As it would not pay to destroy the tunnel, that was let alone.

These remains of the _specus_ are near the well-known tomb called Dio Ridicolo. To this point it runs along the bottom of the valley at the foot of the hill on the side of the small stream or Marrana, here artificial, and parallel to that branch of the river Almo. This open conduit was probably made in the twelfth century, at the same time that the other branch of the Almo, which runs through Rome, was altered and made into a canal or mill-stream where necessary, in order to keep up a constant supply of water, and to avoid its being wasted in floods.

Let us now trace this aqueduct _backwards_ from Rome, in that part near the city. At the Nymphæum, called the fountain of Egeria, it turns at a sharp angle up to another small _castellum aquæ_, close to the church of S. Urbano, which is usually mistaken for a tomb; but the walls are lined with _opus signinum_ or _coccio pisto_, the invariable test of an aqueduct. At this point it turns again towards another fine _castellum aquæ_, at the end of the Circus of Maxentius and of his son Romulus. It comes on there from the head of the valley of the Caffarella, and to that point from the villa of the Quintilii in the Via Appia Antiqua. Thus far we have traced its course _backwards_ from the _thermæ_; in order to identify it more clearly, we will now go to the sources, and bring it down to the same point to which we have traced it from the _thermæ_.

The sources or springs are on the side of the hill of Marino, below Grotta Ferrata, in the same swampy district as those of the river Almo, and of the old aqueducts of the Tepula and the Julia. Several springs are collected into a central reservoir; and, as is usual with other aqueducts, they are then brought into a _specus_, at first underground to the foot of the hill, then upon an arcade, of which there are considerable remains at the Torre di Mezza, Via di Albano, about seven miles from Rome. This fine arcade of the third century goes on to the villa of the Quintilii, and was no doubt built under Aurelius Commodus, after he had obtained possession of that great and fine villa. In various parts of that great building are remains of reservoirs for this aqueduct, and of baths connected with them[183]. About half-a-mile nearer to Rome is, at an angle, as usual, another large reservoir, which has been turned into a farm-house; and the appearance of a medieval chapel or church has been given to it, by building a tower at one end. Possibly it was used for that purpose in the Middle Ages. From thence to the head of the valley of the Caffarella is but a short distance. Where the _specus_ has been carried on an arcade above ground, it has been destroyed as a quarry for the good old bricks; where the ground is higher and the _specus_ is underground, it has been traced in parts only.

THE THERMÆ of Septimius Severus and Commodus were close to each other, and probably connected. They are mentioned together in the Regionary Catalogue as in the first Regio, and there are remains of them under the small hill, called Monte d'Oro, probably, from the golden colour of the sand in its original state, which is situated just within the Porta Latina, between that and the

Porta Metronia. Some excavations were made there in 1870 by the Archæological Society, and large subterranean chambers and corridors were found similar to those under the Thermæ of Antoninus Caracalla. The _specus_ of an aqueduct was also followed for a considerable distance in the direction of the Porta Latina. This must have been for the Aqua Severiana. Just outside of that gate are remains of two _piscinæ_ or _castella aquarum_, one on either side, and on different levels. One of these belonged to the Aqua Aurelia, the other to the Severiana. The course of this latter is more doubtful, but it was probably only a branch from one of the great aqueducts, and would appear to have come in the bank on which that part of the wall of Aurelian was built, from the Porta Metronia to the Porta Latina. It arrived at the bridge over the Almo (on which the gateway-arch of the Porta Metronia is built), from the great _piscina_ and _castellum aquæ_, on the cliff of the Cœlian, near the Porta Capena and the Camenæ, where two aqueducts are now visible, having been brought to light by the excavations of the Archæological Society. The construction of one of these aqueducts agrees with the time of Septimius Severus.

XIV. ANTONINIANA, A.D. 215.

This aqueduct enters Rome at the south-east corner near the Porta di S. Sebastiano, and passes over the arch of Drusus; a part of the arcade is visible by the side of it. The _specus_ can be seen both in the wall of the city, through which it passes, and over that arch, and one of the arches of the arcade remains on the east side of it. It was carried in that manner for some distance across the valley or foss, until it reached the high bank of earth on which the Wall of Aurelian is built, near the Porta di S. Sebastiano, and then along the edge of that bank, which is the great _agger_ of the ancient earthworks, against the outer side of which the Wall of Aurelian is built. The inner side of the bank is supported by a low wall here as in many other parts, and upon or against that inner wall the _specus_ of the aqueduct is carried. It is sometimes on an arcade, in other parts it is carried on the wall to the Thermæ of Antoninus Caracalla. The demolition of part of this arcade in modern times is recorded by contemporary authors.

The _specus_ passed upon an arch over the road in the old foss outside the wall into a garden on the opposite side, where it can be seen on the level of the ground; thence it can be traced through that large garden or vineyard as far as the railway, which passes on the outer side of it in a deep cutting. The remains of the brick arcade here form a wall between this garden and another. It is covered with shrubs, and looks like a hedge, from which circumstance it has hitherto escaped observation. The wall is cut through by the railway, but can be traced on the other side of it along the bank of a narrow deep lane, like what we call in England a Devonshire lane. This lane goes parallel to the Via Latina, on the southern side of it, for about a mile; the aqueduct then leaves it, turning short to the left. Near to this angle, at about half-a-mile outside of the Porta Latina, is a large reservoir belonging to this aqueduct. It is built against the western cliff of the valley of the Caffarella, the top of it level with the summit of the cliff, and therefore is not visible from above, as a person standing on the higher ground looks over it. It is also hidden by a clump of trees; but it is very distinctly visible from the valley below, and from some parts of the Via Appia, and is readily seen to be a _castellum aquæ_ by the boldly-projecting buttresses to support the wall with the weight of water behind it. The Aqua Antoniniana ran along the edge of the cliff, and supplied this large reservoir, which is oblong as usual, and divided down the middle by an arcade, similar to the fine one of the Marcian near Tivoli, and many others. This has been plastered over, and made into a cow-house. It is far above the level of the Aqua Aurelia, which runs below along the side of the valley of the Caffarella. The Aqua Antoniniana clearly came from the higher aqueducts in the main line; and, according to the Einsiedlen Itinerary, it was a branch of the Marcian which went to supply the Thermæ of the Antonines called that of Caracalla. Part of the brick arcade, with the _specus_ upon it, is here visible in another garden against a cliff; it then passes underground for a short distance, but soon emerges again, and can be traced against another cliff as far as the Via Latina, which is here upon a bank, or rather on the edge of higher ground, with the remains of a _piscina_ by the side of it. The _specus_ then again passes underground for some distance, and the next point where we have been able to find it is an old stone quarry, the vault of which fell down in 1870, and revealed this _specus_, which was not visible before. This is in the garden behind the Albergo de' Spiriti, on the Via Appia Nova, about two miles from Rome, and near the point where it crosses the old Via Latina[184].

A large reservoir remains near the Porta Furba, about a quarter of a mile nearer to Rome, and just two miles from the Porta Maggiore. Here we excavated (in 1871) this large subterranean reservoir, near the Claudian arcade on the southern side, but not very close to it, rather nearer to the road to Tusculum (Frascati), which passes near the Porta Furba. This reservoir appears to have belonged to the Anio Vetus, which agrees with the account in Frontinus, of a branch of the Anio Vetus at two miles from Rome, going in the direction of a new road. The _specus_ crosses the Via Appia Nova near the Albergo de' Spiriti, and the Via Appia Nova was probably a new road in the time of Frontinus, as indicated by the tombs of the first century along the side of it.

XV. ALEXANDRINA, A.D. 225.

The Aqua Alexandrina is distinctly mentioned by Lampridius in his life of Alexander Severus (c. 25), as made to bring water to his _thermæ_, which were near those of Nero, and therefore near the Campus Martius and the Pantheon in Regio IX. This could only have been a branch from the Virgo[185], as there is no aqueduct of the third century along the Cœlian, and no trace of a branch from the Palatine or the Capitol.

There is no probability in the theory of Fabretti, that the great aqueduct coming from Gabii, on the eastern side of Rome[186], was the one mentioned in the life of Alexander Severus as made by him to carry water to his _thermæ_, near those of Agrippa, in the Campus Martius, on the northern side of Rome. A branch from the Virgo on the Pincian, or from one of the great reservoirs on the eastern side of Rome, could be made at a tenth part of the cost. There is some reason to believe that there was such a branch passing near the Barberini palace.

Another branch may very well have been made from the great aqueducts between the Porta Maggiore and the Porta S. Lorenzo, to the Nymphæum of Alexander Severus, on the Esquiline in Regio V. An inscription relating to this is said to have been found at the _piscina_ in the garden of S. Croce[187]. It is far more probable that this inscription was found on the wall of the great reservoir, on the other side of the Via di S. Maria Maggiore, near the Minerva Medica, where other reservoirs of extensive _thermæ_ of the third century are visible[188]. These were supplied with water from other reservoirs just within the Porta Maggiore belonging to the different aqueducts; the Anio Vetus, the Marcian, and the Claudian, all appear to have contributed their share. The one specially called Alexandrina was probably the lofty one carried upon a tall arcade, from the reservoir of the Claudia near the Baker's tomb,—forming part of the present city wall. The lower part of the piers of the arcade of this period may be seen built up in the wall; the arches lead to another reservoir between that and the building called the Temple of Minerva Medica, and are there brought to an end, just on the south side of the new arches made for the railway. The _specus_ or conduit, and the arches for it, on these brick piers of the third century, have been rebuilt for the Aqua Felice, in the same rough way as that _specus_ is usually built; but, as that conduit is carried on to the Porta S. Lorenzo in the wall, and as these piers of the third century cease exactly at the point where the conduit of that period would naturally turn off, there seems every probability that this was the Aqua Alexandrina, which was merely a branch from the Claudia and Anio Novus united to supply these _thermæ_, just as the Aqua Antoniniana was a branch from the Marcia to supply the _thermæ_ of Antoninus Caracalla.

The _specus_ of this branch was carried over the Julia on the Marcian arcade to the point where it terminates, which is exactly in a line with a lofty _piscina_ and _castellum aquæ_, now a gardener's house, between the wall and the Minerva Medica, and there are remains of the tall arcade from one to the other; the last pier which joins to that building looks like a large tall buttress to it.

The Temple of Minerva Medica is a brick building of the third century, agreeing with the time of Alexander Severus, and there has evidently been a fountain of importance in the middle of it, with an aqueduct to carry water to it from the large _castellum_ near to it. Upon this _castellum aquæ_ a villa of the sixteenth century has been built; but the vaulted chambers, with the tartar deposit of water, remain in the lower part of this building, and there is a tomb or _columbarium_ of the third century at one end of it.

The dedication of a temple to Minerva Medica, in connection with an aqueduct, is natural, and that this was not an isolated example is shewn by an inscription found near Subiaco[189], and published in 1830 by Martelli, in his work on the Antiquities of Sicily[190]. The Regionary catalogue of the fourth century gives, in the fifth Regio, which contains the Esquiliæ, the Nymphæum of Alexander and the Minerva Medica, all which agrees with the existing remains of this Nymphæum. In the same vineyard, to the north-west or opposite side of the Minerva Medica, and very near to it, are the ruins of another building, called by some "a _nymphæum_," now also a gardener's house, under which the marble pavement remains very evident, the construction belonging to the period of Alexander Severus[191].

Both the Pantheum or hall for the men, and the Nymphæum or hall for the women, had images in the niches round them, and frequently an altar also, so that they were temples at the same time that they were used as waiting-rooms for the baths. The Pantheum of Agrippa was the entrance to his _thermæ_[192]; the building usually called _the Temple_ of Minerva Medica, from an image found there, is called in the Regionary Catalogue Minerva Medica only. A Nymphæum and a Pantheum equally required a _castellum aquæ_ to supply it with water for the fountains and the stream that ran round it, and there are remains of bath-chambers and niches outside of many of the larger reservoirs, as in this instance.

During some extensive excavations, which were carried on in the spring of 1871 by a company, with a view to building new streets in the eastern part of Rome, considerable remains of the lower part of the walls of these great _thermæ_ of the third century were found on both sides of the road made in the sixteenth century, from S. Maria Maggiore to S. Croce. The company bought two large

vineyards, in one of which stands the fine ruin called Minerva Medica, which was evidently one of the halls of the _thermæ_; the ground is full of ancient reservoirs for water at different levels, some underground, others at a considerable elevation, turned into houses; they may be traced at intervals all along the line within the Wall of Aurelian, from the Porta Maggiore to the Porta S. Lorenzo, which is itself here built against the Marcian arcade, and in one part the outer wall of the large _piscina_ and _castellum aquæ_ of the Tepula is incorporated with the wall, of which it now forms part. This ground had been at one period the Esquiliæ or great burial-ground, and afterwards the garden of Mæcenas, so that remains of great works for the supply of water at different periods were likely to be found there, as was the case.

XVI. THE ALGENTIANA, A.D. 300.

This aqueduct is said by some to be only a branch from the Aqua Marcia from the _castellum_ or _piscina_ at the Porta S. Lorenzo, to the Thermæ of Diocletian, and to have been made by him. Considerable remains of the large _piscina_ for these Thermæ were found when the railway station was built, a plan and section of it was preserved by Visconti; it was not destroyed, but was built over and effectually hidden. The aqueduct was continued, A.D. 330, by Constantine to his Thermæ on the Quirinal, now in the Colonna gardens. Others say that the Algentiana comes from the Mount Algidus, near Tusculum. In the Campagna between Frascati and Rome, there are remains of large reservoirs or _castella aquarum_ of the third century, which do not appear to belong to any of the aqueducts hitherto described. They are usually said to be only reservoirs for the supply of the adjacent fields; but they are all on the highest points, and it is difficult to see how the water was conveyed to them. There appears to be a regular line of them, not indeed a straight line, (the nature of the country would not admit of that,) but still a line of them at comparatively short intervals, always within sight of one another. It seems probable that the Aqua Algentiana was brought in a subterranean channel or _specus_ from the great reservoir at Tusculum, which is on very high ground, and that the water was permitted to run into these reservoirs at frequent intervals, instead of being carried on an arcade across the country, as had been done in the case of the earlier aqueducts. It is beyond dispute that the ancient Romans were well acquainted with the principle of the syphon, and that they were quite aware that water will rise to its level after a very considerable distance: they may have therefore thought it expedient in this aqueduct to avail themselves of that principle. It is difficult to explain how water could be supplied to these numerous high reservoirs in any other manner.

XVII. AQUA CRABRA, AND MARRANA, A.D. 1124.

This stream was brought into Rome in the bed or foss of the river Almo (Flumen Almonis), mentioned in the Regionary Catalogue as in Regio I., and not otherwise accounted for in this enumeration. The water now comes from the Marrana, which has its source near Marino, and from the Aqua Crabra, which comes from Rocca di Papa, near the lake of Albano, some miles further up the hill; the waters of these two streams are united before a part of them is carried through the tunnel of the Aqua Julia to a point of junction with the bed of one of the many branches of the small river Almo. The Almo itself comes also from the hill of Marino, but from a different part of it, and is divided into many branches when it arrives on the low ground of the Campagna. One of these was made use of for this mill-stream, a canal being carried in banks of clay in straight lines, where the old bed of the river passed through low ground, and had been therefore liable to floods; but this old bed or foss was used, to save expense, where it passed through higher ground in its old winding course.

Originally that part of the branch which passes through Rome was alternately wet and dry, as many of the other branches are, and was liable to floods after heavy rains. The main branch of the Almo turns off to the south near the Torre Fiscale, following nearly the same line as the cross-road from the Via Appia Nova to the Via Appia Antiqua, and passing under this road twice. In this part of its course it is generally dry in dry weather; but when it arrives at the head of the valley of the Caffarella, several other springs that never fail run into this old deep foss. One comes from near the villa of the Quintilii, another is called the fountain of Egeria, a third the Aqua Santa, from its medicinal qualities. There is a bath-house built over that spring. The original springs on the hill of Marino bring little water in dry weather, not more than sufficient to supply ponds near to them for the cattle; but, in wet weather, the water runs off in the old deep winding foss, which also drains all that part of the country.

The sources of the Marrana are about a mile above Marino, and nearly three miles from Albano; they are in a long, narrow, deep valley in the rocks, and the water gushes out in several places at short intervals on both sides of this valley, which continues on under the rock on which the small town of Marino is built. Close under the town is a tall medieval tower, and at the foot of this is a _piscina_ of rude early character, the lower chamber of which is still full of water. A _specus_ cut in the rock as a tunnel is also visible at this point. On the side of the valley opposite to the town are the splendid ancient quarries of _peperino_, called by Vitruvius _lapis Albanus_, because Marino was in the district of Alba Longa. The stream flows on in the same deep valley, winding

down the hill, and, at the foot of it, the Aqua Crabra, coming from Rocca di Papa, is united with it shortly before it is crossed by the bridge on the road to Grotta Ferrata, ten miles from Rome and near the tunnel through which flows part of the united water, the main body going on straight to the river Anio; the part which is carried through the tunnel turns at a sharp angle to the left, or west, towards Rome. At each end of the tunnel is a loch of early character, partly cut in the rock and partly built of travertine, with the grooves of flood-gates. Over the exit from the tunnel is a piece of old wall faced with _Opus Reticulatum_, of the same rude early character as that of the Aqua Julia.

After the water emerges from the tunnel, it passes in a deep bed to a bridge over the stream of the Marrana, near the _piscinæ_, six miles from Rome. At this point the deep foss of the river Almo is close to it. This is dry in dry weather, but has abundance of water in wet weather, and here the foss is dammed across; this appears to have been done originally to effect a junction with the water of the Marrana, which from this point flows in the foss of one of the many branches of the Almo that intersect the Campagna in this part. This mountain-stream is a very uncertain one; sometimes the deep foss is full of water, flowing at the rate of five or six miles an hour, at other times it is dry. Numerous winding streams are collected into one at the head of the valley of the Caffarella, near the church of S. Urbano. Here it passes through swampy ground at a place called Aqua Santa, on the cross-road from the Via Appia Nova to the Via Appia Antiqua; here also several springs fall into the deep bed, one of which is miscalled the fountain of Egeria[193]. In dry weather this branch of the river Almo appears to begin here, and from thence to the mouth of this branch near S. Paul's, mentioned by S. Gregory as the Almo, the water never fails. All the other branches are deep, dry fosses after dry weather, and the branch that now flows through Rome must originally have been frequently dry, and at other times liable to floods[194].

To remedy this evil, a branch was made from the stream, consisting of the Marrana and Aqua Crabra united, which never fails; and, in those parts where the water passes over low ground liable to be flooded, it is carried in a bank of clay covered with sand, and planted with canes. In such a bank it is carried from near the ford in the natural bed of the river at Roma Vecchia to the Torre Fiscale. Between these two points there is a loch with a flood-gate and a lasher, over which the water falls into one of the deep beds or fosses of the Almo; but this deep bed of a mountain-stream has no other beginning than this same stream, here raised in a bank of clay, into which the water of the Marrana has been turned. In other parts where the ground is high, and consequently the water is below the level of the ground, it follows its ancient, natural, winding course in a deep foss. This is the case both near the original point of junction before reaching the ford at Roma Vecchia, again after passing the Porta Furba, and again under the walls of Rome near the Lateran. From Roma Vecchia, passing by the Torre Fiscale to the Porta Furba, it is carried in a bank of clay many feet above the level of the meadows; but after passing the Porta Furba, it again falls into the old deep foss for about a mile at the foot of the Claudian arcade, winding about sometimes on one side, sometimes on the other, then near to a part of the road to Frascati. For the last half-mile to the Porta S. Giovanni, this road is modern on a large bank of earth across the valley or great foss outside the Wall of Aurelian, and for most part of this line the Marrana is carried in a small bank of clay against the side of the larger bank of the road; but before it reaches Rome it falls again, that is, the earth rises on the terrace under the wall, and the Marrana falls into the old deep bed near the Porta Asinaria, after passing through two mills built on bridges, one on the line of the old Via Asinaria, the other of the old Via Lateranensis.

This small stream enters Rome under the Porta Metronia, which is built on a bridge over it[195]. This bridge has a brick arch of the time of the early Empire, partly concealed by a medieval arch in front of it. Shortly after entering Rome the stream passes at the north end of what is now the nursery-ground of the city, called Orto Botanico, and under a bridge on which another mill is built; by the side of it is the road into that large garden, known to have been that of Crassipes, the son-in-law of Cicero, who mentions in one of his letters a flood of this stream carrying wooden shops from the bank in front of it to the Piscina Publica[196].

This is exactly the direction that the stream takes, as it turns at a sharp angle to the north directly after crossing the Via Appia, and passes close to the Piscina Publica; while the Tiber flows from north to south, and a flood of that river would have carried the shops the other way (if it reached that level at all). There is another mill near the angle on the Via Appia. The stream then passes along a curve at the southern end of the Circus Maximus, (washing the foot of a lime-kiln,) then under the slope of the Aventine and through the gas-works on the site of the Carceres of the Circus, then underground and through another mill in the Via della Marrana near the Bocca della Verità. The eighth and last mill is on the bank of the Tiber, and is built over the mouth of the stream, the back of the building resting on the old tufa wall, called the Pulchrum Littus of the Kings, in which an aperture was left for the Almo when that wall was built. The front of the mill is built on medieval arches standing in the bed of the Tiber.

This alteration of the bed of the Almo may have been made at an early period, of which we have no record, and restored to use in 1124, under Pope Calixtus II., or it may have been entirely made out of the remains of the old aqueducts at that time. We have distinct records of the work done then; but in one of these the expression used is _reduxit_, that is, he "led again" the water from

the old arches. In any case, a great benefit to the city was made at that time, and the account of it fairly belongs to the history of the aqueducts, from which it was made. The following account of it is given by the Cardinal of Arragon, in the time of Pope Calixtus II., A.D. 1124:—

“He (the Pope) also brought water from the ancient arches, and conducted it to the Porta Lateranensis, where he formed a lake to receive it, for watering horses. He also built several mills on the line of the same stream of water, and planted many vines and fruit-trees round the borders of this lake with great care[197].”

Another writer of the same period, called Pandolph of Pisa, relates the same thing:—

“He _reconducted_ a stream of water into the city, and made mills, with vines near a lake[198].”

The ancient aqueduct which was made use of for the purpose was the Julia (V.), (which see,) and the ancient arches mentioned probably mean the tunnel through which the water of the Aqua Crabra and the Marrana united is brought. Its course has been already described, the great reservoir or lake (_lacus_) opposite to the Porta Lateranensis is very distinctly visible in the vineyard by the side of the stream, between that and the Aurelian wall. It is still swampy ground, and is planted with canes; when these are cut at the end of the month of January, it can be clearly seen, and the remains of the lake intercept the path on the bank of the stream. This reservoir might be restored to use with great advantage to the neighbourhood, and at little expense.

There are two mills on bridges across the stream on the side of this lake, and several other mills on the line of the stream, as has been mentioned. The water must always have flowed out of the lake in the old deep bed of the small river Almo, and passed under the bridge on which the Porta Metronia is built, into Regio I., and then under the foot of the Aventine by the side of the Circus Maximus into the Tiber, as before described. The tower built in the twelfth century, against the inside of the gate and the bridge, conceals this from view.

XVIII. AQUA FELICE, A.D. 1587.

This aqueduct is named after the Pope, Felice Peretti, whose title was Sixtus V.; he brought it from a place near La Colonna, the ancient Labicum, about twelve miles from the city, to the fountain of Moses (now so called from a statue) at the Termini on the Esquiline, as recorded on an inscription[199]. It is still in use, supplying the fountains at the Termini, near the Thermæ of Diocletian, of Monte Cavallo, near those of Constantine, and the whole of the upper town. The waters of the Aqua Hadriana were united with some others in the territory called Pantano, at about twelve miles from Rome, where they emerged from the mountains. All these sources or springs of water were collected during the pontificate of Gregory XIII., A.D. 1572-1585, in an immense reservoir, repaired in 1869, with several other smaller ones subservient to it for purification. The aqueduct was built in the time of Sixtus V. (A.D. 1585-1590), but the reservoirs were not completed until the time of Urban VII. or VIII. [1623-44]. From this point the water is carried into the canal or channel through an opening called the _fistula Urbana_, made in a piece of marble. According to Fontana, this water was brought to the Porta Maggiore on a new arcade made out of the materials of the old aqueducts in a very clumsy manner. It was the intention of the Pope to have made use of the canal or conduit of the Aqua Marcia, but that was found to be at too high a level, and his clumsy engineers were obliged to make a new arcade at immense expense. He availed himself, however, of the old arcades as far as he could, by building his new conduit up against the side of the piers of the old ones, sometimes on the Marcian, as may be seen at the place called _Sette Bassi_, and near the Porta Furba, sometimes against the Claudian as near Rome. After bringing it into the city in this canal of rough stone, the water was carried in leaden pipes into the old subterranean channels, as may still be seen in the deep _specus_ on the Cœlian, and the metal pipes pass through the tall brick piers of the arcade of Nero, and are supported on flat arches across from one pier to the other, with a rapid descent over the first or ancient road from S. Croce to the Porta Maggiore, and into the Specus Vetus underground, before arriving at the second or modern one from S. Croce to S. Maria Maggiore. The point of descent is marked by a respirator.

Pantano is about two miles from Gabii, and this reservoir is still in use. It is very near to the ancient _castellum aquæ_, which was made originally by Hadrian[200] for his aqueduct, as is shewn by an inscription found there. The other streams coming from Tivoli are said to have emerged also near this point, and the first engineer of the Felice, Matteo da Castello, considering the Claudian and Marcian lines as the best, followed those to the _piscinæ_; but having made a mistake in the levels, instead of using the Marcian _specus_ and arcade from the _piscinæ_ into Rome, and merely repairing it as the Pope had intended, Fontana was obliged to rebuild it entirely of the materials of the old Marcian arcade, with the help also of those of the Claudian, all the way to Rome. This was done in great haste and in a very clumsy manner[201].

From the Porta Maggiore one branch of the Aqua Felice is carried across the great foss to the Lateran, through the piers of the arches of Nero, and down a cascade-pipe into the old _specus_ of the Appia, and along that to the fountains and reservoirs at the Lateran. This is the branch that goes straight on from the corner of the Sessorium to the west. Another more important branch of the Aqua Felice turns short to the north from the same angle and over the Porta Maggiore, along the city wall to the Porta S. Lorenzo, in a new channel very badly and clumsily built of rough stone from the materials of the old aqueducts, making use of the piers of the Claudian arcade as far as they go, and then of the inside of the wall of Aurelian over the Marcian arcade. The Aqua Felice having here been brought to a higher level, that is to say, the descent from the _piscinæ_ being less rapid than that of the Marcia, after passing the Porta Maggiore, goes over the Marcia upon the Arch of Augustus at the Porta S. Lorenzo. There is a _castellum aquæ_ for it in the wall just to the south of the Porta S. Lorenzo, where the water may be heard rushing through, and the surplus water runs off into an ancient drain on the outside of the wall. With the rapidity of all the public works under that energetic Pope, the undertaking, a decree for which he had signed in April, 1585, was completed in two years, by the labours of from 2,000 to 3,000 men, and the waters were seen to gush from their sculptured fountain in the Piazza di Termini, on the 15th of June, 1587. The Aqua Felice was conducted for fifteen miles underground, and for seven miles upon arcades. Besides the Aqua Felice, the Via Felice and the Via Sistina (Sixtus) in continuation of it, and many other great works were inaugurated by the same Pope, who has been called the real founder of modern Rome. Other old subterranean conduits are employed to carry the pipes of the Felice where convenient for the purpose of conveying water to different parts of the town.

Junctions of the arcade of Sixtus V., or Aqua Felice, with that of the Claudia, take place at an angle where the Torre Fiscale has been built, and again at another angle where there is an archway called the Porta Furba, about two miles from Rome, and a most picturesque ruin of a _piscina_, with a tall tower by the side of it, in which is the ventilating-shaft of the conduit. The difference of construction and of level is very evident, and the three conduits carried on the same arches may be seen distinctly. The construction of the Claudia (VIII.) is of large square blocks of stone. The Anio Novus (IX.) is merely an additional brick conduit, the work is part of that of Claudius and Nero, and is carried over the original one at a great height from the ground. Near the city only small portions of this upper conduit remain here and there, as, for instance, over the Porta Maggiore, and in a few places on the wall. In some places, the arcade of the Aqua Felice runs parallel to the Claudian for a considerable distance, and is joined to it at both ends, as near the Porta Furba. This lower arcade carried part of the conduits of the Aqua Marcia, Tepula, and Julia, which ran from the Porta Furba into the city parallel to the later one of Claudius, at a lower level.

Where the Aqua Felice enters the city, it is carried on the piers of the arcade of Claudius, from the junction with the arches of Nero, over the Porta Maggiore to the old _castellum_ at the corner of the wall, where it turns at a sharp angle. Here the arches of Claudius cease; but the conduit of the Aqua Felice is continued along the city wall, of which it forms part, upon the ancient embankment as far as the Porta S. Lorenzo, and over the archway of Augustus there, using one of the older conduits. It then makes a sharp turn to the west, and after being carried along the north side of the road for a short distance, crosses it again on an archway built for the purpose by Sixtus V., as recorded by an inscription upon it; then it turns sharply to the west again, and is carried on an arcade between the road on the north and the railway on the south, to the great inner _agger_, which it reaches at a point near the Thermæ of Diocletian and the railway station. It is then carried in an old _specus_ in that bank along the east side of the Thermæ, and turns at an angle to the north, at the Via Nomentana, near the Porta Nomentana, a little to the south of the modern Via di Porta Pia; then along the north side of the Thermæ till it arrives at the great reservoir behind the fountain of Termini. The _specus_ is three feet wide, and the water in it is usually from three to four feet deep, running with a rapid current about five miles an hour, and constantly flowing day and night. Thence it is carried in pipes to the different reservoirs and fountains of the upper town. It also supplies the lower part of the city from the Ghetto to the Marmorata, along the bank of the Tiber.

SUMMARY.

Frontinus, who wrote in the time of Nerva and Trajan, mentions (as we have seen) nine aqueducts[202], reckoning as distinct several branches, or additional channels, subordinate to others more important. There is one more important record to which reference has not hitherto been made, namely, the summary at the end of the _Curiosum_ and _Notitia_, in which nineteen are enumerated.

The entry in the Summary of the Regionary Catalogue is as follows:—

Aquæ XIX. I. Traiana [X.] II. Annia (or Anio Vetus?) [II.] III. Attica (Anio Novus) [IX.] IV. Marcia [III.] V. Claudia [VIII.] VI. Herculea [XVII. Almo?] VII. Cerulea [IX.] VIII. Julia [V.] IX. Augustea [I.] X. Appia [I.] XI. Alseatina [VII.] XII. Ciminia (?). XIII. Aurelia [XII.] XIV. Damnata (Cloaca Maxima?). XV. Virgo [VI.] XVI. Tepula [IV.] XVII. Severiana [XIII.] XVIII. Antoniana [XIV.] XIX. Alexandrina [XV.]

Those not previously mentioned are (1.) Attica, (2.) Herculea, (3.) Cerulea, (4.) Augustea, (5.) Ciminia, (6.) Damnata.

1. Attica is supposed by Fabretti to be the same as Alseatina [VII.], but then how is the number of nineteen to be made up? It was probably the Anio Novus, as already described. [See IX.]

2. Herculea. This is mentioned by Frontinus[203] as receiving a part of the Aqua Marcia after its entrance into the city[204]. Another stream of the same name, thirty-eight miles from the city, was added to the Anio Novus[205]; but it seems most probable that the stream here intended is the Almo, which enters Rome under the Porta Metronia, and conveys the water of the Marrana, or Aqua Crabra, coming from these two mountain-streams united, as already described. This is always a very strong stream. It follows the line of the aqueducts for miles towards Rome, and received the surplus water in many places, where there were _piscinæ_; it passes very near to the point where the aqueducts enter Rome at the Porta Maggiore, and may very well have received the surplus water there also of the Marcia, as stated by Frontinus.

3. Cerulea. This is the name of one of the branches of the Claudia, among its sources, and is mentioned in the inscription at the Porta Maggiore; but again, this does not account for one of the nineteen Aquæ.

4. Augustea. A stream was added to the Aqua Marcia by Augustus, and called after him[206]; but that would not account for another stream in Rome here indicated as one of the nineteen Aquæ. It is more probable that the water here intended is the Augustan branch of the Aqua Appia, which was united at the Gemelli within the outer wall of Rome. Frontinus (c. 4), indeed, mentions that the Alseatina was also called Augustea, but that would not account for another of the nineteen streams[207].

5. Ciminia, another name for the Sabbatina [X.], according to Onuphrius Panvinius; but the sources of the Sabbatina are very distant from the Monte Cimino. Ciminia is perhaps written for Curtia, another source of the Claudia; but again, this does not account for another of the nineteen streams.

6. Damnata. This may be the stream that comes from the Quirinal and the Palatine, and which formed the lake of Curtius, whence it was conveyed into the Cloaca Maxima, as it still is. It was therefore _condemned_ to serve for washing out a drain only.

There is reason to believe that some of these nineteen streams are the natural watercourses, and others merely branches from the great aqueducts, as has been said.

There were 1,452 _lacus_, that is wells, or cisterns of water, supplied by the aqueducts in Rome, according to the _Horum Breviarium_ of the _Notitia_, or Catalogue of the fourth century, and they must in many instances have been very near together. A reservoir for the distribution of the water was almost a necessary termination of an aqueduct, and at a junction it was equally necessary.

Rutilius describes the aqueducts about A.D. 417, in such terms as shew that they were not destroyed in the first siege of the Goths[208]. Cassiodorus represents them as perfect, about twenty years before the siege carried on by Vitiges[209]. At the time of the siege by that king, Procopius (i. 19), writing in the sixth century, records only the fourteen aqueducts already mentioned[210].

APPENDIX.—AQUEDUCTS.

Since this chapter was printed, the great excavations that have been carried on in Rome have brought to light many remains of the old Aqueducts in places where they were not previously known or thought of. These are so numerous that we can do little more than mention them, beginning at the Sessorium, where the principal aqueducts entered Rome. In the Sessorian or Palatian gardens, now those of Santa Croce in Gerusalemme, a pit was dug in the reservoir which was used for the Thermæ of S. Helena, which is a large cistern of two narrow chambers, with others similar under them; this was ascertained by digging this pit. Remains of other reservoirs along the line of the north wall of the garden, which is made out of the old aqueduct, were brought to light more clearly. Just outside of this garden is the road from the church of Santa Croce to the Porta Maggiore[211], which is carried on a bank of earth that was the boundary of the Sessorian garden, and on the outer side of it, this bank is supported by a wall of the time of Constantine, no doubt built when his mother, S. Helena, resided there. Just beyond this bank, and in the great foss of the ancient fortress, are two large reservoirs close together, one on either side of the foss. These appear to correspond with the _Gemelli_, or twin reservoirs of Frontinus; an excavation made here was stopped by water, but enough was seen to make it evident that there were other chambers under them, and that they were very deep, but have probably been used for one of the later aqueducts, at a higher level also. It was very usual to carry one aqueduct nearly over another, in order that the older subterranean reservoir might

receive the surplus water of the later and higher ones. It is probable that in this instance the Claudia and Anio Novus had each a reservoir here on the higher level, and that the water of the two was here united and carried on along the Cœlian Hill in one _specus_, on the arches of Nero, to the middle of the city.

The inscriptions on the Porta Maggiore record the distances from the sources of the aqueducts to this point, clearly shewing that this was the entrance into Rome in the outer wall, though not into the CITY, until the boundary of the city was extended to this outer wall by Aurelian, in the third century. On the northern side of this great gate remains of the Marcian arcade were found going from this point, where the three aqueducts pass through the outer wall at one of the angles, and go straight on to the high bank on which the wall of Aurelian was afterwards carried, to the Porta Tiburtina (now di S. Lorenzo), and the reservoirs there. The _specus_ passes underground for some distance, about half-way between the two gates, and is carried on arches near the gates. The fine building called Minerva Medica was full of fountains, as was all the great public garden in which it stands, and all the fountains in Rome were supplied by the aqueducts. Between this building, of the third century, and the wall, is another large reservoir, turned into a house, where considerable excavations have been made. The later aqueduct, called Aqua Alexandrina, was carried in the wall over the earlier ones, to a point just opposite, to the remains of the Minerva Medica. The piers of the arches that supported the _specus_ can be seen in the wall, both outside and inside, as far as this, but they go no farther. This point, where they cease, is close to the place where the railway passes through the wall. Beyond these arches other excavations were made by the archæologists near the Porta di S. Lorenzo, and the arches that carried the Marcia, etc., were shewn. There are remains of two reservoirs near this point; the outer wall of one now forms part of the city wall, and is foolishly called “the house of Cicero;” the other is just within the line, but still on the bank, with the wall of Aurelian built close against it on the outer side. There are remains of another reservoir on the other side of the gate, and one branch goes on from thence to the Prætorian Camp, passing by the Porta Chiusa, where the _specus_ was shewn in some other excavations of the archæologists; and near to it, on the south side, is a large reservoir on the bank, cut through the middle by the wall of Aurelian. This proves that the great bank of earth was there, and had the aqueducts carried upon it, before the time that the wall of Aurelian was built. The _specus_ then goes upon the bank round this camp, but is for the most part concealed; it is visible again on the northern side, which is the only perfect part of the fortification of the camp by Tiberius, and his wall stands upon the earlier _specus_ of the aqueduct; the latter is faced with _opus reticulatum_ where perfect; the wall is of fine brickwork.

The branch that goes from the Porta di S. Lorenzo to the other reservoir, under the Trophies of Marius, is carried on a fine arcade of the first century; this has been brought out far more clearly than it had been for many centuries. The remains of the reservoir at this very high level are also made visible. Signor Ernest de Mauro, the surveyor who took the levels, considers this branch so high, that the only water that could reach it was that of the Claudia and Anio Novus united, which we know from Frontinus was carried into all the fourteen Regiones of Rome, but it was considered by Fabretti to have belonged to the Aqua Julia; the difference of level between the two aqueducts is only ten feet. At this high point the water was divided, and carried in different directions; one branch, of which part of the _specus_ is visible, went to the other great reservoir called the Sette Sale, which supplied the Thermæ of Titus and Trajan on the Esquiline, and the surplus water passed on to the Colosseum and to the fountain called the Meta Sudans. From the other great division of the aqueducts, at the corner of the Sessorian gardens, near the Porta Maggiore, the well-known arches of Nero go along the bank to the Lateran, and from thence along the Cœlian Hill to the great central reservoir of Nero, over the Arch of Dolabella. At that point it has been already shewn that several of the aqueducts met, and were divided into three branches, one straight on to the Palatine, on a double arcade across the valley from the Cœlian, of which there are considerable remains of the lower tier of arches, and one arch of the upper tier, which forms a sort of back gate to the palaces of the Cæsars. A second branch passed over the Porta Capena to the Aventine, at different levels; the earliest and lowest, the Aqua Appia, is the one that can now be the most distinctly traced. After passing over the short _agger_ of Servius Tullius it goes underground under the cliff, at the north end of the Pseudo-Aventine, and at the further end under the hill on which S. Sabba now stands; a series of stone-quarries have been made by cutting away one side of the _specus_, leaving the wells to give air to the quarry.

At this point excavations have repeatedly been made by the archæologists, and as often filled up again by the workmen in the summer months, until 1876, when an arrangement was made with the proprietor to make a more complete excavation, and put up a door to protect it. In this part, which is just before the _specus_ crosses the last road on its way to the Tiber, seven different branches of other aqueducts cast their surplus water into this earliest and lowest; in many parts this was only a tunnel cut in the bed of tufa, and generally half full of a deposit of clay, left by the water which comes from the clayey fields of Lucullus, but in one part it is built of large blocks of tufa, like the walls of the Kings; it is here six feet high and two feet wide; on each side of it is a terra-cotta water-pipe of very early character, and bringing different water in the same tunnel[212].

Near this point it crossed _over_ the road on a bridge (?), or perhaps from the low level _under_ it, at the site of a gate where the four roads meet, to another old stone-quarry of the same kind nearly under Santa Prisca, where the _specus_ was visible in 1874, but is now concealed by some of the vault having fallen in; and from that it has been traced through another series of old stone-quarries to the mouth on the bank of the Tiber, in the very curious cave called that of Picus and Faunus, and Hercules—having previously passed through another reservoir, with water still in it knee-deep, remaining at a considerable distance under the hill, with a _specus_ from thence to the cave at the mouth, partly a natural channel for the water to escape, and partly cut when the aqueduct was made.

The third great branch from the Arch of Dolabella went direct to the Colosseum, and two subsidiary springs still flow there, one under the garden of the Villa Celi-Montana, the other under the garden of the monastery of SS. John and Paul, near to the Colosseum, the latter a very abundant stream, bubbling up copiously; and there are three small pools supplied by it in that quarry, which was formerly called the _Vivarium_, and supposed to have been the place where the wild beasts were kept, but this was a mistake[213]. From that reservoir another branch went in a _specus_ at a considerable depth under the garden of the Marchese Rappellini, behind the monastery of S. Gregory. In this garden there was a landslip in the spring of 1876, and the Marchese thought it probable that the palace of Scaurus had stood there, as it is close by the sloping road called the Clivus Scauri; I thought it more likely to have been the aqueduct which had fallen in, but agreed that the archæologists should excavate it, which was done in May. It turned out to be an old stone-quarry that had fallen in, at the depth of more than 20 ft., but the _specus_ of the aqueduct had passed through the quarry, and remained visible in the pit coming from the cave called the _Vivarium_, and going over the Porta Capena. There is, however, so little of interest left, that the pit was filled up again, after a plan and sketch had been made by Signor Cicconetti.

Another branch of the three aqueducts (Marcia, Tepula, and Julia) went from the Porta di S. Lorenzo along the side of the road or _via_, so called, partly in the bank, by the side of it; the upper _specus_ is now visible, the other two are under it. The whole were underground until the levels were altered in the arrangements for the new city. This branch led straight to the _Mons Justitiæ_, in the centre of the great _agger_ of Servius Tullius. Near this point the four young princes found in their excavation, in 1870, two _cippi_ near together, with inscriptions upon them, stating that the _three aqueducts_ passed between them, and the _specus_ of the upper one, the Julia, was brought to light; the other two, Tepula and Marcia, remained underground. Not much more than a hundred yards from this, another _cippus_ had previously been found, on the top of a well, recording that it descended into the Anio Vetus, which therefore ran under the others, at a great depth in this part, on account of the different levels of the ground, and was then carried along the inner side of this great bank both right and left. The one to the right, or north, going to the gardens of Sallust, or at least a branch from one of the three, went along the horn-work at that corner of the old city, and had a reservoir under the house (now rebuilt by Mr. Spithœver), and then to the _nymphæum_ at the end, and (to the east) of the _Porticus Milliarius_ of Aurelian. In the opposite direction, the left, or south, it went along the inside of the _agger_, on which a row of houses of the first century had been built. It has been found at intervals in several places, one of which is close to the house of Mæcenas. Another branch of an early aqueduct has been found in the tufa rock behind the houses, near the great church of S. Maria Maggiore, on a high level, at the south end of some great building of the first century, or earlier, which was formerly called the _Porticus Liviæ_ and an account of it was published under that name, but the fragment of the Marble Plan of Rome, with the plan of that building and the name upon it, clearly shews this to have been an error. The _Macellum Livianum_, or meat-market of Livia, was found in these excavations near the arch of Gallienus, but there is no connection between the _Macellum_ and the _porticus_, which is represented as an oblong platform, with steps up to it at one end, and with a grand double colonnade all round it. Nothing like this was found near the _Macellum_, and as the earth was carried away to the depth of several feet, if it had been there it must have been found.

In the third century, when nearly all the temples in the Forum were rebuilt, the great public building which forms the north end of that Forum (by whatever name it may be called), was also very much altered in many ways; the main fabric, at the west end, is still original, as it was in the time of Varro, when it was justly mentioned as one of the oldest buildings in Rome. But in the interior great alterations were made, and amongst these, at the west end of the Ærarium (or bank-vaults as they might have been called), the arrangement was entirely altered; the public treasury was transferred to the imperial offices on the Palatine, in what are called the palaces of the Cæsars, and at the west end of the Ærarium an aqueduct was introduced, with a reservoir and a well. A _specus_ of brickwork of the third century is visible, but to which aqueduct it belonged is not easily ascertained; from its level it would agree with the Marcia; it is not high enough for the Anio Novus carried over the bridge of Caligula, though that must have passed near this point; and it is too high for the Anio Vetus, although remains of this have been found also at a short distance; but on lower ground, under, and at the back of a wine-shop in the Via del Consolazione, but quite at the east end of it, and near the corner of the steps

that ascend from it to the door of the Municipio, on the level of the Tabularium, a reservoir that must have belonged to that aqueduct has been found, and the _specus_ traced at the back, parallel to the street, apparently cut out of the tufa rock. Two doors further from the steps the _specus_ is again visible at the back of the shop; and at the same point, but going in an opposite direction, a subterranean passage, which also appears to be cut in the tufa rock, going in the direction of the Piazza del Campidoglio, and said to go as far as the statue of Marcus Aurelius. Whether this had any connection with the aqueduct, or what its object was, is at present not known.

The Plan and Section of the Aqueducts at the Claudium which is also at the end of the arches of Nero, on the Cœlian Hill, the point from which the water was divided into three branches, have been partially shewn in this work, but this could not be done completely until the explorations were made in 1875 and 1876. Subsidiary springs were continually used for the old aqueducts, that no water might be lost that could be used. Of these springs two were found in the space indicated in this Plan, one under part of the garden of Baron Hoffman, near the Navicella, the other under the garden of the monks of SS. John and Paul, in the cave or old stone-quarry which was formerly called a _vivarium_, but which really was a reservoir of the old aqueducts, and this is the most copious spring of the two. It seems almost certain that the water from both these springs found its way into the Colosseum, after the great excavations were made there in 1874-75. To get rid of this water is now (in 1876) a great object. The Government and the Municipality propose, at an enormous expense, to make a new drain from the Colosseum to the Tiber at a great depth. Careful enquiries have been made of the workmen employed in repairing the original drain of the time of Sylla and Scaurus; it was found in a very bad state, and the workmen were afraid to go along it without putting a wooden centering under the old vault, as they were made to fear lest the earth should fall in behind them. This was done for the whole length of the Colosseum, nearly as far as the Arch of Constantine, but the men were then obliged to give up this examination of it for want of air. They state that the main body of the water appeared to come in from under the road from the Navicella, and to run in a continuous stream as if from an aqueduct, and not to bubble up out of the earth as in a spring. This led to the exploration shewn in Plate XXXVI., to ascertain where the water came from[214]. The two springs above mentioned are both on a much higher level than the Colosseum, as will be seen by the Section; and as both are good drinking water, always fresh, it is certain that they must each have some outlet, or they would soon be stagnant and putrid. Every probability seems in favour of these being the springs that supply the inundation of the Colosseum, and if they could be turned off in another direction, as suggested in this Plan, the chief difficulty would be removed. A steam-engine would soon pump the water out, if it did not come in again. The so-called _vivarium_, under the Claudium, is marked on the excellent map of Nolli, in the eighteenth century, as a reservoir for water, which probably had been true; there are three small reservoirs there now which might easily have been united, and the whole be filled by closing the outlet.

Frontinus tells us that the aqueduct of Nero terminated at the temple of Claudius, which was in the centre of the Claudium; this was in fact the sacred enclosure round his temple. A fragment of the Marble Plan of Rome also confirms this, but it is equally clear that soon after the time of Claudius and Nero the water was carried on in three branches, one to the Aventine, another to the Palatine, and the third to the Colosseum, as has been before stated, and there are remains of the arcades of each in all three directions. The _specus_ found in April, 1876, under the garden of the Marchese Rappini, must have come from the reservoir mis-called the _vivarium_, but it had been long out of use.

Many other remains of the aqueducts within the walls of Rome have been found during the great excavations of 1874-1876, in different parts of the city. Some of these have been already mentioned.

Dr. Fabio Gori has sent me an important notice of some excavations recently made between Subiaco and Vico Varo, which throw new light on the line of the _specus_, or channels of the aqueducts, in several places.

On p. 13, note h, it is stated that “the Anio Vetus has its source in the district called _La Connotta_, and passes under the hill of Marano;” but it now appears that the aqueduct in La Connotta belongs to the Anio Novus, because they have discovered at the sources of the Aqua Marcia another aqueduct on a lower level, which must be the Anio Vetus. This is on the opposite side of the river Anio, and passed over the river on the bridge at Vico Varo, of which the great stone piers remain in the bed of the river. He could not find the sources of the Anio Vetus at the fortieth mile, near the bridge of Agosta (twenty miles above Tivoli), because the torrents, in time of flood, have brought down such a quantity of stone in the bed of the river Anio, and the valley through which it flows, that the level of the ground, and of the bottom of the river in this part, is now nearly twenty feet higher than it was when that aqueduct was made.

At p. 60, it is said that Dr. Gori had found the _Piscina Limaria_ of the Anio Novus, made by Claudius, “at the _Prata della Cartiera_ of Subiaco;” that was written when they had found a large aqueduct by the side of the _Emissarium Barberini_; but the recent

excavations have shewn that the water for that aqueduct came from the third loch, near the bridge of S. Mauro, where the opening at the entrance to the _specus_ was found, covered with an iron grating. From this it was inferred that there was a special aqueduct with a private _specus_ to supply the baths and thermæ of the _Villa Neronis Sublacensis_. A quantity of marble of very rare kinds, from this villa, on the margin of the river, has been found, and in the bed of the river the foot of a colossal bronze statue.

The question of the true site of the _Piscina Limaria_, of Frontinus, still remains to be settled, and with it the beginning or source of the great Aqueduct of Claudius, called the _Aqua Claudia_. After carefully examining the bank of the river at a quay at the forty-second ancient mile of the Via Sublacensis, that is to say, between three and four modern miles below Subiaco (which is forty-five miles from Rome), they found the remains of an aqueduct called the _Muraccio_, almost always washed by the water of the river, which enters into it, and then turns at an angle.

On entering into the _Muraccio_, Dr. Gori became convinced that it was the Piscina Limaria of Claudius, as described by Frontinus, c. 15, because the water enters freely into the lower chamber, and to the right the _specus_ of the Anio Novus is seen. The water, according to Frontinus, between the entrance from the river and the _specus_ (_inter amnem et specum_), was stopped and purified in the same chamber, before it entered into the conduit. Considering also that between the three lochs, where the water is now pure, and this piscina, there is a considerable distance. In the rainy season the floods bring down a considerable quantity of earth from the neighbouring fields, which makes the water of the Anio Novus muddy; for which reason the Emperor Trajan began, as Frontinus states, to lengthen that aqueduct to the second upper loch, above the Villa Neroniana Sublacensis. Dr. Gori has found that this work of Trajan was completed, by tracing the whole line of it along the left bank of the river Anio.

ANOTHER AQUA AUGUSTA.

At a meeting of the “Institut de Correspondance Archéologique,” in 1873, the Commendatore G. B. D. Rossi gave an account[215] of another Aqua Augusta, the springs and source of which have been found with that inscription, in the district called _Le Macchie di Rocca di Papa_. This aqueduct appears not to have gone to Rome, but descending into the meadow called the Camp of Hannibal, it went on to the imperial villa at Tusculum, where the magnificent piscina of the time of Trajan or Hadrian is miscalled the House of Cicero.

ERRATA ET CORRIGENDA.

THE AQUEDUCTS.

=Transcriber’s Note:= The errata have not been corrected. Since all notes were reindexed as part of producing this e-text, the note references below have been updated to match the new numbers.

Errata. _Corrigenda._

_p._ x. Julia (v.) Sources on Mons The Sources are near Grotta Algidus (near Tusculum), Frascati, Ferrata, not Tusculum: and Grotta Ferrata. see p. 42.

_p._ x. _col._ 1. (vii.) Lacus Lacus Alsietinus. Alsietina.

col. 2. Lacus Sabatina. Lacus Sabatinus. At the Cariæ. At the Careiæ. Casale Bianca. Casale Bianco.

_p._ xi. _col._ 1. (x.) Lacus Lacus Sabatinus. Sabatina.

col. 2. (xi.) Torre de’ Scavi. Torre de’ Schiavi.

Ibid. (xii., xiii.) Villa de Villa de’ Quintilii. Quintilii.

_p._ xii. (xvi.) (Algentiana). The That opinion is not correct (?). water is said to have been brought The name of _Algentiana_ given by a branch from the Marcia at the to the water is from the Mons Porta di S. Lorenzo. Algidus, near Tusculum. This water now supplies the Villa Aldobrandini at Frascati.

_p._ 3, _note_ 9. loco nomen Gemellorum. respondenti Gemellarum.

_p._ 5, _note_ 14. Torre de’ Scavi. Torre de’ Schiavi.

_p._ 10, _note_ 21. under the _for_ Monastery _read_ S. Maria di monastery of S. Maria del Trinita Malta. Aventinense, or il Priorato di Malta.

_p._ 27. (i.) et ... novum ramus ... novum, i. 5 ... hac tres ... Augustæ, hac tres. fluentes ad Viminalem usque portam. i. 19.

Ibid. (iii.) que vocantur ... qui vocantur ... hi directi. hi directe.

Ibid. (iv.) intra portam intra portam exquilinam. exquelinam.

Ibid. (v.) que locus infra. qui locus est infra.

_p._ 35, _note_ 79. Delle varie Delle vere Sorgenti. Sorgenti.

_p._ 41, _line_ 32. Squaricarelli. Squarciarelli.

_p._ 42, _line_ 8. Canina cleared That _specus_ was of the Aqua out the ancient _specus_ of the Algentiana, and not of the Julia. Julia. The source of the Angelosa is not that of the Julia but of the Aqua Crabra.

_p._ 43, _line_ 8. Near Rocca di This arcade was of the _Aqua Papa an arcade, ... probably a Algentiana_. See Canina, tom. v. part of the Julia. This arcade is called _Arcioni_.

_p._ 50, _line_ 20. _Cariæ._ _Careiæ._

Ibid., _line_ 22. _Lacus Lacus Alsietinus. Alsietina._

Ibid., _line_ 30. Strachia Capra. Stracciacappe.

Ibid., _line_ 32. Lacus Alsietina. Lacus Alsietinus.

_p._ 51, _line_ 5. from the from the lake Alsietinus. Alsietina Lake.

Ibid., _line_ 8. Lacus Sabatina. Lacus Sabatinus.

Ibid., _note_ 109. This lake, This lake is called Sabatinus ... called Sabatina ... from the from the names of those villages, names of the proprietors. _Anguillara_ and _Bracciano_.

Ibid., _note_ 110. ALSEATINA. ALSIETINA.

_p._ 52, _line_ 1. Cariæ. Careiæ.

_p._ 53, _line_ 5. Lacus Sabatina. Lacus Sabatinus.

Ibid., _line_ 8. Cariæ. Careiæ.

Ibid., _note_ 116. Lacus Lacus Alsietinus. Alsietina.

_p._ 89, _note_ 178. _Torre de _Torre de' Schiavi._ Scavi._

_p._ 90, _note_ 179. Aquarum Aquarum ductus etiam infinitos. ductus etiam infinitas.

_p._ 100, _line_ 2. from the Aqua The Aqua Algentiana really comes Marcia. from Mons Algidus, near Tusculum.

_p._ 106, _line_ 19. _fistula the fistula Urbana is of lead, not Urbana_, made in a piece of marble. marble.

_p._ 110. (xi.) Alseatina. Alsietina.

_p._ 118, _line_ 33. Garciano. Carciano.

_p._ 121, _line_ 33, _col._ 2. Torre de' Schiavi. Torre d' Scavi.

_p._ 122. (vii.) ALSEATINA. ALSIETINA.

Ibid. Cariæ. Careiæ.

_p._ 132, _line_ 6. Alseatina. Alsietina.

Ibid. Pantana. Pantano.

LEVELS OF THE AQUEDUCTS, TAKEN BY ERNEST DE MAURO, 1871.

THE SEVEN SPECUS AT THE PORTA MAGGIORE, ARRANGED ACCORDING TO THE LEVELS ABOVE THE SEA.

I. Anio Novus, 65.000.

II. Claudia, 62.336.

The _specus_ at the Trophies of Marius, 59.936.

III. Felice, 59.560.

Specus on the high ground, between the Porta Maggiore and S. Lorenzo, 59.100.

Reservoir at the fountain of Termini, 58.600.

IV. Julia, 58.192.

Reservoir behind the wall near the Porta S. Lorenzo, 53.000.

V. Tepula, 56.712.

Reservoir in the wall near the Porta S. Lorenzo, 49.525.

VI. Marcia, 54.788.

Specus at the Porta S. Lorenzo, 54.405.

VII. Anio Vetus, 45.688.

Reservoir near Porta Furba, two miles from the Porta Maggiore, 47.193.

Reservoir in the Vigna Berardi, 41.731[216].

Reservoir between the Porta Asinaria and the Amphitheatrum Castrense, 34.030.

Reservoir in the Vigna Mangani, near the Minerva Medica, 47.735.

Two small _specus_ in the Via Labicana, 43.857[217].

Antoniana—_Specus_ in the City wall and over the Arch of Drusus, 40.374.

Aurelia—Reservoir on the south side of the Porta Latina, 36.000.

Severiana (?)—Reservoir on the north side of the Porta Latina, 33.400.

Aqua Marcia Pia[218], 60.088, at the Porta Pia.

HISTORICAL PHOTOGRAPHS OF THE AQUEDUCTS.

[_The numbers refer to Mr. Parker's Catalogue._]

Those marked with * are from drawings, valuable for historical purposes, but not as photographs.

In his admirable treatise on the Aqueducts, Frontinus mentions in his first book, as an introduction, that before they were made, the Roman people, for the space of 441 years after the foundation of the City, were content with the water from the Tiber and from certain natural springs which from their salubrity were supposed to be sanctified.

One of the springs, called Aqua Argentina, deserves special attention; it comes out of the rock in a considerable body, and with much force, under the north-west corner of the Palatine Hill, at a great depth, in the cave called the Lupercal, which from its situation may very well have been a wolf's cave at the time of the foundation of Rome. (702* is the plan and section of this). It falls into the larger stream that comes from the Quirinal and Capitoline Hills, and now runs in the Cloaca Maxima (690*). The point of

junction of these two streams can be seen in an opening where the vault has been destroyed (158), near the arch of Janus and the church of S. Georgio in Velabro, which was the silversmiths' quarter in Rome, as is shewn by the arch they erected in honour of Septimius Severus near this spot, the inscription on which remains.

The stream that comes from the foot of the Quirinal, and now runs through the Cloaca Maxima, emerges in a cellar under a house at the back of the church of S. Hadrian, and a great body of water rises with considerable force. Such a spring is no doubt in its original place. Another spring that runs into this stream is the one that rises in the crypt under the church of the Crucifixion, at the foot of the Capitoline Hill, called the Prison of S. Peter, which is another natural source.

Of the wells or reservoirs of rain-water, we have one remarkable example still preserved; it is on the Palatine Hill, at the north-west corner, just behind the most perfect part of the Wall of Romulus, and at one corner of his _arx_ or citadel, called Roma Quadrata, and there are certain peculiarities about it. It has _specus_, or subterranean conduits, to carry water to it from different parts of the hill. The cistern itself is seven feet high, of about the same width, and of considerable length. Into this reservoir descend certain wells of a peculiar and unusual form, like a hollow cone with the wide mouth downwards. This form of well is said to be common in the east; but the only examples known in this part of Italy are this one on the Palatine under the _arx_ of Romulus, and one at Alba Longa, under the corner of the _arx_ or citadel of that ancient city, from which the Romans are said to have been originally a colony. This is certainly a remarkable coincidence, if it is nothing more. One of these wells is shewn in 764 and 765 from nature, and in 366*, 384*, from a drawing. 1630 is a view of the reservoir at Alba Longa (mis-called the Prison). 1940* is from a drawing of the two compared.

The remains of the aqueduct and reservoir at Tusculum (shewn in 1903) are of _opus quadratum_, of very early character, and seem to shew that the inhabitants there had aqueducts before the Romans. Frontinus, indeed, makes no claim to invention, nor were the Romans generally inventors, they rather turned to useful account the inventions of other people whom they had conquered.

I. THE APPIA—was made by the Censor, Appius Claudius Crassus (Cæcus[219]), in the year of Rome 441, B.C. 312, and has its origin in and near to the Latomiæ or Stone Quarries of the time of the Kings of Rome, on the bank of the river Anio, in which one of the sources of this aqueduct is found.

865, 866, 867

The Caves of Cervaro are a continuation of these Quarries, shewn in 1557.

1155* and 1968* are plans of the sources of the Aqua Appia and Aqua Virgo, in the Meadows of Lucullus, near Collatia.

These meadows are now known by the medieval towers called La Rustica, Sapienza (1551), and Cervaro (1552), and the lines of the aqueduct, crossing them from different springs and meeting in a central reservoir, can be traced by the clumps of shrubs over each well. The aqueduct itself being at a great depth, but still having water in it for the greater part of the year, and moisture always, the line of these wells is thus distinguished. From the central reservoir, in which the water was collected, the _Specus_ or Conduit was carried into Rome, always at a great depth.

The spring of the Augustan branch (added A.D. 10) is found under a cottage (1550), near the town or castle of Cervelletta.

The _Specus_, or Conduit of each of the aqueducts, is distinguished by a slight change of form, and often of size also. Sections of fifteen of these are given in the map, and shewn in the photographs of it, 1982*. That of the Appia being the lowest, and always at a great depth, has been the most difficult to distinguish; but within the walls of Rome it passed along the Cœlian Hill[220] (691*, 890*), and then across the short space between the Cœlian and the Aventine, upon the bank or Agger of Servius Tullius (1100, 1136, 1164, 1165, 1289, 1288, 1166), and very near to (_proxima_) the Porta Capena (1138*). After passing the Piscina Publica, and serving as a drain for the surplus water, it is continued at the foot of the cliff of the Pseudo-Aventine, under S. Balbina and S. Sabba, to the mouth of it (84*) on the bank of the Tiber, under the Priorato near the Marmorata and the Porta Trigemina. The _specus_ is here distinctly visible, filled up with the clay deposit to one-third of its height (1116); the view in the stone quarry and a section of one of the wells is shewn in 889*. A Plan of the stone quarry under S. Sabba shews several aqueducts meeting in it, and throwing their surplus water into the Appia, as the lowest (this is given in 834*, 1941*).

The Reservoirs of this most ancient and very deep aqueduct were first in the quarries before mentioned, and even in Rome were chiefly also in quarries, as at the mouth; but just within the Porta Maggiore, and close to the gardens of S. Croce, formerly the

Sessorian Palace, are two large reservoirs very near together, supposed to have been the Gemelli or twin reservoirs mentioned by Frontinus, and these are so deep that they appear to have belonged to the Aqua Appia. Some excavations attempted in them in 1867 were stopped by water (410, 411, 695*). This aqueduct is believed to have entered Rome on the northern side of these gardens, and to have been first received in the reservoir afterwards called after S. Helena, which is very deep, and in this situation (546).

II. ANIO VETUS, MADE IN THE YEAR OF ROME 481, B.C. 272.[221]

The Anio Vetus and the Anio Novus are in fact branches of the river Anio, which falls into the Tiber a short distance above Rome. The water is there seen to be much more pure than that of the Tiber, and after it falls into the muddy Tiber its clear water can be distinguished for a long distance. Several of the aqueducts, as the Appia and the Virgo, are springs, that fell into that river; but part of the water was intercepted and brought into Rome, each in its own distinct _specus_. This was the case with the Anio Vetus, at a much higher level above Tivoli, but below Subiaco. The river itself may be considered to belong to the system of the Aqueducts, and the series of magnificent cascades by which it falls from its high level, are partly artificial, are connected with them, and illustrate their history. Those in Tivoli (1545, 1546, 1547, 1548), the engineers had great difficulty in avoiding. The one near Vico-Varo (1544), above Tivoli, is near the point from which the aqueduct was taken, which is near the valley called Arsoli (1549). It can be seen in the valley of the Arches, two miles above Tivoli, at the foot of one of the piers of the Marcian Arcade (1054), and the one seems to have followed the other all the way into Rome. It passes along with it over the Ponte di S. Antonio, which is one of the finest bridges on the whole line of the Aqueducts, eight miles below Tivoli, across the valley and mountain stream called S. Antonio (1530). This aqueduct can generally be distinguished by being half-underground, or very near the surface. It was repaired or restored by Augustus and Trajan[222], and most of the remains now visible are of their time, and both the _specus_ and the _castella_ can generally be known by being faced with _opus reticulatum_, so much used at that time. There is a fine reservoir or _castellum_ for it near Tivoli, with very peculiar work of this description, and extremely picturesque (950). Another is against a bank, and half underground, near the Torre Fiscale, three miles from Rome, and close to the foot of the Claudian Arcade (896, 1028, 1029). Remains of others may still be seen at the foot of the Wall of Rome in several places, they were distinctly visible in 1870, when these photographs were taken; but have been almost obliterated since in the _restoration_ (?) of the wall by the municipal architect. One is near the Porta Metronia (983), and another at the Porta Latina (985). Remains of other _piscinæ_ are visible near the Amphitheatrum Castrense, on the rock at the foot of the wall (868, 969, 970); at this point one branch of it seems to have been brought into Rome along the line of the Via Appia Nova, which runs near the spot, and entered Rome just beyond, by the Porta Asinaria. It can also be seen at the foot of a wall by the side of the Via Labicana, near the Porta Maggiore, and readily distinguished by the usual reticulated work (1337). One branch enters Rome at the foot of the Marcian Arcade, close to the Porta Maggiore (59), and the _specus_ was visible at that gate, until it was concealed by a brick wall by the modern builders. It passes through the City Wall there, and is visible on the other side in the inner road, in the wall of the garden still under the level of the Marcian Arcade (1876). Here it forked off, one branch went to the left, along the line of the wall of the garden, to a great reservoir for it at an angle close to the junction of two roads, one called the Via Labicana the other the Via di Porta Maggiore, coming from the church of S. Maria Maggiore. At this spot there is a very large and fine reservoir in several chambers at a considerable depth, corresponding to the level of the Anio Vetus; 538 is a view of it, and 700* is a section of it. From this great reservoir two small _specus_ in this part appear to have gone into the _specus_ of the Appia in the Cœlian, under the Arches of Nero, and are visible going into the bank on which this fine arcade stands (854).

Another important branch turns to the north upon the high bank of the Kings, on which the Wall of Aurelian was afterwards built. There are remains of _castella_ for it near the Porta S. Lorenzo (869), and further to the south near the Porta Nomentana (871), after passing the Prætorian Camp. It had previously gone under the Porta Chiusa, which was shewn in the excavation of 1868, and in the photograph 1057. The _specus_ runs under the wall of the Camp all round. It is still visible on the north side, faced with the reticulated work under the fine brickwork of Tiberius (870). There was an opening into it at the north-east corner of the camp, into which a dog or a boy might be sent (981, 982), until it was closed in the recent _restoration_. Remains of it may still be seen at the foot of the wall in several places by experienced eyes. The general plan of this aqueduct is shewn in Nos. 1970*, 1971*, 1976*, 1977*, and 1967*.

III. MARCIA, MADE IN THE YEAR OF ROME, 608, B.C. 145.[223]

This aqueduct was made in the year B.C. 145, and has its source a few miles below Subiaco; the springs are collected in a small lake called Aqua Serena (1537), the water from which flows into the river Anio; but a portion of it was intercepted for this aqueduct,

and is now again taken from the same spot and brought into Rome. It has always been celebrated for its extreme coldness and great purity. The old _specus_ or viaduct was found in 1870 in this lake, having long been concealed by being under water; but by drawing off some of the water it was brought to light, and the engineer of the new company decided on carrying his new _specus_ up to this point. The previous plan had been to draw the water from another lake nearer to Rome, which is nearly equally good water, but not the real Aqua Marcia so much prized, and this is now again brought into Rome. The source of the old aqueduct is celebrated for its extremely picturesque character, as well as for the fine construction of the arcade of large square stones, and the scientific arrangement of the reservoirs (_castella aquarum_) and filtering-places (_piscinæ_). The sources in the Aqua Serena are shewn in Nos. 1538, 1539. Another source for an additional supply was on the lake of the Mole d'Agosta, 1543.

In the earlier part of its course the _specus_ is underground; but on arriving at the valley called the Valley of the Arches, about two miles above Tivoli, it emerges upon the fine arches which give the name to the valley, and is here carried across the river Anio. These arches are in two series, and are among the most picturesque objects in the neighbourhood of Rome; the effect is improved by a medieval tower built upon the first pier of the bridge. This is shewn in Nos. 1053, 1054.

It then appears again on the other side of Tivoli, on the road called the Promenade of Garciano, which is on the edge of the hill looking towards Rome, and above the winding road up the hill; S. Peter's is visible from this point. On this platform there are a number of fine remains of the _specus_ and of the _castella_ of the Aqueducts, some of the finest of which are of the Marcia. The Plan and Section of a very fine Reservoir and Piscina here is given in No. 535*.

Another very fine one has a wall on the edge of the cliff of the character called Cyclopean (Nos. 1513 and 1528). Chambers of this remarkable early reservoir are shewn in Nos. 1520 and 1521.

A considerable part of this aqueduct was rebuilt by Augustus[224] (B.C. 11), and again about a century afterwards by Trajan[225], and of the _specus_ of that time we have examples in 1524 and 1525, shewing a very peculiar kind of the ornamental construction called _Opus Reticulatum_. Another reservoir of this time is shewn in 1526, and an earlier one belonging to the original construction of the kind called _Opus Incertum_, which probably belongs to the earlier period, is shewn in 1527.

From Tivoli the Aqueducts again pass underground for some miles, gradually winding down the hill from the high level to that of Rome on the Campagna, at about seven miles distance. They were carried upon bridges, some of which are very fine and picturesque, across the gorges of the hills and the mountain streams. At the place where they arrive at the lower ground, there are large reservoirs and filtering-places for them, and the locality is called from them the Piscinæ.

From thence they are carried on the fine and celebrated arcades across the Campagna, presenting some of the finest pictures in the neighbourhood of Rome.

At the Piscinæ, the Tepula and Julia, from the Alban Hills near Marino, were added to the Marcia, and carried on the same arcade. The greater part of them was destroyed, and used for building materials by the engineers of the Aqua Felice in the sixteenth century; but there are some very remarkable and picturesque remains of the arcade at intervals, the more interesting because so little is left of it. One fine piece remains at a locality called Sette Bassi and Roma Vecchia, five miles from Rome (1435), where a small portion of each of the three Aqueducts on an arcade can be seen in Nos. 1006 and 536, and the Piscinæ near to it, 534, 1434, 1438.

This arcade is seen again at the Torre Fiscale, a medieval tower built upon the aqueducts at one of the points of junction, and at one of the angles, which they made at every half mile. Here the more lofty arcade of the Claudia and Anio Novus is carried over that of the Marcia, Tepula, and Julia; while the Anio Vetus runs underground at the foot of it, and the Felice is built up against it; so that at this point seven aqueducts cross each other, and have a tall medieval tower built on the top of them[226]. The Torre Fiscale, with this remarkable junction, is shewn in Nos. 528, 529, 530, 531, 532. A plan and section of it are given in 689*.

There is another angle and crossing at the Porta Furba, half-a-mile nearer to Rome, which makes another very picturesque point of view (shewn in Nos. 551, 552). A small portion of it remains built into a gardener's cottage at another angle, about a mile from Rome, and a fine large reservoir near to it. The ground then rises, and the arcade is buried for some distance; the upper part of the arches of brick, as rebuilt by Trajan, are then visible by the side of the old road that runs close to the northern side of the great Claudian arcade, on the line of the Marcian, which was parallel to the Claudian for some miles into Rome.

It then occurs again very conspicuously at the last angle, close to the Porta Maggiore, where the Claudia was again carried over it, and afterwards incorporated in the City Wall of Aurelian. Here the last pier of the arcade remains with the three _specus_ of the

Marcia, Tepula, and Julia passing through the wall at a right angle (31, 59). Inside the wall a part of the first arch remains with the _specus_ upon it (60); on the other side of the road, the pier of the same arch remains built into the wall of the garden; and a little further on in the garden or vineyard, a gardener's house is made out of another reservoir or _castellum aquæ_ (538; section, 700*).

It then passes again underground parallel to the city wall for a short distance, and near the Minerva Medica it runs into the bank on which that great wall is carried. A portion of this underground arcade was brought to light in some excavations in 1871, but is now covered up again (2320). After passing underground in the bank on which the wall stands for some distance, it emerges near the Porta Tiburtina, now called Porta di S. Lorenzo (see a plan and section of this in No. 1938*). As the ground here is lower it is on an arcade, one arch of which is made into the gate (21, 1870), and a portion of the _specus_ is very distinctly visible on the southern side of the gate, with an opening into it by which persons can go inside of it (shewn in Nos. 69, 572*, and 1487).

After passing the Porta Tiburtina, it went on upon the bank or outer _mœnia_ of Rome to the Prætorian Camp, and there was a large reservoir for it near the Porta Chiusa, remains of which were visible in the excavations of 1868, with the wall of Rome built across it (shewn in 1059). From this reservoir the three aqueducts, Marcia, Tepula, and Julia, were carried along the side of the old road to the inner gate in the great _agger_ of Servius Tullius on the Viminal, where the railway station has now been made, and where the three Roman princes carried on excavations in 1869, in which they found the upper _specus_; that of the Julia, which was left open for a time, passing between the _cippi_ or boundary-stones, with inscriptions upon them, recording that _the three aqueducts_ passed there between them.

Another division of the Marcia went along the same line as the Arches of Nero to the Cœlian, and along that hill as far as the great reservoir over the arch of Dolabella; then turning to the left or south, it came to an end above or over the Porta Capena[227]. These words may mean—either, in the reservoir on the cliff of the Cœlian Hill just _above_ the gate, rebuilt in the time of Trajan, of which the remains are shewn in 1147*;—or, in the reservoir in the valley close to the west side of that gate (also rebuilt in the time of Trajan, and now a gardener's house, as before mentioned). In that case it must have passed over the gate, and the _specus_ that is cut in the wall of the western tower belonged to it (710*).

The general plan of the Aqua Marcia near its source is shewn in 1972*, and the line of its course in 1981*, 1982*; the bridge for it in 1983*.

In the early part of its course, above Tivoli, the new aqueduct for this water, called the Aqua Marcia Pia, is carried on a stone _specus_ upon an arcade, after the same fashion as the old one (a portion of this new arcade is shewn in No. 1553).

IV. THE TEPULA, and V. THE JULIA, being carried on the same arcade as the Marcia for the seven miles into Rome, have left remains visible in some places, especially at the Gates of Rome, the Porta Maggiore (31), and the Porta Tiburtina (21, 572*); in other places, they have generally been destroyed. Near the Sette Bassi, there is a portion of the _specus_ of the Julia visible just at the surface of the ground, the other two being then subterranean, as the level is rather higher in this part than usual. This portion has been examined by Signor Moraldi, at a junction whence a branch was carried to supply a reservoir at the great villa called Sette Bassi, and there are remains of the loch in the channel to turn off the water, shewing the same arrangement as in a modern canal. (A plan and section of this is given in 696*.) The _specus_ near this point, built of concrete faced with brick, is also shewn in 1006. The _specus_ of the Marcia is always of squared stone, so that one is readily distinguished from the other. There are remains of a _castellum aquæ_ or reservoir for the Tepula, near the Porta Tiburtina, or Porta Viminalis of Frontinus, now called Porta di S. Lorenzo. This is shewn in the Plan of that Gate, Nos. 1111* and 1238*, and a view of it in No. 25. It is a remarkable building of brick of the first century, and has on a level with the _specus_ a series of small corbels projecting from it, evidently intended to carry a _hourd_, or wooden balcony as a passage for the Aquarii, and perhaps for defence also. It is incorporated in the great Wall of Aurelian. It projects slightly from the line of that wall, and the end of the _specus_, with its triangular head, is visible in the angle.

V. JULIA.

Between this building and the gate, but within the wall, though on the bank on which it stands, are slight remains of another _castellum aquæ_, supposed to have been for the Julia (Nos. 26, 869, 1873), which has its external face in the direction of the wall, and must have been concealed by it when that was built. This is also of the first century, as is shewn by the brickwork, and it seems to have been a _castellum aquæ_ by the disproportional size of the buttresses used to support the weight of the water, one of the invariable marks of such a structure. The other mark is the peculiar cement with which the wall is lined, called _Opus Signinum_ in Latin, _Coccio Pesto_ in Italian, which is made of broken pottery, and is the hardest cement that is known; it is often impossible to

break it, even after it has been exposed to the weather for centuries.

A plan and section of the ground between the two gates, called by Frontinus Esquilina (S. Lorenzo) and Viminalis (Maggiore), shew the difference of level, and the three aqueducts passing underground in the middle between the two gates, and carried on arches at both ends near the gates (see No. 1938*).

The plan of the ground at the sources of the Tepula and Julia is given in 1980*.

VI. THE VIRGO (NOW CALLED AQUA DI TREVI) WAS MADE IN THE YEAR OF ROME 732, B.C. 21.

This aqueduct has its sources in the meadows of Lucullus, on the banks of the river Anio, on the old Via Collatia, eight miles from Rome, about a mile further than the Aqua Appia, not at the same level, but comparatively near the surface. There are several springs, each of which has its own separate reservoir just below the surface of the ground; in some of them the vault is scarcely perceived. These are also called conduit-heads (864, 863, 862). From each of these small reservoirs a conduit runs into the central reservoir (860, 861), which is considerably larger, circular in form, surrounded by a wall, lined with the cement called _coccio pesto_, and one part of this central reservoir under the road now remains. This is near Salone, with its medieval tower. (See the Plan, 1155*.)

From this large central reservoir the surplus water is carried off by short conduits into the country ditches, and so into the river Anio. The main _specus_ into Rome begins at the central reservoir, and runs generally underground along the line of the old Via Collatina, now called Lunghezza. The course of the aqueduct can be clearly traced by the small pyramidal or conical structures over the wells at regular intervals, called Respirators (660*), or which might have been called Ventilators, as they give air to the _specus_ below. It runs in the high bank of the old road for two or three miles, behind the ruin called Torre d' Scavi, supposed to be the Thermæ of the Gordiani, in a direct line towards the Porta Maggiore; but about half-a-mile before arriving there, it turns sharp to the north along the bank of the great _foss_ or valley, and being underground is traced by the Respirators. Further to the north, beyond S. Agnes, at some little distance, the old line can be traced in the catacomb of S. Priscilla on the Via Salaria, where the _specus_ is visible, half filled up with the deposit of clay (1109*, 1466). In the road on the bank on which the Wall of Aurelian is built, near the Porta Salaria, it can be traced by the low arcade at the foot of the wall which is built upon it (5).

But when the line was altered, it was carried still further to the north, and it enters Rome under the garden of the French Academy (the Villa Medici); it here is marked by two _cippi_ (2088, 2089), with inscriptions upon them, and under the garden is a large reservoir very deep, level with the ground in the great foss on the outside, and with the Campus Martius inside the walls. It was then divided into two branches, one of which went along the Via de Condotti, the other along the Via del Nazzareno (83, 1108*) to the Fountain of Trevi, rebuilt in A.D. 1735 (1356); originally, it went to the north end of the Septa, near the Pantheon. Some remains of this were shewn in 1871 in the Piazza di S. Ignazio (2326). The _specus_ can be seen, with an inscription upon it recording repairs by the Emperor Claudius (82), in the yard behind a house near the Palazzo del Buffalo.

The plan of the ground at the sources of the Aqua Virgo (or de Trevi), is given in 1968*, and Sections of it in 1979*.

VII. THE ALSEATINA.

This aqueduct was made by Augustus in the year of Rome 763, A.D. 10, to bring water for his great Naumachia, or sham naval battles in the Trastevere; the water was not good for drinking[228]. It was brought from the lake called Alseatina, in the hills on the western side of Rome. It is altogether distinct from the great series of aqueducts on the eastern side. The source can be seen in the bank of the lake, and the _specus_ or subterranean conduit can now be entered, the water of the lake having recently been drained, and reduced to a much lower level.

To these was added from another lake about three miles distant from the Alseatina, another branch called the Sabatina. The two conduits were united after a few miles near the old city of Cariæ, at a _castellum aquæ_ or reservoir, now made into a house, and called the Osteria Nuova. The Alseatina was at the lowest level of all the aqueducts, and it is now very difficult to see any remains of it, except the _specus_ in the lake at its source.

Trajan afterwards adopted the Aqua Sabatina, but omitted the Alseatina, and carried the Sabatina at the highest level instead of the lowest (see Aqua Sabatina, Aqueduct X.) Pope Paul V., who restored these aqueducts to use, went back to the Alseatina lake, and his _specus_ can be seen there on a different side of the lake to that of Augustus; both are now left dry. There is, near the junction at the Osteria Nuova, a remarkable flight of steps for the use of the _aquarii_, or the men who had charge of the aqueducts. It

passes through the upper _specus_, and goes down to the lower one (No. 2959*). The respirators of these two lines can be seen and traced; they are of a different size and form. The two can be seen close together at the Osteria Nuova (No. 2960*). The _specus_ is also seen in No. 2961*.

VIII. THE CLAUDIA, AND IX. THE ANIO NOVUS, A.D. 38-52.

These two aqueducts were made together, or were so closely connected that we cannot separate their history, although they were not the same water; the Anio Novus came from some miles higher up the river Anio than the Claudia. The latter was, like the previous aqueducts, taken from springs, that were intercepted before they fell into the river Anio; but the Anio Novus was part of the river itself, in which a gigantic loch was made by building a great wall across it, about a hundred yards in front of a natural waterfall, and forcing the water to flow over it, forming a magnificent cascade, and at the same time causing some of the water to flow through the _specus_ which was cut in the cliff by the side of the river, at a rather lower level than the top of the wall. The sources of the Claudia are below this cascade, those of the Anio Novus are above it. The line of each of these aqueducts is distinct in all the early part of its course; but after they come down to the valley of the Campagna of Rome, at the Piscinæ, the two are carried on the same fine lofty arcade into Rome.

These were the highest, and passed over the Marcian arcade with the three aqueducts upon it. They form the finest feature in the landscape on the eastern side of Rome. The sources are above Subiaco, and in what is considered by artists as some of the most picturesque scenery in the world. The photographs illustrating this are very numerous, the subjects being some of the best that can be imagined for this purpose. The history of these two most important aqueducts can now be better seen in this series of photographs than in any other manner, and better understood than by any written description of them, after the outline of their history is once given.

They were begun in the year of Rome 789, A.D. 38, under the Emperor Caius Cæsar, or Caligula; carried on and completed by his successor, Claudius, in the year of Rome 803, A.D. 52. They were therefore fourteen years in construction, according to Frontinus[229]; but Nero was then married to Octavia, he was the actual governor of Rome, and he carried on the great work upon what are called the Arches of Nero, along the Cœlian Hill, as far as the arch of Dolabella, where a large reservoir for this water was built. This work was afterwards carried on by his successors in three branches, one to the Colosseum, a second to the Palatine, and over it to the Capitol, and a third to the Aventine. Frontinus himself, who has left us his admirable treatise on the subject, had the direction of these works for many years; he was Curator Aquarum under the Emperors Nerva and Trajan, and some of the greatest works were done in his time,—at his suggestion, and according to his plans.

Some of the sources of the Claudia were in the lake of S. Lucia, below Subiaco, between that and Vico Varo (see 1536). In its course through the hills the _specus_ is almost entirely underground, and cannot be shewn in photographs; but the line of its course is shewn in the map of the aqueducts from Rome to Subiaco, reduced by photography in Nos. 1967* to 1984*, especially in Nos. 1976*, 1978*, 1979*, 1981*. It crosses mountain streams on the bridges called Ponte Lupo (1532) and Ponte di S. Antonio (1530); and an inscription relating to it, of _A.D._ 88, is given in No. 1976*.

When it reaches the level ground of the Campagna, nearly on the same level as the hills of Rome, the _piscina_ for it is subterranean, and only the summit of this is visible, looking like a _tumulus_ only (688); but from this the _specus_ is seen to emerge, at first only just above ground, but gradually getting higher (or the soil, in fact, is getting lower), until it is carried on the grand series of arches or arcades across the country, which remain nearly perfect for some miles, as far as the Sette Bassi and Roma Vecchia. In 1002, a long line of this arcade is shewn with the Claudian _specus_ upon it, and the Anio Novus over that in many places; the two can readily be distinguished, by the Claudian being built of large blocks of stone (with the edges chamfered off), and the Anio Novus being faced generally with brick, occasionally with _opus reticulatum_. Nearer to Rome, this fine arcade has been very much damaged, or carried off altogether as building material by the farmers, and by the engineers of Pope Sixtus V. to build the Aqua Felice; but some portions of the old arcade remain, and are shewn in No. 1006, where the distinction between the two _specus_ comes out very clearly. In 1005, two of the brick arches with which it had been strengthened by Trajan are shewn, the stone-work having all been carried away.

In 689*, a plan and section of the Torre Fiscale is shewn, with the crossing of six aqueducts. 528 is a view of this tower and of the arches of the aqueducts crossing each other under it, with the Aqua Felice in the background. 529 shews the arch of the Claudia separately, and the construction of it, with the Aqua Felice passing under this arch of the Claudia. 530 gives very distinctly the arch of the Marcia, Tepula, and Julia, with that of the Claudia passing over it. 531 and 532 are more distant and general views of that

tower, and the aqueducts passing under it. 1439 is a side view of it, and of the old tombs on the Via Latina in that part. 1004 shews the arches of the Claudia and Anio Novus in perspective, and the opening into the _specus_ of the Claudia. In 550, another fine portion of the arcade is shewn, with brickwork of Trajan. The Porta Furba and a long line of the arcade is seen in the distance. 548 shews the Porta Furba at another crossing, with the fountain, and a portion of the arcade of the Felice; with the Marrana in the bed of the river Almo passing under it.

62 is a portion of the Claudian arcade, about half a mile nearer to Rome, with the arches filled up with brickwork of the time of Trajan; at this point there is another crossing. 63 shews a portion of the brickwork of Trajan, originally built to strengthen the stone arcade; but the latter has been carried away by the engineers of the Felice. 549 shews some interesting repairs of the time of Nero, with massive square buttresses faced with reticulated work. 70 is a medieval tower at the angle of the garden of the Sessorian Palace, now of the monastery of S. Croce, near the point where the aqueduct enters the wall.

547 shews the interior of the Tower and a _piscina_, at the entrance into Rome, the four chambers of which are visible, the inner wall of this tower having been destroyed; and into the interior of this the water of the Claudia entered in the first chamber and went out at the fourth. This photograph also shews the remains of a large _castellum aquæ_, now forming part of the Wall of Rome, on the north side of the garden, with a continuation of the arcade in the Wall of Rome in this part. In 544 the _specus_ of the Claudia is plainly visible on the top of the wall, and remains of the Anio Novus over it. In the distance are seen some of the arches of Nero, across the valley and foss (?), from the angle near the Porta Maggiore to the Cœlian Hill. This garden might very naturally be called by Lampridius “The Garden of the Specus,” for the _specus_ in the time of the Emperors must have been the most conspicuous object in it, or visible from it (542).

412 shews another of these reservoirs in the same garden, with repairs in brick by Trajan. The arcade of the Aqua Felice, built against the outside of the Wall, is also seen through the arches of the Claudia.

31. The exterior of the Porta Maggiore, with the _specus_ over it, the lower one the Claudia, the upper one the Anio Novus. (The inscription of A.D. 404 is given in 1872.) Under these, but still on the top of the wall, the _specus_ of the Aqua Felice may be seen, built as usual of rough stone concrete. To the right or north of this may be seen the three _specus_ of the Marcia, Tepula, and Julia, passing through the wall in the opposite direction, now under the Felice, and originally under the Claudia and Anio Novus. These three _specus_ are carried upon one of the piers of the Marcian arcade, built into the great wall. Just beyond these, further to the right, is part of the last tower of the Claudian arcade.

32. The Porta Maggiore, with the _specus_ on it, seen sideways, and the north side of the Baker’s tomb.

The last tower and _piscina_ of the Aqua Claudia; it stands at an angle of the wall projecting from it, and shews clearly that it stood there when the wall was built by Aurelian, and then incorporated into it. When the fortifications of Honorius at this gate were destroyed in 1833, the inscription relating to the aqueduct was preserved and built up to the right or south of the gate (shewn in 1872). Within the wall, behind the tower, is a large reservoir or _castellum aquæ_, of which there are slight remains, shewn in 967 and 968.

A panoramic view of the line of the Claudian arcade, on the north side of the Sessorian gardens, taken from the extreme end of them at the west, is shewn in Nos. 542 and 543. On the left hand is the beginning of the arches of Nero, going across the foss towards the Cœlian; then the Porta Maggiore is seen sideways, with the two _specus_ on the top of it. Under this is part of one of the two great reservoirs believed to have been the Gemelli of Frontinus. Then comes the western wall of the Sessorian gardens, rebuilt by S. Helena, the construction being of the time of Constantine. To the extreme right is the ruin of the Basilica or Great Hall of the Sessorian Palace, repaired by him. This is miscalled a temple of Venus and Cupid on some of the maps.

Having thus traced the Aqua Claudia from its sources into Rome, we must now do the same for THE ANIO NOVUS, which in its early part is distinct from it, as we have said.

1514. Sources of the Anio Novus above Subiaco. The river Anio in the highest point, with which the aqueducts are connected, is seen winding through a gorge in the rocky mountain, with remains of the bars or dams, across the river, forming the two upper lakes or lochs. The celebrated monasteries of S. Scholastica and S. Benedict are visible on the hill to the left.

1515. The River Anio, a little lower down, with remains of the second barrage or dam across it, forming the third loch or lake, with the modern bridge built upon the ruins of the old wall that formed the bar. Chapels of the monks of S. Benedict are visible on the hill to the right.

1534. The Bridge of S. Francis, over one of the branches of the Anio that meet near the rocks before mentioned, above Subiaco.

1517. Remains of a great reservoir or _castellum aquæ_, of the time of Trajan, on the bank of the lake or loch before mentioned. The wall is faced with _opus reticulatum_, with layers of brick at intervals, the usual construction of the time of Trajan.

1518. The modern bridge, far below, and remains of the old high wall on which it is built, are seen under it; below are the cliffs of the third lake or loch, cut into a circular form. In the bed of the stream are large stones fallen from the wall or bar across the river.

1519. Remains of another _castellum aquæ_ above Subiaco, and the mouth of a cave connected with the aqueduct.

1555. _Specus_ of the Anio Novus cut in the cliff of the valley of the Anio. This is below the level of the great bar, and the water was forced to go through the _specus_ into Rome by the bar being higher than the _specus_. A modern winding road has now been cut here, and the rock has been in part cut away, shewing an opening into the _specus_, which is six feet high and two feet wide. Above is seen a tower and an embattled wall of the modern Villa Gori.

1516. Part of the _specus_ of Trajan, who repaired this aqueduct. The _specus_ is cut as a tunnel in the cliff, with a reservoir by the side of it.

1556. A view of the gorge in the mountains above Subiaco, where the three lakes are situated.

1536. A small lake at the source of the spring called Fons Novus Antoninianus, one of the sources of the Anio Novus.

1558. Cascade at the Paper Mill, on the site of a _piscina_ of the Anio Novus, above Subiaco.

1057. Arches of the bridges of the Marcia and Anio Novus, in the Valley of the Arches above Tivoli.

1052. Arch of the bridge on the Anio Novus, in the Valley of the Arches above Tivoli, with a medieval tower built upon it, forming one of the most picturesque objects in the neighbourhood of Rome.

1522. Specus of the Anio Novus below Tivoli, on the road to Garciano, called the Promenade, with openings into it, and an old tomb in front of it. This promenade is through an olive wood, and the roots of the olive trees run into many of the ruins.

1523. One side of a _castellum aquæ_ of the aqueduct above the road to Garciano, faced with _opus reticulatum_.

1529. A bridge across a valley that passes the road to Garciano. This bridge is above the road on the left, in the valley called the Arcinelli.

1531. Ponte de S. Antonio, a fine bridge for the aqueduct below Tivoli, across a gorge. It is seen from above looking down upon it, with the chapel of S. Antony at the end of it, and a medieval castle in the distance. The road for horses, and the remains of the _specus_ by the side of it, are here visible.

1532. Ponte Lupo, near Poli, west side, below Tivoli, the finest of all the bridges of the aqueducts. It crosses a valley from one cliff to the other, and is a solid wall for part of the way, the rest on arches. The two _specus_ are here visible, as seen from below on the west side.

687. Arrived in the valley of the Campagna, the great _piscina_ of the Anio Novus and that of the Claudia, which is near to it, is underground, and the summit of it only is visible, appearing like a tumulus. It is near the old Via Latina, and below the present roads to Albano, Frascati and Marino.

74 and 75. After leaving the great _piscinæ_, the two _specus_ are carried on the fine arcade, of which a panoramic view is here given, shewing its general effect for some miles.

554. Passing by the remains of Roma Vecchia to the Torre Fiscale and the Porta Furba (given under the head of the Aqua Claudia), the _specus_ rises to a remarkable reservoir, which from its great elevation must have belonged to the highest of the aqueducts. It is a most picturesque one, near the Mausoleum of S. Helena, but is earlier than her time; it belongs rather to that of Trajan, being faced with fine reticulated work, with layers of bricks on the exterior. The interior is distinguished by remarkably solid central buttresses, to support the wall against the pressure of the water (553).

926. Another large reservoir of the same period and style, and at nearly the same level; it occurs about a mile further from the main line of the aqueducts, at the place called Torre de' Scavi, where the Thermæ of the Gordiani were afterwards made. This appears

also to have belonged to the Anio Novus, as no other aqueduct is high enough for the water to have reached it.

ARCHES OF NERO.

At the great reservoir inside the Porta Maggiore (the Porta Esquilina of Frontinus), the water of the Claudia and the Anio Novus was united for the general use of the City. This aqueduct entered on the highest ground in Rome, and the water supplied the deficiencies of any of the other aqueducts in case of need. Being a part of the river Anio, it never failed. It was forced to come through Rome, as has been shewn by the arrangements in the bed of the Anio above Subiaco. This united water was carried to all the fourteen Regiones of Rome, and in order to ensure an abundant supply, it was conveyed in the great stone _specus_, on the fine arches of Nero along the whole length of the Cœlian Hill for more than a mile; at the west end of the Cœlian an enormous reservoir was built for it on the level of the _specus_ at the top of these arches, so that the base of the reservoir was fifty feet from the ground, and the road passed under it. From this great central reservoir, at a very high level, the water was distributed in various directions.

Before arriving at the Cœlian Hill, it had to be conveyed to and along the Cœliolum (now the Lateran Hill). It had come through the gardens of the Sessorium, as we have seen, in the two separate _specus_, after it had entered Rome at the extreme eastern corner, on the north side of these gardens, which are nearly half a mile long. These are _the palace gardens_ mentioned by Frontinus. The Sessorium with its gardens (now the monastery of S. Croce in Gerusalemme) had been one of the two Prætorian camps, this one being at the south end of the great _agger_ of the Tarquins, which formed the outer _mœnia_ of Rome on the eastern side. The one, called the Prætorian Camp, is at the north end of the same great bank.

Each of these fortified camps was surrounded by a great wide and deep foss or trench. These great banks and trenches are usually mistaken for natural hills and valleys; but natural hills and valleys are not merely high banks fifty feet high and perhaps a hundred feet wide, nor are natural valleys long narrow trenches of the same dimensions, running on each side of the great banks, being in fact the trenches from which the earth has been thrown to form the banks. Such a bank with such trenches can be clearly traced all round Rome by eyes that are accustomed to examine such things, although modern buildings have disguised them so much that an ordinary observer does not see them. People cannot see over modern walls of twelve feet high, still less over the great Wall of Aurelian fifty feet high, and they do not think of comparing the level of the ground on each side of that wall, nor can they easily do so. These great ancient earthworks were extremely convenient for the engineers of the Aqueducts, which were brought upon the high banks at the farthest corner. They were carried along the bank on the north side of the Sessorium, from its north-east corner to the south-west angle, where the great bank of the Tarquins joins on to it. Some branches of the Aqueducts, perhaps the main stream in some cases, were then carried along this high bank of the Tarquins to the north, as far as the other Prætorian Camp, and beyond it along the outer wall of Rome, as we have seen in the case of the Anio Vetus, the Marcia, Tepula, and Julia. These did not pass through the Sessorium, but parallel to it about a hundred yards on the north of it. The Claudian arcade had been at about that distance on the north of it, all the way from the Piscinæ into Rome. The Marcian arcade was made nearly over the Anio Vetus, which ran between that arcade and the Claudian, but much nearer to the Marcian.

On entering Rome, this main stream went straight on through the great bank to the large reservoir on the inner side. The reservoirs for the Tepula and Julia were much to the north, near the Porta di S. Lorenzo (the Porta Viminalis of Frontinus), as we have seen; that of the Marcia was much closer to the Porta Esquilina. The two great reservoirs, called by Frontinus the Gemelli, were made in the great foss between the Sessorium (S. Croce) and the Cœliolum (the Lateran). They had probably been originally made for the Aqua Appia and the Anio Vetus, being both at a low level, though one was much deeper than the other. Advantage was taken of these ancient reservoirs to erect the higher one required for the reception of the waters of the Claudia and Anio Novus over it, or by the side of it, as was very usual throughout Rome. The later reservoirs are always made nearly over the old ones. This is equally the case here at the entrance into Rome and at the other end of the Cœlian. The great high reservoir of Nero is close by the side of, and really over, the great subterranean reservoir of the Aqua Appia (now under the garden of the Villa Cœlimontiana, as described in the account of the Appia).

The foregoing explanation seems necessary to explain the photographs that now follow, belonging to the Arches of Nero. The first of these (No. 77) shews the junction with the Porta Maggiore; the two _specus_ that pass over that great gate are visible to the right of the photograph. The beginning of the Arches of Nero is then seen, where they have to cross the great wide and deep foss of the Sessorium, and were therefore strengthened by sub-arches, as seen in No. 76. A more close view of these arches, nearly at the same point, is seen in 66.

These arches were used by the engineers of the Aqua Felice whenever they suited their purpose, and cut about or destroyed without mercy; they also made use of an old _specus_ to carry their metal pipes whenever it was convenient to do so, and the _old specus_ that ran along the Cœlian was very convenient for that purpose. 1295* is from a drawing made to shew this. The _specus_ of the Aqua Felice was first carried on the lower arches of the double arcade of Nero, the upper part of the arcade being destroyed. The metal pipes were then carried down into the old subterranean _specus_ (_the Specus Vetus_ of Frontinus). This is in the same garden or vineyard as the Gemelli, in the great foss between the Sessorium and the end of one of the banks of the Tarquins, (on which the garden of the Villa Volkonski has been made, and along which the Arches of Nero run.) A portion of the grand arcade, with the _specus_ very visible on the top of it, is shewn in 759. This is close to the Scala Santa of the Lateran; the arcade carrying the aqueduct passed along the bank on the north side of the Lateran fortress on the Cœliolum, and supplied that with water.

On the western side of the Lateran fortress is another great foss, between the Cœliolum and the east end of the Cœlian Hill. It was either thought more convenient to make a bank across that great foss for the aqueduct to rest upon, or this bank which traverses that great foss had been made before for an upper road, and was used first for the Aqua Appia and the Anio Vetus, and afterwards by Nero. The existence of such a foss between the east end of the Cœlian Hill and the Cœliolum is denied by those who have not paid attention to the subject, and have not been into the gardens and vineyards to examine it; but the fact is a matter of demonstration. The tomb of the first century (miscalled the House of Verus, probably a tomb of the great Lateran family), being on the western bank of that fortress and the eastern bank of the foss, and the other tomb of the first century also, in the garden of what was the Museum of Campana (_under_ an arch that carries the modern road), on the western side of that great foss, are a demonstration that there was such a foss on the east side of the City of Servius Tullius, i.e. that the Cœliolum and Lateran did not form part of the City at that time. (See my chapter on the Tombs, and the photographs of these two tombs, 174 and 1942).

The Arches of Nero remain on the Cœlian in many parts of the line, by the side of the road from the Lateran to S. Stefano Rotondo and the Navicella, with the arch of Dolabella, which was under the great reservoir of Nero, and formed the entrance of the Claudium. The Arches of Nero are faced with the finest brickwork in the world (ten bricks to the foot, as usual at that period, and are chosen as typical examples). This is well shewn in 78, and the internal construction of rubble, faced only with the fine brickwork, in 358. A line of these, shewing the picturesque effect, is shewn in 131 and 357. The aqueduct formed one of the usual angles between the Lateran and the arch at the west end of the Cœlian. It has been destroyed in this part; but this accounts for the arches being sometimes on one side of the road and sometimes on the other.

We have now arrived at the arch of Dolabella, built when he was consul, A.D. 10, as an entrance to that part of the Cœlian Hill which had been the keep when it was a separate fortress, and was afterwards made the Claudium. This arch is of very simple construction, of travertine, the same construction as the early part of the Basilica Julia, built by Julius Cæsar and Augustus. It was used by the engineers of Nero as a foundation for their great reservoir, or rather for one corner of it, as we clearly see in 72. The work of the time of Nero terminated here, but the design was carried on by his immediate successors. The water was then divided into three branches; the one on the right hand, to the north, went to the great reservoir between the Cœlian and the Esquiline, called the _Stagna Neronis_, and was used for the sham naval battles. Around these Stagna the Colosseum was afterwards built. A portion of the arcade on which the _specus_ was carried is visible in the garden of the monks called the Passionists of SS. John and Paul, and is well shewn in No. 1773, looking towards the east, with the ruins of the reservoir over the arch of Dolabella, and the church of S. Stefano Rotondo in the distance. There are remains of a reservoir for this, of the third century, in the garden of the monks on the terrace of the Claudium, opposite to the Palatine, shewn in No. 1765. The ruins of the fine arcade of the Claudium stand on this terrace; the _specus_ also is in a wall here, behind the arcade. A portion of another reservoir or _piscina_ for them can be seen at the foot of the cliff of the Claudium, at its north-east corner, opposite that part of the Colosseum near the Meta Sudans; this is also shewn in No. 1743, with _opus reticulatum_ of the time of Nero. This branch continued in use in the third century; for there are remains of another reservoir for it, again at the foot of the Claudium opposite to the Colosseum, but more to the east, near the north-east corner of the Claudium, and near to the eastern end of the Colosseum. The remains of this reservoir are shewn in No. 1735. A colonnade carrying the _specus_ from this reservoir to the second story of the Colosseum, is shewn on one of the coins of Septimius Severus, who probably built this reservoir. In the corridors of the Colosseum are open stone troughs lined with the cement for water. These carried water from this aqueduct in a constant running stream to cool the air. They are work of the third century, with old inscriptions on some of them, shewing that they were made of old materials.

Another branch from the great reservoir went straight across to the Palatine, and from thence to the Capitol; it first follows the line of the road down the Clivus Scauri, on the left or southern side, and a fragment of it is visible opposite to the church of SS. John and Paul, as seen in No. 305. At the foot of the Clivus Scauri it formed an angle, and passed against the cliff on which the apse of the

church was afterwards built; it now forms the lowest and last of the series of arches that are carried across the road to support the side of the church. Then, after this angle to the north, it resumes its course to the west upon the arches across the valley to the Palatine, which was a double arcade; but the lowest tier of it only remains, as is shewn in 116. A portion of the upper tier is also visible at the end of it; an arch of this upper tier remains, which, having been made into a back gate of the Palatine, has been suffered to remain, and is shewn in No. 72. A large reservoir for it was made at the south-west corner of the Palatine, on which the palace of Commodus was afterwards built; part of this reservoir and _specus_ is shewn in 683 (made from a drawing). The _specus_ went across the middle of the Palatine, and has been found more than once in some of the recent excavations, but not understood. It was then carried on the bridge of Caligula to the Capitol, a small portion of which remains connected with his palace, as is shewn in Nos. 1447 and 1451.

The third branch from the great reservoir over the arch of Dolabella on the Cœlian was made in the time of Trajan, to carry water to supply the thermæ on the Aventine, called after Sura, the cousin of the Emperor; these thermæ were closely connected with the private house of his family, rebuilt in his time, and called in the Regionary Catalogue “Privata Trajani,” of which there are considerable remains, now subterranean. The first place where this branch of the aqueduct is visible is in another reservoir (1147) against the cliff of the Cœlian, opposite to S. Balbina. This is partly above the level of the hill, and has been thought part of the Palace of Commodus, on the Cœlian (which may possibly have been built over it, but the existing remains are of the time of Trajan). The lower part is under this, and is excavated in the cliff. These were brought to light in the excavations of A.D. 1868 (559, 1008, 1009, 1010, 1011). The plan and section of it are to be seen in 1150*, 692*. Against the cliff the aqueduct formed one of the usual angles towards the north, and this was carried across the valley on the _agger_ or bank of Servius Tullius, first passing over the arch of the gate of the Porta Capena, above the Aqua Appia, on a much higher level, and on an arcade, probably a double arcade, like the Arches of Nero near the Porta Maggiore, on account of the great height at which the water had to be carried from one hill to the other. All that remains of this lofty arcade is a line of brick piers passing across from the Cœlian to the Aventine, over the Aqua Appia, before described, and passing by the north end of the Piscina Publica, as rebuilt in the time of Trajan over the old one, which had belonged to the older aqueducts. There are considerable remains of the walls of this period, that divided the chambers shewn in 557, 558, 1288.

This arcade can then be traced against the cliff of the Pseudo-Aventine, on the north side of S. Balbina, though partly concealed by the filling up of the space against the cliff before mentioned. The tall arcade then crosses the valley from the Pseudo-Aventine to the other part of the Aventine, and from the garden of S. Balbina to that of S. Prisca, and, in the latter garden, there are considerable remains of it on the cliff opposite to the Palatine. At the north end is the _specus_ upon the arcade (the top is open, and there is a walk upon it), 79. A small portion of the Thermæ of Sura is also shewn, with the _specus_ in front of the ancient wall of tufa, called the Wall of the Latins (833).

From the _piscina_ and reservoir on the cliff of the Cœlian another branch went to the south, over the spring of the Camenæ (?) 692, and near that of Egeria (?); it was carried over the Porta Metronia, and on the bank of the City Wall as far as the Porta Latina.

Another fine arcade of the time of Nero (No. 1317) leads to the Nymphæum before mentioned, where the Trophies of Marius were hung. The elevation shews that this water must have come from the highest of the aqueducts, the Anio Novus; and the remains of the reservoir near the Porta di S. Lorenzo, supposed to have been for the Aqua Julia, being on high ground, may have been for this branch, which conveyed water to the Thermæ of Titus.

X. SABATINA TRAJANA.

Great works for the aqueducts were carried on in the time of Trajan. One great work of his time was to bring water from the lake Sabatina to the top of the Janiculum. Augustus had previously brought water from that lake, supplementary to his aqueduct, from the lake Alseatina (VII.), to supply his Naumachia in the Trastevere; but the Aqueduct of Augustus was on the lowest level, that of Trajan on the highest. It does not appear that Trajan made use of the old _specus_ of Augustus; but his aqueduct was afterwards made use of by the engineers of Pope Paul V. for the Aqua Paola, although they also brought a branch to it from the Alseatina, as Augustus had done.

That of Trajan is chiefly subterranean, and has been described under the head of the Alseatina (VII.), but nearer Rome it is above ground, and is carried on an arcade against the wall of the Villa Pamphili-Doria, near the Porta di S. Pancratio. Both the arcade and the _specus_ are faced with the _opus reticulatum_ of that period. (664* is from a drawing, 1065 from nature.) In some parts, one side of the _specus_ has been cut away (1063). Just on the outside of that garden a large _castellum aquæ_ of this aqueduct has

been made into a farm-house, and in the yard of that house a branch from it can be seen (665*), apparently for the purpose of irrigation; or, as some think, this was formerly the point of division, one branch going to the Vatican, the other to the great fountain on the Janiculum (960), above S. Pietro in Montorio. The division now takes place at a short distance from this point. Procopius, writing in the sixth century, admires the enormous quantity of water brought by this aqueduct to the highest point in Rome; as it descends the hill, it turns the wheels of the flour-mills. After it arrived at the low level of the ground in the Trastevere, the respirators of the pipes for this aqueduct are carried in tall pyramids resembling chimneys (540). Part of the arcade and _specus_ rebuilt by Paul V., near the garden before mentioned, is shewn in 1064, with the inscription of A.D. 1609 above it.

XI. HADRIANA (?), TRAJANA (?) OR ALEXANDRINA (?).

The next great work of the period of Trajan or of Hadrian, on the eastern side of Rome, was probably begun in the time of Trajan. It brought water from springs under Labicum, now La Colonna, the same that is now brought for the Aqua Felice. The water from several springs was collected in a central reservoir, on which an inscription of Hadrian was found by E. Q. Visconti in the eighteenth century. This is between Pantana and Gabii, in the valley under La Colonna (1540). There are several other reservoirs of the time of Trajan or Hadrian along the line (1637, 1638). This aqueduct was considered by Fabretti to be of the time of Alexander Severus, and since his time it has usually been called the Aqua Alexandrina. It may have been partly rebuilt and brought into use again in his time, after having been choked up with stalactite, one of the springs used proving to be a petrifying spring.

Near the sources this arcade is low and much damaged, and the _specus_ where it remains is nearly filled up with stalactite (1541, 1542). In some parts of the line the stalactite has all the appearance of a petrified cascade, and is evidently formed by the water oozing out and dripping and petrifying as it fell (1436). Further on there is a fine arcade for it across the country in the direction of Cento-Celle; and in some places the arcade is double to raise the _specus_ to the necessary level, as in the Arches of Nero (1428, 1429). A portion of the arcade, where it is broken off, is seen in 1427, with the tower of Cento-Celle in the distance. Another portion of this fine arcade is shewn in 1640. It is of two periods; the upper part is of the third century, and may have been rebuilt by Alexander Severus (as has been said). At Cento-Celle the ground is high, and the aqueduct passes underground for some distance, along the side of the road towards Rome.

About a mile nearer to Rome, there is a branch aqueduct from the foot of the Marcian arcade, in the direction of the Mausoleum of S. Helena, which Fabretti considers as part of the same aqueduct; but it is difficult to see upon what grounds. There is a fine arcade here also for about a quarter of a mile; but it is of the time of Constantine, and I have not been able to trace any connection between this and the other. This arcade has been originally double, and the lower one only now remains, with a modern _specus_ made upon it (555 and 556); but the water now flows _from_ the Marrana, at the foot of the arcade of the great aqueducts, which were here on higher ground, and _runs down_ upon this arcade to the garden and small monastery of S. Peter and Marcellinus, at the Mausoleum of S. Helena, called the Torre Pignattara, from the earthenware pots of which the vault was made.

XII. AURELIA, A.D. 185, AND XIII. SEVERIANA, A.D. 190.

These two aqueducts were made to convey water to the Thermæ of Commodus and Severus in Regio I., of which the remains were found in the excavations of 1870, just within the Porta Latina. The first part was originally made by Marcus Aurelius, for the use of his great villa on the Via Appia, called the Villa dei Quintilii, and the great reservoir and thermæ connected with it remain (2346, 2349, 2350, 2351, 2352). From thence it was brought into Rome by his successor, Ælius Aurelius Commodus. The water came from the Alban hills, near Marino (2358, 2359, 2360, 2361, 2362, 2363), at first underground, and then on an arcade, of which there are considerable remains near the Torre di Mezza Via di Albano (1626 and 1627).

From the Villa dei Quintilii it went parallel to the Via Appia. One of the reservoirs of it nearer to Rome is made into a farm-house, with a tower to it, and has the appearance of a church at a little distance; it is called the Casale di S. Maria Nuova (2348); it then passed again underground. Near the head of the valley of the Caffarella there remains a _piscina_ for it nearly perfect (1372); this is very near also to the Circus of Maxentius and his son Romulus. There is another _piscina_ or small reservoir for it near the church of S. Urbano, often mistaken for a tomb; here it again forms an angle, and the _specus_ descends (plan and drawing, 831*) to the Nymphæum, or so-called Fountain of Egeria (262). The _specus_ is then continued in the cliff of the valley of the Caffarella, from that fountain towards the tomb of the first century called Dio Ridicolo. Nearly opposite to that tomb the _specus_ is visible in the cliff, with large openings into it, between which it passes underground. Wherever it was above ground it has been carried off as building materials and destroyed, so that it has not again been found until it arrives at the remains of a _piscina_, just to the south of the Porta Latina (984). It then entered the city of Aurelian through the bank on which his wall is built, and supplied the Thermæ of

Commodus within that gate (as has been said), 1485, 1486.

XIV. ANTONINIANA, A.D. 215.

This aqueduct was used to supply the great Thermæ of the Antonines, now called after Antoninus Caracalla. It is more easily traced backwards, passing along the inner side of the bank on which the Wall of Aurelian is built, then upon an arcade which has been destroyed in this part, but of which remains are visible inside of the Porta Ardeatina (986), by the side of the Arch of Drusus, just within the Porta di S. Sebastiano (73, 1772, 1202). It then passes underground through the bank, and emerges in the city wall at the angle between the Porta di S. Sebastiano and the Porta Latina (539, 883). It here crosses the road, and is visible in the garden on the opposite side (884).

XV. ALEXANDRINA, A.D. 225.

The Aqua Alexandrina is mentioned by Lampridius in his life of Alexander Severus, but it was probably a branch from the Anio Novus only, as the Nymphæum engraved on one of his coins[230] has been identified with the ruins near S. Maria Maggiore (2126, 2127). This stands on very high ground, and the only aqueduct that could reach it was that of the Anio Novus. This branch can be traced in the wall by the piers of the arcade, which have been built into the Wall of Aurelian near the Porta Maggiore (80 A, B). The _specus_ and the arches were destroyed by the engineers of the Aqua Felice; the piers only remain, and these cease just before we arrive at the point where the railway now enters Rome through the wall (99). They come to an end directly in a line with a large reservoir, now a gardener's house, near the Minerva Medica, almost between that and the wall, but a little to the south of it; one pier, however, of the tall arcade of the third century remains, as a sort of buttress, against that side of the fine building of the same period called the Temple of Minerva Medica (537). There are great remains of thermæ and fountains in the large vineyard in which this building stands. Some of these are of an earlier period; but a considerable part of them are of the third century, and of the time of Alexander Severus. The Nymphæum before mentioned was at the north end, and is a fine picturesque ruin, with very evident remains of the aqueduct in it (61, 963, 964). The water was here divided into several branches, of which we see portions of the _specus_ going in different directions. One of the most important of these goes to the great reservoir of the Thermæ of Titus and Trajan, called the Sette Sale. This was made long before the time of Alexander Severus, who only rebuilt the Nymphæum; and there is an arcade of the first century leading to this Nymphæum from a reservoir near the Porta di S. Lorenzo.

At a short distance to the south of this celebrated Nymphæum is another very curious reservoir, now in a very bad state, having been turned into a gardener's house, but which must have been of considerable importance, and probably belonged to the thermæ of the third century (2322, 2323). There is a _cippus_ with an inscription, which indicates that the building was a _castellum aquæ_ (2324).

XVI. ALGENTIANA, A.D. 300.

This aqueduct was made to supply the great Thermæ of Diocletian on the Viminal Hill, but is believed to have been entirely subterranean, so that little is known about it. There was a reservoir for it on the eastern side of the Thermæ, under the present railway station. Drawings and a plan of this were preserved by Visconti[231].

XVII. THE AQUA CRABRA, THE MARRANA, A.D. 1124, AND THE RIVER ALMO.

These three may all be treated as one aqueduct for the supply of Rome, partly natural and partly artificial. They all come from the Alban Hills; the first from near Rocca di Papa on very high ground, the second from about a mile above the small and very picturesque town of Marino; the third lower down the same hill. They are all mountain streams, and partake of the usual character of such streams; in dry weather the springs that supply the Almo bring so little water, that it is only sufficient to fill some ponds for cattle at the foot of the hill. The deep bed of the river, which winds about the Campagna for miles, is therefore dry for a great part of the year, but the other two streams never fail; they are united at the foot of the hill, not far from the place where the Aqua Aurelia came from. The greater part of their united waters runs into the river Anio, but a portion of it is diverted near the ruins of the ancient fortified village or _pagus_, called _Centroni_ (2315, 2316, 2317, 2318, 2319), on the road to Tusculum, (now Frascati,) about eight miles from Rome. This branch to supply Rome is first brought through an ancient tunnel of the Aqua Julia, at each end of which remains can be seen of the stone _specus_ and the flood-gates (2310, 2311, 2312, 2313). The water is then conveyed in a bank of clay for about a mile, and then in the bed of one of the many branches of the mountain stream called the river Almo, and so brought into Rome (1309, 1318), under the Porta Metronia, which is built upon a bridge over it. The stream passes under some other

bridges with mills upon them, and eventually falls into the Tiber through an aperture left for it in the Pulchrum Littus, or fine tufa wall of the Kings (drawing, 1235*; plans, 368*, 1234*; views, 77, 166, 157).

Another branch from it is carried from the junction or separation between the Torre Fiscale and Roma Vecchia (1937*) by the side of the cross road from the Via Appia Nova to the Via Appia Antiqua. Sometimes in the bed of the Almo, and in other parts, where the ground is low and the stream is liable to floods, an artificial canal is made for it, which may be seen in the valley of the Caffarella. This excellent plan was carried out in the most economical but effectual manner by a company in the twelfth century. This is really an aqueduct, though not usually so called; it is kept in repair by the present Water-Company, and is of great importance for Rome; as the floods to which the Almo was always liable along its whole line, and within the walls of Rome, (as is mentioned by Cicero,) are effectually kept out of Rome, and a constant, regular supply of water is obtained.

XVIII. AQUA FELICE, made A.D. 1587 by Pope Sixtus V. (Felice Peretti).

The sources of it are the springs under the hill on which La Colonna stands. The same water had been used long before, and brought into Rome by the aqueduct (XI.) of Hadrian and Trajan before mentioned. The large reservoir for the water now in use is very near to the remains of the old one of Hadrian. The construction of this aqueduct is very rude and rough, of concrete and rubble-stone only, and this stone consists entirely of old materials; still the large scale of the work, and the height at which the _specus_ is carried upon the arcade, give it a grand effect. At a little distance, the inferior construction is not seen, and this almost modern aqueduct is frequently mistaken by strangers for one of the old ones of the time of the Empire, of which it is only an imitation. It is seen in several of the views of the older aqueducts in the Campagna, especially those at the Torre Fiscale (531, 1028, 1029) and the Porta Furba (68, 1437). Here it crosses the road to Frascati on an arch, with an inscription upon it. In the latter part of its course it is made on the piers of the Claudian arcade, and it enters Rome at the same point, the north-east corner of the gardens of S. Croce. After passing along the north side of them, it is divided into different branches by a reservoir at the angle, close to the south side of the Porta Maggiore (30). The principal stream then passes along upon the Wall of Aurelian (80 A, B, 81), on the same high bank as the earlier aqueducts had done; it was cut through in making the railway, but a new bridge over that road was built for it (29). Near this it can be seen that it is carried on the piers of an older aqueduct for some distance (28). See Alexandrina (XV.)

Further on towards the Porta di S. Lorenzo the ground is higher, and in order to keep the level necessary for the _specus_, it is brought within the wall, and built up against the inside of it (1871). The Marcia, Tepula, and Julia, over which it is carried, as is seen at the two gates where their arcade is visible _under_ the _specus_ of the Aqua Felice, are here still under it, but _underground_ also, owing to the higher level of the ground. It passes over the Porta di S. Lorenzo to a reservoir on the north side of it, and then turns to the west by the side of the road, which it crosses upon an arch, with an inscription upon it, at a short distance within that gate (81). The principal termination of it is at the Fountain of the Termini (called of Moses,) 71. Behind the fountain is a reservoir after the old fashion, which is illustrated by a plan and section (704*). The celebrated Fountain of the Triton (1196), in the Piazza Barberini, is also supplied by this aqueduct, as well as all the upper terraces upon the hills. The lower range, on the Campus Martius, is chiefly supplied by the Virgo. Another branch goes from the reservoir at the Porta Maggiore along the bank on which the Arches of Nero are carried, to the Lateran, where the fountains are supplied by this water. The old aqueduct was used according to the custom of the time, and there is a cascade _specus_ from the level of the Marcia to that of the Appia (shewn in 541).

The _specus_ of each of these old aqueducts was used to carry the metal pipes of the Aqua Felice, when it was convenient to do so (1295*), as has been previously mentioned.

THE AQUA MARCIA PIA was made by a Company between 1860 and 1870, and has been mentioned under the head of the Marcia (a part of it is shewn in 1553).

THE AQUEDUCTS.

ANIO NOVUS.—THE RIVER ANIO.

DESCRIPTION OF THE PHOTO-ENGRAVINGS.

PLATE I.

[Illustration: AQUEDUCTS—SOURCE OF AQUA APPIA.

ANCIENT QUARRY OF THE KINGS.]

Source of the Aqua Appia, in a very ancient Stone-quarry of the time of the Kings, in the meadows on the bank of the river Anio, formerly called the meadows of Lucullus. They are not far from Lunghezza, the site of the ancient city of Collatium. This cave has two springs of water in it, and the two streams meet at the mouth of the cave in a channel, which is at first open at the top, and crosses the low meadow with the appearance of a ditch only, to a central reservoir, also in a cave, from which the tunnel _specus_ begins that runs on, into and through Rome. Three streams meet at the same central reservoir, and their united water goes through the _specus_. Each _specus_ can be traced by the line of bushes in the meadows, each bush being over one of the wells; these descend at regular intervals into the _specus_. These wells are also called respirators or ventilators, as they give air to the current of water, or as the people say, enable it to breathe. This cave is easily overlooked, and any person passing on the higher ground over it, is almost sure not to see it. It is scarcely visible until close to it. The ancient quarry from which it comes is earlier than others in the neighbourhood. The celebrated Caves of Cervaro are also ancient quarries; they are about a mile from this point, and although very early, are not quite so early as this, which is more distant from the river Anio. It seems probable that this was one of the quarries for the city of Collatium, before the time of Servius Tullius.

PLATE II.

[Illustration: AQUEDUCTS—SOURCE OF AQUA APPIA.

ANCIENT QUARRY OF THE KINGS.]

SOURCE OF ANOTHER SPRING OF THE AQUA APPIA, in another ancient stone quarry on the bank of the river Anio. This is one of a fine series of ancient quarries, now caves, about a mile higher up the river than the Caves of Cervaro. These are believed to have been the quarries from which the large blocks of tufa for the walls of the Kings of Rome were taken, especially the great wall of Servius Tullius, which was a mile long, fifty feet high, and in some parts twelve feet thick, and which would require an enormous quantity of stone. This was probably floated down the Anio on wooden rafts, which served for timber also. The pool at the source of this spring appears as if it came from the water dripping through the rock above, which serves for a roof; but the old shepherds, who have watched it for years, say that the water never fails, and that it is a natural spring, although the quantity of stone refuse thrown into it makes it impossible to see exactly where it rises. These caves are extremely picturesque, more so even than the Caves of Cervaro, though these are the favourite resort of the German artists in their annual festival.

PLATE III.

1. THE AQUEDUCTS ABOVE SUBIACO.

2. RIVER ANIO, THE UPPER LOCHS.

—— THE THIRD LOCH AND THE BRIDGE.

[Illustration: AQUEDUCTS ABOVE SUBIACO

RIVER ANIO THE UPPER LOCHS

THE THIRD LOCH AND THE BRIDGE]

The water for the aqueducts of Rome was chiefly drawn from the river Anio, or from springs or tributary streams that fell into that river. It rises in the high mountains above Subiaco, which are generally covered with snow for the greater part of the year, and the supply of water never fails entirely, though it is not always equally abundant. It is generally a clear, bright mountain stream, coming through rocks, but it is liable to sudden and violent floods, which bring down a great deal of mud, and therefore great precautions are taken for filtering it. The latest and most important of the great aqueducts were the Claudia and Anio Novus; the latter was the most abundant of all, being in fact a branch of the river compelled to pass through Rome by clever engineering. A series of great lochs was made by building dams across the river, with cascades from one to another. There were three of these about two miles above Subiaco, and about forty-two miles from Rome. The uppermost one of them is seen in the upper part of the plate, but in the third loch, the lowest of the three (shewn in the lower part of the plate), the bed of the river is so deep, that the water is not seen. The country through which it passes is celebrated as among the most beautiful in Italy.

PLATE IV.

[Illustration: AQUEDUCTS ABOVE SUBIACO

ANIO NOVUS, THE THIRD LOCH

ANIO NOVUS, SPECUS CUT IN THE CLIFF]

1. ANIO NOVUS, THE THIRD LOCH, as seen from below, where the dam, that formerly kept up the water and formed a great cascade, has been thrown down, and appears only as rocks in the stream; the modern bridge seen in this view is built upon the two ends of the old dam.

2. ANIO NOVUS, SPECUS. The _specus_ is here a tunnel cut in the cliff, on the side of the valley on which the town of Subiaco stands; it is six feet high, and only eighteen inches wide (an opening into it may be seen in the cliff, on the left-hand side of the view). The round tower, seen on the right, is that of the Villa Gori, about a mile above Subiaco.

PLATE V.

AQUEDUCTS ABOVE SUBIACO—ANIO NOVUS, CASTELLUM.

[Illustration: AQUEDUCTS ABOVE SUBIACO

ANIO NOVUS, CASTELLUM

LINE OF THE SPECUS OF ANIO NOVUS

Photogravure Dujardin, Paris]

This is the loch below the modern bridge, which is made upon the remains of the old dam across the river, destroyed in the fourteenth century by making a hole at the bottom to let the water escape from a flood in the upper country. The force of the water once let loose soon destroyed the dam, and the large stones of which it was built are still lying as rocks in the river, and are seen in the photograph and the photo-engraving.

LINE OF THE SPECUS OF THE ANIO NOVUS. It is here carried in the cliff of the valley of the river Anio, seen on the left of the picture. Both of these views are continuations of those seen in Plate IV., and one helps to explain the other. The _specus_ continued in this way for many miles underground, in one sense, when seen from above, but not underground when seen from below. When it has to cross the mouths of the small subsidiary streams that fall into the Anio, it has to be carried over bridges or arches, at other times it is cut in the rock or cliff.

PLATE VI.

THE CLAUDIA, ANIO VETUS, AND NOVUS, AND MARCIA IN THE VALLEY OF THE ARCHES ABOVE TIVOLI.

[Illustration: AQUEDUCTS—CLAUDIA AND ANIO-NOVUS.

IN THE VALLEY OF THE ARCHES, NEAR TIVOLI.]

This valley is about two miles above Tivoli, where there is a junction of another stream with the Anio, in rather a wider valley than the usual valley of the Anio only. One arch of the lofty Claudian arcade is left on the side of the valley next Tivoli, and on the top of this a medieval tower has been built, which has an extremely picturesque effect. Through the arch may be seen a small portion of the Marcian arcade, and at a few yards to the left the Anio Vetus, which there passes half-underground at the foot of the tall arcade of the Anio Novus.

PLATE VII.

[Illustration: AQUEDUCTS ABOVE TIVOLI

ANIO NOVUS. MEDIEVAL TOWER

IN THE VALLEY OF THE ARCHES

Photogravure Dujardin, Paris]

TWO OTHER VIEWS OF THE RUINS OF THE ARCADES OF THE CLAUDIA AND ANIO NOVUS, in the Valley of the Arches above Tivoli. In the foreground, the Marcian seen through the arch, and the Anio Vetus again through the arch of the Marcian. These views are celebrated for their picturesque character, as indeed is all the country about Tivoli and Subiaco.

PLATE VIII.

AQUEDUCTS AT TIVOLI. CASCADES OF THE ANIO, WITH THE ROUND TEMPLE OF THE SIBYL AT THE TOP.

[Illustration: AQUEDUCTS AT TIVOLI

TEMPLE OF THE SIBYL AND CASCADES

CASCADES OF THE ANIO]

This cascade shews the character of the country through which the aqueducts had to be carried, but the waters of the aqueducts taken out of the river Anio were necessarily confined each within its own _specus_, here in tunnels, which are carried in a zig-zag course gradually down the hill to the level of the Villa of Hadrian in the valley below.

PLATE IX.

AQUEDUCTS BELOW TIVOLI.

[Illustration: AQUEDUCTS BELOW TIVOLI

MARCIA ON THE VIA DI CARCIANO

MARCIA CASTELLUM. B. C. 145]

THE MARCIA, A GREAT CASTELLUM AQUÆ OR RESERVOIR ON THE VIA DI CARCIANO. This is sometimes called the “Promenade” of Carciano, being a favourite walk on the brow of the hill, from which there is a distant view of S. Peter’s at Rome. This fine reservoir (of which two sides are here shewn) is of the time that this aqueduct was made, B.C. 145. It was probably from this reservoir that a branch _specus_ descended to the Villa of Hadrian below, to which there is a bridle-road from near this point.

PLATE X.

AQUEDUCTS BELOW TIVOLI. AQUA MARCIA, RESERVOIR.

[Illustration: AQUEDUCTS BELOW TIVOLI

AQUA MARCIA RESERVOIR

RESERVOIR OF AQUA MARCIA INTERIOR]

This is another of the great reservoirs to receive and retain a supply of water on the edge of the hill, both as one of the many such reservoirs for the supply of water to Rome, and for the purpose of local irrigation. It consists of two large chambers, divided by an arcade, which is the usual plan, and is probably part of the original construction of B.C. 145. These reservoirs are remarkably picturesque and finely situated.

PLATE XI.

AQUEDUCTS BELOW TIVOLI. ANIO NOVUS, CASTELLUM.

[Illustration: AQUEDUCTS BELOW TIVOLI

ANIO NOVUS, CASTELLUM

MARCIA, CASTELLUM OF TRAJAN]

This is another of these fine reservoirs, about a mile further on; it is faced with the reticulated-work of the first century, and is part of the original work of the time of Nero.

MARCIA, CASTELLUM OF TRAJAN, who repaired the aqueducts in several places, as is recorded by inscriptions. The reticulated-work with which this is faced is very peculiar, and is believed to be unique, at least it has not been observed elsewhere.

PLATE XII.

THE CLAUDIA AND ANIO NOVUS IN THE CAMPAGNA OF ROME, NEAR ROMA VECCHIA.

[Illustration: THE AQUEDUCTS. CLAUDIA AND ANIO NOVUS

IN THE CAMPAGNA NEAR THE PISCINAE AND ROMA VECCHIA.]

This grand arcade is the most perfect part of this finest of the aqueducts, and extends for about a mile, from near the farm-house called Roma Vecchia, about four miles from Rome, to the piscinæ where the arcade becomes gradually lower as the ground rises towards the foot of the hills. The two _specus_ are clearly seen with their usual characteristics, the Claudia built of large squared stones; the Anio Novus is visible, faced with brick in most parts, but here is faced with reticulated-work. In the first part of this view are seen the ruins of one of the enormous reservoirs, or Castella Aquarum, at one of the angles which occur at each half mile along its course. The object of these very numerous reservoirs probably was two-fold, one for local irrigation, the other for keeping up a constant and never-failing supply for Rome, even in the hot season, when many springs cease to flow.

PLATE XIII.

[Illustration: AQUEDUCTS ON THE VIA LATINA.

NEAR PORTA FURBA

UNDER THE TOR FISCALE MARCIA & CLAUDIA

Photogravure Dujardin, Paris]

THE MARCIA, TEPULA and JULIA passing under one of the arches of the CLAUDIA and ANIO NOVUS, now under the TOR FISCALE. A medieval tower built upon the celebrated crossing of the aqueducts, where seven aqueducts crossed each other at different levels. The Anio Vetus passes under it just underground, and the AQUA FELICE by the side of it. The _specus_ of the Aqua Marcia, built as usual of squared stone, is seen upon the arch that carried it; the others are concealed by a modern wall, but can be traced passing under the stone arch of the Claudian. The other view in the upper part of the plate shews another crossing, at one of the angles made to break the force of the water. The Marcian and the Claudian arcades running parallel to each other at a short distance only, the angle of this goes across the intervening space, and then changes sides for a time. The road which here runs between the two arcades passes under the arches at both ends of this junction, near the Porta Furba, which is seen in the distance. The character of the brickwork of the arch in the foreground indicates the time of Trajan, with later repairs, which were made at all periods in this arcade.

PLATE XIV.

[Illustration: AQUEDUCTS

MARCIA AT PORTA TIBURTINA

CLAUDIA AND ANIO NOVUS AT ANGLE OF THE SESSORIUM]

The upper view represents the stone _specus_ of the Aqua Marcia at the PORTA TIBURTINA, now of S. Lorenzo, just within the gate, and in the wall on the southern side, with an opening by the side of it, through which a man can now walk into the _specus_ and along it. To the right of this, still in the wall, is a Castellum of the Aqua Felice, which is here, as at the Porta Maggiore, above the Marcia, Tepula and Julia, and below the Claudia and Anio Novus.

In the lower view is the Claudia and Anio Novus, at the north-east angle of the gardens of the Sessorian Palace (now of S. Croce in Gerusalemme). One of the stone piers of the Aqua Claudia is seen just within the projection of the tower at the angle, which is an addition of a later period. Within this portion of the City wall is a great Castellum Aquæ, extending from the corner to the tower, through which the aqueducts entered Rome. The interior of the tower is a piscina, which is shewn in another plate.

PLATE XV.

AQUEDUCTS AT THE PORTA MAGGIORE. THE MARCIA, TEPULA, AND JULIA ENTERING ROME.

[Illustration: AQUEDUCTS AT THE PORTA MAGGIORE.

MARCIA TEPULA JULIA ENTERING ROME

MARCIA ETC. WITHIN THE WALL.]

The upper view shews the exterior of the wall, with the three _specus_ passing through it, under an arch of the Claudian arcade, now destroyed. These are carried upon one of the piers of the Marcian arcade, built of squared stone, as the part near Rome always was. In the left lower corner of this view may be seen the Anio Vetus, half underground, as usual for this aqueduct. [This opening has been built up since the photograph was taken. The demolition of all traces of the old aqueduct as far as possible was part of the plan of the architect, who directed what were miscalled the _restorations_ of the City wall.]

The lower view represents the _specus_ of the Aqua Marcia, of squared stone, carried on one of the arches of the Marcian arcade through the wall, within it at the same point as that of the exterior shewn above.

PLATE XVI.

CLAUDIA AND ANIO NOVUS.

[Illustration: AQUEDUCTS

ANIO NOVUS ON THE CAELIAN

CLAUDIA AND ANIO NOVUS OVER THE PORTA MAGGIORE]

I. OVER THE PORTA MAGGIORE. In the lower view the two _specus_ are seen endways, built of squared stone, as part of the gateway. The point of view for this is nearly the same as that of Plate XV., looking south instead of west. The curious tomb of the Baker Eurysaces is seen on the left, with the stone kneading-troughs of which it is built.

II. The upper view is one corner of the great reservoir of Nero on the Cœlian, near the west end, over the Arch of Dolabella, which is seen built of well-cut stone, and perfectly plain. This has an inscription, with the names of the Consuls of the time of Augustus (A.D. 10), forty years afterwards; the arch, which was the eastern entrance into the Claudium, was used by the engineers of Nero as a substructure for the corner of the great reservoir of water for the supply of that part of Rome, which was carried at the height of thirty feet from the ground. Some small square windows are seen in the wall, which belonged to the chapel of S. Thomas _in formis_ (or in the arches), made in the remains of the arcade in the eighth century, and removed in the twelfth for a larger chapel, now in the garden of the Villa Celi-montana near to it. At the left-hand corner of this view is seen the gateway of the small monastery of the Redemptorists, with the celebrated mosaic picture over it, representing Christ between a black and a white slave, shewn in another plate of this work.

PLATE XVII.

ARCHES OF NERO WITHIN THE PORTA MAGGIORE.

[Illustration: AQUEDUCTS. ARCHES OF NERO.

WITHIN THE PORTA MAGGIORE.

AQUA MARCIA, WITHIN THE PORTA MAGG: 1871.]

This double arcade crosses the valley or inner foss of the Sessorian Palace. It was built on this plan for greater strength, as the piers are of a great height. This arcade is a continuation of the one that forms the northern wall of the Sessorian gardens, in a direct line to the west, over the Cœlian to the great reservoir over the Arch of Dolabella (shewn in the last plate). The _specus_ was carried at the top, and conveyed the water of the Claudian and Anio Novus, _united_ at _the Gemelli_ (a great twin reservoir which was close to that point, and at the north-west angle of the Sessorian gardens). The Claudian as a separate water turns at a sharp angle, and goes on to the Porta Maggiore, with the Anio Novus over it, and terminated at another tower just to the north of the place where the Marcia, Tepula, and Julia pass through the wall. But they left a considerable part of their water at that angle to be united to that of the Anio Novus at the Gemelli.

The lower view represents a fragment of the Aqua Marcia, as repaired and restored by Trajan, to the north of, and near the Porta Maggiore, in the vineyard in which the Minerva Medica stands, which has been the Exquiliæ, and afterwards the gardens of Mæcenas. This, which is parallel to the City wall, is joined to it a little further on. It was accidentally brought to light by some excavations in 1871, and is now buried again.

PLATE XVIII.

THE CLAUDIAN AND THE ANIO NOVUS, IN THE NORTH WALL OF THE SESSORIAN GARDENS, NEAR THE PORTA MAGGIORE.

[Illustration: AQUEDUCTS NEAR PORTA MAGGIORE.

CLAUDIA AND ANIO NOVUS IN THE WALL OF THE SESSORIUM.

NYMPHAEUM OF ALEXANDER SEVERUS WHERE THE TROPHIES OF MARIUS WERE HUNG.]

The wall for about a quarter of a mile is entirely made out of this arcade, with the arches filled up, but it is built upon the old earthwork of the Sessorium, probably of the time of the Kings. The arcade extends from the angle at the north-east corner, where the aqueduct entered Rome, to the north-west angle near the Porta Maggiore, which was called Porta Sessoriana, because it entered into the Sessorian gardens.

The lower view represents the NYMPHÆUM OF ALEXANDER SEVERUS, WHERE THE TROPHIES OF MARIUS WERE HUNG.

This is identified by a representation of it on one of the coins of that Emperor. It is commonly miscalled a Castellum of the Aqua Julia, but it is on too high a level for that water, and there is no other but the Anio Novus which is high enough; this was brought along the wall to another reservoir near the Porta Tiburtina, and then by a branch arcade to this point, where there is another large reservoir on high ground, from which the water was dispersed in different directions. One branch went to supply the great reservoir called the _Sette Sale_, which supplied the Thermæ of Titus and Trajan on the Exquiliæ, and from thence went on to the Colosseum and to the Tiber. Another branch supplied the Thermæ of Constantine, on the Quirinal.

PLATE XIX.

RESERVOIR ON THE ARCHES OF NERO OVER THE ARCH OF DOLABELLA.

[Illustration: AQUEDUCTS—ON ARCHES OF NERO.

OVER THE ARCH OF DOLABELLA]

This Plate is almost a repetition of Plate XV., but from a different point of view, and this great reservoir is of so much importance for the history of the aqueducts in Rome, that it was necessary to shew it as clearly as possible. Without repeating what has been said before, we may add that the arch seen to the right in this view is the beginning of an arcade which led to the Colosseum. Another branch in a more direct line led to the Palatine, after passing first along the north wall of the garden of the Villa Celimontana, then by the western side of the Clivus Scauri, parallel to the church of SS. John and Paul, and at the foot of the hill passing across the road, and under the apse of the church; then turning again southwards on an arcade across the valley to the Palatine, of which there are remains; afterwards passing along the whole length of the Palatine underground, it is visible at the mouth of a tunnel on the platform opposite to the Capitoline Hill, and went across the Forum Romanum over the bridge of Caligula. The work of Nero stopped at the Arch of Dolabella, but it was taken up and completed by his successors.

Another branch went also to the left, on the west wall of the garden of the Villa Celimontana, to the valley between the Cœlian and the Aventine. There is a large reservoir for it on the cliff of the Cœlian, partly below and partly above it, and in the garden of the monks of S. Gregory. It then went on a tall arcade, over the Porta Capena and the _agger_ of Servius Tullius, to the Piscina Publica, and from thence, again crossing the valley between the two parts of the Aventine, to the Thermæ of Sura, and the private house of Trajan, and the temples on the edge of the Aventine, and to the mouth of the aqueducts in the cave under the Priorato at the Porta Trigemina, and so to the Tiber.

DESCRIPTION OF THE DIAGRAMS.

PLATE I.

PLAN OF THE SOURCES OF THE APPIA (I.) AND VIRGO[232] (VI.)

[Illustration: I.

AQUEDUCTS—AQUA APPIA AND VIRGO.

PLAN OF THE SPRINGS AT THE SOURCES IN THE MEADOWS OF LUCULLUS, ON THE BANK OF THE RIVER ANIO, EXCAVATED IN 1868]

1. Farm-house of Cervaro. 2. —— Cervelletta. 3. —— La Rustica. 4. —— Salone. 5. Church. 6. Sources of the Aqua Appia. 7. —— Virgo. 8. —— Augusta. 9. Tombs. 10. Aqueduct of the Virgo. 11. Road of Cervaro. 12. —— La Rustica. 13. —— Prænestina (?). 14. —— Collatia. 15. Bed of the stream of the Fontanille. 16. —— of Tor Sapienza. 17. —— of Ponte Nono, the Rivus Herculaneus. 18. Direction of the Aqueduct of the Appia. 19. Stone-quarry of Collatium and Necropolis.

PLATE II.

[Illustration: II.

AQUEDUCTS—AQUA APPIA, SPECUS.

IN A TOWER OF THE PORTA CAPENA, UNDER THE CŒLIAN, NOW A GARDENER'S COTTAGE, EXCAVATED IN 1868.]

THE APPIA (I.) at the PORTA CAPENA, in the eastern tower of the gate, now in the house of the gardener of the monks of S. Gregory. The _specus_ is built of large blocks of tufa, and the lower part of it cut in the tufa wall of Servius Tullius; it was distinctly visible in the excavations of 1870, when this drawing was made. The line of the aqueduct upon the short _agger_ between the Cœlian and the Aventine was also visible for several yards, and in three different places, where pits were dug fifteen feet deep, the last was where a branch was carried into the Piscina Publica. The middle pit was in waste land on the western side of the present south road through the gate of S. Sebastian, or the modern line of the Porta Appia. It was to this pit that his holiness Pius IX. was taken to see it by the Cavaliere Guidi, and he said there was no denying that this was part of the wall of Servius Tullius, but he was surprised that his Roman friends had not discovered this. The greater part of the pits that he opened might have been left open, if it had not been for the prejudices of the subordinate officers of the Government. The particular pit in question was in waste ground by the side of the road, and might have been left open without any inconvenience.

PLATE III.

[Illustration: III.

AQUEDUCTS—AQUA APPIA, SPECUS.

IN A STONE QUARRY UNDER S. SABBA, ON THE AVENTINE, WHERE SEVEN BRANCHES OF LATER AQUEDUCTS CAST THEIR SURPLUS WATER INTO THE APPIA, EXCAVATED IN 1868.]

The Appia (I.) under S. Sabba, in an old subterranean stone quarry. Several branches of other and later aqueducts here cast their surplus water into the _specus_ of the Appia, the earliest and the lowest (as shewn in the plan). The _specus_ is also visible in several places, filled up to one-third of its depth by the deposit of clay left by the water, which comes from swampy meadows on the bank of the river Anio, in which the soil is clay, upon tufa rock, called the "Meadows of Lucullus."

Over the plan in this plate are two sections of the _specus_; in the one to the right the clay deposit left by the water is shewn, in the one to the left a small pipe coming into the _specus_, probably part of the system of irrigation, which was one great use of the aqueducts; the green lines winding through the quarry represent the lines of the various streams of water coming at different levels, sometimes with a very rapid descent, and all falling into the old deep _specus_ of the Appia, before that was carried across the last road that it had to pass. In this instance it was probably carried under the road, and not over the arch of the gate. At this point four roads meet, which is almost a certain indication of the site of a gate. In most cases the _specus_ was carried over the gate, but here the level seems too low, unless the old foss-way has been filled up even more than the usual fifteen feet. The _specus_ is

visible again in another subterranean stone quarry under S. Prisca, in the same large vineyard formerly of the Jesuits, now of Prince Torlonia, in which, at a higher level, are also the remains of the Wall of the Latins on the Aventine, and of the Thermæ of Sura and the private house of Trajan. Another aqueduct passed over this to supply the Thermæ; this is on a very high level, and was carried on a tall arcade across the valley, from the Cœlian to the Aventine, passing over the Porta Capena and on the old _agger_. There are remains of the tall brick piers in several places, and of the arcade and _specus_ on the hill near S. Prisca, visible from the Palatine.

PLATE IV.

[Illustration: IV.

AQUEDUCTS—AQUA APPIA, MOUTH.

IN A CAVE OF THE AVENTINE, UNDER S. ALEXIO, AT THE PORTA TRIGEMINA, NEAR THE MARMORATA, EXCAVATED IN 1868.]

Mouth of the Appia (I.), in a cave under the Priorato or Priory of the knights of Malta on the Aventine, near the Marmorata and the Porta Trigemina. At the back of the cave, and connected with it by a natural tunnel, is a large reservoir of water in the heart of the hill, supplied by a natural spring, which was added to the water brought by the aqueduct for distribution. The latter part of this cave, behind the part here shewn, is under the garden of the monastery of S. Alessio, and the cave belonged to those monks. A plan and section of it is given in another plate. In the inner part of the cave is the natural spring, so that it is always knee-deep in water. This seems a likely place to have driven cattle into for concealment; there is no other natural cave under the Aventine, and this is close to the Porta Trigemina. The idea that there was a cave near the Forum Boarium seems to have arisen from a misunderstanding as to the exact site of the Porta Trigemina, which was supposed to be close to that Forum, instead of being a quarter of a mile from it, and close to the Sublician, or wooden bridge, where some remains of it have been found. The _specus_ of the Aqua Appia leads directly into this cave, and other aqueducts also meet there. The surplus water of the Trajan, far above this level, descends into it by a vertical pipe of terra cotta. Piranesi, in the last century, recognised the cave as the mouth of the Aqua Appia, and gives one of his admirable etchings of this part of the Aventine, with the cave at its foot. He was in advance of his time, but a great deal of fresh evidence has come to light since that period.

PLATE V.

I. AQUA APPIA.

[Illustration: V.

THE AQUEDUCTS.—APPIA.

RESERVOIR IN THE GARDEN OF THE SESSORIUM, NOW OF S. CROCE, CALLED THERMÆ OF S. HELENA.

A. SECTION. B. PLAN.]

The Aqua Appia (I.) is at so great a depth near the Porta Maggiore (which stands on very high ground), that it is difficult to trace it, but the _specus_ was found in making the railway in a deep cutting about half-a-mile outside of that gate, and was described in the _Bulletino di Correspondenza Archæoligia_ at the time it was found. There is reason to believe that it entered Rome under the wall on the north side of the Sessorian Gardens, and was received in a reservoir, of which there are remains at a considerable depth, especially the lower story. This is near the reservoir of the great Basilica or Hall of the Palace, of which the apse remains. The plan and section of this reservoir are shewn in this diagram. The _specus_ from this point turned to the west, and passed along the Cœlian Hill at a low level, nearly under the arches of Nero; but before arriving at these, it passed through another large and deep reservoir to the south of the Porta Maggiore, now in a vineyard, with another large reservoir close to it. These two are believed from the situation to be the Gemelli of Frontinus. An inscription was found on the one in the garden of the Sessorium relating to the Thermæ of S. Helena, who resided in that palace, and probably the water for her bath-chambers was taken from this reservoir.

PLATE VI.

II. ANIO VETUS.

[Illustration: VI.

THE AQUEDUCTS.—ANIO VETUS. RESERVOIR NEAR THE PORTA FURBA.

A. SECTION, SHEWING THE DEPTH UNDERGROUND.

B. PLAN OF THE TWO CHAMBERS AND THE ENTRANCE.]

The reservoir, of which the plan and section are given in this plate, is situated at about a quarter of a mile from the Porta Furba, near the junction of the old Via Latina with the Via Appia Nova. It is just two miles from Rome, and so agrees with the text of Frontinus. It seems clear that at this point part of its water was carried by the Octavian _specus_ to the Porta Maggiore, while the main stream went on along the side of the Via Appia Nova to the Asinian Gardens, just within the Porta Asinaria. It was shewn in some excavations made under my direction in 1871. We had long been looking for it, and the gardener informed us that there was a vaulted chamber under part of that garden or vineyard, where we found it, a few feet underground, and about a hundred yards from the arcade of the great aqueduct on the southern side, nearer to the present road than the reservoir.

PLATE VII.

LOCH IN THE AQUA JULIA, NEAR THE IMPERIAL VILLA, CALLED THE SETTE BASSI (SEPTIMIUS BASSUS?).

[Illustration: VII.

THE AQUEDUCTS.

A LOCH IN THE AQUA JULIA, NEAR THE VILLA CALLED SETTE BASSI. PLAN AND SECTION.

A. SECTION OF THE BRANCH.

B. THE SPECUS.

B. PLAN, SHEWING THE DIVISION AND THE LOCH.

A. A. THE SPECUS.

B. THE LOCH FOR THE BRANCH.]

The Aqua Julia at this point, which is about four miles from Rome, is just underground, and this loch and branch to supply the Villa was discovered about 1850 by Signor Moraldi, when he was making a map of the Aqua Marcia, with a view to having it brought again into use; which has since been done, but by a different line.—To save carrying it so far round as the old aqueduct was carried (in order to avoid the mouths of the many streams that run into the river Anio), the modern engineers used metal pipes in this part. Above Tivoli they built a stone _specus_ after the old fashion, as in that stone country they found it the cheapest and the best plan. They now say they regret that they did not continue the stone _specus_ over the level Campagna also, as the metal pipes are continually bursting from the force of the water. Previous to this discovery of Signor Moraldi, it was not known that there were lochs in the aqueducts, though it is obvious that when branches had to be taken from them, such an arrangement would be required. The Tepula and the Marcia are underground in this part. The Julia, being the uppermost of the three, was close to the surface. This was also the case on the side of the great _agger_ of Servius Tullius near the railway station, where the Julia only was excavated, with two cippi, on which were inscriptions stating that _the three_ aqueducts passed there.

PLATE VIII.

AQUEDUCTS AND RIVER ALMO, NEAR THE PORTA FURBA.

[Illustration: VIII.

THE AQUEDUCTS AND RIVER ALMO, NEAR THE PORTA FURBA.

A. PLAN AT A CROSSING.

B. PLAN AND SECTION AT ANOTHER POINT.

C. PLAN AND SECTION IN THE QUARRY AT THE ALBERGO DE’ SPIRITI.

D. PLAN AND SECTION OF RESERVOIR NEAR THE SAME.]

A. Arcades of the Marcia, Tepula, and Julia; the Claudia and Anio Novus at one of the angles and crossings; and the Aqua Felice, which is carried first on one and then on the other of the old arcades. Also, there is an indication of the situation of the great tumulus and tomb called “Monte del Grano,” in which the fine sarcophagus was found which is now in the Capitoline Museum, and was long supposed to be that of the Emperor Alexander Severus and his wife Mammea. This is given to indicate the situation. The river Almo is seen crossing the two arcades near the gate or arch over the road.

B. The same two arcades, at about a quarter of a mile nearer to Rome, or just two miles, with the river Almo winding between them; and a Section to shew the elevations.

C. Plan of the junction of the old Via Latina, with the modern road to Albano, at two miles from Rome, shewing the situation of the aqueduct in a stone-quarry at the back of the “Albergo dei Spiriti,” near C.

D. Plan and Section of the reservoir, at two miles from Rome, near the Porta Furba.

PLATE IX.

THE SEVEN AQUEDUCTS AT THE TOR FISCALE.

[Illustration: IX.

THE AQUEDUCTS AT THE TOR FISCALE.

A. SECTION.

B. PLAN, SHEWING THE CROSSING OF FIVE AQUEDUCTS IN THE TOWER, AND TWO UNDER IT.]

At this important junction and crossing of the aqueducts the Marcian arcade originally made one of the usual angles. The more lofty arcade of the Claudia and Anio Novus was then carried over it, with the Anio Vetus half underground, nearly on the same line; and the modern aqueduct, called the Felice, is here carried against and partly upon the old Marcian arcade. The medieval architects took advantage of this crossing to build a tall tower upon it; the five conduits or _specus_ can be seen inside the tower, and half arches abutting against it in a very picturesque manner, all of which are shewn in the Section in the upper part of the plate, and in the Photo engravings.

The Plan in the lower part of the plate shews the arrangement, and also the small river Almo, now called the Marrana, winding round it.

PLATE X.

[Illustration: X.

THE AQUEDUCTS.—CLAUDIA AND ANIO NOVUS.

ENTERING ROME IN A TOWER OF THE SESSORIUM.

A. SECTION.

B. PLAN, OF THE PISCINA MADE IN THE TOWER.]

Piscina of the Anio Novus at the entrance into Rome, in a tower of the Wall of Aurelian, and of the gardens of the Sessorian Palace, now of S. Croce in Gerusalemme.

A. The Section.

B. The Plan.

By a singular coincidence it happens that the inner wall of this tower has been destroyed, so that the whole of the interior is displayed, and shews exactly what an ancient piscina was. The water comes into the right-hand upper chamber, it then descends into the chamber under it, as is marked by the arrow in the drawing, it then passes through small holes in the partition wall into the left-hand lower chamber. [The artist has represented a _large_ opening through this wall, but this must be a mistake, owing to the

wall being partially broken away; there are always _small_ holes through this partition wall.] The space between this tower and the corner of the wall in the Sessorian gardens, where it turns sharp to the west, was a large reservoir, or Castellum Aquæ, for the Claudia; it is not at a sufficiently high level for the Anio Novus.

PLATE XI.

THE AQUEDUCTS AT THE PORTA MAGGIORE AND THE PORTA TIBURTINA.

[Illustration: XI.

THE AQUEDUCTS.—AT THE PORTA TIBURTINA.

A. MARCIA, TEPULA, JULIA, AND FELICE.

THE AQUEDUCTS.—AT THE PORTA MAGGIORE.

B. MARCIA, TEPULA, JULIA, AND FELICE; CLAUDIA AND ANIO NOVUS CROSSING OVER THEM.]

In the lower part of this plate is seen the Wall of Rome on the northern side of the Porta Maggiore, with the tomb of Eurysaces the Baker in front of it. The wall here makes an angle, and the section of it is shewn just beyond the gate; the Claudia and Anio Novus (which here passed over it) are shewn in section, the _specus_ of the Claudia being nearly square, that of the Anio Novus over it considerably higher in its proportions. The Marcia, Tepula, and Julia here pass under these at a right angle, and through the wall, which in that part is made by filling up the arches of the Claudian arcade of the aqueducts. A pier of the Marcian arcade is shewn in the lower part of the section. The Aqua Felice is carried between the Julia and the Claudia, and it continues on to the Porta Tiburtina, always at the same level, over the Marcian arcade, but between the gates it passes through higher ground, and is therefore in that part underground, but emerges on arches at the two ends, near the gates, as Frontinus mentions. The Claudian arcade terminated at a tower in an angle of the wall, just to the north of this view, and with a great reservoir within the wall. In the upper view the Porta Tiburtina is shewn, with the Marcia, Tepula, and Julia passing over it. The different levels of the old road and the new one are also shewn. The arch on which the aqueducts are carried has inscriptions upon it of the time of Augustus, A.D. 10, and is of his time; it is buried up to the springing of the actual arch; the jambs are entirely buried by the filling up of the foss-way, but the two arches of the time of Honorius, A.D. 405, are tall arches, standing on the ground at its present level; the raising of the level of the road, therefore, took place between A.D. 10 and A.D. 400.

PLATE XII.

ANIO NOVUS—NYMPHÆUM, WHERE THE TROPHIES OF MARIUS WERE HUNG.

A. SECTION OF THE TOWER AND ARCHES.

B, C. PLANS OF THE THREE STORIES.

[Illustration: XII.

THE AQUEDUCTS.—ANIO NOVUS.

AT THE NYMPHÆUM, WHERE THE TROPHIES OF MARIUS WERE HUNG.

A. SECTION OF THE TOWER AND ARCHES.

B. C. PLANS OF THE THREE STORIES.]

This Nymphæum is represented on one of the coins of Alexander Severus, and belonged to the great Thermæ of the third century on the eastern side of Rome, which, having been long in progress, are called by the names of different emperors of that period. The ground had been originally the Exquiliæ, the great burial-ground of the time of the Republic, afterwards the garden of Mæcenas; it is full of aqueducts of different periods, and at different levels, and there are several reservoirs for them, some underground, others at a higher level. This one was formerly considered to have belonged to the Aqua Julia, but on taking the levels it appears that the only water in Rome that is high enough to reach it is the Anio Novus, the highest of the aqueducts, and the water has been brought from a reservoir belonging to that, near the Porta Tiburtina; having just been brought along the high bank on which the Wall of Rome stands, part of an arcade of an aqueduct leading to it remains, coming from that gate. Near the Porta Maggiore there are

also remains of an aqueduct at a very high level, coming from the Anio Novus, but the construction of the arcade is of the third century. It is now part of the wall.

This Nymphæum or reservoir at that high level has several branches leading from it, one of which goes in the direction of the other great reservoir on the Esquiline Hill, called the _Sette Sale_, and this, from the high level, probably supplied the Sette Sale and the Thermæ of Titus and Trajan.

PLATE XIII.

RIVER ALMO. DIVISION INTO TWO BRANCHES, NOW A LOCH OF THE MARRANA.

[Illustration: XIII.

RIVER ALMO, NOW THE MARRANA.

DIVISION INTO TWO BRANCHES, NOW AT A LOCH OF THE MARRANA. PLAN, VIEW, AND SECTION.]

This loch is situated about half-way between the Tor Fiscale and the farm-house called Roma Vecchia, rather more than three miles from Rome, and a quarter of a mile to the left of the Via Appia Nova. The Almo is a mountain stream coming down from the Alban hills, often flooded in the rainy season and dry in the hot season, with a very deep bed called a foss. This bed was convenient for the engineers who made the mill-stream, now called the Marrana, in the twelfth century, and they used it when the ground was high and the foss deep; but in other parts, when the ground was low and liable to be flooded, they banked up the stream, or made a new channel for it on a raised bank, for sometimes half a mile together, then joined the old winding bed again for perhaps another mile. At the point where the division into two streams takes place, one branch is banked up and comes through Rome, the other remains in the deep bed and receives the surplus water from the loch, made at this point, and this second stream runs through the valley of the Caffarella, and has its mouth near the church of S. Paul f. m. The Plate shews the plan at the division, one section of the loch, and the lasher. The second stream has no other beginning than this division, and the deep bed or foss can be traced in its winding course by the side of the cross-road from the Via Appia Nova to S. Urban, at the head of the valley of the Caffarella.

PLATE XIV.

RIVER ALMO, NOW THE MARRANA.

ENTRANCE INTO ROME UNDER THE PORTA METRONIA.

[Illustration: XIV.

RIVER ALMO, NOW THE MARRANA.

ENTRANCE INTO ROME UNDER THE PORTA METRONIA.

A. ELEVATION, WITH THE BRIDGE UNDER THE GATE.

B. PLAN AND SECTIONS—A. B. THE BRIDGE; C. D. SECTIONS.

C. PLAN OF THE GROUND WITHOUT AND WITHIN THE WALL OF ROME.]

A. Elevation, with the bridge under the gate.

The lower bridge under the modern road is of the time of the Early Empire, and can be seen, though not without some little difficulty, by climbing upon the bank of the mill-stream, which now runs in the deep winding foss of the Almo, and makes a bend under the gate, as is seen in the small plan in the centre, marked M.

B. Plan and sections, longitudinal and transverse, of the bridge, with the gate upon it. The longitudinal section A B has the line of it, marked on the small plan M; the transverse section is marked C D.

C. Map of the corner of the Wall of Rome, shewing the great bend that it makes to the south at this point. The wall is indicated by the towers at short intervals, and the stream of water by its winding course. The roads within the walls, and the road on the outside under the wall are also indicated. The house shewn in the lower part, to the left in the plan, is believed to be on the site of that of

Crassipes, the father-in-law of Cicero, near the Via Appia. The stream after passing the road turns sharply round to the north, under the cliffs of the Aventine, and runs through the Vallis Murcia, in which the Circus Maximus was made, first having passed by the Piscina Publica, under that part of the Aventine on which the Reformatory of S. Balbina now stands.

PLATE XV.

RIVER ALMO. MOUTH IN THE PULCHRUM LITTUS. VIEW.

[Illustration: XV.

RIVER ALMO, NOW THE MARRANA.

MOUTH IN THE PULCHRUM LITTUS. VIEW.]

This is the mouth within the Walls of Rome from the earliest period, and it was here in all probability that the priests washed the blood off their knives, and not at S. Paul's, a mile outside the town. The remains of the early wall of tufa in this part are well shewn in the drawing, and the mouth for the stream to pass through, left when the wall was built. This was part of the second Wall of Rome, built when the peace was made between the Romans and the Sabines. The construction of that period, of the usual large blocks of tufa with very fine joints, is clearly shewn in the drawing.

PLATE XVI.

RIVER ALMO. MOUTH IN THE PULCHRUM LITTUS. PLAN.

[Illustration: XVI.

RIVER ALMO, NOW THE MARRANA.

PLAN OF THE MOUTH IN THE PULCHRUM LITTUS.]

In the Plan the old arrangement is clearly shewn, and the division of the stream into two branches, one of which now turns a mill-wheel, and is probably part of the alterations in the twelfth century,—this is the straight line. The other is probably the original end of the stream, or at least of this branch of it. The frequent change of the sand-banks by the great floods of the Tiber sometimes obscure this part. Advantage was taken of the water being low in the Tiber to get this plan and the view in Plate XV.

THE AQUEDUCTS.

PLATE XVII.

SOURCES OF THE AQUA APPIA.

[Illustration: XVII.

SOURCES OF THE AQUA APPIA.]

DESCRIPTION OF PLATE XVII.

SOURCES OF THE AQUA APPIA[233].

A. Spring in a very ancient stone-quarry on the bank of the river Anio, probably one of those from which Servius Tullius had obtained the stones for his great wall, which had been floated down the river on rafts. The spring is so filled up with broken stones that it looks like merely a pond formed by drippings from the roof and the earth above, but the shepherds are certain that it is a spring, and the water never fails.

B. Central reservoir where two streams meet and are united in one _specus_, which conveyed the water into Rome. The aperture in the rock above is not original, or it has been greatly enlarged. This was probably a well to draw water for the cattle, and to give air to the _specus_.

C. Two streams coming out of a sort of double cave, and meeting at the mouth of it, from whence they are carried across the meadow in a _specus_ open at the top for a certain distance, and having the appearance of a ditch only; but the water from this

spring also never fails, and these two streams united gave a certain steady supply to the aqueduct. The meadow through which these streams flow has a clay soil, and the water is always liable to be muddy after rain, and left a large deposit of clay in the _specus_, as is shewn in other plates.

THE AQUEDUCTS.

PLATE XVIII.

AQUA APPIA, OR APPIAN AQUEDUCT.

[Illustration: XVIII.

THE APPIAN AQUEDUCT PASSING OVER THE PORTA CAPENA AND THROUGH THE TOWER.]

DESCRIPTION OF PLATE XVIII.

AQUA APPIA, OR APPIAN AQUEDUCT.

Crossing the valley from the Cœlian to the Aventine upon the _agger_ of Servius Tullius and over the Porta Capena, this was the only part that was above ground, as we are told by Frontinus[234]. In this view the pavement of the Via Appia is seen in the foreground, then the wall of Servius Tullius, twelve feet thick, (as usual with the walls of the Kings;) by the side of this, to the left, is seen the arcade that carried the _specus_ of the aqueduct; this goes as far as the branch of the river Almo (now called the Marrana), which runs through the valley. On the further side of the stream the land is high, and the aqueduct is again underground, but it has been traced not only across the valley, but under the cliff on the northern side of the Pseudo-Aventine, with a branch to the left to supply the Piscina Publica, which was an enormous swimming-bath for the whole population of Rome at that period, extending as far as the north end of the Thermæ of Caracalla, where the hollow with the bank round it can still be seen, and where a great reservoir remains, lined with the cement called _opus signinum_ (or _coccio pisto_). The ruins of another great reservoir rebuilt in the time of Trajan are at the north-west corner, nearly under the Aventine, and are called the Piscina Publica.

THE AQUEDUCTS.

PLATE XIX.

PLAN AND SECTION IN A CAVE IN THE AVENTINE.

[Illustration: XIX.

AQUEDUCTS—PLAN AND SECTIONS IN A CAVE IN THE AVENTINE]

DESCRIPTION OF PLATE XIX.

PLAN AND SECTION IN A CAVE IN THE AVENTINE.

This is the same cave on the Pseudo-Aventine, nearly under the church and monastery of Santa Sabba, which has been before described when partially excavated (Plate III.[235]), but which has now, in 1875-6, been more thoroughly examined and made accessible.

A A. General Plan of this part of the _specus_ of the Aqua Appia, made into a stone-quarry for many years, and part of it still in use for that purpose, but another large part has been long out of use[236].

B. Entrances to the two parts, the steps distinguish that leading to the part excavated.

C C. Section of part of the cave-quarry.

D. View of that part of the _specus_ of the Aqua Appia which is built of squared stones, and has a terra-cotta water-pipe on each side of it.

E E. Longitudinal Section of this part.

F. Transverse Section of the same.

DETAILS OF THE PLAN A.

a a. Entrance to the cave or quarry.

b b. Via di San Paolo, the carriage-road to that gate.

c c. Via di Santa Sabba, the carriage-road up the hill to the south.

d. Via di Santa Prisca, the road up the hill to the north.

e e. The most perfect part of the _specus_ where it is built, and not merely a tunnel cut in the bed of tufa, as in other parts.

f f f f. Windings of the tunnels for the Aqueducts.

g g. Water-pipes of terra-cotta, by the side of the _specus_ in the part where it is built, and not merely cut out of the tufa.

h. The _specus_ half filled up with the deposit of clay.

i. Steps made to give access to the cave.

THE AQUEDUCTS.

PLATE XX.

THE JUNCTION AT THE WEST END OF THE CŒLIAN, NEAR THE CLAUDIUM.

PLAN AND SECTION.

[Illustration: XX.

AQUEDUCTS AT THE WEST END OF THE CELIAN]

DESCRIPTION OF PLATE XX.

THE JUNCTION AT THE WEST END OF THE CŒLIAN, NEAR THE CLAUDIUM.

PLAN AND SECTION.

A B C. Line of the Section.

a. Colosseum.

b. Claudium.

c. Arch of Dolabella.

d. Reservoir and Spring of water.

e. Aqueduct of Nero.

f. Cave-reservoir and Spring, with ten wells down into it, erroneously called a _vivarium_.

g g g. Porticus of the Claudium.

h. Church of SS. John and Paul.

i. —— S. John of Mata.

k. —— S. Maria in Domnica.

l. —— S. Gregory.

m. Clivus Scauri.

n. House of the family of S. Gregory the Great.

o. Villa Celi-Montana (formerly called Villa Mattei).

p. Vineyard of Marchese Rappini.

q. Ground called Orto Botanico.

r. Place of S. Gregory.

s. Arch of Constantine.

t. Meta Sudans.

u. Via Sacra.

v. Summa Sacra Via.

x. Proposed Drain, for turning off the water of this spring from the Colosseum.

y. Branch of an existing subterranean drain under the Via di S. Gregorio, between the Cœlian and the Palatine.

z. Excavation made in 1876 in the Vigna Rappini, in consequence of a land-slip; but nothing was found beyond an old quarry of tufa, at a great depth, and a branch of an aqueduct at nearly the same depth, the water having come originally from the spring in the cave (?) or quarry (?) called a _vivarium_.

THE AQUEDUCTS.

PLATE XXI.

SECTIONS OF THE SPECUS OF EACH OF THE FIFTEEN AQUEDUCTS OF ROME.

[Illustration: XXI.

SECTIONS OF THE SPECUS OF EACH OF THE 15 AQUEDUCTS OF ROME]

DESCRIPTION OF PLATE XXI.

SECTIONS OF THE SPECUS OF EACH OF THE FIFTEEN AQUEDUCTS OF ROME.

The names of each are given under the section of it, and it will be observed that no two are alike; this was no doubt done in order that the workmen might always know which aqueduct each belonged to, at the points where they cross each other, so that if there was any obstacle in one of them it might be readily removed. Some of those which came from a clay soil, as the Appia and the Virgo, were liable to get choked up by the quantity of deposit left by the water, and it was necessary to have them cleared out from time to time, as is still the case with the Virgo, now called the Aqua di Trevi. One of the small streams that were collected to form the Aqua Hadriana, which comes from near Gabii, was a petrifying spring, which quite choked up the _specus_ in the course of a century. It was restored by Alexander Severus, but the same water seems still to have been used. The Aqua Felice comes from the same sources, but the petrifying spring was carefully excluded, and now runs in a ditch, giving a coat of stone to the sticks and the weeds.

PLAN OF THE AQUEDUCTS. ON THE CŒLIAN.

[Illustration: AQUEDUCTS ON THE CŒLIAN AND ESQUILINE LEADING TO THE COLOSSEUM.]

PLAN OF THE AQUEDUCTS.

ON THE CŒLIAN[237].

Three branches diverge from the great central reservoir at the Arch of Dolabella,—one goes straight on, nearly due north to the Palatine, the second north-east to the Colosseum, and the third west to the Aventine.

AND ON THE ESQUILINE.

From the other great reservoir called the Sette Sale, or the Thermæ, and from thence to the Colosseum.

A.A.A. The drain under the road between the Cœlian and the Palatine, now called Via di S. Gregorio, leading to the Via Appia.

B. Arch of Constantine.

C. Meta Sudans.

D. Thermæ of Titus on the Esquiline, with the great _piscina_ called Sette Sale, and the aqueduct leading from it to the Colosseum.

E. Monastery and Church of S. Gregory.

F. Site of the Porta Capena, with the aqueduct over it, leading to the Piscina Publica under the Aventine: and on to the mouth at the Porta Trigemina, in the bank of the Tiber.

G. Church and monastery of SS. John and Paul.

H. Church and monastery of S. Clement.

I. The great reservoir and Piscina of Nero over the Arch of Dolabella, and reservoir of the Aqua Appia to the left of it; this is underground in the garden of the Villa Celimontana, and from thence the _specus_ goes underground to the cliff of the Cœlian, where another _piscina_ is shewn, near the bottom of the plan, to the left.

Under that part of the Cœlian Hill on which the Claudium stood are seen four _piscinæ_, two on the western side opposite to the Palatine, and two on the northern side opposite to the Colosseum; of these latter the one at the corner is of the time of Nero, that in the middle of the northern front is of the time of Alexander Severus, when the upper storey of the Colosseum was building of stone.

MAP OF THE AQUEDUCTS ON THE EASTERN SIDE OF ROME.

[Illustration: MAP OF THE AQUEDUCTS ON THE EASTERN SIDE OF ROME

Whiteman & Bass, _Photo-Litho' to the Queen_, 236, Holborn]

This map is reduced by photography from one made for this work on a very large scale, which was thought necessary in order to shew the line of the course of each aqueduct, which, being to a large extent subterranean, are not shewn in the usual maps of the country. In the immediate neighbourhood of Rome the lines are so complicated that they could only be shewn on this large scale. (At the Tor Fiscale, for instance, they remind English travellers of the railways at Clapham Junction near London. There are many coincidences between the aqueducts and the railways; both are carried at different levels in order to cross each other; both are in some parts in tunnels, and in other parts carried on embankments, or on arches). This map was made by Signor De Mauro, an engineer and surveyor, who took much interest in the work, and is generally very careful and accurate, under the direction chiefly of Dr. Fabio Gori, who is a native of Subiaco, near which the principal aqueducts have their sources. The author of this work went with them from time to time to verify what they had done, but as it was a work of several months, and necessarily done in the summer, it was not practicable for him to do more than to go to the source of each aqueduct and follow it down to its mouth. The large map, which covers one side of a room, being 135 ft. long and 90 ft. wide, has been reduced by photography to three different sizes; the first makes eighteen photographs of the usual size, called the "normal size," and the whole on this scale is about 15 ft. long and 10 ft. wide; this again has been reduced to two sheets[238], 21 ins. long and 14 ins. wide; and then to the same size as this outline; but on this small scale the lettering requires a powerful magnifying-glass, and therefore the bare outline has been taken from it to shew the general features of the line of the great aqueducts. The reservoir at the source of each is marked by a dark circle, and from each of them the line can be traced into Rome. Within the walls a separate and careful examination was required, as so much of the work is subterranean; this examination has been made, and the line of each of the aqueducts has been traced to its mouth. It will be observed that the _specus_ or conduit of each aqueduct is of a separate form, and this was no doubt necessary to distinguish one from the other, as they frequently intersect and cross one another in a very singular manner, and in case of repair being necessary, it would have been very difficult for the workmen to know which aqueduct was at fault, or how to find the part that wanted repair, without this arrangement.

1. The earliest aqueduct, the APPIA[239] (B.C. 312), being entirely underground at a considerable depth, is marked by a dotted line. It comes from old stone quarries on the bank of the river Anio, just beyond the Caves of Cervaro, about eight miles from Rome, near the ancient Via Collatina, called by Frontinus Prænestina, because in his time the road to Præneste went through Collatia.

2. ANIO VETUS[240] (B.C. 272), comes also from the bank of the river Anio, but at a much higher level than the Appia, between Tivoli and Subiaco, near the village of Agosta, twenty miles from Rome, but the winding course makes the whole length of the aqueduct 42 miles, 779 paces underground, and 221 paces (about 350 yards) above ground on a substructure. It is brought at a considerably higher level than the Appia, but still underground for the most part, though near the surface, and sometimes only half underground. It was not legal to build over an aqueduct anything but another aqueduct, consequently the later aqueducts are all brought on the same line, each on a higher level, so that the line of the Anio Novus, carried on the arches of Nero, shews at the same time the line of the Anio Vetus nearly under it.

3. MARCIA[241] (B.C. 145). This stream also comes from near Subiaco, 39 miles from Rome, 36 on the Via Valeria, and 3 off it on a cross-road, near the village of Arsoli. There is a small lake 38 miles from Rome on the same road (which is another source of this aqueduct), into which the water gushes out from under the limestone rock; it is intensely cold in all weathers, and the water is of a light green colour in the lake. “The length of the course is 61 miles 710 paces, of which 54 miles 247 paces are underground, 7 miles 463 paces above ground, on an arcade for 6 miles 472 paces, on a substructure for 528 paces,” and in several places on bridges across the gorges in the hills. This water was brought into Rome again in 1860-70 by a new line, and was then called Aqua Marcia Pia, from Pius IX.; the name of Pia has since been dropped.

4. VIRGO[242] (B.C. 21), made by Agrippa for his Thermæ, restored to use by the popes in the eighth century, and frequently repaired; now called the Aqua di Trevi, from the fountain so named. The source is on the Via Collatina, 8 miles from Rome and 1 mile beyond the source of the Appia. There are several springs, each with a separate small reservoir, collected in one large reservoir, now under the road. “The length of the course is 14 miles 105 paces.”

5. TEPULA[243] (B.C. 126). The sources of this are 12 miles from Rome, near Grotta Ferrata and Marino, 2 miles from the old Via Latina.

6. JULIA[244] (B.C. 34). This source is on the cross-road from Grotta Ferrata to Marino, on the old Via Latina, 14 miles from Rome, and also 2 from the Via Latina (there are still washing-places at each of these two sources). The two streams, when they arrived on the level ground at the foot of the hill, were carried on the same arcade as the Marcia for 6 miles into Rome.

7. AUGUSTA[245]. This name is a mistake of the artist for Aurelia; it is the aqueduct made by Marcus Aurelius for the Villa de Quintilii on the old Via Appia, and united with the Severiana to supply the Thermæ Aurelianæ et Severianæ in Rome.

8. ANIO NOVUS[246] (A.D. 52). “The source of this is 42 miles from Rome, on the Via Sublacensis; the length of the channel is 58 miles 700 paces, of which 49 miles 300 paces are underground, 9 miles 400 paces above ground, 2 miles 3 paces in the upper part and near the City, 609 paces on substructure, 6 miles 491 paces on an arcade of the highest arches, in some places 109 ft. high.” This stream was part of the river Anio itself; a great dam was made across the river in a rocky part, about 2 miles above Subiaco. A great loch (_lacus_) was formed between this dam and a natural cascade about a hundred yards higher up the river, and a _specus_ was cut in the rock by the side of it at rather a lower level than the top of the dam, so that the water of the river must go into the _specus_ and so into Rome, before any of it could fall over the artificial cascade made by the dam. From this cause the water of this aqueduct never failed in the hottest and driest weather, but it was sometimes muddy after a flood in the upper country, and had many _piscinæ_ or filtering-places for that reason; there is usually one at each half mile in the arcades near Rome, and a _castellum aquæ_, or reservoir along with it, at each of the angles, made to break the force of the water.

9. CLAUDIA[247] (A.D. 38). The source of this is 38 miles on the Via Sublacensis, just above Subiaco, about 2 miles nearer to Rome than the Anio Novus. They are carried in two distinct _specus_ as far as Tivoli and to the foot of the hill, but on the level ground; both _specus_ are carried on a lofty arcade, which turns at an angle at every half-mile, and there has a _piscina_, and at each of these points it was carried across the lower arcade, which served for the Marcia, Tepula, and Julia.

10. HADRIANA or TRAJANA[248] (A.D. 120), and ALEXANDRINA (?). The sources of this are under La Colonna, about three miles from Gabii. The _specus_ is carried on a fine arcade for two or three miles between the two great roads. The same water was afterwards used for the Felice, with the exception of one of the springs, which was found to be of a petrifying quality, and had choked up the _specus_ of the old aqueduct. It seems probable that the stalactite produced by the petrifying spring had choked up the _specus_ of Trajan and Hadrian before the time of Alexander Severus, that he restored it to use, and it was then called by his name. The construction of the Piscina and Castella Aquæ near the source is distinctly of the time of Hadrian, but in some parts the arcade which carries the _specus_ is of the time of Alexander Severus.

11. SEVERIANA[249] (A.D. 190). The sources of this are in a swampy ground on the lower part of one of the Alban Hills, under Marino and Grotta Ferrata, nearly the same as those of the small river Almo, and the Tepula and Julia. The course is at first underground as far as the Torre di Mezza Via di Albano; from thence it is carried on a fine arcade of the third century to the Villa de Quintilii, and from thence into Rome for the Thermæ of Aurelius Commodus and Septimius Severus, near the Porta Latina.

12. ALEXANDRINA (?)[250]. There is some doubt about the source and the line of this aqueduct.

13. ALGENTIANA[251]. This aqueduct went to the Thermæ of Diocletian, where the _specus_ has been found, but it is almost the same as the last. Both were probably branches from the great early aqueducts.

14. AQUA FELICE[252], A.D. 1587. Made by the Pope, Felice Peretti, or Sixtus V. Its source is the same as that of the Hadriana, which was mistaken in his time for the celebrated Aqua Marcia.

15. AQUA MARCIA PIA. The real old Marcian water was brought into Rome by a Company in 1860-70. The course as far as Tivoli is in a stone _specus_, like the old aqueduct, but after it reaches the level ground it is carried in cast-iron pipes on the other side of the river Anio, and passes under it by a great syphon. This was to avoid repeating the great circuit made by the old aqueduct, and was also done to escape the necessity of crossing the mouths of the number of small streams that fall into the river Anio and drain the Campagna; these are often flooded in the wet season, and would have been likely to injure the bridges of the aqueducts where they crossed the stream; the iron pipes avoid them by being on the other side of the river.

MAP OF THE AQUEDUCTS ON THE WESTERN SIDE OF ROME[253].

[Illustration: MAP OF THE AQUEDUCTS ON THE WESTERN SIDE OF ROME

Whiteman & Bass, _Photo-Litho' to the Queen_, 236, Holborn]

The account given of the map of the eastern side of Rome applies almost equally to this, but the difficulty to be surmounted was here greater. Neither Dr. Gori, nor Signor De Mauro, nor the author knew the ground; we had only Frontinus and Fabretti to help us, and the course is much more subterranean on this side than on the other. There are none of the great arcades to carry the _specus_ for five or six miles; the only portion where they are carried on an arcade for any distance is on the side and upon the wall of the garden of the villa Pamphili-Doria, and there the arcade as seen is the work of Pope Paul V. (Borghese), who restored them to use in the sixteenth century, making use of the old subterranean _specus_ and the ruins of the old arches, which can be seen against the wall of that garden. From this point they are mostly subterranean, we traced them to the three lakes which served as reservoirs for them. The first _specus_ on this side of the Lacus Alsietinus has been kept separate from the one on the other side. In the time of Augustus the water came from the two upper lakes, but it was brought at a very low level, and the water from these being always muddy and bad, Frontinus, under Trajan, rejected it, and brought the water only from the Sabatina; Pope Paul returned to the use of the upper lake, Alsietina.

This map is also reduced by photography from one on a much larger scale, though not so large as the one for the eastern side, as that was found inconveniently large, and on this side there was less complication to examine and explain. Great credit is due to Signor de Mauro for the tact with which he traced the subterranean lines. He found that there are wells and air-holes at intervals, not always regular, but nearly so, and that when they are in grass-land or barren land, shrubs have always grown over the top of each well on account of the moisture that remained in it, and by means of these shrubs he was able to follow the line.

These aqueducts, which supplied the fountains in the Trastevere, all come from the lakes on the hills. The Alsietina of Augustus comes from the lake of that name (now called Martignano), between the Via Claudia and the Via Aurelia, but not very near to either, being 6½ miles from the Via Claudia at the fourteenth milestone, as Frontinus states. This was made to supply the Naumachia of Augustus, which were near the present monastery of S. Cosimato in Trastevere; the water was very abundant, but not fit for drinking. It entered Rome at a lower level than any of the other aqueducts, because the Naumachia were very little above the level of the Tiber. At the small town called the Cariæ (near the present Osteria Nuova), about fifteen miles from Rome, it received an additional supply of water from the Lacus Sabatinus. Trajan restored to use that part which came from the latter lake; this is better water than the Alsietina. Pope Paul III., A.D. 1540, again restored this to use, and it is now called Aqua Paola. His engineers brought the water from three lakes, the two before mentioned, and a smaller one above the Alsietina, called Stracciacappe. The object of bringing the water from this very high level, 500 ft. above Rome, was to supply the splendid fountains in front of S. Peter's, the water of which rises to a great height. This lake was drained in 1870, and at the same time the water in the Alsietina was also much lowered, by which means the three _specus_ were brought to light on the bank, and the sites are shewn on this map. The

Aqueduct of Trajan was carried at a much higher level than that of Augustus, and entered Rome on the top of the Janiculum. Procopius, in the sixth century, admired the profuse supply of water at that point; and the water was then, as it is now, used for a series of mills on the slope of the hill. The engineers of Pope Paul made use of the water of all the three lakes, and a most abundant supply still flows into Rome through the Fountain, above the Church of S. Pietro in Montorio. How far the old _specus_ was used it is difficult to tell, but most probably that of Trajan was used for a large part of the distance; it is almost entirely underground until the last mile into Rome, where it was carried on an arcade of the time of Trajan. The Aqua Paola is there also carried on an arcade, parallel to it and near to it, but not the same.

FOOTNOTES

[1] During the first season that I was resident in Rome, it was my habit to go with my friend Mr. William Long, of Balliol College, Oxford, then resident in Rome, into the Catacombs every Monday morning, and along the line of the Aqueducts also once or twice a-week, when the weather permitted. We procured all the best maps of the Campagna that were to be had, but could find none that would enable us to trace the course of the Aqueducts. Moltke's map is the best as far as it goes; but, being intended as a military map only, he paid no attention to the antiquities. The one known in England by the name of Gell, and in Rome by the name of Nibby, is made especially for the Antiquities; but it is on a small scale, and we found it impossible to trace the Aqueducts upon it. Eventually I have had one made on a large scale, to make it clear, have added the other Antiquities, and then had it reduced by photography to two smaller sizes: one very small, to give the general lines only; the other on a size convenient for the pocket; and, by using the portion near Rome separately, it makes a good and convenient map for the purpose.

[2] Frontinus is usually said to have died A.D. 106.

[3] See notably Plutarch, Vita Anci Marcii; Dionys., Hal. Ant. Rom., lib. iii. c. 679, sect. 9; Strabo, lib. v.; Cassiodorus, lib. vii. cap. 6, &c.

[4] These wells may have included the cisterns for holding rain-water, one of which exists on the Palatine.

[5] In the best text, that of the MS. at Monte Cassino, and in the best printed edition of the text, that of Buecheler (Lipsiæ, 1858), the passage runs "Salubritatem enim ægris corporibus afferre creduntur, sicut _Camænarum, et Apollinis, et Juturnæ_." The spring of the Camænæ or Muses referred to, is that which existed in the grove outside the Porta Capena, and beneath the western slope of the Cœlian. There was an Area Apollinis in the same Regio, and possibly there was a spring there; but no writer refers to it. A stream, now subterranean, still exists, and is very copious, running into and through the Cloaca Maxima; it may be seen in the excavations of the Forum Romanum. This subterranean stream comes from three different springs; the source of one is near the Arch of Titus, or more immediately in front of the usual entrance to the Palatine;—a second has its source near the foot of that part of the Quirinal Hill on which the Torre de' Conti and the Torre delle Milizie are situated; it now emerges in a cellar under a shop behind the church of S. Hadriana;—a third comes from the prison of S. Peter, at the foot of the Capitol. These streams meet near the church of S. Maria Liberatrice and the celebrated three columns of the temple of Castor and Pollux; by their union they formed the lake usually called after Curtius, but by Ovid the Lacus Juturnæ (Ovid. Fasti, l. i. ver. 708). This is not the same as the stream so called on Nolli's Map. The lake was between that part of the Velabrum of the Palatine on which the church of S. Maria Liberatrice and S. Teodoro are situated, which formed the southern side of the lake, and the Forum Romanum the northern side.

The Aqua Juturnæ, marked 1056 in Nolli's Map, is the stream that gushes out in great volume from the rock at the foot of the Palatine in the Lupercal of Augustus, which is now in a very ruinous state, the cave being used as a mill-head to a modern mill, between that point and the Cloaca Maxima. This cave is close to the Carceres of the Circus Maximus. The authority for the name of this stream is doubtful; it is now usually called Aqua Argentina, and falls into the Cloaca Maxima, near the church of S. Giorgio in Velabro and the arch erected by the silver-smiths in honour of Septimius Severus.

[6] The Augustan is a name applied also to a branch of the Marcian close to its source, as well as to one supplementary to the Appian within the city.

[7] Frontinus, c. 5.

[8] Ibid.

[9] "Jungitur ei ad Spem [Specum] veterem in confinio hortorum Torquatianorum et Pallantianorum ramus Augustæ, ab Augusto in supplementum ejus additus, ... loco nomen respondenti Gemellarum." (Ibid.)

[10] “Incipit distribui [Aqua] Appia imo Publicii clivo ad portam Trigeminam.” (Ibid.)

And again: “Rivus Appiæ, sub Cœlio monte et Aventino actus, emergit, ut diximus, infra clivum Publicii.” (Ibid., c. 22.) The cave reservoir which formed the mouth of this stream, where it was distributed, has been found near the Marmorata, or marble-wharf. The Porta Trigemina was between that and the Salaria, or salt-wharf. Both of the wharves are still in use. Some good antiquaries consider that the Porta Trigemina consisted of three double gates, at intervals along the narrow strip of ground between the Aventine and the Tiber, and that the one of which remains have been found near the Sublician bridge was the middle one of the three: if so, this cave would be literally _in_ the Porta Trigemina. In any case, it must have been close to it.

[11] That is, in the reservoir, or _castellum aquæ_, through which the conduit or _specus_ passed. This reservoir exists, or rather considerable remains of it, just within the Porta Maggiore, between that and the church of S. Croce, and just outside the _agger_ of the Sessorium, on which the road from S. Croce to this gate now runs.

[12] “... Cujus aquæ ad caput inveniri mensura non potuit, quoniam ex duobus rivis constat. Ad Gemellos tamen, qui locus est infra Spem (_Specum_) veterem, ubi jungitur cum ramo Augustæ, inveni altitudinem aquæ pedum quinque, latitudinem pedis unius, dodrantis: fiunt areæ pedes octo, dodrans: ... quas esse ex eo adparet quod in plerisque urbis partibus perdita aqua observatur, id est quæ ex ea manat, sed et quasdam fistulas intra urbem illicitas deprehendimus, extra urbem autem propter pressuram libræ, quam vidi infra terram ad caput pedibus quinquaginta, nullam accipit injuriam.” (Frontinus, c. 65.)

[13] There is good reason to believe that such tombs were not _exclusively_ Etruscan, but were also used by the Latins and other nations at the same period, and this one may very well be early Roman.

[14] The modern carriage-road, so called, was called Via Gabina in the time of Frontinus. The old Via Prænestina is now a bridle-road only for the first three miles out of Rome, to the Torre de’ Scavi; it is then a cart-road, called Via Collatina, with a branch road into it from the present carriage-road.

[15] In the Map of Gell and Nibby, along the Via Prænestina will be seen the name _Pupinia_. The spot is just north of this, and not far off from the piece of road marked in the same map as the Via Collatina.

[16] Frontinus, c. 22.

[17] In the _Bullettino dell’ Instituto Archeologico_, and the _Civiltà Cattolica_, for the year 1861, it is stated that for the works of the iron railroad between the Via Labicana and the Via Gabina the _specus_ of the Aqua Appia was found, 450 yards (metres) from the Porta Maggiore. It was constructed of square stone of tufa, and was incrusted with _tartar_, had an acute vault, which was 5 ft. 9 in. high, and 2½ ft. wide.

[18] This is on the line of the wall of Servius Tullius. It appears that Trajan made a reservoir here over the old one. The _specus_ of the Appia passes through the present gardener’s house lengthwise, from east to west. This _specus_ was found again in another excavation to the west of it, by the side of the present road.

[19] “Substitit ad veteres arcus _madidamque_ Capenam.” (Juvenal, sat. iii. ver. 11.) “Capena grandi porta qua _pluit gutta_.” (Martial, lib. iii. epigr. 47.) The distance from the foot of the Cœlian to the Marrana is just a hundred yards along the line of the wall of Servius Tullius, across this part of the valley or great primitive foss. The ground on the side of the wall is all made earth and rubbish, and two aqueducts are carried on arcades against the wall, one on either side. These arcades have not been traced beyond the Marrana, the ground there being higher. At the Piscina Publica, where another pit was dug 20 ft. deep, the wall is built against the tufa rock, and there is a third _specus_ in a tunnel in the rock under the wall.

[20] Or perhaps the road was a deep foss-way, and the _specus_ passed over the arch of the gate at this point, where four roads meet.

[21] In the spring of the year 1870, another excavation was made close to this point, and a way was found into another old subterranean stone-quarry long out of use. Through this cave, or quarry, the _specus_ of five different aqueducts pass on their way to the Tiber. Some of these come down at a steep decline, and the water of the whole seems to have been carried into the lowest one, the Appia, at this point. This _specus_ must have been carried over the deep foss-way upon or under the arch of the gate of the old wall of _the city_, where four roads meet. It is also visible again in another old subterranean stone-quarry on the other side of the road, nearly under S. Prisca, and from thence it must have gone to the old cave, used as a reservoir near the Marmorata, and the Porta Trigemina, immediately under the monastery of S. Maria del Trinita di Malta, where the _specus_ is again visible, and

where the wells of other aqueducts run into the same cave reservoir at the mouth of the aqueducts in this part of Rome. One of these runs down a vertical pipe from the reservoir nearly over this cave, but under S. Sabina on the hill above, excavated in 1865, and described by M. Descemet (Sect. xi.) There is another large reservoir in the interior of the hill, still full of water, supplied by a spring rising there; the water from this still passes through the same passage to the Tiber. This is also said to have been called the cave of Faunus by the poets. It is probably also the same as that of Cacus, being a large natural cave, with a spring of water, and a natural reservoir of considerable size in it about knee-deep, the entrance to which is by a narrow passage made into the _specus_ of the aqueduct. Such a cave might very well have been used to drive cattle into for concealment, and a resolute, well-armed man standing at the entrance might defend it against any number. Solinus (i. 7) says that the cave of Cacus was at the Porta Trigemina, and that he dwelt in the Salinæ, which are close by this spot. “Qui Cacus habitavit locum cui Salinæ nomen est, ubi Trigemina porta.”

[22] On the wall of the smaller reservoir, the fragment of an inscription, relating to the Thermæ of S. Helena, now in the Vatican Museum, is said to have been found:—

D. N. HELENA ... VEN. ... AVG. MAT. AVIA ... BEATIS ... THERMA ... SI ... ESTRV ...

[23] Frontinus says, c. 5, at the sixth milestone on the Via Prænestina, about nine hundred and eighty paces off to the left, and near the Via Collatina, this stream has its source. The sources both of the Aqua Appia and of the Augusta were traced by Signor Fabio Gori and Mr. J. H. Parker, in March, 1868, and were afterwards shewn to the British Archæological Society of Rome.

[24] The source of the _Appia_ was 780 paces off the road, between the 7th and 8th milestone. That of the _Augustan_ 880 paces off, and by the 6th milestone. The former was measured to its termination, giving 11■ miles. The latter went only to the “Specus Vetus” (which is two miles less) and gave 6■ miles. Two miles is the distance from the Porta Maggiore to the Porta Trigemina and the Salaria. In all probability the Augustan branch was carried for the six miles into Rome along the bank of the Via Prænestina, here a deep foss-way between two high banks; and at a later period the Aqua Virgo was carried over it at a higher level, till within about half a mile of Rome, where it arrives at the outer bank of the great foss, and is carried at a sharp angle to the north to the Pincian. The Appia, being much deeper, was carried straight on at the bottom of the great foss into Rome, and entered at the extreme eastern corner, under the line afterwards taken by the Claudian arcade, to the two great reservoirs or _gemelli_ before mentioned; the main line running here parallel to it, a little to the south, till it reached the Piscina of S. Helena, the two lines converging at the _gemelli_.

[25] There are considerable remains of two large reservoirs in a garden just outside of the boundary-wall of the Sessorium, which wall is of the time of S. Helena, on its western side. Some excavations made in them in 1869 under my direction shewed that they went to a great depth, the workmen being stopped by water. These two great reservoirs, so close together in the line of the Aqua Appia, seem to have been the Gemelli mentioned by Frontinus. From this point the _specus_ can be traced along the Cœlian, and the reservoirs are below the level of that _specus_ (_infra specum veterem_).—F. ii. 65.

[26] If the “Plautian” be the better reading, they may have been the gardens of Plautius Lateranus, which were near those of the Sessorian Palace.

[27] Frontinus, cap. 19: “Marcia autem partem sui post hortos Pallantianos in rivum qui vocatur Herculaneus, dejicit.” Cap. 20: “Finiuntur arcus earum (Anionis Novi, et Claudiæ), post hortos Pallantianos.” Cap. 69: “Præterea (Julia) accepit prope urbem, post hortos Pallantianos.” In the _Notitia_ and the _Curiosum Urbis_ the “Horti Pallantiani” are given as being in the Regio V. or the “Esquiliæ.”

[28] Remains of these _thermæ_ were accidentally brought to light in 1871, during some excavations made by a building company, who had bought the ground on speculation. They are of great extent, and on both sides of the present road from S. Maria Maggiore to S. Croce in Gerusalemme, which was made in the sixteenth century by Sixtus V.

[29] “Exquiliæ locus in quo sepeliebantur corpora extra portam illam in qua est Sessorium.” (Acron ad Horat., lib. i. Sat. viii.)

“Eodem tempore fecit Constantinus Augustus basilicam in palatio Sessoriano, ubi etiam de ligno S. crucis D. N. Jesu Christi posuit.” (Anastasius in vita S. Silvestri papæ, xxxiv. § 41.)

[30] Frontinus, c. 6. Pyrrhus was king of Epirus, and came to the aid of the Samnites against the Romans; he was conquered _c._ B.C. 272.

[31] The passage is corrupt, as will be explained. The following is the reading, as given by Buecheler, whose text is _an exact copy_ of the best manuscript, that of Monte Cassino:—“Anio Vetus citra quartum milliarium _infra Novum_, _qui_ a via Latina in Lavicanam _inter_ arcus trajicit, et ibi piscinam habet. Inde intra secundum milliarium partem dat in specum, qui vocatur Octavianus, et pervenit in regionem _viæ Novæ_ ad hortos Asinianos, unde per illum tractum distribuitur. Rectus vero ductus, _secundum Spem_ (_Specum_) veniens intra portam Exquilinam, in altos rivos per urbem deducitur.” (Frontin., c. 21.) _Infra Novum_, therefore, signifies within the fourth mile on the Via Nova, the New Road of the time of Frontinus, the Via Appia Nova (?).

[32] Frontin., c. 18.

[33] Signor F. Gori, who is a native of Subiaco, and has followed the line of the aqueducts on foot from Subiaco to Rome, says that he has found the source of the Anio Vetus in the river Anio, at three miles from Subiaco, on the _Via Sublacensis vetus_, twenty miles from the old gate of Tibur or Tivoli, in the district called _Le Connotta_, where he finds two _specus_, the higher one the Anio Novus, the lower one the Anio Vetus. He traces the same _specus_ near Marano, a village thirty-eight miles from Rome, on the Via Sublacensis Neroniana, near _Vico-varo_; and again near Tivoli, on the bank of the _Valle degli Arci_. “Delle vere Sorgenti dell’ Acqua Marcia e delle altre acque allacciate dai Romani presso le Vie Valeria e Sublacense,” per F. Gori. Roma, 1866, 8vo., pp. 53, 54.

[34] The local _patois_ for _Albergo_ or _Auberge_.

IMP. CAESAR DIVI. F. AVGVST. EX . S.C. dclix. P. CCXL.

IMP. CAESAR . DIVI. F. AVGVST. EX . S.C. dclxix. P. CCXL.

[35] By the side of a plan of Rome in the first volume of his magnificent work (pl. xxxviii.), Piranesi gives a section of the relative heights of the Aqueducts, as compared with each other. The figures refer to the base of each _specus_ above that of the Appian, and the following is the result, according to his measurements, reduced to English feet:—

Above Specus of Appian. Palmi. Feet.

Anio Novus 173.8 127 Claudian 163.2 119 Julian 145.1 106 Tepulan 138.7 101½ Marcian 128.7 92½ Anio Vetus 75.4½ 55½ Virgo 9.3 7 Appian — —

At a lower level than Specus of the Appian.

Alsietina in the Trastevere 37.6½ 27½

He gives as the total full range, i.e. from the _specus_ of the Alsietina (the lowest), to that of the Anio Novus (the highest), as 211.2½ _palmi_, or 154½ English feet. The height of the Appian, he shews by his diagram to be about 24 English feet above the Quay of the Tiber. The points at which Piranesi obtained his measurements, and the mode employed, are not recorded. It seems hardly possible that the Appia is 55 ft. under the Anio Vetus in Rome.

[36] See ante. Frontinus, cap. 21.

[37] The passage, as it stands in the Codex Cassinensis, is, “Anio Vetus _citra_ quartum miliarium _infra_ novum _qui_ a Via Latina in Lavicanam _inter_ arcus trajicit, et ipse piscinam habet.” This piscina is visible at the third modern milestone on the Via d’Albano, and at the fourth on the Via Latina. The Codex Vaticanus is an inferior copy of the Codex Cassinensis; but the Codex Urbinas, now also in the Vatican Library, is distinct. No other MS. is of any authority.

[38] Remains of the tombs on the Via Latina are distinctly visible and rather prominent objects, close to the Torre Fiscale. The Marrana, or Almo, the small stream that received the surplus water of the aqueducts, also washes the foot of the tower.

[39] This _castellum aquæ_ is exactly two miles from the Porta Maggiore, another proof that the entrance _to Rome_ (though not to the City) was considered by Frontinus to have been at that gate. All the aqueducts on the eastern side of Rome are measured by him from this gate, and the inscriptions put over that gate as the entrance into Rome indicate the same thing. The level of this _castellum_ above the sea is about 153 ft.; at the Porta Maggiore, where the Anio Vetus enters Rome, it is about 146 ft., allowing a descent of about 3 ft. 4 in. for the two miles, which is natural. The Via Appia Nova, in the part near Rome, was made out of the old Via Asinaria. Frontinus says that this branch “was conveyed to the Asinian gardens,” which were between the Lateran and the Sessorium, and to which the Porta Asinaria (or gate of the Asinii) was the entrance. Between that gate and the Amphitheatrum

Castrense are remains of an ancient reservoir or _castellum aquæ_, cut in the rock at the foot of the wall and half underground, as was very usual with the Anio Vetus. The branch that goes along the Via Latina appears to have gone from the same reservoir, but to be distinct from the one mentioned by Frontinus, and to have been made after his time. This last branch seems to be the same as the Aqua Antoniniana of the Regionary Catalogue, having been made in the third century to supply the great Thermæ of the Antonines. In the Middle Ages, this was considered to have been a branch of the Aqua Marcia; but if this had been the case, there must have been some remains of the arcade for it across the valley.

[40] This branch is believed to have been called AQUA ANTONINIANA, as it conveyed water to supply the great Thermæ of the Antonines, called after Antoninus Caracalla. But it seems doubtful whether it may not be the SEVERIANA, which conveyed water to the Thermæ of Septimius Severus. There appear to have been two aqueducts along this point of the Via Latina at different levels, and the higher one, passing over the Arch of Drusus, is said to have been a branch from the Marcia.

[41] Frontinus, c. 21. On the subject of the word _Spes_ (?) or _Specus_ (?), see the Appendix to this Chapter.

[42]

ANI_o_ IMP . CAESAR DIVI . F . AVGVST . EX . SC VII PCCXL

_i_MP . CAESAR DIVI . F . AVGVST . EX . SC VI_i_ PCCXL C

[43] “Descrizione del luogo denominato anticamente Speranza Vecchia, del monumento delle Acque Claudia ed Aniene Nuova, e del Sepolcro di Marco Virgilio Eurisace, dell’ architetto cav. Luigi Canina.” 8vo., Roma, 1839, with six Plates; extracted from the Annali dell’ Instituto Archeologico.

[44] There are two other temples known to have been dedicated to Spes, and the one near the Porta Carmentalis is thus entered in the _Notitia_ and _Curiosum Urbis_: “Fortunæ et Spei Templa _Nova_.” We know that there had been a great fire here, and that these temples were rebuilt, and therefore the _Nova_ has reference only to the new structure. Besides, to be analogous, it should have been “Spes Nova,” or “Templum Spei Novæ.” According to Dionysius, another Temple of Spes was a mile or eight _stadia from the City_. (Dion. Hal., ix. 24.) “Having in the first battle, which was fought at the distance of eight stadia from _the City_, near the temple of Hope, overcome the enemy and beaten them out of the field, and after that fought them again near the gate called Collina,” &c. The Porta Maggiore, in the outer wall of _enceinte_, is just a mile from the Porta Esquilina, in the inner wall of _the City_, and the Arch of Gallienus. On the other hand, the line of the _specus_, with the foss-way by the side of it, must have been important ground for a battle. The modern theory that the whole of the eastern side of Rome was called after Spes, has no ancient authority. Another instance is on all accounts very puzzling. It is a passage in Lampridius, in the life of Heliogabalus: “Ipse secessit ad hortos Spei Veteris, quasi contra novum juvenem.” (Lampridius, Antoninus Heliogabalus, 13.) It would almost appear that there were some gardens called by the name of Spes, unless indeed in transcribing some such error should have been made as in the case of the transcriber of Frontinus, and “Spei” written for “Specus,” by a scribe to whom the former word was familiar but the latter not, who had mistaken _Spc■_ for _Sp■_. It is a strong passage in favour of the temple theory; but still there is strong evidence on the other side. This garden was that of the Sessorium, one side of which was enclosed by the arcade carrying the _specus_ of the Claudian aqueduct.

[45] The seven places where the abbreviation of _spem_ or _specum_ occurs in Frontinus are given in another page, with tracings of these passages from the best manuscript.

[46] Polenus and Buecheler have demonstrated that the Codex Cassinensis is the earliest and best. It was discovered at Monte Cassino by Poggio in the fourteenth century. The Codex Vaticanus is a copy of the above; but the Codex Urbinas, though of later date, is not a copy from that manuscript. Probably both are copies from an earlier one, not now extant. Some of the various readings in the Codex Urbinas are better than those of the Codex Cassinensis. See the edition of Frontinus by Polenus, Prolegomena, p. 20. Patavii, 1722, 4to.

[47] Other excavations, made in 1871 in the large vineyard near the Porta Maggiore, near the building called Minerva Medica, shewed the aqueducts very distinctly passing through the higher ground and going along the line of the wall towards the Porta di S. Lorenzo.

[48] Frontinus, c. 87.

[49] Piranesi, Le Antichità Romane, vol. i. pl. x.

[50] I am indebted to the kindness of the abbot of the monastery at Monte Cassino, for the tracings of these passages here reproduced by the process of photo-engraving.

[51] The manuscript called _Codex Urbinas_ reads, _jungitur ei ad anionem veterem_. In the present instance, the true reading is evidently _specum_. Frontinus is describing the Aqua Appia, the oldest of the aqueducts, and the junction of the Augusta with the old _specus_. This could have nothing to do with the Anio Vetus.

[52] _ascus_ (?): Buecheler reads this _ad spem_.

[53] The Torquatian Gardens were near the Porta Maggiore, and probably the same as those of the Sessorium, now those of Santa Croce in Gerusalemme.

[54] Canina published a volume on what he considered to be the Temple of Spes, by the side of the Porta Maggiore (as before mentioned); but a few years afterwards those ruins were pulled down to make room for a modern guard-house. In doing so, the inscription of the dedication to HERCULES was found by the architect, Felice Cicconetti, and sent to the Vatican Museum. This statement was made to me some years since by Signor Cicconetti himself, and was confirmed by his friend, Signor Simelli, the photographer, who said he had seen it.

The fact is now denied by the Roman archæologists, and when challenged by the Cavaliere Visconti to shew him the inscription in the Vatican Museum, they say they cannot now remember anything about it; and the stone with the inscription upon it has not been found. It is printed by Dr. Henzen in his collection of Inscriptions as _then_ in the warehouse of the Vatican Museum; but he considers it to have belonged to a wayside altar only, not to a temple.

The twin reservoirs are very near the same spot; but the place where the Aqua Appia enters Rome is in the gardens of the Sessorium, some distance from the gate, to the east of it. An old _specus_ certainly runs along the Cœlian Hill, nearly under the Neronian Arcade, and part of it is now used for the Aqua Felice. I have been along it for more than a quarter of a mile, from near the Porta Maggiore to the Lateran. The Aqua Felice is carried down a sharp incline into that old _specus_, and the metal pipes on the slope are still supported on brickwork of the first century, probably part of the Marcian Arcade, when rebuilt in that part by Frontinus. The old _specus_ runs on (or ran on, it is said to be now interrupted,) to the reservoir on the Cœlian Hill, at the Arch of Dolabella.

That a part of the eastern side of Rome went by the name of _Spes Vetus_, is said to be proved by a curious graffito upon the bottom of an amphora, found in 1871 in the excavations in the Exquiliæ, near the Porta Maggiore, of a cobbler's stall, in that district:—

TYCHICI SVTORIS A. SPEM VE TERE.

This piece of _terra-cotta_ is of the first century of the Roman Empire; but _at what period_ the name and address of the cobbler was scratched upon it, is a question not so easily answered.

[55] The Aqua Claudia and Anio Novus enter Rome at the extreme eastern point on a lofty arcade, which formed the northern boundary of the Sessorian gardens, and was incorporated in the Wall of Aurelian. This extends for about a quarter of a mile; it then turns at a sharp angle to the north, and passes over the Porta Maggiore, to its final reservoir in a tower at an angle to the north of that gate. But part of the water of the Claudia and the Anio Novus united, was carried straight on along the bank on which the arches of Nero stand, to the Cœlian Hill and the reservoirs at the west end of it. The temple, called by Canina _Spes_, stood near the angle where the water was divided into two distinct channels, between that point and the Porta Maggiore.

[56] The name of _Porta Esquilina_ is here given to the Porta Maggiore, the outer gate on the road to the Esquiline. The same name was also given to the inner gate in the _agger_ of Servius Tullius; but there must always have been an outer gate also in the outer _mœnia_, or bank and wall for enclosure, which was a necessary part of every fortified city. (The same name, _Porta Angelica_, is still given to both the inner and the outer gate of the Leonine City, near the Vatican.) The high streams were carried on this bank to the Porta Viminalis of Frontinus, now called the _Porta di S. Lorenzo_. The remains of these three aqueducts can be plainly seen on entering through the city wall close to the Porta Maggiore, on the north side, and going along on this bank to the Porta di S. Lorenzo. The _specus_ is visible at both ends, carried on arches. In the middle the ground is higher, and the _specus_ pass through it underground, and then emerge and are carried again upon arches, exactly as described by Frontinus. The Aqua Felice is carried _over_ the three aqueducts of the Marcian arcade; it is on arches twenty feet from the ground at each end, and in the middle, where these three are underground. The lower part of the _specus_ of the Aqua Felice almost touches the ground,

while the other three are underground.

[57] The _gemelli_ are, in all probability, the large twin reservoirs just outside the western wall of the Sessorium, now in a large vineyard near the Porta Maggiore, through which the Neronian arches pass. These reservoirs are below the level of the _specus_ of the Anio Vetus, as was shewn by some excavations made in them under my direction in 1869.

[58] Some of the water had been thrown into the old _specus_ at the junction of the Claudian with the Neronian arches.

[59] There are remains of more than one _specus_ crossing the valley from the Cœlian to the Aventine upon the _agger_ of Servius Tullius, and passing over the Porta Capena at the foot of the Cœlian. One of these was the Marcia, from the reservoir over the Arch of Dolabella, which is near the site of the Claudium and Temple of Claudius. There were great reservoirs for the aqueducts at this point on different levels; one of them underground is still in use, the remains of the others are among the most picturesque objects in Rome. This passage cannot apply to the temple of Hope, which is full a mile away from the Aventine.

[60] “Quum hæc accepta clades esset, jam C. Horatius et T. Menenius consules erant. Menenius adversus Tuscos, victoria elatos, confestim missus. Tum quoque male pugnatum est, et Janiculum hostes occupavere: obsessaque urbs foret, super bellum annona premente, (transierant enim Etrusci Tiberim) ni Horatius consul e Volscis esset revocatus: adeoque id bellum ipsis institit mœnibus, ut primo pugnatum ad Spei sit æquo Marte, iterum ad Portam Collinam. Ibi quanquam parvo momento superior Romana res fuit, meliorem tamen militem, recepto pristino animo, in futura prœlia id certamen fecit.” (Livii Hist., lib. ii. c. 51.)

[61] “Romæ fœdum incendium per duas noctes ac diem unum tenuit: solo æquata omnia inter Salinas ac Portam Carmentalem cum Æquimælio Jugarioque vico. In templo Fortunæ ac matris Matutæ et Spei extra portam late vagans ignis, sacra profanaque multa absumpsit.” (Ibid., lib. xxiv. c. 47.)

[62] “Comitia deinde a prætore urbano de senatus sententia plebisque scito sunt habita: quibus creati sunt quinqueviri muris turribusque reficiendis: et triumviri bini; uni sacris conquirendis donisque persignandis; alteri reficiendis ædibus Fortunæ et matris Matutæ intra Portam Carmentalem, sed et Spei extra portam, quæ priore anno incendio consumptæ fuerant.” (Livii Hist., lib. xxv. c. 7.)

[63] “Theatrum et proscenium ad Apollinis, ædem Jovis in Capitolio, columnasque circa poliendas albo locavit: et ab his columnis, quæ incommode opposita videbantur, signa amovit: clipeaque de columnis, et signa militaria affixa omnis generis dempsit. M. Fulvius plura et majoris locavit usus: portum et pilas pontis in Tiberim; quibus pilis fornices post aliquot annos P. Scipio Africanus et L. Mummius censores locaverunt imponendos; basilicam post argentarias novas et forum piscatorium, circumdatis tabernis, quas vendidit in privatum; et forum, et porticum extra Portam Trigeminam, et aliam post navalia, et ad fanum Herculis, et post Spei ad Tiberim ædem Apollinis Medici.” (Ibid., lib. xl. c. 51.)

[64] “Sive autem medii montes erunt inter mœnia et caput fontis, sic erit faciendum, uti specus fodiantur sub terra librenturque ad fastigium,” &c. (Vitruv., _De Architectura_, lib. viii. c. 6. § 3.)

[65] “Alexandria est fere tota suffossa, specusque habet ad Nilum pertinentes, quibus aqua in privatas domos inducitur.” (Aulus Hirtius, _De Bello Cæsaris Alexandrino_, cap. 4.)

[66] Frontinus, lib. i. c. 7. He also quotes from Fenestella concerning the delays which occurred, and speaks of the Decemvirs consulting the Sybilline books, and being supposed to have found that it was not the Marcian but rather the Anio which should be brought into the Capitol: (“Invenisse dicuntur, non esse aquam Marciam, sed potius Anionem in Capitolium perducendam.”) Eventually, however, Marcius prevailed, and his plan was carried out.

Pliny also refers to the work of Marcius: “Sed dicantur vera æstimatione invicta miracula; Q. Marcius Rex jussus a senatu aquarum Appiæ, Anienis, Tepulæ _ductus reficere_, novam a nomine suo appellatam cuniculis per montes actis intra prætura suæ tempus adduxit.” (Nat. Hist., lib. xxxvi. c. 121; see also further details in Plin., xxxi. 41, and ibid.)

[67] “Qui lapide quadrato ampliores ductus excitavit, perque illos aquam quam acquisiverit rei publicæ commodo, trium millium opera fabrorum duxit cui ab auctore,” &c. These words are wanting in the best manuscript, that of Monte Cassino. In place of them we have “(... priores ductus restituit et tertiam illam aquarum in urbem perduxit) cui ab auctore,” &c. This does not agree with the opinion of the learned, that the Urbinas Manuscript is a copy of the one at Monte Cassino, unless great liberties were taken with it. The fact that the arcade with the _specus_ of the aqueduct is always built of large squared stones, is strongly in favour of the Codex Urbinas. It is also certain from the nature of the work, that a large number of men must have been employed upon it. This

passage seems to have been omitted in the Codex Cassinensis, which is a proof that the Codex Urbinas is not a _copy_ from it. Dederich, p. 15, suggests after “commodo,” the words “trium millium opera fabrorum.”

[68] Frontinus, lib. i. c. 7.

Frontinus states in another chapter (c. 12) that Augustus brought underground another stream, which should be supplementary to the Marcian whenever the dryness of the season rendered extra supply necessary. It was called from the name of the contriver, Augusta, and had its rise above the spring of the Marcian. This additional _ductus_, or Specus Augusta, was 800 paces long.

[69] Frontinus, c. 18.

[70] “Salientibus aquis instruxit urbem.” Ibid., c. 9.

[71] Ibid., c. 87.

[72] Ibid., c. 8.

[73] Ibid.

[74] Ibid., c. 9.

[75] Ibid.

[76] Frontinus, c. 19.

[77] ‘The three aqueducts’ in this passage may mean either the Anio Vetus, the Marcia, and the Claudia, all of which come from the neighbourhood of Subiaco, and follow the same line on the bank of the river Anio, and the cliffs above it as far as Tivoli, but diverge considerably between Tivoli and the Piscinæ; or it may mean that the Tepula and the Julia coming from near Marino, and the Marcia coming from Tivoli, meet at this point—both are true. The _piscinæ_ of the Claudia, the Anio Novus, the Marcia, the Tepula, the Julia, are all within half-a-mile of each other.

[78] Dr. F. Gori says that the lake of S. Lucia, in the territory of Arsoli, near Subiaco, is _not_ the source of the Aqua Marcia, but of the Aqua Claudia only, and that the sources of the Aqua Marcia are nearer to Subiaco, and are called by the people _Acque Serene_. He also considers that the branch of the Aqua Augusta added to the Marcian by Augustus, now called _Le Rosoline_, comes from near the village of Agosta, and that the spring, now called _La Fonte_ (_Fons novus Antoninianus_), added to the Marcian by Antoninus Caracalla, is under the same village of Agosta. One of the inscriptions on the Porta S. Lorenzo records this. See Delle varie Sorgenti dell’ Acqua Marcia, &c., pp. 56, 57.

[79] The new company had at first proposed to draw their chief supply of water from the small lake called the Lago di S. Lucia, which is nearer to Rome, and which they had been misinformed was the Aqua Marcia. Dr. Fabio Gori, from his great local knowledge and his archæological researches, was able to shew that this was a mistake, and wrote to that effect a letter in the Roman newspaper called the _Osservatore Romano_. This letter at first gave great offence, and a very warm controversy was carried on for some time on that subject. Eventually, however, a new engineer of the company thought it better to examine the ground himself, and the result was to establish that Gori’s views were perfectly correct. He then became a warm advocate for the company, which he thinks entitled to great praise for the admirable manner in which its works in the valley of the Anio have been carried out as far as Tivoli. Their works almost equal those of the time of the Empire, and are carried out on the same principles; but from Tivoli to Rome the water is carried in metal pipes, and not in a stone _specus_ as it is above Tivoli. This enables the company to carry it in a more direct line.

[80] See the Appendix to this Section.

[81] A great deal too much importance has been attached to this Cyclopean Masonry, _Opus Cyclopæum_. See the Chapter on the Construction of Walls.

[82] It is probably the case that part of this supply was brought in metal pipes only, from the evidence of this inscription. A stone _specus_ passes under the wall on the bank round three sides of the camp on the exterior of the walls, and is plainly visible at the north-east corner; but this agrees with the general character of the Anio Vetus, and was probably a branch from that aqueduct.

The inscription is as follows:—

IMP. CAES. M. OPELLI . SEVERI . MACRINI . AVG M. OPELLI . SEVERI . DIADVMENIANI . CAES. PRINC. IV CASTRIS . PRAETORI TERENTIVS . CASSANDER . FECIT

[83] “[Honorius, Papa III.] Ecclesiam Sanctæ Bibianæ juxta formas aquæ Martiæ cum Monasterio Monialium restituit.” (Ciaconi, Vitæ Pontif. Roman., &c., vol. ii. col. 46, C.)

[84] An inscription recording repairs by Agrippa is said by Ligorio to have been found on a _cippus_ of travertine at the third mile on the Via Latina. The genuineness of this is doubted by Fabretti, because the number of miles does not agree; but it seems more probable that this was an error in transcribing, than that the inscription should be forged without any motive for doing so:—

AQVAE . IVLIAE . TEPVLAE. IMP. CAES. DIVI . IVLI . F. AVGVSTVS . PONTIF. MAX. COS. X■I■I■. TRIB. POT. X■I■X■. IMP. X■I■I■I■. CVRANTE M. VIPSAN . AGRIPPA . AEDIL . CVRVL . L. C. C. P. MILL. X.

Another inscription, also recording repairs of the time of Augustus, was found by Fabretti himself, in the Vinea Bartholomæi Virginii, two miles from the Porta Maggiore, between the ruins of the arcades of the Marcian and Claudian, and was preserved in a private museum:

IVL. TEP. MAR. IMP. CAESAR. DIVI . F. AVGVSTVS. EX. S. C. LXIII. P. CCXI.

[85] _Marrana_ is a general name for a running stream in the Campagna round Rome, probably a provincial word; but it is also the special name of this particular stream coming from Marino.

[86] “Tepula concipitur via Latina ad decimum milliarium, diverticulo euntibus ab Roma dextrorsus millium passuum duum ... inde suo rivo in urbem perducebatur.” (Frontinus, c. 8.)

[87] It is the building pointed out in guide-books as “The House of Cicero,” although there does not appear to be any historical ground for this name.

[88] “... ad milliarium ab urbe duo-decimum via Latina, _diverticulo_ euntibus ab Roma dextrorsus millium passuum duum alterius aquæ proprias vires collegit et Tepulæ rivum intercepit. Acquisitæ aquæ ab inventore nomen Juliæ datum est, ita tamen divisa erogatione, ut maneret Tepulæ appellatio.”—(Frontinus, c. 9.)

[89] “Præter caput Juliæ transfluit aqua quæ vocatur Crabra. Hanc Agrippa omisit.”—(Frontinus, c. 9.)

[90] Pag. clxxxii. 8, “In tubulo plumbeo reperto ad portam S. Laurentii,”—

P. CORNELIO . DOLABELLA . C . IVN . SILANO . COS—AQVA . MAR

[91] Gruter, pag. clxxxiii. 4,—

Q. AQVILLIO . SABINO . II. SEX . AVR . ANVLLINO CASTR . PRÆT . L. VRBIS . OFF . PED . COS . CCCLXXXIII. AQVA . MARC

[92]

HAC RIVI AQVAR TRIVM EVNT CIPPI POSITI IVSSV A. DIDI. GALLI T. RVBRI. NEPOTIS M. CORNELI FIRMI CVRATORVM AQVAR

[93] Frontinus, c. 10.

[94] “Concipitur Virgo via Collatia ad milliarium octavum palustribus locis, _signino circumjecto_ continendarum scaturiginum causâ.” _Signinum_ is the particular kind of cement to hold water, always used to line the walls of the Aqueducts. It was not used after the time of the Empire, and the art of making it is said to be lost. It is the usual characteristic of the remains of an aqueduct.

[95] Frontinus, c. 10.

[96] Ibid., c. 22.

[97] This water is now usually called Acqua di Trevi, because its terminus is at the great fountain of Trevi. The sources are in the estate of Salone, as above described. It is still in use, and was long considered as the best water brought into Rome. The line now used is the one repaired and restored by the Popes; but, near Rome, it has been altered, probably after it had been damaged by the Goths or the Lombards. The old _specus_ passed through the Catacomb of S. Priscilla, in the Via Salaria, where it may be

seen. This is demonstrated by the _cippus_ of the aqueduct of Virgo, discovered in the Via Salaria, and so recorded by Muratori, Thes. Vet. Inscr., ccccxlii. 7, “Romæ in Via Salaria:”—

VIRG. TI . CÆSAR . AVG. PONTIF . MAXIM. TRIB. POT. XXXVIII. COS . V■. IMP. V■I■I■I■. I. P. CXL.

This inscription is A.D. 36.

It was then brought to the bank or _mœnia_ on which the wall of Aurelian was afterwards built near the Porta Salaria, and may be traced upon or in that bank under the present wall of Rome for about a mile. For a short distance, where this ground is low, it was carried on an arcade, of which there are remains under the wall built upon it. After this it goes on as far as the garden of the Villa Borghese and the French Academy, under which it now passes through the Pincian Hill.

[98]

TI . CLAVDIVS . DRVSI . F. AVG. GERMAN. PONT. MAX. TRIBVNIC. POT. V. IMP. IX. P.P. COS. III. DESIG. IIII. ARCVS . DVCTVS . AQVÆ . VIRGI NIS . DISTVRBATOS . PER . C. CÆSAREM . A. FVN DAMENTIS . NOVOS . FECIT . AC . RESTITVIT

This inscription was erected A.D. 46.

[99] There are remains of the Septa in the cellars under the houses on the west side of the Corso, in its lower part. These remains of the arcade are now chiefly underground, owing to the filling up of the great foss, called in this part Via Lata, because the wide foss under part of the Quirinal and of the Capitol had at one time been made into a wide street or place, on the eastern side of which is situated the Church of the “SS. Apostoli in Via Lata” and that of S. Maria in Via Lata on the western side, at the north-west corner. The great public building called the Septa went down the western side of this wide place from S. Maria to the Venetian Palace, with an arcade towards the street or place, of which many of the arches remain in the cellars. These arches under the church of S. Maria are absurdly called the house of S. Paul. They are visible also under the Palazzo Doria to the south of that church, and in other cellars.

[100] “Idem et Virginem adduxit ab octavi lapidis diverticulo duobus millibus pass. Prænestina Via.

“Juxta est Herculaneus rivus quem refugiens Virginis nomen obtinuit.” (Plinii Nat. Hist., lib. xxxi. c. iii. § 25.)

[101] Of this stream and its introduction into Rome in the twelfth century, an account will be found in the second part of this chapter.

Frontinus, c. 15 and 19.

[102] Frontinus, c. 11.

[103] Ibid., c. 18.

[104] Ibid., c. 71.

[105] The draining of the lakes in the hills round Rome is a great mistake, and very injurious to the health of the city. Such lakes are a wise provision of nature for collecting some of the surplus water in the rainy season, and preserving it for use in the hot and dry season, when the evaporation from the lakes helps to cool the air. The water also drawn from these lakes was most useful for the irrigation of the country round Rome, and watering the gardens in Rome itself, thereby promoting vegetation, which is essential for health in a hot and dry climate. It is well known that the leaves of plants and trees (more especially of deciduous trees) absorb _nitrogen_, which is the part injurious to human life, and give out _oxygen_, that portion which is beneficial to, and necessary for, human life. Where there is no vegetation, therefore, the climate cannot be healthy, and without water there can be no vegetation; for water is the necessary food of plants.

[106] The line of this subterranean aqueduct can also be traced by the wells descending into the _specus_, in the same manner as the Aqua Appia was traced in 1870, that is, by the bushes growing at the top of each of the wells, and generally enclosed by a wooden railing to prevent animals from falling into them.

[107] The rock in which the tunnel is cut is a sort of peperino, hard and rough, covered with a bed of clay.

[108] This lake, called Sabatina in the time of Frontinus, was called Anguillara in the Middle Ages, and is now called Bracciano, in both cases from the names of the proprietors. The great family of Anguillara had their origin from this village, of which they were the proprietors, and where they had a castle on the bank of the lake. The present proprietors are the Dukes of Bracciano. The lake

produces a great abundance of fish, especially a small fish much resembling the white-bait of London, at least when cooked.

[109] There is a small construction over this flood-gate, and at the back of it is this inscription:—

ACQVA PAOLA ALLA PRESA DELL' ACQVA ALSEATINA

[110] There are interesting remains of the Necropolis of this ancient city close to the fountain before mentioned, on each side of a deep ravine. On one side, there are nine chambers cut out of the rock on the edge of the cliff, the entrance being in the central chamber, with four others on either side of it. All are full of small square _columbaria_, of very early character. On the opposite side of the ravine, is a similar series of tombs, but in a less perfect state.

[111] There is _Opus Reticulatum_ of rude and early character (more like the _Opus Incertum_ of the Emporium than the mausoleum of Augustus) at the entrance of this passage, which is mentioned by Nibby. There is a stone-quarry also at the entrance, of the hard, dark-coloured stone used for making roads, and excellent for that purpose. This is the same stone that is called _selce_ or _silex_ in Rome, and seems to be similar to the hard lava under which Herculaneum is buried, and of which there are quarries near the tomb of Cecilia Metella.

[112] The persons employed by Mr. Parker went down to the bottom of this steep tunnel-passage to ascertain this.

[113] Nibby, Analisi storico-topografico-antiquaria della carta de' Dintorni di Roma, tom. i. Roma, 1837, 8vo. art. _Alsietina_.

[114] Cassio, Corso delle Acque, vol. i. p. 147.

[115] Nibby considers this a mistake, and is of opinion that the water was the Sabatina, not the Alsietina; but the mistake is made by Nibby himself, not by the engineers of Pope Paul, who certainly brought the water from the Lacus Alsietina and the other small lake above it (as mentioned on p. 50). By the draining of these lakes, the aqueduct is _now_ made to depend on the Lacus Alsietina only. The sources of the Alsietina are very different from those of the Sabatina. The former was taken by Augustus from the lake Alsietinus, now called Lago di Martignano, and the latter by Trajan from the sources between the lake Sabatinus and the villages of Vicarello, Bassano, and Oriolo. The Alsietina was at the lowest level of all the aqueducts, and the Sabatina at the highest. The first _specus_ was for the most part subterranean, and the other was carried upon arcades for part of its course.

[116] By the more usually received computation, the second year of Caligula would be A.U.C. 791; and the year of the consulship of Sulla and Titian, A.U.C. 805.

[117] It surpassed all the others _in quantity_, and being the highest, was used to supply the others when the water fell short; but the water was not so good for drinking.

[118] Frontinus, c. 13.

[119] That is, higher than any other aqueduct.

[120] Frontinus, c. 20.

[121] The road to Subiaco.

[122] Frontinus, c. 14.

[123] Ibid.

[124] Ibid.

[125] Ibid., c. 18.

[126] _In Subruino_ is the reading given in the text by Dederich. _In suo rivo_ is the reading adopted by Polenus, Jocundus, and other editors. A third reading has been suggested, "In Simbrivio," or in Simbruino, that is, referring to the Simbruine hills. This is the reading of Buecheler (1868), who follows verbatim the manuscript of Monte Cassino. The reading, however, bears little upon the evidence.

[127] _Herculaneus Rivus._ This is not the same _Herculaneus Rivus_ as the one mentioned by Frontinus in connection with the Anio Vetus, in ch. 19. The same name is given in these places to different streams, all strong and rapid.

[128] Frontinus, c. 15.

[129] Ibid., c. 93.

[130] Ibid., c. 91.

[131] Frontinus, c. 76.

[132] “At ex alia parte Anio in monte Trebanorum ortus lacus tres amœnitate nobiles, qui nomen dedere Sublaqueo defert in Tiberim.” (Plinii Nat. Hist., iii. 109.)

[133] The inhabitants of Filettino probably belonged to the tribe of the Trebani, or of Trebula, who were located in the neighbourhood of Trevi, where was a Roman colony and principality. Inscriptions giving the names and titles of Augustus, Septimius Severus, and Commodus, were found here, and are published by Signor Gori in his Trattato dell’ Acqua Marcia, &c., 12mo., 1866, p. 37. Another inscription at Anagni, on the front of the Governor’s palace, gives the name of Publius Vecellius, curator of the Republic of the Trebani.

Martial mentions the Treba Augusta of Frontinus, under the name of Trebula:

“Trebula nos genuit, commendat gratia duplex Sive levi flamma, sive domamur aqua.” (Lib. v. epigr. 65, and lib. xiii. epigr. 33.)

Livy also mentions it: “Eodem anno Arpinatibus Trebulanisque civitas data.” (Livii Hist., x. 1.)

[134] IMP CAESARIS NERVAE TRAIA(_ni_) ... OP(T)IMI AVG GERMANIC DACICI.

[135] “Lacus monasterii ad nihilum redactus, quia duo monachi levaverunt duo lapides, qui fuerunt firmati cum aliis petris; et sic aqua destruxit.” (Chronicon Sublacense, apud Muratori, Rer. Ital. Script., tom. xxiv. col. 962, D.) The author of this Chronicle was living in the year 1390.

[136] Gruter, Inscriptiones, p. clv. 4.

[137] Probably the text of Frontinus here is corrupt, because the Piscina Limaria and the _specus_ of Claudius are at the forty-sixth mile on the Via Sublacensis, “ad milliarium quadragesimum _secundum_,” for “Ad milliarium quadragesimum _sextum_.”

[138] Dr. Fabio Gori, who is a native of Subiaco, claims the credit of being the first person to point out what this great work of Trajan really was. He also states that the Rivus Herculaneus, rising at thirty-eight miles on the Via Sublacensis, must have been a clear stream, which he finds on the left side of the river, opposite to the lake of S. Lucia and to this source of the aqueduct of the Claudia, called Acqua dell’ Arco, or water of the aqueduct.

[139] Frontinus, c. 72.

[140] The _piscina_ made in one of the towers in the wall at the point where it enters Rome, has the four chambers visible, the inner wall of the tower having been destroyed.

[141] Inscriptions on the Porta Maggiore:—

TI . CLAVDIVS DRVSI F. CAISAR AVGVSTVS GERMANICVS PONTIF MAXIM TRIBVNICIA POTESTATE X■I■I■. COS. V. IMPERATOR X■X■V■I■I■. PATER PATRIÆ AQVAS . CLAVDIAM EX FONTIBVS . QVI VOCABANTVR CAERVLEVS ET CVRTIVS . A MILLIARIO X■X■X■X■V■.

ITEM ANIENEM NOVAM A. MILLIARIO L■X■I■I■. SVA IMPENSA IN VRBEM PERDVCENDAS CVRAVIT.

IMP . CAESAR . VESPASIANVS AVGVST . PONTIF . MAX . TRIB. POT. I■I■. IMP. V■I■. COS. I■I■I■. DESIG. I■I■I■I■. P.P

AQVAS CVRTIAM ET CAERVLEAM PERDVCTAS A DIVO CLAVDIO . ET POSTEA INTERMISSAS DILAPSASQVE

PER ANNOS NOVEM . SVA IMPENSA VRBI RESTITVIT.

IMP . T. CAESAR DIVI F. VESPASIANVS AVGVSTVS PONTIFEX MAXIMVS . TRIBVNIC

POTESTATE X. IMPERATOR X■V■I■I■. PATER PATRIAE . CENSOR . COS . V■I■I■I■.

AQVAS CVRTIAM ET CAERVLEAM PERDVCTAS A DIVO CLAVDIO ET POSTEA

A DIVO VESPASIANO PATRE SVO VRBI RESTITVTAS . CVM A CAPITE AQVARVM A SOLO VETVSTATE DILAPSAE ESSENT . NOVA FORMA REDVCENDAS SVA IMPENSA CVARVIT. (Orelli, vol. i. p. 77, Nos. 54-56.)

These inscriptions shew that considerable repairs were made by Vespasian and Titus to the Claudian aqueducts; and these repairs were continued by their successors, Nerva, Trajan, and Hadrian. Many parts and branches belong to the time of these Emperors.

[142] Vide “Delle vere Sorgenti dell’ Acqua Marcia,” &c., “trattato di Fabio Gori.” Roma, 1866. An admirable map shewing the sources and the line of each of the Aqueducts, has been made for me under the direction of the author.

[143] Frontinus (c. 15) gives the length of the _specus_ of the Anio Novus as 58 miles and 700 _passus_; add to this the length of the Piscina Limaria and of the three lakes, and we have the distance of 62 miles from Rome for this aqueduct.

[144] “Qui colles, (mons Cœlius et Aventinus,) priusquam Claudia perduceretur, utebantur Marcia et Julia. Sed postquam Nero Imperator Claudiam, opere arcuato altius exceptam, usque ad templum Divi Claudii perduxit, ut inde distribueretur, priores non ampliatæ, sed omissæ sunt: nulla enim castella adjecit, sed iisdem usus est, quorum, quamvis mutata aqua, vetus appellatio permansit.” (Frontinus, c. 76)

[145] The large square part of the Cœlian Hill, with scarped cliffs round three sides of it and part of the fourth, which had probably been originally the _arx_ or citadel of the Cœlian when that was a separate fortress, and on which Claudius erected some great public building with a temple, is marked on the modern maps of Rome as a _castellum aquæ_: this is an exaggeration. A _specus_ runs along the western side opposite to the Palatine in the wall, and goes straight towards the Colosseum, and there are remains of a piscina of the first century at the north-west corner of the Claudium, near the Colosseum, and the Meta Sudans; but this is at a low level, and does not agree with there being a large reservoir under the whole of that space.

[146] Frontinus did not live to see this completed.

[147] Cap. 86, 91, 92, and 105.

[148] These are at present almost hid by modern houses built up against them, but it is expected that these modern erections will shortly be removed. The remains of the bridge project at a right angle from the palace of Domitian. It had the aqueduct at the top at a very high level, and a road for horses by the side of it at a lower level, as at the Ponte Lupo, Ponte S. Antonio, and other bridges of the aqueducts.

[149] These imperial “Edicts” or “Decrees,” or Laws and Constitutions, have been published in various works. The later ones relating to this subject are published by Polenus, in the Appendix to his edition of Frontinus, 4to. Pataviæ, 1722; and by Rondelet, as a supplement to Frontinus, who had published those issued up to his time. See Commentaire de Frontin sur les aqueducs de Rome, 2 parts, 4to. and atlas folio, Paris, 1802; and Rondelet, Opere, 6 vols. 4to. Mantova, 1841, tom. vi. p. 117, &c.

[150] This water was celebrated for its coolness, as mentioned in the life of Alexander Severus by Lampridius, c. 30.

[151] The new company for bringing these springs into Rome again, under the name of the Aqua Marcia-Pia, has been obliged to make compensation to the town of Tivoli for the possible injury to the manufactories established there, which depend upon the force of the water, although the damage was in a great degree imaginary. This new aqueduct brings the water of the Marcia only. The water is nearly of the same quality as that of the Claudia, and is still found as cool as it was in the time of the early Empire, notwithstanding that it is brought into Rome in metal pipes for the last ten miles. A number of shops for the sale of this cool water have been opened in different parts of Rome. Nature never changes, and the same qualities of particular springs which prevailed two thousand years ago, prevail still. It is said by persons who have witnessed the experiment tried, that in the hot summer weather of Italy, when the thermometer of Fahrenheit stands above 100, the contrast between the heat of the air and the coldness of the water is so great that if a glass tumbler is suddenly put into the water near its source, the glass will break in the same manner as a glass tumbler will break in England if boiling water is poured into it in frosty weather.

[152]

In the above the _m_ = to the Roman mile = 1,000 Roman passus. _p_ = to the Roman passus = 5 Roman feet. The Roman mile (_mille passus_) = 1,618 English yards. The Roman passus = 4 English feet 10·428 inches. The Roman foot = 11·6496 English inches.

[153] The Roman foot was nearly as long as our own, being, according to the most accurate estimate, about 11½ English inches (11.6496).

[154] Frontinus, c. 24.

[155] Dederich reads “unciæ in popularibus rationibus adhuc observantur,” which seems better. The _uncia_ was an Italian, the _digitus_ a Greek measure.

[156] It is evident from his making the square of the diameter ³⁄■■ greater than the area of the circle drawn upon the same diameter, that he takes the ratio of the area to the diameter as ¹¹⁄■■ to diameter 1. This is very near to the truth. The converse as given by him also agrees, as is seen by ¹¹⁄■■ + ³⁄■■ of ¹¹⁄■■ = 1.

[157] Frontinus, c. 65.

[158] It is of little consequence, but perhaps it may be interesting to know more accurately the result of the calculation. If we take 1.25 as the diameter of the quinary, and multiply the square of this by 0.7854 (the corrected ratio), we obtain the result in square digits, 1.22718. This multiplied by the 1825 gives 2239.6, that is, the result within one digit as given by Frontinus.

[159] An Anglo-Roman company has now (1872) brought the Aqua Marcia (III.) again into Rome at so high a level, that it will supply cisterns at the tops of the houses. At present a number of ingenious contrivances are in use for sliding small buckets of water from the well or reservoir in the courtyard, to the upper windows and galleries round the central courts of the old houses or palaces. These reservoirs, whether large or small, are called _lacus_ by Frontinus and in the Regionary Catalogue.

[160] The expression _reddita_ would imply that originally the Marcian had supplied the Aventine, and that, it having been superseded by the Claudian, it was now restored and used in addition to the other. See the extract—Frontinus, c. 76.

[161] Frontinus, c. 89.

[162] Ibid., c. 90, 91.

[163] The division of the surface water from the sewerage, in the question of the drainage of large towns, is meeting with much favour, as it appeals to reason that what is good for the purposes of manure, is destructive to the healthy condition of the river, while the surface water, which finds its proper place in the river, interferes with the proper distribution of sewage. In Rome, there is frequently a small _specus_ or channel for pure water, contrived in the vault or upper part of the great _cloacæ_ or drains for the refuse water. Could not the same plan be adopted in London with advantage? But while this is canvassed, it seems singular that we hear little of the division of the _supply_, which, on the same principle, should certainly be divided. There are several towns so situated, that a fair supply of pure water might be brought very acceptable for drinking, but not in sufficient quantities to be applicable to other offices. The words of Frontinus are very concise and pointed:—

“Marciam ut ipsam, splendore et frigore gratissimam, balneis ac fullonibus et relatu quoque fœdis ministeriis deprehenderimus servientem. Omnes ergo discerni placuit, tum singulas ita ordinari, ut in primis Marcia potui tota serviret, et deinceps reliquæ secundum suam quæque qualitatem aptis usibus assignarentur, sicut Anio Vetus pluribus ex causis, quo inferior excipitur minus salubris, in hortorum rigationem atque in ipsius urbis sordidiora exiret ministeria.” (Frontinus, c. 91, 92.)

[164] See C. C. J. Bunsen’s _Beschreibung der Stadt Rom._ Stuttgart und Tübingen, 1830, 8vo.

[165] The mother of Cola di Rienzi was one of those who gained a livelihood by selling water in the streets.

[166] The ruined _castellum_ at the Porta Furba, two miles from Rome, (previously mentioned,) seems to have been of this description; it rises considerably above the level of the conduits, vertically, as if either for water or air to rush up it.

[167] Cassiodori Var., lib. vii. 6, and iv. 31.

[168] Procopius, de Bello Gothico, lib. i. c. 19.

[169] This is shewn by the large corbels in the wall on the bank of the river at this point, opposite to the Cloaca Maxima, which are pierced with holes through them, in which a pole was placed to attach the chain. These corbels remain perfect on the western side; on the eastern side, they have been destroyed, or covered over by medieval houses. Those which remain are carved into the form of gigantic lions’ heads, of the character called Etruscan, but are of the time when the Port of Rome was made in the Tiber, B.C.

180.

[170]

IMP. CAESAR DIVI NERVAE F. NERVA TRAIANVS AVG GERM. DACICVS PONT. MAX. TR. POT. XIII IMP. VI. COS. V. P.P AQVAM TRAIANAM PECVNIA. SVA IN VRBEM PERDVXIT EMPTIS LOCIS PER LATITVD. P. XXX

[171]

PAVLVS V. PONT. OPT. MAX FORMIS AQVAE ALSIETINAE OLIM AB AVG. CAES. EXSTRVCTIS MOX COLLAPSIS. AB. ADRIANO I. P.M INSTAVRATIS IISDEM RVRSVS OB VETVSTATEM DIRVTIS. OPERE SVBTERRANEO. ET ARCVATO AQVAM EX AGRO BRACHIANENSI DITIONIS VRSINORVM SALVBRIORIBVS FONTIBVS DERIVATAM IN VRBEM PERDVXIT ANN. SAL. MDCXI. PONT. SVI VII.

[172] In the life of Hadrian by Spartianus (c. 20), we are told that a number of aqueducts were made in his time and called after him. But his name is not retained in the Regionary Catalogue.

[173] Frontinus, c. 88.

[174] We have seen before that Eadmer mentions the malaria in Rome as early as the twelfth century. (Historiæ Novor., lib. ii. ad calcem S. Anselmi operum, p. 51, D. Lut. Par. 1675, fol.) In the following century, the author of “Sir Bevis of Southampton” gives a strange account of the fevers arising from the Pontine Marshes into the Campagna di Roma. There were, says he, two dragons there; one having fled to Toscan [Tusculum?],—

“That other dragoun ’is flight nome (took) To Seinte Peter ’is brige of Rome: Thar he schel leggen ai (lay for ever) Til hit come domesdai; And everi seve yer ones, Whan the dragoun moweth (moves) ’is bones, Thanne cometh a roke (reke, smoke) & a stink Out of the water, under the brink, Than men therof taketh the fevere, That never after mai he kever (recover); And who that n’el nought leve (believe) me, Wite (know, inquire) al pilgrimes that ther hath be; For thai can tell yow, I wis, Of that dragoun how it is.”

(Weber, “Metrical Romances,” &c., vol. iii. p. 315. Edinburgh, 1810, 12mo.)

[175] The fragment of an inscription relating to this aqueduct was found near Gabii, and is described by E. Q. Visconti in his _Monumenti Gabini_, Roma, 1797, 8vo. maj., p. 14.

IMP. CAESAR DIVI TRAiani (Parthici filius Trajanus Hadrianus) AVG. PONTIF[ex Maximus] AQVAE DVCTVM GABINIS . . . QVAM . . . . .

The second line appears to be an interpolation of the editor, but this is not material. The aqueduct begun by Nerva was not finished till the time of Hadrian. The aqueduct of Gregory XIII. and Sixtus V. (Felice) (A.D. 1572-1590) receives the water of this aqueduct, but at Colonna other springs are collected and added to it; this was the work of Fontana.

[176] The Torre Pignattara is so called from the earthenware pots (_pignatte_) of which the vault was built. Other remains of buildings of importance have been found near the Mausoleum of S. Helena, and there is some reason to believe that another imperial villa was situated there during the first three centuries.

[177] Some say the popular name is _Torre de Scavi_, or of the excavations from some great works of excavation made there in the twelfth century.

[178] Note f, p. 88. “Aquarum ductus etiam infinitas hoc nomine (Hadriani) nuncupavit.” (Spartianus in Hadriano, c. 20.)

[179] It is immediately opposite to the Palatine, and there is a remarkably fine view from the portion of the _specus_ that remains, the vault of which has been removed, and it is used as a terrace.

[180] Mémoire sur les fouilles exécutées à Santa Sabina. Paris, Imprimerie Impériale, 1868, 4to.

[181] EX . FIG . . . . AEAM . . AUGVS . RUST . IT . ET . AQVI . . (Ap. Fea, Fasti Consul., p. cxviii. No. 62.) Junius Rusticus et Aquilinus were Consuls, temp. Marci Aurelii, A.D. 162.

[182] Commodus was emperor from 180 to 192, but was slain at the early age of 31; and it is probable that this great work was left unfinished, and was completed by his successor, Septimius Severus. In the Regionary Catalogue they are mentioned together, and

there was probably no division between them.

[183] It was usual to take advantage of the _castella aquæ_ of the great aqueducts to construct bath-chambers of various kinds, both for hot and cold and swimming baths.

[184] This is also mentioned in our account of the Anio Vetus (II.), as the branch at the second mile from Rome according to Frontinus. From the low level, it is more probable that this branch came from the Anio Vetus than from the Marcia, and an itinerant pilgrim of the eighth or ninth century may have been mistaken on this point.

[185] This was probably the branch that now runs under the Via dei Condotti. The main line to supply the Thermæ of Agrippa has been traced beyond the fountain of Trevi to the Piazza di S. Ignazio, very near the Pantheon, which was the entrance-hall to these _thermæ_. Those of Nero and Alexander Severus were more to the north.

[186] See Aqueduct XI. Trajana.

[187]

HERCVLI . CONSERVATORI INVICTO . COMITI D. N. SEVERI . ALEXANDRI PII . VICTORIS . SEMPER AVG. AC. OPTIMI . PRINCIPIS M. AVRELIVS . PRISCILLIANVS V. C. CVRATOR . NYMPHAEI DEVOT . NVM . M. Q. E.

[188] The great Thermæ of the third century in the Esquiliæ, where the building known as the Minerva Medica stands, and to which the other building, called after the Trophies of Marius, is supposed to have been the entrance; this has been identified as a Nymphæum of Alexander Severus, by the representation of it on one of his coins.

[189] SOPRA TREBIA (TREVI) VICINO ARCINAZZO (upon Trevi, near Arcinazzo).

[190]

MINERVAE . MEMORI COELIA . IVLIANA INDVLGENTIA . MEDICI NARVM . INFIRMITATE . EIVS GRAVI . SANATA . D. P

[191] There is a subterranean reservoir under it, and there are several other subterranean reservoirs in this ground.

[192] This great Pantheum was a temple of all divinities, and also a hall for the men, being connected by a large vaulted passage at the back with the _thermæ_, of both of which there are visible remains.

[193] This spring is considered by some authors as the one source of the river Almo; but it is only one of many, and it falls into the deep bed of the river, coming from some miles beyond that point.

[194] In the valley of the Caffarella, a stone _specus_ has been made by the side of the natural bed of this branch; it is open at the top, has lochs in it, and is on a higher level than the natural stream. The object of this was obviously to keep a supply of water from the springs in dry weather.

[195] The two arches of the Porta Metronia remain, both built of brick of the time of Aurelian. The outer arch is visible in the city wall; the inner one is concealed by a medieval tower built up against it. In the year 1871, Signor Rosa made a new gate on the east side of the Porta Metronia for his carts to pass through, in which the earth, excavated from the Palatine, is carried out into the meadow beyond, outside of the walls. This is certainly better than continuing to fill up the valley between the Aventine and the Pseudo-Aventine, and thereby concealing more of the Wall of the Kings under S. Balbina and burying more of the Aqua Appia, than has already been done under his orders.

[196] Cicero, Epist. ad Q. Fratrem, lib. iii. ep. 7.

[197] “Hic etiam derivavit aquam de antiquis Formis, et ad Portam Lateranensem conduxit, ibique lacum pro adaquandis equis fieri fecit. Plurima quoque molendina in eadem aqua construxit, et multas vineas cum fructiferis arboribus secus ipsum lacum plantari studiosissimè fecit.” (Muratori, Rerum Italic. Script., tom. iii. p. 420, col. 2, E.)

[198] “Aquam ad Urbem reduxit, molendina cum vineis juxta lacum aptavit,” &c. (Pandolphus Pisanus, ibid., p. 419, col. 1, E.)

[199]

SIXT. V. PONT. MAX. PICENVS. AQVAM . EX . AGRO . COLVMNAE. VIA . PRAENEST . SINISTRORSVM. MVLTARVM . COLLECTIONE . VENARVM. DVCTV . SINVOSO . A. RECEPTACVLO . MIL. XX. A. CAPITE XXII. ADDVXIT. FELICEMQVE . DE . NOMINE. ANTE PONT. DIXIT. COEPIT . ANNO. PRIMO. ABSOLVIT III. M.D. L. XXXVII.

[200] See Aqueduct XI.

[201] The Pope insisted on the work being completed at the time originally fixed, notwithstanding that the blunder of his engineer made it necessary to rebuild the whole arcade for seven miles.

[202] “Nunc autem in urbem influunt: 1. Aqua Appia, 2. Anio Vetus, 3. Marcia, 4. Tepula, 5. Julia, 6. Virgo, 7. Alsietina (quæ eadem vocatur Augusta), 8. Claudia, 9. Anio Novus.” (Frontinus, 4.)

[203] Id., c. 19.

[204] See Aqueduct III.

[205] Frontinus, c. 15, in both cases called by him, Herculaneus.

[206] Frontinus, c. 12.

[207] Id., c. 5.

[208]

“Quid loquar aërio pendentes fornice rivos, Qua vix imbriferas tolleret Iris aquas? Hos potius dicas crevisse in sidera montes, Tale giganteum Græcia laudat opus. Intercepta tuis conduntur flumina muris; Consumunt totos celsa lavacra lacus.”

(Cl. Rutilii Itiner., l. 1, v. 97. and following.)

[209] “In formis autem Romanis utrumque præcipuum est ut fabrica sit mirabilis et aquarum salubritas singularis. Quod enim illuc flumina quasi constructis montibus perducuntur, naturales credas alveos soliditates saxorum, quando tantus impetus fluminis tot sæculis firmiter potuit sustineri. Cavati montes plerunque subruunt, meatus torrentium dissipantur, et opus illud veterum non destruitur, si industria suffragante servetur.”—(Cassiodori Variar., l. vii. c. 6.)

[210] It is possible that the number of nineteen was made up by adding the different branches that supplied the Thermæ of the later Emperors, (Septimius) Severus, Antoninus, Alexander (Severus), (Aurelius) Commodus, Constantinus.

To these must now be added the two modern aqueducts, the Marrana and Aqua Crabra [XVII.], united and brought through Rome in the twelfth century in the bed of that branch of the river Almo, and the Aqua Felice [XVIII.], made in the sixteenth; also the Aqua Marcia-Pia, made between 1860 and 1870, which now brings the water of the Aqua Marcia into Rome by a different line.

[211] This was also the principal gate of the Sessorian Palace, and was sometimes called the Porta Sessoriana.

[212] See Diagrams III. and XIX.

[213] See the Plans and Sections of this, Plate XXI.

[214] The water pumped out by the steam-engine employed by Signor Rosa was always good clear drinking water, and had all the appearance of coming from an aqueduct; it was sent along an open channel the whole length of the Colosseum, and made a great swamp round the arch of Constantine for several months in the spring of 1875, the outlet for it being made on the outer side of the drain under that arch, which had been constructed by the Municipality about 1866. At last it was observed that an aperture into that drain might easily be made on the inner side, and so avoid the swamp in the road, and washing the foot of the arch. Soon after this the steam-engine was stopped on account of the enormous expense of it, after it had gone on for more than a year, always pumping out good drinking water, and sending it to waste.

[215] This article will be found in the _Annales de l’Institut de Correspondance Archéologique_, 1873.

[216] Near the Porta Maggiore, and under the arches of Nero. There are two large reservoirs close together in this vineyard, probably the Gemelli of Frontinus.

[217] _Descending_ from the reservoir into the old _specus_ under the arches of Nero.

[218] The Aqua Marcia was brought again into Rome by a new water company in the year 1870, after several years of very arduous work, and overcoming many difficulties. The company who made this great aqueduct consisted chiefly of English shareholders, with a mixture of French and Italian. It was long under the direction of the late Mr. Shepherd, an Englishman, whose loss was much regretted in Rome, and latterly under a Belgian engineer.

[219] See Frontinus de Aqueductibus, c. 5.

[220] There is a large and deep reservoir for it near the arch of Dolabella, under the garden of the Villa Mattei, now called the Villa Cœlimontana, and from thence it passed, still underground, to the cliff of the Cœlian, opposite to the Aventine. A short tunnel was made from this deep reservoir to a Nymphæum under the Cœlian, now S. Stefano Rotondo, called of Septimius Severus. The ruins of it are shewn in 895; a _specus_ has been traced from one to the other.

[221] See Frontinus de Aqueductibus, c. 6.

[222] Ibid., c. 125, and 93.

[223] Frontinus de Aqueductibus, c. 6.

[224] Frontinus, c. 125.

[225] Ibid., c. 93.

[226] They remind English people of the Clapham Junction of the railways near London, where trains crossing each other at different levels can be seen.

[227] Supra Portam Capenam, F. i. 19.

[228] See Frontinus de Aqueductibus, caps. 11, 18, 22, and 71.

[229] Frontinus de Aqueductibus, cap. 13, 14, 18, 20.

[230] Cohen. Méd. Imp. Alex. Sev., (Nos. 239, 334).

[231] This water is not mentioned in the Regionary Catalogue, and its whole history appears doubtful. Some think the name is a corruption of Argentina, the short stream that rises in the Lupercal or Wolf's Cave, under the north-west corner of the Palatine, as before mentioned.

[232] These sources are on the cliffs above the river Anio, at from five seven miles from Rome, and two miles from Ponte Nono, in swampy meadows called "the meadows of Lucullus," and some in old stone quarries.

[233] See also the Photo-engravings, Plates I. and II.; and Historical Photographs, Nos. 865, 866, 867.

[234] See page 3, and Historical Photographs, Nos. 632, 710, 1138, 1139, 1140, 1141, 1142, 1253; and Plates X. and XI. of the Supplement to Part I.

[235] See Photos., Nos. 1116 and 889.

[236] This is now, in 1876, taken possession of by the British and American Archæological Society, with the consent of the owner of the ground, who has allowed a door to be put up at the entrance.

[237] See also Plate XX.

[238] This map is to be had on either of these two larger scales, for those who require more minute information.

[239] See p. 3.

[240] See p. 13.

[241] See p. 32.

[242] See p. 46.

[243] See p. 39.

[244] See p. 41.

[245] See p. 92.

[246] See p. 55.

[247] See p. 54.

[248] See p. 86.

[249] See p. 92.

[250] See p. 97.

[251] See p. 100.

[252] See p. 106.

[253] See No. VII., p. 50.

THE AQUEDUCTS OF ANCIENT ROME, TRACED FROM THEIR SOURCES TO THEIR MOUTHS, CHIEFLY BY THE WORK OF FRONTINUS; VERIFIED BY A SURVEY OF THE GROUND.

BY JOHN HENRY PARKER, C.B. HON. M.A. OXON., F.S.A. LOND., &c. AND ASSISTANTS.

=OXFORD:= JAMES PARKER AND CO. =LONDON:= JOHN MURRAY, ALBEMARLE-STREET. 1876.

[Illustration: CHARTA TOPOGRAPHICA]

[Illustration: CHARTA TOPOGRAPHICA]

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Italian and Tyrolese violin makers.

Jon Masters <jcm@perihelion. (none) >
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Some minor changes to the text are noted at the end of the book. These are indicated by a dashed blue underline. Original cover Frontis The Zodiacal Light THE STORY OF THE UNIVERSE

Told by Great Scientists and Popular Authors

COLLECTED AND EDITED

By ESTHER SINGLETON

Author of "Turrets, Towers and Temples," "Wonders of Nature," "The World's Great Events," "Famous Paintings," Translator of Lavignac's "Music Dramas of Richard Wagner"

FULLY ILLUSTRATED

VOLUME I

THE STARRY SKIES

P. F. COLLIER AND SON

NEW YORK

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[Pg 1] PREFACE

In the following pages I have endeavored to present a comprehensive and general view of the material side of the universe. Instead of trying myself to tell the story of the universe, I have gone to the works of acknowledged weight and authority in this line of research and selected from them extracts of a popular character, especially those that are entertaining as well as merely instructive. The average reader is frequently repelled from the study of the sciences by the dry treatment adopted by those who try to instruct him. He cares little for laws, theories, or affinities; and he can not help being bored by attempts to make him understand classifications with their long lists of words manufactured from the names of modern celebrities or non-entities and roots from dead languages. I have therefore kept constantly in mind the person who seeks entertaining knowledge, and not the scientific specialist. I have tried to avoid all technicalities wherever possible.

Of late years, in fact ever since the foundation of the British Association, there has been a constantly increasing interest in the wonders of nature; and the specialist has responded to this popular interest in his scientific labors by speaking in language that an intelligent child can comprehend. People as a rule prefer to read of the habits, instincts, intelligence, and movements of animals and plants, rather than of their organs and structure. Thus the study of Natural History has received a great impetus from the writings of such men as Darwin and Lubbock; and Astronomy has been rendered more attractive to the lay reader by Flammarion, Gore, Proctor, and Ball. Every traveler who[2] returns from remote or hitherto unknown Arctic or Torrid Zones has something fresh to tell us of the phenomena and life of our universe, which adds fresh stimulus to the popular interest in the Natural Sciences.

The Story of the Universe naturally falls under the following four heads:

First, the bodies moving in infinite space, including stars, dark and lucid, planets, nebulæ, comets, and meteors.

Second, the Earth, considered as a separate world and the only one of which we have precise detailed knowledge. In this chapter we learn of the past of our globe from the evidence afforded by the rocks of which its crust is composed. The varying conformations of its present surface are described, as is its atmospheric envelope and attendant phenomena. The ocean and its movements and depths are likewise fully considered.

Third, the Earth's Garment—its flora. In this chapter we are told of the wonders and beauties of plant-life, its development and distribution.

Fourth, the Earth's Creatures. Here we have a general view of animal life, from the mighty mammoth to the fairy fly: even the beings visible only to the microscope are not forgotten. Special attention is also paid to man, from his origin to the present day.

I have made the selections from authentic editions of the writings of the scientists; and have taken no liberties with the text, with the exception of occasional cutting.

In the Introduction I have given a short sketch of the development of the Natural Sciences, from the dawn of written history to the present day.

E. S.

New York, March, 1905.

[3] INTRODUCTION

The knowledge of the Natural Sciences among the Greeks and Romans was derived principally from the Egyptians and Babylonians. The Phœnicians in their voyages, also, necessarily paid considerable attention to Astronomy. Their Cynosura consisted of the tail of the Little Bear, by which they steered. The great names in Greek Astronomy are Aratus, Hipparchus, and Ptolemy.

From the fancies of Astrology, in which the early Arabs largely indulged, and which, though discountenanced by Mahomet himself, have never been wholly abandoned by their descendants, a not unnatural transition, led to the study of Astronomy. Under the patronage of the Abbaside Caliph Al-Mamun (813-833 A. D.) this science made rapid progress.

Astronomy was zealously studied in the famous schools of Bagdad and Cordova.

The Almagest, or System of Astronomy, by Ptolemy, was translated into Arabic by Alhazi and Sergius as early as 812. In the Tenth Century, Albaten observed the advance of the line of the apsides in the earth's orbit; Mohammed-ben-Jeber-al-Batani, the obliquity of the ecliptic; Alpetragius wrote a theory of the planets; and Abul-Hassan-Ali, on astronomical instruments. The obliquity of the ecliptic, the diameter of the earth, and even the precession of the equinoxes, were then calculated with commendable accuracy; and shortly after, Abul-Mezar's Introduction to Astronomy and his Treatise on the Conjunction of the Planets, with the Elements of Al-Furjanee (though this last author was largely indebted to the Egyptian labors of Ptolemy), proved that the caliph's liberality had been well bestowed.[4] But Al-Batinee, a native of Syria (879-920 A. D.), surpassed all his predecessors in the nicety alike of his observations and computations. Geber, at Seville, constructed (1196 A. D.) the first astronomical observatory on record; and Ebn-Korrah in Egypt proved by his example that the Arabs could be even better astronomers than the Greeks.

Ulug Bekh, grandson of the great Tamerlane, was a diligent observer. He established an academy of astronomers at Samarcand, the capital of his dominions, and constructed magnificent instruments. Ulug Bekh, too, made a catalogue of the fixed stars—the only one that had been compiled since that of Hipparchus, sixteen centuries previously.

Gradually, by their intercourse with civilized nations, the Arabian conquerors were themselves subjected to the humanizing influence of letters, and, after 749 A. D., or during the reign of the Abassides, literature, arts, and sciences appeared, and were generously fostered under the splendid sway, first of Almansor (754-775), and afterward of the celebrated Harun-al-Raschid (786-808). Learned men were now invited from many countries and remunerated for their labors with princely munificence; the works of the best Greek, Syriac, and old Persian writers were translated into Arabic, and spread abroad in numerous copies. The Caliph Al-Mamun, who reigned from 813 to 833, offered to the Greek emperor five tons of gold and a perpetual treaty of peace on condition that the philosopher Leo should be allowed to give instruction to the former. Under the same Caliph the famous schools of Bagdad, Basra, Bokhara, and Kufa were founded, and large libraries were collected in Alexandria, Cairo, and Bagdad. The school

of Cordova in Spain soon rivaled that of Bagdad, and in the Tenth Century the Arabs were everywhere the preservers and distributers of knowledge.

Pupils from France and other European countries repaired to Spain in great numbers, to study mathematics and medicine under the Arabs. There were fourteen academies,[5] with many preparatory and upper schools, in Spain, and five very considerable public libraries; that of the Caliph Hakem containing, as is said, more than 600,000 volumes.

In Geography, History, Philosophy, Medicine, Physics, and Mathematics the Arabians rendered important services to science; and the Arabic words still employed in science—such as algebra, alcohol, azimuth, zenith, nadir, with many names of stars, etc. (see The Arabian Heavens, pages 106-120 of Vol. I)—remain as indications of their influence on the early intellectual culture of Europe. But Geography owes most to them during the Middle Ages. In Africa and Asia, the boundaries of geographical science were extended, and the old Arab treatises on geography and works of travels in several countries by Abulfeda, Edrisi, Leo Africanus, Ibn Batuta, Ibn Foslan, Ibn Jobair, Albiruni the astronomer, and others, are still interesting.

The structure of the earth received little attention from the ancients; the extent of its surface known was limited, and the changes upon it were neither so speedy nor violent as to excite special attention. The only opinions deserving to be noticed are those of Pythagoras and Strabo, both of whom observed the phenomena which were then altering the surface of the earth, and proposed theories for explaining the changes that had taken place in geological time. The first held that, in addition to volcanic action, the change in the level of sea and land was owing to the retiring of the sea; while the other maintained that the land changed its level, and not the sea, and that such changes happened more easily to the land below the sea because of its humidity.

From the fall of the Roman empire, during the Dark Ages, the physical sciences were neglected. In the Tenth Century, Avicenna, Omar, and other Arabian writers commented on the works of the Romans, but added little of their own.

Geological phenomena attracted attention in Italy in the Sixteenth Century, the absorbing question then being[6] as to the nature of fossils; only a few maintained that they were the remains of animals. Two centuries elapsed before the opinion was generally adopted.

Aristotle was the first who collected, in his work On Meteors, the current prognostics of the weather. Some of these were derived from the Egyptians, who had studied the science as a branch of Astronomy, while a considerable number were the result of his own observation. The next writer upon this subject was Theophrastus, one of Aristotle's pupils, who classified the opinions commonly received regarding the weather under four heads, viz., the prognostics of rain, of wind, of storm, and of fine weather. The subject was discussed purely in its popular and practical bearings, and no attempt was made to explain phenomena whose occurrence appeared so irregular and capricious. Cicero, Virgil, and a few other writers also wrote on the subject; but the treatise of Theophrastus contains nearly all that was known down to comparatively recent times. Partial explanations were attempted by Aristotle and Lucretius, but their explanations were vague, and often absurd.

In this dormant condition meteorology remained for ages, and no progress was made till proper instruments were invented for making real observations with regard to the temperature, the pressure, the humidity, and the electricity of the air.

Solomon spoke of "trees, from the cedar in Lebanon even to the hyssop that springeth out of the wall." There is reason also to believe that Zoroaster devoted some attention to plants, and that this study early engaged some of the philosophers of Greece. The oldest botanical work which has come down to us is that of Theophrastus, the pupil of Aristotle, who flourished in the fourth century B. C. His descriptions of plants are very unsatisfactory, but his knowledge of their organs and of vegetable physiology may well be deemed wonderful. It was not, indeed, till after the revival of letters in Western Europe, that it was ever again studied as it had been by him. About four hundred[7] years after Theophrastus, in the First Century of the Christian era, Dioscorides of Anazarbus, in Asia Minor—a herbalist, however, rather than a botanist—described more than 600 plants in a work which continued in great repute throughout the Middle Ages.

About the same time, the elder Pliny devoted a share of his attention to Botany, and his writings contain some account of more than 1,000 species, compiled from various sources and mingled with many errors. Centuries elapsed without producing another name worthy to be mentioned. It was among the Arabians that the science next began to be cultivated, about the close of the Eighth Century. The greatest name of this period is Avicenna. Among the Arabs, Botany, like Chemistry, was chiefly studied as subsidiary to medicine; but as an adjunct to the old herbal pharmacopœia, it received close attention. The principal mercurial and arsenical preparations of the materia medica, the sulphates of several metals, the properties of acids and alkalies, the distillation of

alcohol—in fine, whatever resources chemistry availed itself of up to a very recent date—were, with their practical application, known to Er-Razi and Geber. In fact, the numerous terms borrowed from the Arabic language—for instance, alcohol, alkali, alembic, and others—with the signs of drugs and the like, still in use among modern apothecaries, remain to show how deeply this science is indebted to Arab research.

Aristotle seems to have been the first to study Zoology. Some of the groups he established still retain their place in the most modern classifications. His two great sections of the Animal Kingdom consisted of Enanima (red blood) and Anima (having a circulation of colorless fluid). Ælian and Pliny wrote on the subject, but they indulged largely in fables. There was little advance in the science during the Dark and Middle Ages. The Bestiaries were written for the sake of moral teaching, and the animals had to behave with that end in view. Albertus Magnus is the only famous name in this department before the revival of learning.

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The shining light of the Thirteenth Century was Roger Bacon. His Opus Majus is “at once the Encyclopædia and the Novum Organum of the Thirteenth Century.” In this, besides other branches of scientific research, he devotes a rapid examination to questions of Climate, Hydrography, Geography, and Astrology. Scientific research, however, was out of date, and from the educated world Roger Bacon received small recognition. His writings earned only a prison from his own Order, and he died, in his own words, “unheard, forgotten, buried.”

The Revival of Learning, commonly known as the Period of the Renaissance, naturally entailed renewed interest in the sciences as well as the arts. Green gives a comprehensive view of it:

“The last royalist had only just laid down his arms when the little company who were at a later time to be known as the Royal Society gathered round Wilkins at Oxford. It is in this group of scientific observers that we catch the secret of the coming generation. From the vexed problems, political and religious, with which it had so long wrestled in vain, England turned at last to the physical world around it, to the observation of its phenomena, to the discovery of the laws which govern them. The pursuit of physical science became a passion; and its method of research, by observation, comparison, and experiment, transformed the older methods of inquiry in matters without its pale. In religion, in politics, in the study of man and of nature, not faith but reason, not tradition but inquiry, were to be the watchwords of the coming time. The dead-weight of the past was suddenly rolled away, and the new England heard at last and understood the call of Francis Bacon.

“Bacon had already called men with a trumpet-voice to such studies; but in England at least Bacon stood before his age. The beginnings of physical science were more slow and timid there than in any country of Europe. Only two discoveries of any real value came from English research before the Restoration; the first, Gilbert’s discovery of terrestrial magnetism in the close of Elizabeth’s reign; the next, the great discovery of the circulation of the blood, which was taught by Harvey in the reign of James. Apart from these illustrious names England took little share in the scientific movement of the continent; and her whole energies seemed to be whirled into the vortex of theology and politics by the Civil War. But the war had not reached its end when a little group of students[9] were to be seen in London, men ‘inquisitive,’ says one of them, ‘into natural philosophy and other parts of human learning, and particularly of what hath been called the New Philosophy,... which from the times of Galileo at Florence, and Sir Francis Bacon (Lord Verulam) in England, hath been much cultivated in Italy, France, Germany, and other parts abroad, as well as with us in England.’ The strife of the time indeed aided in directing the minds of men to natural inquiries. ‘To have been always tossing about some theological question,’ says the first historian of the Royal Society, Bishop Sprat, ‘would have been to have made that their private diversion, the excess of which they disliked in the public. To have been eternally musing on civil business and the distresses of the country was too melancholy a reflection. It was nature alone which could pleasantly entertain them in that estate.’ Foremost in the group stood Doctors Wallis and Wilkins, whose removal to Oxford, which had just been reorganized by the Puritan Visitors, divided the little company into two societies. The Oxford society, which was the more important of the two, held its meetings at the lodgings of Dr. Wilkins, who had become Warden of Wadham College, and added to the names of its members that of the eminent mathematician Dr. Ward, and that of the first of English economists, Sir William Petty. ‘Our business,’ Wallis tells us, ‘was (precluding matters of theology and state affairs) to discourse and consider of philosophical inquiries and such as related thereunto, as Physick, Anatomy, Geometry, Astronomy, Navigation, Statics, Magnetics, Chymicks, Mechanicks, and Natural Experiments: with the state of these studies, as then cultivated at home and abroad. We then discoursed of the circulation of the blood, the valves in the venæ lacteæ, the lymphatic vessels, the Copernican hypothesis, the nature of comets and new stars, the satellites of Jupiter, the oval shape of Saturn, the spots in the sun and its turning on its own axis, the inequalities and selenography of the moon, the several phases of Venus and Mercury, the improvement of telescopes, the grinding of glasses for that purpose,

the weight of air, the possibility or impossibility of vacuities, and Nature's abhorrence thereof, the Torricellian experiment in quicksilver, the descent of heavy bodies and the degree of acceleration therein, and divers other things of like nature.'

"The other little company of inquirers, who remained in London, was at last broken up by the troubles of the Second Protectorate; but it was revived at the Restoration by the return to London of the more eminent members of the Oxford group. Science suddenly became the fashion of the day. Charles was himself a fair chymist, and took a keen interest in the problems of navigation. The Duke of Buckingham varied his freaks of riming, drinking,[10] and fiddling by fits of devotion to his laboratory. Poets like Dryden and Cowley, courtiers like Sir Robert Murray and Sir Kenelm Digby joined the scientific company to which in token of his sympathy with it the King gave the title of 'The Royal Society.' The curious glass toys called Prince Rupert's drops recall the scientific inquiries which, with the study of etching, amused the old age of the great cavalry leader of the Civil War. Wits and fops crowded to the meetings of the new society. Statesmen like Lord Somers felt honored at being chosen its presidents. Its definite establishment marks the opening of a great age of scientific discovery in England. Almost every year of the half century which followed saw some step made to a wider and truer knowledge. Our first national observatory rose at Greenwich, and modern astronomy began with the long series of astronomical observations which immortalized the name of Flamsteed. His successor, Halley, undertook the investigation of the tides, of comets, and of terrestrial magnetism. Hooke improved the microscope, and gave a fresh impulse to microscopical research. Boyle made the air-pump a means of advancing the science of pneumatics, and became the founder of experimental chymistry. Wilkins pointed forward to the science of philology in his scheme of a universal language. Sydenham introduced a careful observation of nature and facts which changed the whole face of medicine. The physiological researches of Willis first threw light upon the structure of the brain. Woodward was the founder of mineralogy. In his edition of Willoughby's Ornithology, and in his own History of Fishes, John Ray was the first to raise zoology to the rank of a science; and the first scientific classification of animals was attempted in his Synopsis of Quadrupeds. Modern botany began with his History of Plants, and the researches of an Oxford professor, Robert Morison; while Grew divided with Malpighi the credit of founding the study of vegetable physiology. But great as some of these names undoubtedly are, they are lost in the lustre of Isaac Newton. Newton was born at Woolsthorpe in Lincolnshire, on Christmas Day, in the memorable year which saw the outbreak of the Civil War. In the year of the Restoration he entered Cambridge, where the teaching of Isaac Barrow quickened his genius for mathematics, and where the method of Descartes had superseded the older modes of study. From the close of his Cambridge career his life became a series of great physical discoveries. At twenty-three he facilitated the calculation of planetary movements by his theory of Fluxions. The optical discoveries to which he was led by his experiments with the prism, and which he partly disclosed in the lectures which he delivered as mathematical professor at Cambridge, were embodied in the theory of light which he laid before the Royal Society on[11] becoming a Fellow of it. His discovery of the law of gravitation had been made as early as 1666; but the erroneous estimate which was then generally received of the earth's diameter prevented him from disclosing it for sixteen years; and it was not till the eve of the Revolution that the Principia revealed to the world his new theory of the Universe."

Ever since the Fifteenth Century, when Copernicus revived the ancient theory of Pythagoras that the planets revolved around the sun (a theory left in an imperfect state and demonstrated later by Kepler, Galileo, Newton, and others) astronomical research has progressed steadily. It must be remembered, however, that De Revolutionibus Orbium, which met with great opposition, contained nothing regarding the laws of motion, for these had not been as yet discovered, and Saturn marked the boundaries of the Solar System. Copernicus assigned the "fixed stars" to a sphere, as in Ptolemy's heavens (see page 331).

The great Danish astronomer, Tycho Brahe, whose idea of the Solar System is represented on page 343, was his opponent. Brahe, however, a devoted student, a man of wealth, the favorite of kings and princes, and the proud possessor of the Castle of Uraniberg (City of the Heavens), an observatory equipped with fine instruments and built for him by Frederick II, King of Denmark, on the island of Hueen, and after his death the protégé of Rudolph II at Benatek, near Prague, contributed greatly to the advancement of the science by means of his discoveries, computations, solar and lunar tables, and catalogue of stars. He, like Copernicus, placed the "fixed stars" in an outer sphere. His observations on the planets were made to prove the truth of his system. This mass of observations was used instead by Johann Kepler, who had been his assistant at the Benatek Observatory, to prove Copernicus's theory. Of Kepler, the discoverer of the three famous laws, who gave a complete theory of solar eclipses, calculated the transits of Mercury and Venus, and made numerous discoveries in optics and general physics, Proctor says:

[12]

"Kepler was not merely an observer and calculator; he inquired with great diligence into the physical causes of every phenomenon, and made a near approach to the discovery of that great principle which maintains and regulates the planetary motions. He possessed some very sound and accurate notions of the nature of gravity, but unfortunately conceived it to diminish simply in

proportion to the distance, although he had demonstrated that the intensity of light is reciprocally proportional to the surface over which it is spread, or inversely as the square of the distance from the luminous body."

Great names follow in rapid succession. One of Kepler's contemporaries was Galileo Galilei, the discoverer of the "three laws of motion" and the relation of time and space in falling bodies, the first to apply the newly invented telescope to the observation of the heavens and the discoverer of four satellites of Jupiter (named by him the "Medeiran Stars" in honor of his patron). He also detected spots on the sun's disk, the phases of Venus, and irregularities on the moon's surface, and declared the Milky Way to be composed of a countless tract of separate stars.

When we remember the limited power of the telescope of the age, we can but marvel, not at how little, but how much was known regarding the starry skies.

During this period, numerous observers rendered great service to Astronomy, and other scientists were engaged in making useful drawings, charts, maps, tables, and catalogues of stars.

To this period also belongs John Bayer of Augsburg, who published a description of the constellations with maps upon which the stars were marked with the letters of the Greek Alphabet—a convenient method that was universally adopted and is still in use. Other names include Gassendi, Riccioli, Grimaldi, and Hevelius—the latter a rich citizen of Dantzig, who had a fine observatory of his own, where he worked for forty years. His drawings and descriptions of the moon, his researches on comets, which he still believed moved in parabolas, and his celestial charts engaged most of his attention.

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The Dutch astronomer Huygens (born in 1629) is famous for his improvements in the telescope use of the pendulum clock and developments in the machinery of astronomical instruments. He discovered the ring of Saturn and four of his satellites. Edmund Halley, an English astronomer (born in 1656), also took a great interest in the telescope, and went to Dantzig to settle a controversy between Robert Hooke and Hevelius regarding the best glasses for use in astronomical observations; for Hevelius still worked with the ancient instruments, while Hooke believed in the lens.

Halley revived the ancient idea that comets belonged to the Solar System, and predicted that the comet of 1681 would return to its perihelion in 1759. This was the first prediction of its kind verified.

During the last quarter of the Seventeenth Century, the telescope assumes importance and two great observatories begin their work. In 1670 the Paris Observatory, of which Cassini was made director, was finished, and five years later the Greenwich Observatory, where Flamsteed was installed as royal astronomer.

Of Cassini, Lalande remarks that under him Astronomy underwent revolutions, and in France he was regarded as the "creator of the science." Cassini discovered that Saturn's ring was double and found four satellites of Jupiter.

Flamsteed's observations on planets, satellites, comets, "fixed stars," and his catalogue of 2,884 stars were valuable contributions to science; and his Historia Cœlestis is said to have "formed a new era in sidereal astronomy."

Flamsteed was succeeded by Halley, particularly famed for his investigations of comets. The next great astronomical event was the discovery of Uranus by Sir William Herschel in 1781. Sir William Herschel also discovered two more of Saturn's satellites, and began the great work of resolving the Milky Way and other clusters into swarms of suns, single stars into double and triple stars, inquiries[14] into the mysteries of the nebulæ, and in every way enlarging the general conception of the sidereal universe.

To the end of the Eighteenth and beginning of the Nineteenth Centuries belongs the brilliant French astronomer and mathematician Laplace, who published in 1799-1808 his Mécanique Céleste, in which he announced his Nebular Hypothesis (described on page 433 of Vol. II. The discoveries of the Planetoids are described on pages 396-403, and that of Neptune in 1846 on pages 430-432). The latest important additions to the Solar System are the discovery by Prof. Barnard of Jupiter's Fifth Satellite in 1892 and Saturn's Ninth by Prof. W. H. Pickering in 1904. The discovery even of a Seventh Satellite of Jupiter has just been announced from the Lick Observatory.

It would be impossible to mention the names of the astronomers whose work from the middle of the last century to its closing years has been distinguished in various fields. Space only permits brief mention of the new methods of research by means of the spectroscope and celestial photography. With the first the name of the English astronomer, William Huggins, is identified and has

yielded most important and startling information regarding the composition of heavenly bodies, and with the application of the photographic telescope these new methods have created a revolution in astronomical observation.

It may be interesting to gain a slight idea of the numbers of stars revealed by the camera by referring to Sir Robert Ball:

“If we take a position on the equator, from whence, of course, all the heavens can be completely seen in the lapse of six months, the number of stars that can be reckoned with the unaided eye will, according to Houzeau, amount to about six thousand. If we augment our unaided vision by a telescope of even small dimensions, such as three inches in diameter, the number of stars in the Northern Hemisphere alone is upward of three hundred thousand. We may assume that the Southern Hemisphere has an equally numerous star-population, so that the entire multitude visible with this optical aid is about six hundred thousand. Thus we see that[15] the use of a telescope small enough to be carried in the hands suffices to multiply the lucid stars one-hundredfold. Great telescopes no doubt soon show us that the hundreds of thousands are only the brighter members of a host of millions, and now we receive the assurance of photography that the telescopic stars are only the more conspicuous members of that vast universe. Mr. Roberts indeed declares that the multitudes of stars on the photographic plate grow with each increase of exposure to such a degree that it would almost seem as if the plate would be a wellnigh continuous mass of stars if the operations could be sufficiently protracted.”

Naturally the past years have witnessed the making of new catalogues and maps of stars, and many valuable computations of parallaxes, etc. Some of the results obtained by these new methods are described in the chapters on the Nebulæ and Swarms of Suns, The Great Nebula of Orion, and The Colored, Double, Multiple, Binary, Variable, and Temporary Stars in Vol. I. From this brief survey of the progress of Astronomy the fact will be appreciated, therefore, that all the discoveries and researches have resulted in a larger conception of the universe, and the Solar System sinks into insignificance in the vast ocean of stars and suns.

The study of the Earth’s crust and its contents divested of superstition dates from the end of the Seventeenth Century. Nicolaus Steno (1638-1687), a Dane, devoted himself to geology, and in 1669 observed successive layers of strata. He is called “the father of Palæontology.” In 1680 Leibnitz proposed the theory that the Earth was originally in a molten state. The classification of strata was begun about the middle of the Eighteenth Century. The views of James Hutton (1788), who returned to the theories advanced by Ray (a return to the views of Pythagoras), were continued by Sir Charles Lyell.

Geology and Palæontology have progressed side by side. Among the most famous investigators are Cuvier, Dawson, Marsh, Owen, Huxley, Agassiz, De Blainville, Kaup, Sir Roderick Murchison, Boyd Dawkins, Sir William Flower, R. Lydekker, and E. D. Cope.

To the review of the new developments of meteorology[16] and the science of probabilities by Sir Ralph Abercromby, on pages 784-792 of Vol. II, it is only necessary to add that the interest in meteorological research developed greatly after Torricelli’s discovery in 1643 of weight and pressure in the atmosphere led to the perfection of the barometer and the development of the thermometer and hygrometer, both in the Seventeenth Century. The theory of trade-winds George Hadley announced in the Philosophical Transactions for 1735. Dalton’s Meteorological Essays, published in 1793, and Dr. William Charles Wells’s Theory of Dew, published in 1814, attracted much attention. Regarding the inquiries into the laws of light by Snell, Newton, Descartes, Thomas Young, and Sir George Airy, the reader is referred to the chapter on The Rainbow in Vol. II, by John Tyndall, with whose researches in the latter half of the Nineteenth Century every one is more or less acquainted.

Little need be said here regarding the history of Botany, which is reviewed on pages 984-1000 of Vol. II. We may add, however, that one of the first to revive this study was Otto Brunsfels, whose Historia Plantarum Argentorati was published in two folio volumes with cuts in Strasburg in 1530. He had many followers on the Continent and in England. During the revival of learning, chairs of Botany were founded in the universities; botanic gardens were established in many places (the Jardin des Plantes was founded in 1626); and botanists began to travel to remote countries to search for unknown flora.

To the Seventeenth Century belong the names of Dr. Turner, “the father of English Botany”; Robert Morison, professor of Botany at Oxford; John Ray, Nehemiah Grew, Malpighi, Henshaw, and Robert Hooke. The two latter were among the first to employ the newly invented microscope to the study of this science. It may be mentioned in passing, that Huygens is said to have taken from Holland to England microscopes about the size of a grain of sand, and that the first microscope consisting of a combination of lenses is attributed to Jansen, a spectacle-maker of Holland.[17] Hooke, whom Herschel calls “the great contemporary and almost the rival of Newton,” gave a tremendous impetus to Microscopy, and practically laid the foundation of Histology or the Inner Morphology of Plants, due to Grew and Malpighi. Schleiden undertook to explain the mysteries of cell formation in 1838, further

investigated by Schwann, and is now known as the Schleiden-Schwann theory. Nägeli and Von Mohl continued researches on this line. To the contents of the cell Von Mohl gave the name protoplasm.

In 1849, Hofmeister began investigations into the life-histories of plants, since when the study of Vegetable Physiology has progressed side by side with Chemistry. To Darwin great subjects are due: the cross-fertilization of plants, their reproduction, and their relations to insects and their movements. It may be mentioned, however, that in 1693 Ray attempted to explain the movements of leaves, tendrils, and petals by physical and mechanical laws.

Since the middle of the Nineteenth Century, the branches of Botany that have been particularly studied are Vegetable Physiology and Pathology, Inner Morphology, and Fossil Botany—and the discoveries made have naturally had an effect upon the classification of vegetable life.

According to Agassiz:

“We must come down to the last century, to Linnæus, before we find the history taken up where Aristotle had left it, and some of his suggestions carried out with new freshness and vigor. Aristotle had already distinguished between genera and species; Linnæus took hold of this idea, and gave special names to other groups, of different weight and value. Besides species and genera, he gives us orders and classes—considering classes the most comprehensive, then orders, then genera, then species. He did not, however, represent these groups as distinguished by their nature, but only by their range; they were still to him, as genera and species had been to Aristotle, only larger or smaller groups, not founded upon and limited by different categories of structure. He divided the animal kingdom into six classes: Mammalia, Birds, Reptiles, Fishes, Insects, and Worms.”

[18]

Linnæus’s classification was, therefore, the first attempt to group animals; but until Cuvier there was no great principle of classification. In 1707 Buffon succeeded in making Zoology, which had been regarded as a most uninteresting study, popular and respected. He also had the idea of collecting all the known facts of scientific investigation and arranging them systematically. Buffon was ridiculed as a scientist by his contemporaries, Hevelius, Diderot, D’Alembert, and Condillac, who opposed his explanations of natural phenomena. Buffon’s Histoire Naturelle Générale et Particulière is his most important work. A complete edition in thirty-six volumes appeared in Paris in 1749-1788. Although it is said to “have made an epoch in the study of the natural sciences” in Buffon’s day, it now possesses little scientific value.

Cuvier’s classification has never been overthrown. His original investigations in various departments of science, and particularly that of fossil vertebrate animals, opened up new fields of study. His talents with both pen and pencil contributed largely to making that branch of science popular.

Lamarck, Cuvier’s contemporary, divided the animal kingdom into Vertebrates and Invertebrates. Lamarck, like Geoffroy Saint-Hilaire, was a believer in the theory of evolution, which was opposed by Cuvier.

Lamarck turned from the study of Meteorology to that of Botany, and later again to that of Zoology. In 1793 he became professor of the natural history of the lower classes of animals in the Jardin des Plantes. His theories have greatly influenced modern science, particularly that of the “Variation of Species,” which was set forth in his Philosophie Zoologique (two vols., Paris, 1809) and other works. Lamarck’s Histoire des Animaux sans Vertèbres (seven vols., Paris, 1815-22) is his greatest work.

Karl Ernst von Baer, the Russian naturalist, a pupil of Döllinger in Würzburg, devoted himself chiefly to the study of embryology and made valuable discoveries.

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Passing by many illustrious names, we come to that of Sir Richard Owen, of whom it has been said that “from the sponge to man, he has thrown light over every subject he has touched.” His work in the Hunter Museum, his descriptions and restorations of extinct birds and animals, and his original works on every branch of animal life, form an enormous contribution to the progress of science. He promulgated the advanced views of John Hunter, the great physiologist and surgeon, of whose famous museum of more than ten thousand specimens, illustrative of anatomy and natural history, he became curator.

Three names shine with especial lustre upon the Nineteenth Century—Darwin, Huxley, and Spencer. The theory of evolution first appeared in De Maillet’s work, Telliamed, published in 1758, but written in 1735. More than thirty writers before Darwin treated this

theory, among whom were Erasmus Darwin, Goethe, Lamarck, and Geoffroy Saint-Hilaire. Largely owing to the opposition of Cuvier, it never succeeded until it was revived by Charles Darwin, who, after twenty-one years of work, published his results in 1858 in the Journal of the Linnæan Society, followed in the next year by The Origin of Species by Means of Natural Selection (see pages 1482-1512 of Vol. IV).

“The lifeless earth,” says Sir Robert Ball, “is the canvas on which has been drawn the noblest picture that modern science has produced. It is Darwin who has drawn this picture. He has shown that the evolution of the lifeless earth from the nebula is but the prelude to an organic evolution of still greater interest and complexity. He has taken up the history of the earth at the point where the astronomer left it, and he has made discoveries which have influenced thought and opinion more than any other discoveries that have been made for centuries.”

The neglected department of Marine Zoology the Nineteenth Century has made particularly its mission to investigate, but space only permits mention of four names: Edward Forbes, Lord Kelvin (Sir Wyville Thomson), Ernst Heinrich Haeckel, and the Prince of Monaco.

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The first, whom Lord Kelvin considers “the most accomplished and original naturalist of his time,” was a pupil of Geoffroy Saint-Hilaire, Jussieu, and De Blainville. He is regarded as the originator of the use of the dredge for collecting specimens and the first who undertook the systematic study of Marine Zoology with reference to the distribution of fauna. In 1859 his Natural History of the European Seas appeared after his death.

One of the most important investigators in this line is Prof. Haeckel, famous for his studies of the lower class of marine animals. He is also distinguished for his researches in other branches of Zoology and Palæontology, and was one of the first followers of Darwin in Germany.

Entomology has also made enormous progress during the Nineteenth Century. At the end of the Seventeenth Century, Ray estimated the number of insects throughout the world at 10,000 species! The great entomologists of the Eighteenth Century include Linnæus, De Geer, and Fabricius. Next follow Latreille, Kirby and Spence, and a host of distinguished scientists in Europe and the United States, of whom Sir John Lubbock (Lord Avebury) heads the list. A comparatively new line of investigation is that of the Chalcididæ (see Fairy Flies, pages 1449-1458, in Vol. IV).

ESTHER SINGLETON.

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THE

STORY OF THE UNIVERSE THE HEAVENS.—Amédée Guillemin

What are the heavens? Where the shores of that limitless ocean; where the bottom of that unfathomable abyss?

What are those brilliant points—those innumerable stars, which, never dim, shine out unceasingly from the dark profound? Are they sown broadcast—orderless, with no other bond save that which perspective lends to them? Or, if not immovable, as we have so long imagined, if not golden nails fixed to a crystal vault, whither are they bound? And, finally, what are the parts assigned to the sun, our earth, and all the earths attendant on the glorious orb of day in this tremendous concert of celestial spheres—this sublime harmony of the universe?

These are magnificent problems of which the most fertile imagination would have in vain attempted the solution, if, for the greater glory of the human mind, astronomy—first born of the sciences—had not at length come to our aid.

How wonderful is the power of man! Chained down to the surface of the earth, an intelligent atom on a grain of sand lost in the immensity of a space, he[26] invents instruments which multiply a thousand-fold his vision, he sounds the depths of the ether, gauges the visible universe, and counts the myriads of stars which people it; next, studying their most complicated movements, he measures exactly their dimensions and the distances of the nearest of them from the earth, and next deduces their masses; then, discovering in the seeming disorder of the stellar groupings real bonds of union, he at last evolves order from apparent confusion.

Nor is this all. Rising by a supreme flight of thought to the most abstract speculations, he discovers the laws which regulate all celestial movements, and defines the nature of the universal force which sustains the worlds.

Such are the fruits of the unceasing labors of twenty generations of astronomers. Such the result of the genius and of the patient perseverance of men who have devoted themselves for two thousand years to the study of the phenomena of the heavens. The Chaldean shepherds were, they say, the first astronomers. We can well believe it. Dwelling in the midst of vast plains, where the mildness of the seasons permitted them to pass the night in the open air, where the clear sky unfolded before them perpetually the most glorious scenes, they ought to have been, and they were, contemplative astronomers. And all of us would be what they were did not the rigor of our climate and our variable atmosphere so often prevent us observing the heavens; and did not, moreover, the turmoil and cares of civilized life deprive us of the necessary leisure.

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Nothing is more fitted to elevate the mind toward the infinite than the pensive contemplation of the starry vault in the silent calm of night. A thousand fires sparkle in all parts of the sombre azure of the sky. Varied in color and brilliancy, some shine with a vivid light, perpetually changing and twinkling; others, again, with a more constant one—more tranquil and soft; while very many only send us their rays intermittently, as if they could scarce pierce the profundity of space.

To enjoy this spectacle in all its magnificence, a night must be chosen when the atmosphere is perfectly pure and transparent—one neither illuminated by the moon, nor by the glimmer of twilight or of dawn. The heavens then resemble an immense sea, the broad expanse of which glitters with gold dust or diamonds.

In presence of such splendor, the senses, mind and imagination are alike inthralled. The impression gathered is an emotion at once profound and religious, an indefinable mixture of admiration, and of calm and tender melancholy. It seems as if these distant worlds, in shining earthward, put themselves in close communication with our thoughts.

At a first glance at the starry firmament the stars seem pretty regularly distributed; nevertheless, look at that whitish, undecided, vapory glimmer which girdles the heavens as with a belt. It is the Milky Way.[1] As we approach the borders of this star-cloud in our inspection, the stars appear more and more[28] crowded together, and most of them so small that the eye can scarcely distinguish them. The accumulation of stars in the direction of the Milky Way is more especially visible when we examine the heavens with the aid of a powerful telescope.

The Milky Way itself is nothing more than an immensely extended zone of stars, that is, of suns, since each star, from the most brilliant to the faintest, is a sun.

Here, then, is an immense group, a gigantic assemblage of worlds, which seems to embrace all the universe, if it be true that the greater number of the scattered stars situated out of the Milky Way nevertheless form part of it. In reality, this multitude of millions of suns is divided into numerous and distinct groups, and those into others still more restricted in number, each composed of two or three suns.

What breadth of space does each of these groups occupy? What is the measure of the space which holds them all? The most powerful imagination in vain attempts to answer these questions intelligibly; here numbers fail us.

Let us add—a fact well proved, and one which will seem strange to many—

Our sun himself is a star of the Milky Way.

In examining attentively every part of the starry vault, a keen eye perceives here and there whitish spots resembling little clouds. One would say they were so many patches detached from the Milky Way, from which, however, they are often very distinct and very distant. The telescope discovers by thousands[29] those cloud-patches, these—to give them their astronomical name—Nebulæ.

It was formerly imagined that each of these star-clouds was nothing more than an accumulation of stars, very close together, and very numerous—so many Milky Ways lying outside our own, and for the most part so distant that the most powerful instruments were able only to distinguish a confused glimmering. One of the most important observations of modern times, however, has shown that many of these nebulæ, including the most glorious one in our northern hemisphere—that in the sword-handle of Orion—are but masses of glowing gases.

Others, again, of these cloud-like masses—cloud-like by reason of their distance—show us, faintly shining on a background of apparent nebulæ, brilliant stars, larger no doubt, or more brilliant, than their fellows, and some of these objects called "Star-Clusters," which are nearest to us, are among the most glorious objects revealed to us by our telescopes.

Let us attempt now to conceive what fearful distances separate these archipelagoes of worlds from our own!

Unfathomable abysses whose unspeakable depths the most powerful telescopes increase indefinitely! Profound, endless, bottomless, but lighted up by millions of suns!

Such appears to us the universe from the natural observatory where we are placed. But to obtain a more complete idea of its constitution, of the infinite variety of its members, we must descend from those regions, where the sight and mind are lost, to a[30] group, nearer to us, and therefore more accessible to the investigations of man—to that group, or system, of which the earth forms part.

Of this the sun is the centre.

Round this focus of light and heat, but at various distances, revolve more than a hundred secondary bodies—Planets, some of which are accompanied by smaller ones—Satellites. Not self-luminous, they would be invisible to us, if the light, which they receive from the sun, were not reflected toward the earth, making them also appear as luminous points spread over the celestial vault like so many stars. Such would be the appearance of the earth seen in space, at a distance sufficiently great.

A common character distinguishes all the celestial bodies that form part of this group—the Solar System—from the multitude of other stars. For while the suns, composing what is called the Sidereal Universe, are situated at distances seemingly infinite, the bodies composing the group of which we speak are relatively much nearer the earth, are, in fact, our neighbors.

What results from this double fact? Two very simple consequences, easily understood.

The first is, that the stars do not undergo any sensible change of position in the starry vault. Their distance is such that they appear actually at rest in the depths of space; hence the term Fixed Stars—now abandoned, because a minute and elaborate study of their relative positions has established the fact that the stars really do move in the remote regions of the heavens. The apparent immobility of[31] which we have spoken, and which is one of their characteristics, is evidenced by the uniformity of appearance preserved for centuries by the artificial groups of stars, to which the name of Constellations has been given.

Now, it is otherwise with the bodies that revolve round our sun: they are near enough to the earth to allow of their displacements in space being perceived in short intervals of time. Traveling, by virtue of their proper motions along the starry vault, distances which appear greater as their own distance from us is less, these bodies received at the outset the name they have since retained—Planets, or Wandering Stars.

It is thus that, when we stand in the middle of an extensive plain, we judge distant objects—those that border the horizon—to be immovable; while we instantly perceive the slightest change of place in the near ones. It is true that when we ourselves move, the real movements become complicated with the apparent movements, but the former must be distinguished, if we wish to have an exact idea of the actual course traveled. This complication of the apparent movements of the planets—a necessary consequence

of the movement of the earth—is one of the most striking testimonials to the reality of the latter; but it must also be added, that this was precisely the stone of stumbling of ancient astronomy until the time—and that not long ago—when the real movements were made known. Movements of rotation, movements of revolution, around the common centre, the duration of these movements, distances,[32] forms and dimensions, distribution of light and heat, all change in passing from one planet to another. And yet, marvelous thing, the same laws govern, all in such a way that the unity of plan is not less marked than the astonishing variety of the phenomena.

One circumstance common to all the bodies of the solar system forcibly strikes the imagination. It is, that these enormous masses—these globes, many of which are much heavier than the earth, and lastly, the earth itself—are not only suspended in space, but move through the ether with velocities truly stupendous.

Imagine yourself a spectator, standing immovable in space. A luminous body appears in the distance, little by little you see it approach and increase in size; its immense circumference, which exceeds a hundred thousand leagues, is in rapid rotation, which makes each point on its periphery travel through nine miles a second. The globe itself passes before you, carried through space with a velocity twenty-four times greater than that of a cannon-ball. In such a way Jupiter would appear to you traveling in its orbit. This headlong course would banish it forever to the most remote regions of the visible universe, if it were not subdued and held by the powerful attraction of a globe a thousand times larger than its own—by the sun himself. Not only does astronomy show, by undeniable proofs, the reality of these marvelous movements—not only has she arrived at the knowledge of their invariable constancy, at least during thousands of centuries; but she[33] has found in their very rapidity the cause of the stability of all the celestial bodies.

If there is difficulty in imagining such masses freely circulating in the ether, how much more are we impressed when we consider that these rapid movements are not confined to the planets; and when we look upon the sun with all his retinue as moving in an orbit yet unknown, himself attracted no doubt by a more powerful sun, or by a group of suns! All the stars which by reason of their infinite distances appear immovable, move in different directions; and we shall see later, that if these movements are performed with extreme slowness, the slowness is apparent only. In reality, these are the most rapid celestial movements that we know of.

Thousands of centuries will be necessary before these immense sidereal voyages are accomplished. Their vast periods are to the length of our year what the dimensions of the earth are to the distances of the stars; and, according to the happy expression of Humboldt, they make of the universe an eternal timekeeper. Thus, in the contemplation of celestial phenomena, the idea of infinite duration impresses itself on the mind with the same irresistible power as the idea of the infinity of space. FOOTNOTES:

[1] Via Lactea. It is also called the Galaxy, from the Greek word for the same thing. SPACE.—Richard A. Proctor

Although astronomy tells us in the clearest words of the vast depths of space which surround our earth on all sides, we are not thereby enabled to realize their enormous extension. It is not[34] merely that the unknown depths beyond the range of our most powerful telescopes are inconceivable, but that the parts of space which we can examine are on too large a scale for us to conceive their real dimensions. It is hardly going too far to say that our powers of actual conception are limited to the extent of space over which the eye seems to range in the daytime. Of course, in the daytime, at least in clear weather, there is one direction in which the eyesight ranges over a distance of many millions of miles—namely, where we see the sun. But the sense of sight is not cognizant of that enormous distance, and simply presents the sun to us as a bright disk in the sky, or perhaps rather nearer to us than the sky. Even the distance of the sky itself is underestimated. A portion of the light we receive from the sky on a clear day comes from parts of the atmosphere distant more than thirty or forty miles from us; but the eye does not recognize the fact. The blue sky seems a little further off than the clouds, but not much; the light clouds of summer seem a little, but not much, further off than the heavier clouds of a winter sky; a cloud-covered winter sky seems a little further off than heavy rain-clouds. The actual varieties of distance among clouds of various kinds are not much more clearly discerned than the actual varieties of distance among the heavenly bodies. The estimate formed of the distance of a cloud-covered sky overhead probably amounts to little more than a mile, and it is very doubtful whether the mind presents the remotest depths of a blue sky overhead at more than two miles. Toward the horizon the distance[35] seems greater, and probably on a cloudy day the sky near the horizon is unconsciously regarded as at a distance of about five miles, while blue sky near the horizon may be regarded as lying at a distance of six or seven miles, the arch of a blue sky seeming to be far more deeply curved than that of a cloud-covered sky.

It is to distances such as these that the mind unconsciously refers the celestial bodies. We know that the moon is about 2,000 miles in diameter, but the mind refuses to present her to us as other than a round disk much smaller than those other objects in sight

which occupy a much larger portion of the field of vision. The sun can not be conceived to exceed the moon enormously in size, seeing that he appears no larger; and all the multitude of stars are judged by the sight to be mere bright points of light in reality as they appear to be.

How, then, can we hope to appreciate the vastness of space whereof astronomy tells us? To the student of science attempting to conceive the immensities of whose existence he is assured, the same lesson might be taught in parable which the child of St. Augustine's vision taught the Numidian theologian. As reasonably might an infant hope to pour the waters of ocean into a hollow, scooped with his tiny fingers in the sand, as man to picture in his narrow mind the length and breadth and depth of the abysses of space in which our earth is lost.

Yet, as a picture of a great mansion may be so drawn on a small scrap of paper as to convey just ideas of its proportions, so may the great truths which[36] astronomy has taught us about the depths of space be so presented that just conceptions may be formed of the proportions of at least those parts of the universe which lie within the range of scientific vision, though it would be hopeless to attempt to conceive their real dimensions.

When we learn that a globe as large as our earth, suspended beside the moon, would seem to have a diameter exceeding hers nearly four times, so that the globe would cover a space in the heavens about thirteen times as large as the moon covers, we form a just conception of the size of the moon as compared with the earth, though the mind can not conceive such a body as the moon or the earth really is. When, in turn, we are told that if a globe as large as the earth, but glowing as brightly as the sun, were set beside the sun, it would look a mere point of light, we not only learn to picture rightly to ourselves how largely the sun exceeds the earth, but also how enormous must be the real distance of the sun.

Another step leads us to a standpoint whence we can form a correct estimate of the vast distance of the fixed stars; for we can learn that so enormous is the distance of even the nearest fixed star, that the tremendous space separating the earth from that star sinks in turn into the merest point, insomuch that if a globe as bright as the sun had the earth's orbit as a close-fitting girdle, then this glorious orb (with a diameter of some 184,000,000 of miles) would look very much smaller than such a globe as our earth would look at the sun's distance—would, in fact, occupy but about one-fortieth[37] part of the space in the sky which she, though she would then look a mere point, would occupy if viewed from that distance.

But there is a way of viewing the immensities of space which, though not aiding us indeed to conceive them, enables the mind to picture their proportions better than any other. The dimensions of the earth's path around the sun sink into insignificance beside those of the outermost planets; but these in their turn dwindle into nothingness beside those of some among the comets. From the path of these comets, if only sentient and reasoning beings could trace out in a comet's company those mighty orbits, and could have for the duration of their existence not the brief span of time which measures the longest human life, but many circuits of their comet home around the same ruling orb (as we live during many circuits of our globe around the sun), the dimensions of the star-depths, which even to scientific insight are all but immeasurable, would be directly discernible. Not only would the proportions of that mighty system be perceived, whose fruits and blossoms are suns and worlds, but even the gradually changing arrangement of its parts could be discerned.

Some comets, indeed, do not travel around the sun, but flit from sun to sun on journeys lasting millions of years, paying each sun but a single visit. A being inhabiting such a comet, and having these interstellar journeys as the years of his existence, so that he could live through many of them, would have a wonderful insight into the economy of the stellar system. If his powers of conception as far exceeded[38] ours as the range of his travels and the duration of his existence, he would be able to recognize the proportions of a large part of the stellar universe as clearly as we recognize the proportions of the solar system.

But leaving these wonderful wanderers, whose journeys are as far beyond our powers of conception as the immensity of the regions of star-strewn space, we may find, among the comets belonging to the sun's domain, bodies whose range of travel would give their inhabitants far clearer views of the architecture of the heavens than even the profoundest terrestrial astronomer can possibly obtain.

Such a comet as Halley's, for instance, though one of comparatively limited range in space, yet travels so far from the sun that, from the extreme part of its path, it sees the stars displaced nearly twenty times as much (owing to its own change of position) as they are from the earth on opposite sides of her comparatively narrow orbit. And the length of this comet's year, if it indicated the lives of all creatures traveling along with it, would suggest a power of patiently watching the progress of changes lasting not a few of our years only, but for centuries. Seventy-five or seventy-six years elapse between each return of this comet to the sun's

neighborhood, and one who should have lived during sixty or seventy circuits of this body around its mighty orbit would have been able to watch the rush of stars, with their velocities of many miles per second, until visible displacements had taken place in their positions.

This, however, is as nothing compared with the[39] mighty range in space and the enormous period of the orbit of the great comet of the year 1811. This comet is, on the whole, the most remarkable ever known. It was visible for nearly seventeen months, and though it did not approach the sun within 100,000,000 miles, and was therefore not subject to that violence of action which has caused enormous tails to be thrown out from comets which have come within a few million miles of him, or even within less than a quarter of his own diameter, it flourished forth a tail 120,000,000 of miles in length. Its orbit has, according to the calculations of the astronomer Argelander, a space exceeding the earth's distance from the sun 211 times, and thus surpassing even the mighty distance of Neptune fully seven times. It occupies in circuiting this mighty path no less than 3,065 of our years (with a possible error either way of about forty-three years). So that, according to Bible chronology, this comet's last appearance probably occurred during the rule of the Judge Tola, son of Puah, son of Dodo, over the children of Israel, though it may have occurred during the rule of his predecessor Abimelech, or during that of his successor Jair.[2] During one-half of the enormous interval[40] between that time and 1811 the comet was rushing outward into space, reaching the remotest part of its path somewhere about the year 278 (A. D.), and from that time to 1811 it was on its return journey. It is strange to think, however, that though the remotest part of its path lay 211 times further from the sun than the earth's orbit, yet even this mighty path, requiring more than 3,000 years for a single circuit, can not be said to have carried the comet into the star-depths. If the earth were to shift its position by the some enormous amount, the nearest fixed star would have its apparent position changed only by about an eighth part of the apparent diameter of the sun or moon, or by about one-quarter of the distance separating the middle star of the Bear's tail from its close companion.

But this fact of itself is most strikingly suggestive of the vast distance of the stars. For consider what it means. Imagine the middle star of the Bear's tail to be the really nearest of all the stars instead of lying probably twenty or thirty times further away. Conceive a comet belonging to that sun after making its nearest approach to it to travel away upon an orbit requiring 3,000 years for each circuit. Then (supposing that star equal to our sun in mass) the comet, though rushing away from its sun with inconceivable velocity during 1,500 years, would, at the end of that vast period, seem to be no further away than one-fourth of the distance separating the sun from its near companion. Look at the middle star of the Bear's tail on any clear night, and on its small satellite, remembering this fact, and the awful immensity[41] of the star-depths are strongly impressed upon the mind. But the observer must not fail to remember that the star really is many times more remote than we have here for a moment supposed, and that such a comet's range of travel would be proportionately reduced. Moreover, many among the stars are doubtless hundreds, even thousands, of times still further away.

Let us turn lastly to the amazing comet of the year 1744. We find that though it had the longest period of any which has ever been assigned to a comet as the result of actual mathematical calculation, yet its range in space would scarcely suffice to change the position of the stars in such sort that the aspect of the familiar constellations would be materially altered. Euler, the eminent mathematician, calculated for this comet a period of 122,683 years, which would correspond, I find, to a distance of recession equal to 2,469 times the distance of the earth from the sun, or about eighty times the distance of Neptune. Yet this is but little more than twelve times the greatest distance of the comet of 1811. Probably the actual range of such an orbit from the middle star of the Bear's tail would be equal in appearance to the range described above on the supposition that the star is no further from us than the nearest known star (Alpha Centauri). That is, such a comet, if it could be seen and watched during a period of about 122,000 years, would seem to recede from the star to a distance equal to about one-fourth the space separating it from its close companion, and then to return to the point of nearest approach to its ruling sun.

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Such are the immensities of star-strewn space! The journey of a comet receding from the sun with inconceivable velocity during hundreds of thousands of years carries it but so small a distance from him compared with the distance of the nearest star as scarcely to change the appearance of the celestial landscape; and yet the distances separating the sun from the nearest of his fellow suns are but as hairbreadths to leagues when compared with the proportions of the scheme of suns to which he belongs. These distances, though so mighty that by comparison with them the inconceivable dimensions of our own earth sink into utter nothingness, do not bring us even to the threshold of the outermost court of that region of space to which the scrutiny of our telescopes extends. Yet the whole of that region is but an atom in the infinity of space. FOOTNOTES:

[2] It might be suggested that the appearance of this blazing comet among the stars drove the more superstitious of the Israelites at that time to the worship of star-gods, as we read how, during the Judgeship of Jair, they “served Baalim and Ashtaroth, and the gods of Syria and the gods of Moab, and the gods of the Philistines, and forsook the Lord and served not Him.” To a people like the Jews, who seem to have been in continual danger of returning to the Sabaistic worship of their Chaldean ancestors, the appearance of a blazing comet may have been a frequent occasion of backsliding. EXTENT OF THE SIDEREAL HEAVENS.—Sir Robert S. Ball

Of all the discoveries that have ever been made in science there are two which especially baffle our powers of comprehension. They lie at the opposite extremes of nature. One relates to objects which are infinitely small, the other relates to objects which are almost infinitely great. The microscope teaches us that there are animals so minute that if a thousand of them were ranged abreast they would easily swim without being thrown out of line through the eye of the finest cambric needle. Each of those minute creatures is a highly organized number of particles,[43] capable of moving about, of finding and devouring its food, and of behaving in all other respects as becomes an animal as distinguished from an unorganized piece of matter. The mind is capable of realizing the structure of these little creatures, and of fully appreciating their marvelous adaptation to the life they are destined to lead. If these animals excite our astonishment by reason of their extreme minuteness, there is an appeal made to conceptions of an entirely different character when we learn the lessons which the telescope teaches. As the microscope reveals the excessively minute, so does the telescope disclose the sublimely great. In each case myriads of objects are submitted to our astonished view, but while the microscope brings before us creatures of which countless millions could swim about freely in a thimbleful of water, the telescope conducts our vision to uncounted legions of stars, many of them millions of times larger than the earth.

The grandest truth in the whole of nature is conveyed in that first lesson in astronomy which answers the question: What are the stars? This is a question that a child will ask, and I have heard of a child’s pretty idea that the stars were little holes in the sky to let the glory of heaven shine through. The philosopher will replace this explanation by another hardly less poetical, which will enable us to form some more adequate notion of the real magnificence of the universe. Each star that we see is, it is true, only a glittering little point of light, but that is merely because we are a long way from it. An electric light which will dazzle your eye when quite[44] close will be reduced to an agreeable illumination if it is at a little distance, will become a faint light a mile away, and at no great distance will become altogether invisible. We must remember that out in space there is plenty of room—there are no bounds; and therefore when we see light glistening in the far distant depths we can not at once conclude that the light is a faint one because it appears to us to be faint. It may be that the light is only faint because it comes from such a tremendous distance. In fact, the brightest light conceivable could be reduced to the insignificance of a small star if only it were removed sufficiently far.

The most intense light we know of comes, of course, from the light which rules by day, from our sun himself. The sun pours his unrivaled beams around us in all directions with prodigal abundance, notwithstanding his enormous distance of ninety-three millions of miles. Let me describe an experiment with respect to our sun, an experiment, it is needless to say, which could never be performed, but the results to which it leads us are none the less certain. Astronomers have demonstrated them in many other ways.

Suppose that the sun were gradually to be moved away further and further into space; suppose that by this time to-morrow the great luminary should be twice as far as it is now, and the next day should be three times as far, and the day after that four times, and so on until in a year’s time we should find that the sun was 365 times the distance from us that it is at present. Let us now trace the changes[45] which we should see in the brilliancy of our orb of day. When he had reached double his distance from us, we should find that the light had decreased to a quarter of its present amount, and the heat which we derived from his beams would have decreased in the same proportion. In ten days we should find that the light had become so feeble as to be only one-hundredth part of that which we enjoy now. The apparent size of the sun would also be steadily decreasing, for as the distance of a body increases its apparent dimensions diminish. Sometimes the diminution of apparent size with distance is well illustrated on a clock tower. You would hardly believe that the hands and face of a clock like that at Westminster were so large until you happen to see a man cleaning or repairing it, when he appears a mere pigmy in comparison with the mighty dial which points out the hours. In a similar way with every increase of distance, the apparent size of the sun would decline, and in the lapse of a year the sunlight would be reduced to a feeble twilight. The sun itself would remain visible for many years, even if it were steadily moving away, though its lustre would continually decline, and its size would continually diminish, until at last it would have shrunk to the insignificance of a small point of light, still visible as a glittering object, but too minute to enable any definite form to be perceived.

Further still, the sun might recede until it passed beyond the reach of vision of the unaided eye; the telescope would, however, be able to pursue the retreating luminary until at last it sank into the[46] depths of space beyond the reach of any instrument whatever.

This little argument will prepare us for an explanation of the stars. They merely appear to us to be points of light of varying degrees of brightness, but we have seen that our own sun might be reduced in lustre to that of the very dimmest of the stars if only it were removed sufficiently far. If, therefore, the stars are at a great enough distance from our system, it may indeed be that they also are suns, possibly equaling, or possibly even surpassing, our own sun in magnificence.

Here is indeed an imposing suggestion. Can it be that the host of stars which adorn our midnight sky are actually suns themselves of an importance comparable with that of our own? This is a great thought, and we desire to test it by every means in our power. You will see from the reasoning I have given that the whole question turns simply on one point, and that is: How far off are the stars?

The tiniest point of light that is just seen as a glimmer in the mightiest of telescopes may be indeed a sun as great, or indeed a million times greater, than our sun, if only that star be sufficiently far off. To find the distance of a star is a problem which taxes the utmost powers of the painstaking astronomer; every refinement of skill in making his measurements and of care in the calculation of his observations have to be lavished on the operation. Alas! it but too often happens that the astronomer's labors prove to be futile. The surveying navigator often has to mark on his chart that no bottom could be[47] found in the depths of the sea. His appliances would not work, or work reliably, in those ocean abysses; so, too, the astronomer, when he tries to sound the depths of space to the distances of the stars, has also to mark, generally speaking, "No bottom here," as the result of most of his investigations. When this is the case we know for certain that the star on which his calculations have been made must be a gorgeous sun, because we are assured of the greatness of its distance, even though we have not been able to find out what that distance was. There are, however, some few places through the sky where the astronomer's sounding line can, so to speak, touch bottom; there are a few stars of which we do know the distance, and the result is not a little significant. Were our sun to be withdrawn from us to a distance so great as that of the very nearest of the stars, our magnificent ruler and benefactor would certainly have lost all his splendor; he would, in fact, have shrunk to the similitude of a little star not nearly so bright as many of those which we see over our heads every night. Imagine the sun's light subdivided into two hundred thousand parts, each of which would give us only a feeble illumination, and then imagine that each of these parts was again divided into two hundred thousand parts more, and it is one of these last fragments that would represent the miserable lustre which the sun would then display.

From these considerations we can enunciate the magnificent truth which astronomy discloses to us. I do not think that in the whole range of nature there is any thought so magnificent or so imposing as that[48] which teaches us to regard every star of every constellation as a sun. We can not indeed assert that they are all so great as our sun, but we can affirm with certainty that many of them are far greater and far more splendid. Considering that our sun presides over a system of worlds of which the earth is one, that it gives light and heat to those worlds, and guides them in their movements, it would greatly enlarge our conceptions of the universe if we were assured that there was even one more sun as large and as splendidly attended as is our own. But now we find that not only is there one additional sun, but that they teem in uncounted thousands through space. Look, for example, on the next fine night at the Great Bear, the best known of all our northern constellations, and there you see seven stars forming the well-known feature. Figure in your mind's eye each one of those stars in the likeness of a majestic sun, as big, warm, and bright as our sun, and look at other parts of the sky and repeat the process with the other constellations, and your conception of the magnificence of the starry system will begin to assume proper proportions. But this is only the first step, you must next look at the smaller stars, and reflect that they, too, are also suns, only much further off as a general rule than the brighter stars, though this is by no means invariably the case. Thus your estimate of the number of suns in the universe will rise to thousands, but you will not stop there, you will get a telescope to help you, and, to your extreme delight and wonder, you will find that there are hosts of stars—too faint to be visible to the[49] eye, but which the telescope will immediately disclose. You will get a more powerful instrument, and then you will perceive that the stars are to be numbered by tens of thousands, and even by millions, and with every fresh accession of power in your telescope fresh troops and myriads of suns are revealed. Suns in clusters, suns strewn thickly here and sparsely there, so as to give us the notion that the only limit to the number we can see is the power of the telescopes we are using. Attempts at actual numeration are futile, for who can tell the number of the stars?

We can, however, form an estimate, and by taking samples, so to speak, of the sky here and other samples there, we have been enabled to learn the overwhelming fact that our universe does contain at the very least one hundred millions of suns.

In discussing the extent of the visible universe, it must always be borne in mind that the further a source of light is from us the fainter is the illumination which we receive from it. Suppose that a star which just lies on the limits of naked-eye visibility were somehow to be transported to a distance which is twice as great, then the lustre of that star would be diminished to one-fourth of its original amount. It would, therefore, be of course invisible to the unaided eye, but could still be easily perceived by a telescope.

Indeed, the very word telescope means an instrument for looking at objects a long way off, and the effect of the telescope is to reduce the apparent distance of the object.

The bulk of a grain of sand as compared with the[50] bulk of a football may illustrate the space accessible to our eyes when compared with the space accessible to one of the great telescopes. The larger of these spaces has a thousand times the diameter of the others; therefore, the relative quantities of these spaces are to be obtained by multiplying 1,000 by 1,000 and by 1,000 again. Thus we finally learn that the amplitude of our vision is augmented to one thousand million times its original extent by the use of our greatest telescopes. It need, therefore, be no matter for surprise that the number of stars visible through our great telescopes or recorded on the sensitive films of photographic plates should number scores of millions. In fact, it would sometimes seem surprising that the number of telescopic stars is not even greater than it actually appears to be. If we are able to explore one thousand million times as much space, we might expect that the number of objects disclosed would be also increased about a thousand million-fold, but this is certainly not the case. The truth seems to be that our sun is but one star of a mighty cluster of stars; we happen to lie near the middle of the cluster, and the rest of the stars belonging to it form what we know as the Milky Way. There are, of course, other clusters scattered through the heavens, some of them, perhaps, as great as that body of stars which forms the Milky Way. Owing to our residence in this cluster we see the neighboring suns in multitudes, and thus we receive the impression that the solar system lies in an exceptionally rich part of the universe in as far as the distribution of stars is concerned.

[51]

On the outskirts of the universe lie those faintest and dimmest of objects which we can just perceive through our greatest telescopes. We know that many of the stars around us would still remain visible in great instruments, even though they were removed a thousand times as far off. Among the myriads of faint stars which we see from our observatories, there may be many, indeed there must be many, which are fully a thousand times as distant as the bright stars which twinkle in our comparative neighborhood. We thus obtain some conception of the stupendous distance at which the outskirts of the universe are situated.

There are different ways of illustrating this point, but I think the simplest, as well as the most striking, is that which is founded on the velocity of light. It is a remarkable fact that the beautiful star known as Vega[3] has a distance from us so tremendous that its light must have taken somewhere about eighteen years to travel hither from thence. Notwithstanding that the light dashes along with such inconceivable speed that it will cover 185,000 miles in every second, notwithstanding that a journey at this pace will complete the entire circuit of this globe seven or eight times between two successive ticks of the clock, the light will, nevertheless, take eighteen years to reach our eye from the time it leaves Vega. We do not, therefore, see the star as it is at present; we see it as it was eighteen years ago. For the light which this evening enters our eyes has been all that[52] time on its journey. Indeed, if Vega were actually to be blotted out from existence it would still continue to shine out as vividly as ever for eighteen years before all the light on its way had reached us.

We have been led to the belief that among the more distant stars in the universe there must be many which are fully a thousand times as far from us as is Vega, hence we arrive at the startling conception that the light they emit has been on its journey for 18,000 years before it reached us. When we look at those lights to-night we are actually viewing them as they were 18,000 years ago. In fact, those stars might have totally vanished 17,000 years ago, though we and our descendants may still see them glittering for yet another thousand years.

We shall realize a little more fully what this reasoning involves if we suppose that astronomers dwelt on such a star, and that they had eyes and telescopes sufficiently keen not only to discern our little earth, but even to scrutinize its surface with attention. Let us suppose that the stellar astronomers looked at England: do you think they would see a network of railways joining mighty and populous cities, furnished with immense manufactories and with countless institutions? Such would be the England of to-day. But from the distance at which these astronomers are situated light takes 18,000 years for its journey, and, therefore, what they would see would be England as it was 18,000 years ago. To them England would even now appear as a country mainly covered with forests inhabited by bears and wolves, and totally void of any trace of civilization. This illustration[53] will, at all events, serve to convey some conception of the distance at which the outskirts of our visible universe are plunged in the depths of space.
FOOTNOTES:

[3] Vega is the brightest star in the Lyre and is nearly always at night directly overhead in our latitude.—E. S. THE STARS.—Amédée Guillemin

No sight is at once so awe-inspiring and so grand as that of the heavens on a beautiful night. If care be taken to choose as a standpoint for observation an open place, such as a plain or the summit of a hill on land, or, again, the open sea, and if the atmosphere, somewhat charged with dew, possesses all its transparency and purity, we shall see thousands of luminous points twinkling in all directions, accomplishing slowly and together their silent march. The contrast of the obscurity which reigns on the surface of the earth with the brightness of that resplendent vault gives an indefinite depth to the celestial ocean that deepens over our heads. But let us here leave the magnificence of the spectacle to study it in its most minute details.

Let us commence with the appearances. A characteristic common to all the stars is an incessant and very rapid change of brightness, which has received the name of scintillation. This is accompanied by variations of color equally rapid, due to the same cause as the successive disappearances and reappearances. All stars scintillate, whatever may be their brilliancy, at least in our temperate regions. But the intensity of this luminous movement is not the same in all, and it varies, moreover, both with the degree of purity of the sky, the elevation of the[54] stars above the horizon, and the temperature of the night.

According to Arago, scintillation is due to the difference of velocity of the various colored rays traversing the unequally warm, unequally dense, unequally humid atmospheric strata. Thus, in tropical regions, where the atmospheric strata are more homogeneous, scintillation is rarely observed in stars the elevation of which above the horizon is more than 15°, or the sixth of the distance of the horizon from the zenith. “This circumstance,” says Humboldt, “gives to the celestial vault of these countries a particularly calm and soft character.”

Another specific character of the stars is that their diameters are without appreciable dimensions. To the naked eye, this distinction would be insufficient, since, the moon and the sun excepted, the most considerable planets have not sensible diameters. But, while the magnifying power of optical instruments shows us the principal planets under the form of clearly defined disks, the most powerful glasses only show a star as a luminous point. The distance which separates us from these bodies is so great that there is nothing to astonish us in such a result.

Wollaston affirms that the apparent diameter of the most brilliant star in the heavens, Sirius, is not more than the fiftieth part of a second of an arc. But let us hasten to say that this result still leaves a good margin as to the real dimensions of the star, since, at the distance of Sirius, an apparent diameter would represent a real diameter of 11,000,000 miles; that is, twelve times the diameter of our sun.

[55]

Let us add, lastly, that the absence of appreciable dimensions does not suffice to distinguish absolutely the stars from the planets, since a certain number of the latter, as we have before seen, appear in telescopes only as simple luminous points. Let us come, then, to a permanent specific characteristic, the knowledge of which will always prevent us from confounding a star with one of the known or unknown bodies which form part of our solar group. This characteristic is as follows:

The stars, properly so called, preserve among themselves—nearly enough for our present purpose—the same relative distances. They form, then, on the celestial vault apparent groups, the configuration of which is nearly invariable. Centuries must elapse to show a change of form, unless we employ extremely delicate measures. A planet, on the contrary, moves rapidly across these groups, to such a degree that, in the interval of a night, or at most of a few nights, this displacement is very perceptible; hence the old denomination of fixed stars, in opposition to the wandering ones, or planets.

We must be careful, however, to guard against assigning to this word a rigidity which it does not possess, for the stars really move with a velocity not inferior to that which animates the members of our system. Their immense distance is the only cause of their apparent immobility, which vanishes when precise observations, embracing a sufficient interval of time—some years, for example—are made.

A fact which strikes every one is the great diversity of brightness in the stars which people the[56] heavens. All degrees of intensity are remarked, from the resplendent light of Sirius to the scarcely perceptible glimmer of those hardly visible to the naked eye.

Whence arises this difference of brightness? This question we can not answer for any star in particular, but it is easy to imagine that it may result from various circumstances, such as their less or greater distance, the real and various dimensions of the bodies, and, lastly, the intrinsic brightness of the light peculiar to each. However this may be, astronomers without regard to the unknown causes which may influence the intensity of the stellar light, have divided stars into classes or magnitudes; and when we speak of a star of the first, second, or fifth magnitude, it is understood that this way of speaking refers only to the apparent brightness, and that

nothing is affirmed either as to the real dimensions or distance, or even intrinsic brightness.

Besides, as the stars, arranged in the order of their brightness, would form a progression decreasing by imperceptible degrees, the classes adopted are themselves conventional and arbitrary. The first six magnitudes comprise all stars visible to the naked eye. But the use of the most powerful telescopes brings to view stars of feebler light, descending to the sixteenth and seventeenth magnitudes. In truth, the progression has no inferior limit: it extends more and more in proportion as the progress of the optician's art increases the penetrating power of our instruments.

To gain an idea of the respective intensities of the light emitted by the stars of the first six magnitudes,[57] following the scale adopted by astronomers, the accompanying illustration (Fig. 1), should be inspected; in it the stars are figured by disks, the surfaces of which are in proportion to their brilliancy.

But, we repeat, it must not be thought that the stars ranked in the same class are, on that account, of the same brightness. Thus the light of Sirius is estimated at four times the star Alpha Centauri; but both, nevertheless, are included by astronomers in the number of the stars of the first magnitude. Relative star brightness Fig. 1.—Relative Brilliancy of Stars of the first Six Magnitudes

We here give the names of the twenty most brilliant stars of the two hemispheres which it is usual to consider as forming the first class. They are here arranged in the order of their brightness: 1. Sirius 11. Achernar 2. Eta Argus 12. Aldebaran 3. Canopus 13. Beta Centauri 4. Alpha Centauri 14. Alpha Crucis 5. Arcturus 15. Antares 6. Rigel 16. Altair 7. Capella 17. Spica 8. Vega 18. Fomalhaut 9. Procyon 19. Beta Crucis 10. Betelgeuse 20. Pollux

Lastly, Regulus, a bright star in the constellation of the Lion, is also ranked by some astronomers in the[58] first magnitude, while others only admit in this class the first seventeen stars in the above list. These divergences are of no importance.

In proportion as the scale of brilliancy or magnitude is descended, the number of the stars contained in each class rapidly increases. The number of second magnitude stars in the heavens is about 65; of the third, about 200; of the fifth, 1,100; and of the sixth magnitude, 3,200. Adding these numbers together, we obtain a few over 5,000 stars of the first six magnitudes, and these comprise very nearly all those that can be seen with the naked eye.

The smallness of this number nearly always astonishes those who have not tried to form an exact estimate of the number of stars which shine in the celestial vault on the most favorable nights.

The aspect of the multitude of sparkling points which are scattered over the sky makes us disposed to believe that they are innumerable, and to be counted, if not by millions, at all events by hundreds of thousands. This is, nevertheless, an illusion. All observers who have taken the trouble to make an exact enumeration of the stars visible to the naked eye have arrived at a maximum of 3,000 as the mean number which can be observed in every part of the heavens, visible at the same time, at the same place; this, of course, is but half of the entire heavens.

Argelander has published an exact catalogue of the stars visible on the horizon of Berlin during the course of the year. This catalogue comprises 3,256 stars. According to Humboldt, there are 4,146 visible on the horizon of Paris in the whole course of[59] the year; and as this number increases in proportion as we approach the Equator, that is to say, in proportion as the double movement of the earth unfolds to us during a year a more extensive portion of the heavens, 4,638 stars are already visible to the naked eye on the horizon of Alexandria.

We repeat, the maximum number is comprised between 5,000 and 6,000 stars for the entire heavens, including those seen by the most piercing and most accustomed eyes in the best nights for observation. When the atmosphere is lit up by the moon, or by twilight, or, as happens in the great centres of population, by the illumination of the houses and streets, the lowest magnitude stars are effaced altogether, and the number of those visible is consequently much more limited. We may add in conclusion, that the more the scintillation, the more easy it is to distinguish very faint stars.

A word now on the number of stars that can be seen with the help of the telescope. Here we shall find the numbers which our imagination had erroneously led us to believe are visible to the naked eye.

According to the illustrious director of the Observatory of Bonn—Argelander—the seventh magnitude comprises nearly 13,000 stars; the eighth, 40,000; and, lastly, the ninth, 142,000. The calculations of Struve give the total number of stars visible in the entire heavens by the aid of Sir William Herschel's 20-foot reflector as more than 20,000,000. But, without doubt, these approximate numbers are much below the real ones. It will be seen, besides, that the richness of the heavens in stars is very unequal.[60] The

bright zone known under the name of the Milky Way alone contains, according to Herschel, 18,000,000. THE LUCID STARS.—J. E. Gore

The term “lucid” has been applied to the stars visible to the naked eye, without optical aid of any kind.[4] Many people think that the number of stars visible in this way is very large. But in reality the number visible to the naked eye is comparatively small. Some persons are, of course, gifted with very keen eyesight—“miraculous vision” it is sometimes called—and can see more stars than others; but to average eyesight the number visible in this way, and which can be individually counted, is very limited. The famous Hipparchus formed a catalogue of stars in the year 127 B. C. This presumably contained all the most conspicuous stars he could see in his latitude, and it includes only 1,025 stars. Al-Sûfi, the Persian astronomer, in his Description of the Fixed Stars, written in the Tenth Century, describes the positions of only 1,018 stars, although he refers to a number of other faint stars, of which he does not record the exact places. Pliny thought that about 1,600 stars were visible in the sky of Europe.

In modern times, however, a considerable number of fainter stars have been recorded as visible to the naked eye. The famous German astronomer, Heis, who had keen eyesight, records the positions of 3,903[61] stars north of the Equator, and 1,040 between the Equator and 20 degrees south declination, or a total of 4,943 stars between the North Pole and 20 degrees south of the Equator. This would, I find, give a total of about 7,366 stars for both hemispheres if the stars were equally distributed. Behrmann, in his Atlas of Southern Stars, between 20 degrees south declination and the South Pole, shows 2,344 stars as visible to the naked eye. This would give a total of 7,124 for both hemispheres. The actual number seen by Heis and Behrmann in both hemispheres is 4,943 + 2,344, or 7,287 stars. The Belgian astronomer, Houzeau, published a catalogue and atlas of the stars in both hemispheres, made from his own observations in Jamaica and South America, and finds a total of 5,719 stars in the whole sky. As all these observers had good eyesight, we may take a mean of the above results as the total number visible to the naked eye in the whole star sphere. This gives 6,874 stars, or in round numbers we may say that there are about 7,000 stars visible to average eyesight in both hemispheres. This gives, of course, about 3,500 stars to one observer at the same time at any point on the earth’s surface.

As the whole star sphere contains an area of 41,253 square degrees, we have an average of one star to six square degrees. In other words there is, on an average, one lucid star in a space equal to about thirty times the area covered by the full moon! This result may seem rather surprising considering the apparently large number of stars visible to the naked eye on a clear night, but the fact can not be denied.[62] The stars are not, of course, equally distributed over the surface of the sky, but are gathered together in some places, and sparsely scattered in others, and this may perhaps help to give the impression of a greater number than there really are.

That the stars are of various degrees of brightness was recognized by the ancient astronomers. Ptolemy divided them into six classes, the brightest being called first magnitude, those considerably fainter the second, those much fainter still the third, down to the sixth magnitude, which were supposed to be the faintest just visible to the naked eye on a clear moonless night. Ptolemy only recorded whole magnitudes, but Al-Sûfi, in the Tenth Century, divided these magnitudes, for the first time, into thirds. Thus a star slightly less than an average star of the second magnitude he called 2—3, that is nearer in brightness to 2 than to 3; one a little brighter than the third he recorded as 3—2, or nearer to 3 than to 2, and so on. This method has been followed by Argelander, Behrmann, Heis, and Houzeau, but in the photometric catalogues of Harvard, Oxford, and Potsdam the magnitudes are measured in decimals of a degree. This has been found necessary for greater accuracy, as the heavens contain stars of all degrees of brightness.

The term “magnitude” means the ratio between the light of a star of a given magnitude and that of another exactly one magnitude fainter. This ratio has been variously estimated by different astronomers, and ranges from 2.155, found by Johnson in 1851, to 3.06, assumed by Pierce in 1878. The value[63] now universally adopted by astronomers is 2.512 (of which the logarithm is 0.4). This number is nearly a mean of all the estimates made, and agrees with the value found by Pogson in 1854 by means of an oil flame, and by Rosen with a Zöllner photometer in 1870. It simply means that an average star of the first magnitude is 2.512 times the brightness of a star of the second magnitude; a star of the second, 2.512 times brighter than one of the third, and so on. This makes a star of the first magnitude just 100 times brighter than one of the sixth.

There are several stars brighter than an average star of the first magnitude, such as Aldebaran. These are Sirius, which is nearly 11 times brighter than Aldebaran (according to the revised measures at Harvard); Canopus, the second brightest star in the heavens, and about two magnitudes brighter than Aldebaran; Arcturus, Capella, Vega, Alpha Centauri, Rigel, Procyon, Alpha Eridani, Beta Centauri, and Alpha Orionis. Al-Sûfi rated 13 stars of the first magnitude, visible at his station in Persia, and Halley

enumerates 16 in the whole sky. According to the Harvard photometric measures, there are 13 stars in both hemispheres brighter than Aldebaran, which is rated 1.07.

As average stars of the different magnitudes the following may be taken as examples, derived from the Harvard measures: First magnitude, Aldebaran and Spica; second magnitude, β Aurigæ and β Canis Majoris; third magnitude, ι Aurigæ and β Ophiuchi; fourth magnitude, θ Herculis and ε Draconis; and fifth magnitude, ρ Ursæ Majoris and ω Sagittarii.[64] Stars of about the sixth magnitude are, of course, numerous, and lie near the limit of naked-eye vision for average eyesight, although on clear moonless nights still fainter stars may be “glimpsed” by keen-eyed observers.

The stars have been divided into groups and constellations, now chiefly used for the purpose of reference, but in ancient times they were associated with the imaginary figures of men and animals, etc. The origin of these constellation figures is doubtful, but they are certainly of great antiquity. Ptolemy’s constellations were 48 in number, but different writers from the First Century B. C. give different numbers, ranging from 43 to 62. Bayer’s Uranometria, published in 1603, contains 60, 12 new constellations in the Southern Hemisphere having been added by Theodorus to Ptolemy’s original 48.

The figures representing the constellations were originally drawn on spheres, or celestial globes, as they are now called. The ancient astronomers attributed the invention of the sphere to Atlas. It seems certain that a celestial sphere was constructed by Eudoxus in the Fourth Century B. C. Strabo speaks of one made by Krates about the year 130 B. C., and according to Ovid, Archimedes had constructed one at a considerably earlier period. None of these ancient spheres has been preserved. There is, however, in the Vatican a fragment in marble of a Græco-Egyptian planisphere, and a globe in the museum of Arolsen, but these are of much later date. Our knowledge of the original constellation figures is derived from the accounts given by Ptolemy and[65] his successors, and from a few globes which only date back to the Arabian period of astronomy. Among the Arabian globes still existing the most famous is one made of copper, and preserved in the Borgia Museum at Velletri in Italy. It is supposed to have been made by a person called Caisar, who was executed by the Sultan of Egypt in A. D. 1225. The most ancient of all is one discovered some years ago at Florence. It is supposed to date back to A. D. 1081, and to have been made by Meucci. There is also one in the Farnese Museum at Naples, made in A. D. 1225. Of modern celestial globes the oldest is one made by Jansson Blaeu in 1603. This gives all the constellations of the Southern Hemisphere as well as the Northern.

Ptolemy’s figures of the constellations were restored by the famous painter Albert Dürer of Nuremberg in 1515. The figures on modern globes and maps have been copied from this restoration. Dürer’s maps are now very rare.

In 1603, an atlas was published by Bayer. This was the first atlas to show the southern sky, and the first to designate the brightest stars by the letters of the Greek alphabet.[5] Flamsteed published an atlas in 1729. Maps and catalogues of the lucid[66] stars have been published in recent times by Argelander, Behrmann, Heis, Houzeau, Proctor, and others. Of these Heis’s is, perhaps, the most reliable, at least so far as accurate star magnitudes are concerned. Houzeau shows both hemispheres, all the stars had been observed by himself in Jamaica and South America. Behrmann’s maps are confined to the Southern Hemisphere, between the South Pole and 20 degrees south of the Equator. The maps of the Uranometria Argentina, made at Cordoba in the Argentine Republic, show all the southern stars to the seventh magnitude, but many of these are beyond the reach of ordinary eyesight.

It is a well-known fact that the planets Venus and Jupiter are bright enough to form shadows of objects on a white background. It has also been found that the brightest stars, especially Sirius, are sufficiently brilliant to cast shadows. Kepler stated that a shadow was formed by even Spica, but I am not aware that this has been confirmed by modern observations.

There are some remarkable collections or clusters of stars visible to the naked eye, of these the Pleiades are probably the best known. To ordinary eyesight 6 stars are visible, but Möstlin, Kepler’s tutor, is said to have seen 14 with the naked eye, and some observers in modern times have seen 11 or 12. Other naked-eye clusters are the Hyades in Taurus, called Palilicium by Halley, and the Præsepe, or Bee-Hive in Cancer. Of larger groups, the Plow or Great Bear, Cassiopeia’s Chair, and Orion are probably known to most people.

[67]

Many of the lucid stars are double, that is, consist of two components, but most of these are only visible in powerful telescopes. There are, however, a few objects visible to the naked eye as double, and these have been called “naked-eye doubles,” although not strictly double in the correct sense of the term.

Ptolemy applied the term double to the star ν Sagittarii, which consists of two stars separated by a distance of fourteen minutes of arc, or about half the apparent diameter of the moon. According to Riccioli, Van der Hove saw two naked-eye doubles, one in Capricornus, 5 to 5½ minutes distant, and the other in the Hyades, 4½ or 5 minutes apart. The one in Capricornus was probably α, and the one in the Hyades θ Tauri. The middle star in the tail of the Great Bear, or handle of the Plow, has near it a small star, Alcor, which to many eyes is distinctly visible without optical aid. The famous Belgian astronomer, Houzeau, who seems to have had excellent sight, saw the star χ Tauri double, and 51 and 56 Tauri separated, also ι Orionis, and others.

Many of the stars are variable in their light, and several hundred of these curious and interesting objects are now known to astronomers. In a few of these the light changes may be followed with the naked eye. It is an interesting question whether any of the lucid stars have disappeared or changed in brightness since the early ages of astronomical observations. Al-Sûfi failed to find seven of Ptolemy's stars, and Ulug Bekh, comparing his observations with the catalogues of Ptolemy and Al-Sûfi, announced[68] twelve cases of supposed disappearance. Some of these may, however, be due to errors of observation. Montanari, writing in 1672, mentions two stars as having disappeared, namely β and γ of the constellation Argo, but these stars are now visible in the positions originally assigned to them.

In a careful examination of Al-Sûfi's description of the stars written in the Tenth Century, and a comparison with modern estimates and measures, I have found several very interesting cases of apparent change in the brightness of the lucid stars. Al-Sûfi was an excellent and careful observer, and as a rule his estimates agree well with modern observations. We can therefore place considerable reliance on his estimates of star magnitudes. The Story of Theta Eridani has been well told by Dr. Anderson, and there seems to be no doubt that this southern star, which is now only of the third magnitude, was a bright star of the first magnitude in Al-Sûfi's time! The following are other interesting cases of apparent change which I have met with in my examination of Al-Sûfi's work. The Pole Star was rated third magnitude by both Ptolemy and Al-Sûfi, but it is now of the second magnitude, or a little less. The star γ Geminorum was rated third magnitude by Ptolemy and Al-Sûfi, or equal to δ Geminorum, but γ is now of the second magnitude, and its great superiority in brightness over δ is noticeable at a glance. Another interesting case is that of ζ and ο Persei, two stars which lie near each other, about seven degrees north of the Pleiades. Al-Sûfi distinctly describes these stars as both of the 3—4 magnitude; but Argelander,[69] Heis, and the photometric measures at Harvard agree in making ζ about one magnitude brighter than ο. The stars being close are easily compared, and their present great difference in brightness is very noticeable. This is one of the most remarkable cases I have met with in Al-Sûfi's work, and strongly suggests variation in ο, as ζ is still about the same brightness as Al-Sûfi made it. The identity of the stars is beyond all doubt, as Al-Sûfi describes their positions very clearly, and says there is no star between them and the Pleiades, a remark which is quite correct for the naked eye. The remarkable decrease in brightness of β Leonis (Denebola) since Al-Sûfi's time has been considered in my paper on Some Suspected Variable Stars. That it was a bright star of the first magnitude is fully proved by the observations of Al-Sûfi and Tycho Brahe. These were careful and accurate observers, and they could not have been mistaken about a star of the first magnitude. β Leonis is now fainter than an average star of the second magnitude, and there can be no reasonable doubt that it has faded considerably since the Tenth Century.

There are some other discrepancies between Al-Sûfi's observations and modern estimates, but the above are perhaps the most remarkable. With reference to lucid stars not mentioned by Al-Sûfi, he has not, I think, omitted any star brighter than the fourth magnitude in that portion of the sky visible from his station. There are, however, a number of stars between the fourth and sixth magnitudes which he does not mention. Of these the brightest[70] seem to be ε Aquilæ, ρ and μ Cygni, and ζ Coronæ Borealis.

With reference to the distribution of the lucid stars in the sky there seems to be a well-marked tendency to congregate on the Milky Way. It is a remarkable fact that of the 15 brightest stars in the heavens, no less than 11 lie on or near the Milky Way, although the space covered by the Galaxy does not exceed one-fifth or one-sixth of the whole sky. From a careful enumeration of the stars in or near the Milky Way which I made some years ago, I found that of stars brighter than the fourth magnitude there are 118 on the Milky Way out of a total of 392, or about 30 per cent. From the Southern catalogue known as the Uranometria Argentina, Colonel Markwick, F.R.A.S., found 121 out of 228 stars to fourth magnitude, or a percentage of 53 per cent. These results seem to show some intimate relation between the lucid stars and the Galaxy. FOOTNOTES:

[4] Except concave spectacles used by short-sighted persons.

[5] This custom has since prevailed. The following are the letters and their names: α Alpha η Eta ν Nu τ Tau β Beta θ Theta ξ Xi υ Upsilon γ Gamma ι Iota ο Omicron φ Phi δ Delta κ Kappa π Pi χ Chi ε Epsilon λ Lambda ρ Rho ψ Psi ζ Zeta μ Mu σ Sigma ω Omega THE CONSTELLATIONS.—Camille Flammarion

The earth is forgotten, with its small and ephemeral history. The sun himself, with all his immense system, has sunk in the infinite night. On the wings of inter-sidereal comets we have taken our flight toward the stars, the suns of space. Have we exactly measured, have we worthily realized the road passed over by our thoughts? The nearest star to us reigns at a distance of 275,000 times 37[71] millions of leagues—that is to say, at ten trillions[6] of leagues (about twenty-five billions of miles); out to that star an immense desert surrounds us, the most profound, the darkest, and the most silent of solitudes.

The solar system seems to us very vast, the abyss which separates our world from Mars, Jupiter, Saturn, and Neptune appears to us immense; relatively to the fixed stars, however, our whole system represents but an isolated family immediately surrounding us: a sphere as vast as the whole solar system would be reduced to the size of a simple point if it were transported to the distance of the nearest star. The space which extends between the solar system and the stars, and which separates the stars from each other, appears to be entirely void of visible matter, with the exception of nebulous fragments, cometary or meteoric, which circulate here and there in the immense voids. Nine thousand two hundred and fifty systems like ours (bounded by Neptune), would be contained in the space which isolates us from the nearest star!

If a terrible explosion occurred in this star, and if the sound could traverse the void which separates it from us, this sound would take more than three millions of years to reach us.

It is marvelous that we can perceive the stars at such a distance. What an admirable transparency in these immense spaces to permit the light to pass, without being wasted, to thousands of billions of[72] miles! Around us, in the thick air which envelops us, the mountains are already darkened and difficult to see at seventy miles; the least fog hides from us objects on the horizon. What must be the tenuity, the rarefaction, the extreme transparency of the ethereal medium which fills the celestial spaces!

Let us suppose ourselves, then, on the sun nearest to ours. From there our dazzling furnace is already lost like a little star, hardly recognizable among the constellations: earth, planets, comets sail in the invisible. We are in a new system. If we thus approach each star we find a sun, while all the other suns of space are reduced to the rank of stars. Strange reality!—the normal state of the universe is night. What we call day only exists for us because we are near a star.

The immense distance which isolates us from all the stars reduces them to the state of motionless lights apparently fixed on the vault of the firmament. All human eyes, since humanity freed its wings from the animal chrysalis, all minds since the minds have been, have contemplated these distant stars lost in the ethereal depths; our ancestors of Central Asia, the Chaldeans of Babylon, the Egyptians of the Pyramids, the Argonauts of the Golden Fleece, the Hebrews sung by Job, the Greeks sung by Homer, the Romans sung by Virgil—all these earthly eyes, for so long dull and closed, have been fixed from age to age on these eyes of the sky, always open, animated, and living. Terrestrial generations, nations and their glories, thrones and altars have vanished: the sky of Homer is always there. Is it astonishing that[73] the heavens were contemplated, loved, venerated, questioned, and admired even before anything was known of their true beauties and their unfathomable grandeur?

Better than the spectacle of the sea calm or agitated, grander than the spectacle of mountains adorned with forests or crowned with perpetual snow, the spectacle of the sky attracts us, envelops us, speaks to us of the infinite, gives us the dizziness of the abyss; for, more than any other, it seizes the contemplative mind and appeals to it, being the truth, the infinite, the eternal, the all. Writers who know nothing of the true poetry of modern science have supposed that the perception of the sublime is born of ignorance, and that to admire it is necessary not to know. This is assuredly a strange error, and the best proof of it is found in the captivating charm and the passionate admiration which divine science now inspires, not in some rare minds only, but in thousands of intellects, in a hundred thousand readers impassioned in the search for truth, surprised, almost ashamed at having lived in ignorance of and indifference to these splendid realities, anxious to incessantly enlarge their conception of things eternal, and feeling admiration increasing in their dazzled minds in proportion as they penetrate further into Infinitude. What was the universe of Moses, of Job, of Hesiod, or of Cicero, compared to ours! Search through all the religious mysteries, in all the surprises of art, painting, music, the theatre, or romance, search for an intellectual contemplation which produces in the mind the impression of truth,[74] of grandeur, of the sublime, like astronomical contemplation! The smallest shooting star puts to us a question which it is difficult not to hear; it seems to say to us, What are we in the universe? The comet opens its wings to carry us into the profundities of space: the star which shines in the depths of the heavens shows us a distant sun surrounded with unknown humanities who warm themselves in his rays. Wonderful, immense, fantastic spectacles, they charm by their captivating beauty and transport into the majesty of the unfathomable the man who permits himself to soar and wing his flight to Infinitude. Nel ciel che più della sua luce prende Fu' io, e vidi cose che ridire Né sa, né può qual di lassù discende.

“I have ascended into the heavens, which receive most of His light, and I have seen things which he who descends from on high knows not, neither can repeat,” wrote Dante in the first canto of his poem on “Paradise.” Let us, like him, rise toward the celestial heights, no longer on the trembling wings of faith, but on the stronger wings of science. What the stars would teach us is incomparably more beautiful, more marvelous, and more splendid than anything we can dream of. Northern hemisphere Chart of the Northern Constellations Showing the principal Stars of the first five magnitudes visible to the naked eye

Among the innumerable army of stars which sparkle in the infinite night, the gaze is especially arrested by the most brilliant lights and by certain groups which vaguely present a mysterious bond between the worlds of space. These groups have been[75] noticed at all epochs, even among the rudest races of men, and from the earliest ages of humanity they have received names, usually derived from the organic kingdom, which give a fantastic life to the solitude and the silence of the skies. Thus were early distinguished the seven stars of the North, or the Chariot, of which Homer speaks; the Pleiades, or the “Poussinière”; the giant Orion; the Hyades in the head of Taurus; Boötes, near the Chariot or Great Bear. These five groups were already named more than 3,000 years ago, and so were the brightest stars of the sky, Sirius and Arcturus, etc.

The epoch of the formation of the constellations is unknown, but we know that they were established successively. The centaur Chiron, Jason’s tutor, has the reputation of having first divided the sky on the sphere of the Argonauts. But this is mythology; and, besides, Job lived before the epoch at which Chiron is supposed to have flourished, and Job had already spoken of Orion, the Pleiades, and the Hyades 3,000 years ago. Homer also speaks of these constellations in describing the famous shield of Vulcan. “On its surface,” says he, “Vulcan, with a divine intelligence traces a thousand varied pictures. He represents the earth, the heavens, the sea, the indefatigable sun, the moon at its full, and all the stars which wreath the sky: the Pleiades, the Hyades, the brilliant Orion, the Bear, which they also call the Chariot, and which revolves round the pole; this is the only constellation which does not dip into the ocean waves” (Iliad, chapter xviii.).

Several theologians have affirmed that it was[76] Adam himself, in the terrestrial paradise, who gave their names to the stars; the historian Josephus assures us that it was not Adam, but his son Seth, and that in any case astronomy was cultivated long before the Deluge. This nobility is sufficient for us.

Attentive observation of the sky also noticed from the beginning the beautiful stars Vega of the Lyre, Capella of Auriga, Procyon of the Little Dog, Antares of the Scorpion, Altair of the Eagle, Spica of the Virgin, the Twins, the Chair of Cassiopeia, the Cross of the White Swan, stretched in the midst of the Milky Way. Although noticed at the epoch of Hesiod and Homer, these constellations and stars were probably not yet named, because doubtless men had not yet felt the necessity of registering them for any application to the calendar, to navigation, or to voyages.[7]

[77]

At the epoch when the maritime power of the Phœnicians was at its apogee, about 3,000 years ago, or twelve centuries before our era, it was the star β of the Little Bear which was the nearest bright star to the pole, and the skilful navigators of Tyre and Sidon (O purpled kings of former times! what remains of your pride?) had recognized the seven stars of the Little Bear, which they named the Tail of the Dog, Cynosura; they guided themselves by the pivot of the diurnal motion, and during several centuries they surpassed in precision all the mariners of the Mediterranean. The Dog has given place to a Bear, doubtless on account of the resemblance of the configuration of these seven stars to the seven of the Great Bear, but the tail remains long and curled up, in spite of the nature of the new animal.

Thus the stars of the North at first served as points of reference for the first men who dared to venture on the seas. But they served at the same time as guides on the mainland for the nomadic tribes who carried their tents from country to country. In the midst of savage nature, the first warriors themselves had nothing but the Little Bear to guide their steps.

Imperceptibly, successively, the constellations were formed. Some groups resemble the names which they still bear, and suggested their denomination to the men of ancient times, who lived in the midst of nature and sought everywhere for relations with their daily observations. The Chariot; the Chair; the Three Kings, also named the Rake; Jacob’s Staff and the Belt of Orion; the Pleiades, or the Hen and Chickens; the Arrow (Sagitta); the[78] Crown; the Triangle; the Twins; the Dragon; the Serpent; and even the Bull, the Swan, the Giant Orion, the Dolphin, the Fishes, the Lion, Water and Aquarius (the Water-bearer), etc., have given rise to the analogy. These resemblances are sometimes vague and far-fetched, like those we find in the clouds; but it appears much more natural to admit this origin than to suppose, with the classic authors, that these names were suggested by the concordance between the seasons or the labors of the fields and the presence of the stars above the horizon. That the name of the Balance

(Libra) was given to the constellation of the equinox because then the days are equal, seems to us more than questionable; that Cancer (the Crab) signifies that the sun goes back to the solstice, and that the Lion has for its object to symbolize the heat of summer, and Aquarius the rain and inundations, appears to us no less imaginary. However, they have also had other origins. Thus, the Great Dog Sirius certainly announced the rising of the Nile and the dog-days (which remain in our calendar as a fine type of anachronism). Poetry, gratitude, the deification of heroes, mythology, afterward transferred to the sky the names of personages and sovereigns—Hercules, Perseus, Andromeda, Cepheus, Cassiopeia, Pegasus; later, in the Roman epoch, they added the Hair of Berenice and Antinous; later still, in modern times, they added the Southern Cross, the Indian, the Sculptor's Workshop (Cœlum), the Lynx, the Giraffe (Camelopardus), the Greyhounds (Canes Venatici), the Shield of Sobieski, and the little Fox (Vulpecula).[79] They even placed in the sky a Mountain, an Oak, a Peacock, a Swordfish, a Goose, a Cat, a Crane, a Lizard, and a Fly, for which there was no necessity.

This is not the place to describe and draw in detail all these constellations, with their more or less strange figures. The important point for us here is to form a general idea.

The sky remains divided into provinces, each of which continues to bear the name of the primitive constellation. But it is important to understand that the positions of the stars themselves, as we see them, are not absolute, and that the different configurations which they may show us are only a matter of perspective. We already know that the sky is not a concave sphere on which brilliant nails could be attached; that it is not a species of vault; that an immense infinite void envelops the earth on all sides, in all directions. We know also that the stars, the suns of space, are scattered at all distances in the vast immensity. When, therefore, we remark in the sky several stars near each other, that does not imply that these stars form the same constellation, that they are on the same plane, and at an equal distance from the earth. By no means; the arrangement which they assume to our eyes is but an appearance caused by the position of the earth relatively to them. This is a mere matter of perspective. If we could leave our world, and transport ourselves to a point in space sufficiently distant, we should see a variation in the apparent arrangement of the stars so much the greater as our station of observation were more distant from where we are at present. A moment's[80] reflection is sufficient to convince us of this fact, and save us from insisting further on this point.

Once these illusions are appreciated at their true value, we can begin the description of the figures with which the ancient mythology has constellated the sphere. A knowledge of the constellations is necessary for the observation of the heavens and for the researches which a love of the sciences and curiosity may suggest; without it we find ourselves in an unknown country, of which the geography has not been made, and where it would be impossible to know our exact position. Let us make, then, this celestial geography; let us see how to find our way, in order to read readily in the great book of the heavens.

There is a constellation which everybody knows; for greater simplicity we will begin with it. It will serve us well as a point of departure from which to go to the others, and as a point of reference to find its companions. This constellation is the Great Bear, which has also been named the Chariot of David.

It may well boast of being celebrated. If, notwithstanding its universal notoriety, some of our readers have not yet made its acquaintance, the following is a description by which they may recognize it. Stars of Great Bear Fig. 2

Turn yourself toward the north—that is to say, opposite to the point where the sun is found at noon.[81] Whatever may be the season of the year, the day of the month, or the hour of the night, you will always see there a large constellation formed of seven fine stars, of which four are in a quadrilateral, and three at an angle with one side; all are arranged as we see in Fig. 2.

You have all seen it, have you not? It never sets. Night and day it watches above the northern horizon, turning slowly in twenty-four hours round a star of which we shall speak directly. In the figure of the Great Bear, the three stars of the extremity form the tail, and the four in the quadrilateral lie in the body. In the Chariot, the four stars of the quadrilateral form the wheels, and the other three the pole, the horses, or the oxen. Above the second of these latter stars, ζ, good sight distinguishes quite a little star named Alcor, which is also called the Cavalier. It serves to test the power of the sight. Each star is designated by a letter of the Greek alphabet: α and β mark the first two stars of the quadrilateral, γ and δ the two following, ε, ζ, η, the three of the pole. Arabic names have also been given to these stars, which we will pass in silence, because they are generally obsolete, with the exception, however, of that of the second horse—Mizar. With reference to the Greek letters, many persons think that it would be preferable to suppress them and to replace them by numbers. But this would be impossible in the practice of astronomy; and, moreover, inevitable confusion would result, on account of the numbers which the stars bear in the catalogues.

The Latins gave to plowing oxen the name of[82] triones; instead of speaking of a chariot and three oxen, they came to call them the seven oxen (septemtriones). From this is derived the word septentrion, and there are now doubtless but few persons who, in writing this word, know that they are speaking of seven oxen. It is the same, however, with many other words. Who remembers, for example, in using the word tragedy, that he speaks of a song of a goat: tragôs-ode?

Let us go back to Fig. 2. If we draw a straight line through the two stars marked α and β which form the right side of the square, and produce it beyond α to a distance equal to five times that from β to α, or to a distance equaling that from α to the end of the tail, η, we find a star a little less brilliant than at the extremity of a figure similar to the Great Bear, but smaller and pointing in the opposite direction. This is the Little Bear, or the Little Chariot, also formed of seven stars. The star to which our line leads us—that which is at the tip of the tail of the Little Bear, or at the end of the pole of the Little Chariot—is the polar star. Pole star Fig. 3

The polar star enjoys a certain fame, like all persons who are distinguished from the common, because,[83] among all the bodies which scintillate in the starry night, it alone remains motionless in the heavens. At any moment of the year, by day or by night, when you observe the sky, you will always find it. All the other stars, on the contrary, turn in twenty-four hours round it, taken as the centre of this immense vortex. The pole star remains motionless at the pole of the world, from whence it serves as a fixed point to navigators on the trackless ocean, as well as to travelers in the unexplored desert. Square of Pegasus Fig. 4

In looking at the pole star, motionless in the midst of the northern region of the sky, we have the south behind us, the east to the right, the west to the left. All the stars turn round the pole star in a direction contrary to that of the hands of a watch; they should, then, be recognized according to their mutual relations rather than by reference to the cardinal points.

On the other side of the pole star, with reference to the Great Bear, is found another constellation which[84] we can also recognize at once. If from the middle star, δ, we draw a line to the pole, and produce this line by the same distance (see Fig. 3), we arrive at Cassiopeia, formed of five principal stars arranged somewhat like the strokes of the letter M. The little star χ, which completes the square, gives the constellation the form of a chair. This group assumes all possible positions in turning round the pole; it is found sometimes above, sometimes below, sometimes to the right, and sometimes to the left; but it is always easily recognized, for, like the preceding group, it never sets, and is always opposite to the Great Bear. The pole star is the axle round which both these constellations turn. Pleiades; Pegasus Fig. 5 Fig. 6

If, now, we draw from the stars α and δ of the Great Bear two lines through the pole, and produce them beyond Cassiopeia, we come to the Square of Pegasus (see Fig. 4), which shows a line of three stars somewhat similar to the tail of the Great Bear. These three stars belong to Andromeda, and lead to another constellation, Perseus. The last star of the Square of Pegasus is, as we see, the first (α) of Andromeda; the three others are named γ, α, and β.[85] To the north of β of Andromeda is found, near a little star, ν, an oblong nebula, which can be distinguished with the naked eye. In Perseus, α, the brightest—on the prolongation of the three principal stars of Andromeda—appears between two others less brilliant, which form with it a concave arc very easy to distinguish. This arc serves us for a new alignment. Producing it in the direction of δ, we find a very brilliant star of the first magnitude; this is Capella (the Goat). Forming a right angle with this prolongation toward the south we come to the Pleiades (Fig. 5). Not far from that is a variable star, Algol, or the Head of Medusa, which varies from the second to the fourth magnitude[8] in 2 days, 20 hours, 48 minutes, 51 seconds. We may add, that in this region the star γ of Andromeda is one of the most beautiful double stars (it is even triple). Lyre; Altair Fig. 7 Fig. 8

If, now, we produce beyond the Square of Pegasus (Fig. 6) the curved line of Andromeda, we reach the Milky Way, and we meet in these parts Cygnus, like a cross; the Lyre, where Vega shines (Fig. 7); the Eagle, and Altair (not Atair, as it is sometimes written) with two companions (Fig. 8).

[86]

Such are the principal constellations visible in the circumpolar regions on one side; we shall make a fuller acquaintance with them directly. While we are tracing the lines of reference let us still have a little patience and finish our summary review of this part of the sky. Arcturus Fig. 9

Look now at the side opposite to that of which we have just spoken. Let us return to the Great Bear. Producing the tail along its curve, we find at some distance from that a star of the first magnitude, Arcturus (Fig. 9), or α of Boötes. A little circle of stars which we see to the left of Boötes constitutes the Northern Crown (Corona Borealis). In the month of May, 1866, there was seen shining there a fine star, the brightness of which lasted only fifteen days. The constellation of Boötes is traced in the form of a pentagon.

The stars which compose it are of the third magnitude, with the exception of Arcturus, which is of the first. This is one of the nearest to the earth; at least, it is one of a small number whose distance has been measured. It shines with a beautiful golden yellow color. The star ε, which we see above it, is double—that is to say, the[87] telescope resolves it into two distinct stars, one yellow, the other blue. Vega; Arcturus; Pole star Fig. 10.

This technical description is far from the poetry of Nature; but it is especially important here to be clear and precise. Let us suppose ourselves, however, under the starry vault on a beautiful summer's night, splendid and silent, and let us consider that each of these points which we seek to recognize is a world, or rather a system of worlds. Look at this equilateral triangle (Fig 10); it permits us to cast our eyes successively on three important suns: Vega of the Lyre, Arcturus of Boötes, and the pole star, which watches above the solitudes of our mysterious North Pole. Many martyrs of science have died looking at it! In twelve thousand years our descendants[88] will see the Lyre at the pole, ruling the harmony of the heavens.

The stars which are near the pole, and which have for that reason received the name of circumpolar stars, are distributed in the groups which have just been indicated. I earnestly invite my readers to profit by fine evenings, and try to find for themselves these constellations in the sky.

We have here the principal stars and constellations of the Northern Hemisphere, the North Pole being at the centre of the circle. We come now in the order of our description to the twelve constellations of the zodiacal belt, which makes the circuit of the sky, inclined at 23° to the Equator, and of which the ecliptic, the apparent path of the sun, forms the centre line.

The name of zodiac, given to the zone of stars which the sun traverses during the course of the year, comes from ζ■δια, animals, an etymology which is due to the species of figures traced on this belt of stars. Animals, in fact, predominate in these figures. The entire circumference of the sky has been divided into twelve parts, which have been named the twelve signs of the zodiac; our ancestors called them the "houses of the sun," or "the monthly abodes of Apollo," because the day star visits them each month, and returns every spring to the beginning of the zodiacal city. Two memorable Latin verses of the poet Ausonius present to us these twelve signs in the order in which the sun travels through them, and this still appears the easiest method of learning them by heart.

[89] Sunt Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libraque, Scorpius, Arciteneus, Caper, Amphora, Pisces;

or, in English, the Ram ■■, the Bull ■■, the Twins ■■, the Crab ■■, the Lion ■■, the Virgin ■■, the Balance ■■, the Scorpion ■■, the Archer ■■, Capricornus ■■, Aquarius ■■, and the Fishes ■■. The signs placed beside these names are a vestige of the primitive hieroglyphics which described them: ■■ represents the horns of the Ram, ■■ the head of the Bull; ■■ is a stream of water, etc.

If we now know our northern sky, if its most important stars are sufficiently noted down in our mind, with the reciprocal relations which they preserve among themselves, we have no more confusion to fear, and it will be easy to recognize the zodiacal constellations. This zone may be of use to us as a line of division between the north and the south. Here is a description of it:

The Ram, which, moving in front of the herd, and regulating, so to say, the march, opens the series. This constellation has in itself nothing remarkable; the brightness of its stars indicates the base of one of the horns of the leader of the sheep; it is but of the second magnitude. After the Ram comes the Bull. Admire on a fine winter's night the charming Pleiades which scintillate in the ether; not far from them shines a fine red star—this is the eye of the Bull—Aldebaran, a star of the first magnitude and one of the finest of our sky. We now arrive at the Twins, whose heads are marked by two fine stars of the second magnitude, situated a little above a star of the first magnitude—Procyon, or the Little Dog; Cancer, or the Crab, a constellation very little conspicuous (its most visible stars are but of the fourth magnitude, and occupy the body of the animal); the Lion, a fine constellation, marked by a star of the first magnitude, Regulus, by one of the second, β, and by several others of the second and third magnitudes arranged in a trapezium; the Virgin, indicated by a very brilliant star of[90] the first magnitude; Spica, situated in the neighborhood of a star, also of the first magnitude, Arcturus, which is found on the prolongation of the tail of the Great Bear; the Balance (Libra), indicated by two stars of the second magnitude, which would exactly resemble the Twins if they were nearer to each other; the Scorpion, a remarkable constellation; a star of the first magnitude, of a fine red color, marks the Heart (Antares), in the middle of two stars of the third magnitude, above which are three bright stars arranged in a diadem; Sagittarius, the Archer, of which the arrow, indicated by three stars of the second and third magnitudes, is pointed toward the tail of the Scorpion; Capricornus, a constellation not conspicuous, which is recognized by two stars of the third magnitude very near each other, and representing the base of the horns of the hieroglyphic animal; Aquarius, indicated by three stars of the third magnitude arranged in a triangle, of which the most northern occupies a point on the equator; Pisces, the Fishes, composed of stars, barely conspicuous, of the third to fourth

magnitudes, situated to the south of a large and magnificent quadrilateral—the Square of Pegasus—of which we have already spoken.

We have now enumerated the zodiacal constellations in the order of the direct motion (from west to east) of the sun, moon, and planets which traverse them. They marked at the epoch of their formation, the monthly passage of the sun into each of them. The distribution of the stars in figurative groups was the first truly hieroglyphical writing; it was engraved on the firmament in indelible characters.

The zodiac has played a great part in the ancient history of every nation—in the formation of the calendar, in the appointment of public festivals, and in the constitution of eras. The zodiac of Denderah, discovered by the French savants in Egypt at the end of the Eighteenth Century, was at first believed to have an antiquity of 15,000 years; but it is now proved that it is necessary to deduct from that number[91] of years half the cycle of precession—that is to say, nearly 13,000 years—which brings down the date of this sculpture to 2,000 years before our epoch; and this in fact corresponds with the evidence of archæology. It is remarkable that all the ancient zodiacs and calendars which have been preserved to us begin the year with the constellation of the Bull, as we have already noticed. The zodiac of the Elephanta Pagoda (Salsette) has at the head of the procession the sign of the sacred Bull, the ox Apis, Mithra—of which the promenade of the fat ox, which is still performed in the environs of Paris, is a vestige. The ceiling of a sepulchral chamber at Thebes shows the Bull at the head of the procession. The zodiac of Esne, the astronomical picture discovered by Champollion in the Ramesseum of Thebes, carries us back to the same origin, between two and three thousand years before our era; Biot supposes the date of this to be the year 3285, the vernal equinox passing through the Hyades on the forehead of Taurus. Father Gaubil has proved that from ancient times the Chinese have referred the beginning of the apparent motion of the sun to the stars of Taurus; and we have a Chinese observation of the star η of the Pleiades as marking the vernal equinox in the year 2357 before our era. Hesiod sings of the Pleiades as ruling the labors of the year, and the name of Vergilia, which the ancient Romans gave them, associates them with the beginning of the year in spring. Arabic zodiac Fig. 11

Without entering into any details of the different zodiacs which have been preserved to us from the[92] most ancient and diverse nations, a glance at those which are reproduced here will lead us to appreciate the part which they have played in ancient religions. Several zodiacal signs have become veritable gods. The zodiac represented by Fig. 11 was engraved, in the Thirteenth Century, on an Arabic magic mirror, and dedicated to the sovereign prince Aboulfald, “Victorious Sultan, Light of the World,” if we are to believe the bombastic inscription which[93] encircles it. Fig. 12 shows an ancient Hindoo zodiac. Fig. 13 shows a Chinese zodiac stamped upon a talisman, even now in use. The twelve signs differ from ours; they are: the Mouse, the Cow, the Tiger, the Rabbit, the Dragon, the Serpent, the Horse, the Ram, the Ape, the Hen, the Dog, and the Pig. Fig. 14 represents a Chinese medal, on which we see the constellation Teou, the Great Bear[9] (which they call the Bushel), the Serpent, the Sword, and the Tortoise. This is a talisman intended to give courage;[94] it appears that it is in great demand among the Chinese, and is as well circulated as the medals of the Immaculate Conception are in France. Hindoo zodiac Fig. 12.—Ancient Hindoo Zodiac

Of all the zodiacal constellations, that of the Bull has played the principal rôle in ancient myths; and in this constellation it was the sparkling cluster of the Pleiades which appears to have regulated the year and the calendar among all the ancient nations. The Mosaic deluge itself, referred to 17 Athir (November), in commemoration of an important inundation, had its date coincident with the appearance of the Pleiades.[10] Chinese zodiac Fig. 13.—Chinese Zodiac, from Fig. 14.—Chinese Medal, showing a Talisman the Great Bear

But we forget the stars. If our descriptions have been carefully followed, the reader will now know the zodiacal constellations as well as those of the north. There remains but little to do to know the entire sky. But there is an indispensable addition to be made to what precedes. The circumpolar stars[95] are perpetually visible above the London horizon; at any time of the year when we wish to observe them it is sufficient to turn to the north, and we shall always find them, either above the pole star or below it, to one side or the other, and always maintaining among themselves the relations which we have employed to find them. The stars of the zodiac do not resemble them from this point of view, for they are sometimes above the horizon, sometimes below. It is necessary, then, to know at what epoch they are visible. For this purpose it will be sufficient to remember the constellation which is found in the middle of the sky at nine o’clock in the evening on the first day of each month—that, for example, which crosses at that moment a line descending from the zenith to the south. This line is the meridian, of which we have already spoken; all the stars cross it once a day, moving from east to west—that is to say, from left to right. In indicating each of the constellations which pass at the hour indicated, we also give the centre of the visible constellations.

On January 1 Taurus passes the meridian at 9 o'clock in the evening; notice Aldebaran, the Pleiades. On February 1 the Twins (Gemini) are not yet there; we see them a little to the left. March 1, Castor and Pollux have passed; Procyon to the south, the little stars of the Crab (Cancer) to the left. April 1, the Lion, Regulus. May 1, β of the Lion, Berenice's Hair. June 1, Spica of the Virgin, Arcturus. July 1, the Balance (Libra), the Scorpion. August 1, Antares, Ophiuchus. September 1, Sagittarius, Aquila. October 1, Capricornus, Aquarius. November 1, Pisces, Pegasus. December 1, Aries, the Ram.

Our general review of the starry sky must now be completed by the stars of the southern heavens.

[96]

Below Taurus and Gemini, to the south of the zodiac, you notice the giant Orion, who raises his club toward the forehead of the Bull. Seven brilliant stars are here distinguished; two of them, α and β, are of the first magnitude; the five others are of the second magnitude, α and γ mark the shoulders, κ the right knee, β the left knee; δ, ε, ζ mark the belt or girdle. Below this line is a luminous train of three stars, very near each other; this is the Sword. Between the western shoulder and Taurus is seen the Shield, composed of a row of small stars. The head is marked by a little star (λ) of the fourth magnitude.

On a fine winter's night turn toward the south, and you will immediately recognize this giant constellation. The four stars, α, γ, β, κ, occupy the angles of a great quadrilateral. The three others, δ, ε, ζ, are crowded in an oblique line in the middle of this quadrilateral; α, at the northeast angle, is named Betelgeuse (not Beteigeuse, as some books print it); β, at the southeast angle, is called Rigel.

The line of the Belt, produced both ways, passes to the northeast near Aldebaran, the Eye of the Bull, which we know already, and to the southeast near Sirius, the finest star of the sky, which we shall soon consider.

It is during the fine nights of winter that this constellation shines in the evening above our heads. No other season is so magnificently constellated as the months of winter. While nature deprives us of certain enjoyments in one way, it offers us in exchange others no less precious. The marvels of the heavens[97] present themselves from Taurus and Orion in the east to Virgo and Boötes on the west. Of eighteen stars of the first magnitude which are counted in the whole extent of the firmament, a dozen are visible from nine o'clock to midnight, not to mention some fine stars of the second magnitude, remarkable nebulæ, and celestial objects well worthy of the attention of mortals. It is thus that nature establishes a harmonious compensation, and while it darkens our short and frosty days of winter, it gives us long nights enriched with the most opulent creations of the sky.

The constellation of Orion is not only the richest in brilliant stars, but it conceals for the initiated treasures which no other is known to afford. We might almost call it the California of the sky.

To the southeast of Orion, on the line of the Three Kings, shines the most magnificent of all the stars, Sirius, or α of the constellation of the Great Dog. This star of the first magnitude marks the upper eastern angle of a great quadrilateral, of which the base near the horizon of London, is adjacent to a triangle. This constellation rises in the evening at the end of November, passes the meridian at midnight at the end of January, and sets at the end of March. It played the greatest part in Egyptian astronomy, for it regulated the ancient calendar. It was the famous Dog Star; it predicted the inundation of the Nile, the summer solstice, great heats and fevers; but the precession of the equinoxes has in 3,000 years moved back the time of its appearance by a month and a half, and now this fine star announces nothing,[98] either to the Egyptians who are dead or to their successors.

The Little Dog, or Procyon, is found above the Great Dog and below the Twins (Castor and Pollux), to the east of Orion. With the exception of α Procyon, no brilliant star distinguishes it.

Hydra is a long constellation, which occupies a quarter of the horizon, under Cancer, the Lion, and the Virgin. The head, formed of four stars of the fourth magnitude, is to the left of Procyon, on the prolongation of a line drawn from that star to Betelgeuse. The western side of the great trapezium of the Lion, like the line from Castor and Pollux, points to α, of the second magnitude. This is the Heart of Hydra; we remark the asterisms of the second class, Corvus the Crow, and Crater the Cup.

Eridanus, Cetus, Piscis Australis, and the Centaur are the only important constellations which remain to be described. We find them, in the order which we have indicated, to the right of Orion. Eridanus is a river composed of a train of stars winding from the left foot of Orion and losing itself below the horizon. After following long windings, it ends with a fine star of the first magnitude, α Eridani, or Achernar. This is the river into which Phaeton fell when he unskilfully directed the Chariot of the Sun. It was placed in the sky to console Apollo for the death of his son.

To find the Whale (Cetus), we may notice below the Ram a star of the second magnitude which forms an equilateral triangle with the Ram and the Pleiades; this is α of Cetus, or the Jaw; α, μ, ξ, and γ[99] form a parallelogram which represents the head. The base, α, γ, may be produced to a star of the third magnitude, δ, and to a star of the neck marked ο. This star is one of the most curious in the heavens. It is named the Wonderful, Mira Ceti. It belongs to the class of variable stars. Sometimes it equals in brightness stars of the second magnitude, sometimes it becomes completely invisible.[11] Its variations have been followed since the end of the Sixteenth Century, and it has been found that they are reproduced periodically every 331 days on the average. The study of these singular stars presents us with curious phenomena.

Lastly, the constellation of the Centaur is situated below Spica of the Virgin. The star θ, of the second magnitude, and the star ι, of the third, mark the head and the shoulder. This is the only part of this figure which rises above our horizon. The Centaur contains the nearest star to us (α) of the first magnitude, the distance of which is about twenty-five billions of miles. The feet of the Centaur touch the Southern Cross, formed of four stars of the second magnitude, always hidden below our horizon. It reigns in silence above the icy solitudes of the Southern Pole, where ships proceed only with difficulty. Further on, at the centre of the other hemisphere, is the southern celestial pole, which is not marked by any remarkable star.

It was from this region, Dante relates, that,[100] having visited hell, inclosed in the centre of the earth, he went to the Mountain of Purgatory, and from there to the Heights of Paradise. These beautiful dreams have disappeared in the sunshine of modern astronomy.

We will complete these descriptions by a little astronomical chronology, which is not without interest. From a careful examination of the most ancient historical sources of classical astronomy, the following is the order in which the constellations appear to have been noticed, formed, and named, beginning with the most ancient: Most Ancient Reference The Great Bear Job (ch. xxxviii. ver. 32) (Seventeenth Century before our era), Homer (Ninth Century). Orion Job (ch. ix. ver. 9), Homer, Hesiod. The Pleiades (the Hyades) Job (ch. xxxviii. ver. 31), Homer, Hesiod. Sirius and the Great Dog Hesiod mentions it. Homer calls Sirius the Star of Autumn. Aldebaran (Taurus) Homer, Hesiod. Boötes, Arcturus Job (ch. xxxviii. ver. 32), Homer, Hesiod. The Little Bear Thales (Seventh Century), Eudoxus, Aratus. Draco (the Dragon) Eudoxus (Fourth Century), Aratus (Third Century). The Man on his Knees, or Hercules Id. The Branch and Cerberus[12] Id. Corona Borealis Id. Ophiuchus or Serpentarius Id. The Scorpion Id. Virgo and Spica[101] Eudoxus (Fourth Century), Aratus (Third Century) Gemini (the Twins) Id. Procyon Id. Cancer (the Crab) Id. Leo (the Lion) Id. Auriga (the Charioteer) Id. Capella (the Goat, the Kids) Id. Cepheus Id. Cassiopeia Id. Andromeda Id. Pegasus (the Horse) Id. Aries (the Ram) Id. The Triangle Id. Pisces (the Fishes) Id. Perseus Id. Lyra Id. The Bird, or Cygnus (the Swan) Id. Aquila (the Eagle) Id. Aquarius Id. Capricornus Id. Sagittarius Id. Sagitta (the Arrow) Id. Delphinus (the Dolphin) Id. Lepus (the Hare) Id. Argo (the Ship) Id. Canobus (afterward written Canopus) Id. Eridanus Id. Cetus (the Whale) Id. Piscis Australis (the Southern Fish) Id. Corona Australis Id. The Altar Id. The Centaur Id. The Wolf (Lupus) Id. Hydra Id. Crater (the Cup) Id. Corvus (the Crow) Id. Libra (the Balance) Manetho (Third Century B. C.) Geminus (First Century) B. C.). The Hair of Berenice[13] [102] Callimachus, Eratosthenes (Third Century). Feet of the Centaur Hipparchus (First Century B. C.). Propus (η of Gemini) Hipparchus. The Manger and Donkeys Id. The Little Horse (Equuleus) Id. The Head of Medusa Id. Antinous[13] Under the Emperor Adrian (130 A. D.). The Peacock (Pavo) John Bayer, 1603. Toucan Id. Grus (the Crane) Id. Phœnix Id. Doradus Id. The Flying Fish Id. Hydrus Id. Chamæleon Id. The Bee (Musca) Id. The Bird of Paradise (Apus) Id. Triangulum Australis Id. The Indian (Indus) Id. The Giraffe (Camelopardus) Bartschius, 1624. The Fly (Musca) Id. The Unicorn (Monoceros) Id. Noah's Dove (Columba) Id. The Oak of Charles II Halley, 1679. The Southern Cross (already seen by the ancients) Augustine Royer, 1677. The Great and Little Cloud (Magellanic Clouds) Hevelius, 1690. The Fleur de Lys Id. The Greyhounds (Canes Venatici) Id. The Fox and Goose (Vulpecula et Anser) Id. The Lizard (Lacerta) Id. The Sextant of Urania (Sextans) Id. The Little Lion (Leo Minor)[103] Hevelius, 1690. The Lynx Id. The Shield of Sobieski Id. The Little Triangle Id. Mount Mænalus Flamsteed, 1725. The Heart of Charles II (α Canum Venaticorum) Id. The Sculptor's Workshop (Sculptor) Lacaille, 1752. The Chemical Furnace (Fornax) Id. The Clock (Horologium) Id. The Rhomboid Reticule (Reticulum) Id. The Engraver's Pen Id. The Painter's Easel (Pictor) Id. The Compass (Circinus) Id. The Air Pump (Antlia) Id. The Octant (Octans) Id. The Compass and Square Id. The Telescope (Telescopium) Id. The Microscope (Microscopium) Id. The Table Mountain (Mensa) Id. The Reindeer Lemonnier, 1774. The Solitaire (Indian Bird) Id. Le Messier Lalande, 1776. The Bull of Poniatowski Poczobut, 1877. The Honors of Frederick Bode, 1786. The Harp of the Georges Hell, 1789. The Telescope of Herschel Bode, 1787. The Electrical Machine Id, 1790. The Printer's Workshop Id. The Mural Quadrant Lalande, 1795. The Air Balloon Id., 1798. The Cat Id., 1799.

Such are the constellations, ancient and modern, venerable or recent, into which the celestial sphere has been divided. The ancient names are respectable[104] and respected, on account of their relations, known or unknown, with the origins of history and religion;

the new ones must be ephemeral. It is useful to know them, because several stars celebrated under different titles have for their principal designation their position in these asterisms; but what we should wish would be to see them disappear.[14]

Many other substitutions have, however, been attempted. I have in my library a splendid folio of the year 1661, containing twenty-nine engraved plates, illuminated in gold and silver, among which are two which represent the sky delivered from the pagans and peopled with Christians. Instead of divinities more or less virtuous, in place of animals of forms more or less fantastic, we behold the elect—apostles,[105] saints, popes, martyrs, sacred persons of the Old and New Testament—seated in the celestial vault, clothed in rich costumes of all colors, embroidered with gold, and carefully installed in the place of all the pagan heroes who for so many ages reigned in the sky.

The author of this metamorphosis was named Jules Schiller, and it was in the year 1627 that he introduced it, coupling his name with that of John Bayer. He began his dissertation by showing how the pagan constellations are opposed to Christian opinion and even to common-sense. He quoted the Fathers of the Church who expressly disapprove of them: Isodorus, who treats them as diabolical; Lactantius, who condemns the corruption of the human race; Augustine, who sends their heroes to hell, etc.

These constellations formed by chance, in the course of ages, without a fixed object; their inconvenient size, the uncertainty of their boundaries; the complicated designations, for which it was sometimes necessary to exhaust whole alphabets; the bad taste with which observers have introduced into the southern sky the frigid nomenclature of instruments used in science alongside mythological allegories—all these accumulated defects have often suggested plans of reform for the stellar divisions, and even the banishing of all configuration. But ancient customs are difficult to overcome, and it is very probable that, except the recently named groups, which we may now suppress, the venerable constellations will always reign.

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Such are the provinces of the sky. But these provinces are of no intrinsic value; the important point for us is to make acquaintance with the inhabitants. FOOTNOTES:

[6] The French trillion is equivalent to the English billion, or a million times a million (1,000,000,000,000).—J. E. G.

[7] The Chinese had designated them all, it is true, at the same epoch, but their groups as well as their denominations are absolutely different from ours, and do not appear to have exercised any influence on the foundations of astronomical history. It was another world, other methods, other inspirations, as if Asia and Europe formed two distinct planets. A distinguished author, M. Schlegel, published in 1875 a Chinese Uranography, which is composed of 670 asterisms, and of which he believes he can trace back the origin to 17,000 years before our era. His argument is not convincing, and it seems to me that the origin of the astronomy of the Celestial Empire can not be very much anterior to the reign of the Emperor Hoang-Ti—that is to say, to the Twenty-seventh Century before our era—and would go back at furthest to the time of Fou-Hi that is to say, to the Twenty-ninth Century. It was about the same epoch—the Twenty-eighth Century before our era—that the Egyptians, observing Sirius, the early rising of which announced the inundation of the Nile, formed their canicular year of 365 days.

[8] More correctly, from 2.3 magnitude to 3.5 magnitude.—J. E. G.

[9] The author possesses in the Museum of the Observatory at Juvisy a Japanese executioner's sword, on the guard of which this constellation is engraved. Was it believed that the souls of executed criminals were sent there?

[10] See Astronomical Myths, based on Flammarion's History of the Heavens. By J. F. Blake. London, 1876.

[11] That is, to the naked eye; it never descends below the tenth magnitude, and always remains visible in a 3-inch telescope.—J. E. G.

[12] A constellation wrongly attributed by Arago and others to Hevelius. It is found on the sphere of Eudoxus.

[13] Constellations incorrectly attributed to Tycho Brahe. The first is given by Eratosthenes, the second dates from the Emperor Adrian.

[14] Especially those which are absolutely superfluous, and occupy places stolen from the ancient constellations, like the Heart of Charles II, the Fox and Goose, the Lizard, the Sextant, the Shield of Sobieski, Mount Mænalus, the Reindeer, the Solitaire, the Messier, the Bull of Poniatowski, the Honors of Frederick, the Harp, the Telescope, the Mural Circle, the Air Balloon, the Electrical Machine, the Printer's Workshop, and the Cat. I know, however, with reference to this last animal, that Lalande wrote: "I love cats! I

adore cats! I may be pardoned for having placed one in the sky after my sixty years of assiduous labors." But the illustrious astronomer had no necessity for this plea in order that his name should remain inscribed in letters of gold on the tablets of Urania. The Heart of Charles II is but the flattery of a courtier; the Shield of Sobieski, the Bull of Poniatowski, should fall from the sky; the Messier is but a play on words which makes the celestial flocks guarded by a pastor whose name is the same as that of the prolific hunter of comets, Messier. As for the Honors of Frederick, they usurp an unmerited place, for, in order to make room for them, Andromeda has been obliged to draw in her arm, which she had stretched out there for three thousand years. THE ARABIAN HEAVENS.—Ludwig Ideler

The majority of Arabic star-names mentioned by Kazwini owe their origin to the astronomy of the Greeks. For instance, to the latter belong El-dschediain, the two Kids (Hædi); El-ma'lef, the Manger; El-hhimârain, the two Asses; Kalb el-ased, the Lion's Heart; El-sumbela, the Ears; El-zubênâ, the two Claws. Others indicate the positions of the stars in the Greek constellations as Râs el-tinnîn, Dragon's Head; Râs el-hhauwâ, Head of the Snake Man; Râs el-dschêthi, Head of the Kneeling (Hercules); Dseneb el-dedschâdsche, the Hen's Tail (Swan's); Dseneb el-dschedi, Goat's Tail (Wild-goat); Dseneb Kaitos, Whale's Tail; Fom el-hhût, Jaw of the (southern) Fish; Ridschl el-dschebbâr, Giant's Foot (Orion), etc. Still others, such as Khebd el-ased, Dafîra el-ased, El-dsirâ el-mebsûta, and el-mekbûda, El-nethra, El-dschebha, El-zubra, Sâk el-ased, Adschaz el-ased, refer to the Arabic Lion, which is a caricature of the Greek one.

Now if we separate these and many similar expressions from the astronomical nomenclature of the Arabs, there remains a class of star-names that present sufficient internal evidence to show plainly that they are indigenous to Arabia. It is worth while taking the trouble to collect and compare them. We[107] shall in this way obtain a clearer idea of the sky that was altogether peculiar to this people.

In the first place, a large number of names of animals attracts our notice. In the vicinity of the North Pole, a shepherd (El-râï, Gamma in Cepheus), accompanied by his dog (Khelb el-râï, Zeta in Cepheus), is pasturing a herd of sheep (El-firk and El-agnâm, Alpha, Beta, Eta, and smaller stars in Cepheus), to which group also seem to belong two calves (El-ferkadain, Beta and Gamma in the Little Bear), a she-goat (El-anâk, Zeta in the Great Bear), a he-goat (El-tais in the Dragon), a young he-goat (El-dschedi, Alpha in the Little Bear), four mother-camels, a camel-foal, and a single camel pasturing by itself (El-awaîd, El-raba, and El-râfid, collectively on the head of the Dragon).

Various predatory animals are slinking around this herd, two Jackals (El-dsîbain, Zeta and Eta in the Dragon), which are specially stalking the camel-foal; a male-hyena (El-dsîch, Iota in the Dragon) and many other she-hyenas (El-dibâ, Beta, Gamma, Delta and Mu in Boötes), and other she-hyenas with their young (Aulâd el-dibâ, Theta, Iota, Kappa, Lambda, and others in the same figure).

In the neighborhood of the two jackals (two stars in the Dragon) bear the name of their claws (Adhfâr el-dsîb).

Another shepherd (El-râï, Alpha in Ophiuchus) pastures his sheep (El-agnâm, small stars in the region of Hercules's Club) on a mead (El-rauda), which is defended on the side of the above-mentioned hyenas by two hurdles (Nasak schâmi and Nasak[108] jemêni, rows of stars in Hercules and in the upper part of the Snake), and is open in the direction of the shepherd's two dogs (Khelb el-râï, Alpha in Hercules and Beta in Ophiuchus).

A third shepherd and a third herd are to be found further to the south in the Milky Way. The latter was represented as a river in which four animals (camels or sheep) are drinking, while four others (El-naâîm el-sâdira, Zeta, Sigma, Tau, and Phi, in the Archer), are going away from it after having quenched their thirst. Lambda in the Archer was regarded as their shepherd (Râï el-naâïm).

Yet another shepherd was signified by the star Beta in Orion (Rigel). He was called Râï el-dschauzâ, the shepherd in the Dschauzâ, or Nut-region, i. e., in the region of Orion, which is splendid with many conspicuous stars. The herd which he was given to pasture are probably the "Thirst-quenched Camels" (El-nihâl), which were regarded as being the stars Alpha, Beta, Gamma, and Delta, in the Hare in the vicinity of the Milky Way.

Besides these groups of animals, there are several others scattered over the heavens. The three pairs of stars standing close together at the feet of the Great Bear were likened to the footmarks of a gazelle. They were called the Gazelle's Springs, or Hoofs (Kafzât el-dhibâ or Dhufra el-gizlân). Naturally the animal itself was regarded as being in the neighborhood of its tracks. On the one hand, Omicron, Pi, Rho, Sigma, A and d, on the head of the Great Bear, and on the other, as it appears, the stars of the Little Lion were included under the name[109] Gazelle (El-dhibâ). The latter group also appears under the names the Gazelles and their Young (El-dhibâ w' aulâdhâ).

The five stars of the Virgin, Beta, Eta, Gamma, Delta, and Epsilon, were looked upon as so many yelping dogs (El-auwâ); Alpha and Beta in the Archer as a pair of birds peculiar to Arabia (El-suradain); Alpha (Fomalhaut) in the Southern Fish and Beta (Diphda) in the Whale as two Frogs (El-difda el-awel and El-difda el-thâni); four stars in the Great Dog and the Dove and as many Monkeys (El-kurûd), and the two bright stars of the latter constellation as a pair of Ravens (El-ag'riba).

All the creatures so far mentioned are familiar to the Arabs, the camel most of all. Just as their language is rich in words which refer to this useful animal, so also it plays the chief rôle in their astronomical nomenclature. We have already met with some camel-groups in the Arabian heavens. We find two more in the Bull and in the Crow. The brightest star in the Hyades has the name of "the Large Camel" (El-fenîk or El-fetîk), the others are called "the Small Camels" (El-kilâs or El-kalâjis). The four principal stars of the Crow were regarded as so many male-camels (El-adschmâl), analogous to the above-mentioned four female-camels in a similar figure at the head of the Dragon.

Just as frequently do we come across the ostrich in the Arabian heavens. The Southern Crown bears the name of the Ostrich Nest (Udha el-naâm), to which two pairs of ostriches (El-dhalîmain, Lambda and Mu in the Archer) appear to belong. A second[110] ostrich-nest was formed from a number of stars in the upper part of Eridanus. In the neighborhood are five hen-ostriches (El-naâmât, Zeta, Eta, Theta, Tau, and Upsilon) in the belly of the Whale, and somewhat further away are two male birds (El-dhalîm, Alpha in the Southern Fish and Alpha in the River). The latter have a number of young ostriches (El-rijâl stars in the Phœnix) between them. Ostrich eggs (El-baid), or their shells (El-kaid), are represented by small stars in the vicinity of the nest.

Besides the groups, we also find various isolated animals in the starry heavens of the Arabs. Among these is the Black Horse (El-dschaun, Epsilon in the Great Bear), perhaps belonging to the neighboring Governor (El-kâïd, Eta, in the same constellation); the beast of prey (Anâk el-ard, Gamma in Andromeda); the Male Camel (El-fahl), which was represented by Canopus and the Dog running in front of Sirius (El-khelb, Beta in Canis Major). This nomenclature, borrowed from the animal kingdom, to which must be added the Maidens (El-adsâra Omicron, Eta, Delta, and Epsilon in Canis Major); the Outrider and the Man-riding-behind (El-fawâris and El-ridf, Delta, Gamma, Epsilon, Zeta, and Alpha in the Swan); this nomenclature, I say, is peculiar in that only one star was always used to distinguish one animal.

The Arabs with so lively an imagination saw in the skies sheep, camels, ostriches, but without being led to it by the resemblance of the contour of the entire star group, as was the case of the designers of[111] the Greek heavens. They therefore had no animal figures proper, but only animal names, such as the She-goat, the two He-goats, and the two Asses of the Greeks. On two occasions, however, it happened that more than one star was given to one animal. When the eight stars of the Archer, which were represented under the figure of only four animals at pasture going to and returning from drinking, were regarded by some as two ostriches, this does not seem to be an exception to the rule, but a misunderstanding instead, caused by the resemblance of two words (Naâïm and Naâm). The case is probably the same with the four stars, Delta, Pi, Rho, and Epsilon, in the Dragon which are called the He-goat by a very late Arab astronomer; for a star-name given by the lexicographer, Firuzabadi, would argue that analogy held true here also.

The two unmistakable cases to which I refer are those of the falling and flying Eagle (El-nesr el-wâki and El-nesr el-tâïr), the former of which was made up of three stars in the form of an equilateral triangle, and the latter of three standing in a straight line (Alpha, Epsilon, and Zeta of the Lyre, Alpha, Beta and Gamma of the Greek Eagle).

We need not take into consideration in this connection either the Arabic Lion or the complete Horse, since most probably both owe their origin to false interpretations of later grammarians.

It is quite different with a second class of Arabic star-names which signify inanimate objects. These have to do with real forms throughout, which, however, for the most part consist of only a few stars[112] after the manner of the Greek Arrow and Triangle. To these belong El-chibâ, the tent of the Arab nomads resting on three or four supports. One of these was represented by three stars of the Charioteer (Lambda, Mu, and Sigma), and another by the four chief stars of the Crow.

El-athâfi, the three stones which the nomadic Arab placed under his pot or kettle in the form of an equilateral triangle to form the hearth. Every triad of stars standing in a similar figure might be called an Athâfi; for instance, Delta, Epsilon, and Rho in the Ram, and the three on the head of Orion, which were actually likened to one of these. In just so many words, however, the only stars that occur under this name are Alpha, Epsilon, and Zeta in the Lyre, and Sigma, Tau, and Upsilon in the Dragon.

El-kidr, the Pot, a ring of stars in the vicinity of the last Athâfi, which was formed from a number of small stars of Cepheus and the Swan.

El-midschdah, the wooden twirling-stick (spit). A kitchen utensil of similar triangular form was represented by the Hyades. The name in course of time came to be restricted to the chief star of this group.

El-fekka, the sounding plate with the broken rim, or Kas'a el-masâkhîm, the Beggar's-dish. This name was given to the stars of the Northern Crown, which stand in a circle open toward the northeast.

El-mîzân, the Scale-beam, an appropriate name for three stars in a straight line. The ancient Arabs used it for Theta, Eta, and Delta in the Eagle; the modern ones use it to distinguish the three stars on[113] the Belt and the three on the Sword of Orion, the former of which, on account of their equal distance from each other, are called the true scale-beam, and the latter the false one, on account of the unequal intervals.

El-dsirâ, the Ell, a term which may fitly be applied to every pair of conspicuous stars standing a certain distance from one another. It was used for the two pairs of stars on the head of the Twins and in the Little Dog.

El-ma'lef, the Manger—the name of the stars of the Cup which stand in a circular form. The more familiar Manger in the Crab belongs to the Greek Heavens.

El-kubba, the Traveling-tent, drawn by camels of the Arab's female apartment. This name was given by some to the stars of the Southern Crown, while others, as has already been remarked, regard it as an Ostrich Nest.

El-zaurak, the Boat, was represented by the chief stars of the Phœnix. El-delv, the Well-Bucket, represented by the Square of Pegasus, occurred more frequently than any other, as is shown by the star-names relating to it—El-ferg, El-arkûwa, El-khereb, and Elnaâïm. Elna'sch, the Bier, was applied to the well-known quadrangle in the Great and Little Bear. The term particularly signifies the death-bier, and taken in this sense each of the two biers is accompanied by three mourning women—Benât—biers and mourners combined are called Benât na'sch, literally Daughters of the Bier, i. e., belonging to the Bier.

El-salîb, the Cross: one of these was referred to[114] under the four stars on the head of the Dragon, which others regarded as four mother camels. A second was found in the stars of the Dolphin.

El-serîr, El-khursi, El-arsch, various kinds of Thrones. One, named Serîr benât na'sch, was represented by seven stars standing in the form of a bow on the head of the Great Bear, which were also called El-hhûd, the Pond. Two other thrones under the names Khursi, or Arsch el-dschauzâ, were distinguished under four stars of Eridanus, and four in the Hare, and yet another, named Arsch el-simâkh el-a'zal, in the stars of the Crow.

El-nidâm and El-nedm, every set of things arranged in a row, especially the Pearl Necklace, which was the name given to the four stars 1, 2, 3, 4, and Phi of the Whale standing in a straight line, and the three on Orion's Belt. Synonymous with this, among words taken in their common acceptation is El-nasak, a name used for two rows of stars in the upper part of the Snake and Hercules, which also has a picturesqueness about it, since the two rows were regarded as hurdles around the meadow on which the above-mentioned shepherd pastures his flock.

El-fikrat, El-fekâr, and El-kelâda, the Brooch: the first of these appears as the name of the stars on the vertebra of the Scorpion's tail; the second, for Orion's Belt; the third, for stars of the Archer. El-dschauzâ, the Nuts, and El-lekat, the Golden-grains or Spangles. The former name was used for the stars of Orion and the neighboring Twins collectively, the latter merely for those on Orion's Sword.[115] Finally, to this class belongs El-khaf el-chadîb and El-khaf el-dschedsmâ, the Dyed and the Mutilated Hand, which figures were represented by the five chief stars of Cassiopeia and the five better known on the head of the Whale. Several of these figures, as we have seen, appear at more than one place in the sky. Hence arose, for astronomers at least, the necessity for distinguishing epithets. Thus the Cross on the head of the Dragon was called "the falling," the Tent in the Crow "the southern," one of the Biers "the smaller," the other, "the greater"; one of the thrones in the vicinity of Orion, "the front"; the other, "the back."

When these distinctions are wanting, as in the case of the Athâfis, it is probably because the astronomers only made use of the one in the Dragon. Ulug Bekh does not name the other in the Lyre; Kazwini also states that it only occurred in the speech of the common people.

There is still a third and very numerous class of genuine Arabic star-names, which, borrowed neither from animate nor inanimate objects, are consequently names that do not represent any figures. They owe their origin to many circumstances, the majority of which are lost to us. I will content myself with mentioning only a few of them whose origin is not shrouded in doubt.

The small star over the middle of the Great Bear's tail is called El-suhâ, the Forgotten, the Lost, because it is only noticeable to a sharp eye; also El-saidak, the Touchstone (test-stone), because by it the eyesight was tested; Arcturus, Hâris el-semâ, the[116] Warder of the Heavens, because it is never entirely lost in the rays of the sun; Capella, Rakîb el-thorejâ, the Watchman of the Pleiades, because it rises at the same time as they do; Alpha (Aldebaran), in the Bull, Hhâdi el-nedschm, the Driver of the Seven Stars; also El-tâbi and El-debarân, the Follower, because it rises immediately after that constellation; Beta (Denebola) in the Lion, El-serfa, the Breaker-up (Upsetter), because at its rising and setting in the morning twilight the hot and cold weather change; Alpha (Ras Alhague) in the Watersnake; El-ferd, the Isolated, because it is situated in a starless region, etc. Besides this, among this class we must include the Su'ûd, or fortunate stars, four of which are in Pegasus, two in the Wild Goat, and four in the Waterman.

It will already have been noticed that in this nomenclature single stars frequently appear under several names. Thus the stars of the Crow are sometimes called El-adschmâl, the Camels; sometimes El-chibâ el-jemêni, the Southern Tent; sometimes Arsch el-simâkh el-a'zal, the figure of the throne in the neighborhood of Spica—three quite different names which express so many various notions and have also so many separate authors.

Who were the originators of this nomenclature as a whole?

The Arabs, and particularly the nomad Arabs. To prove this we have only to cast a glance at the names in the first two classes.

The inhabitants of the northern part of the Arabian peninsula, the so-called "desert" and "stony"[117] Arabia, for the most part, lead a nomadic kind of life.

The country is a treeless and waterless plain covered with naked rocks and sand-drifted hills, on which lie scattered single oases watered by springs and glorified with a luxuriant vegetation. On these the Arabs camp with their herds, and do not leave them until the provender is consumed, or until more powerful tribes force them to depart. They call themselves Bedâvi (Bedouins), that is, Scenitæ, Nomads, as they were called by the Greeks. These nomads, cut off from all intercourse with the world around them, who have never been subjugated by a foreign power, have preserved their character and their customs unchanged for several thousand years. Their most important occupation is cattle-breeding. Besides this, they follow the chase, or war upon their enemies, regarding as such all those not belonging to their race or who are not under their protection. They dwell in tents. Several families are under a Schech and several Schechs generally under an Emîr, who rules over the whole tribe.

The majority of these nomadic Arabs were Sabians, or Star-worshipers, before the adoption of Islam. History has preserved for us the names of several tribes who paid divine honors to single planets, or conspicuous fixed stars. No wonder that they should have fallen into such idolatry! The dust raised by the desert wind, which, as a rule, only blows during the day, and the heat of the sun compel them to pasture their herds and to undertake their hostile expeditions during the night. Leisure and[118] necessity bid them gain information by directing their gaze at the starry sky, which is presented to them in a splendor of which we in our northern regions can scarcely form any idea. Since, therefore, the aborigines must have noticed at an early period that the nearly regular succession of changes in their climate took place in conformity with the annually recurring phenomena of the fixed stars, they ascribed to the latter a divine power. Thus originated the worship of the stars; and this once established, no other motives were needed to induce them to devote their constant attention to the starry skies. One result of this was that they applied proper names to the most conspicuous stars and groups of stars which were borrowed partly from the animal world around them, partly from their simple household effects, partly from various qualities and circumstances which they noticed in the stars. One tribe selected one name; another, another; and so it came to pass that one star, or group of stars, frequently bears more than one name. When, on the other hand, stars no less bright bear no names at all, the probable reason is that only fragments of the astronomical nomenclature of the Arab nomads have come down to us.

After this terminology had been transmitted by oral tradition, and especially by folk-songs, for hundreds, perhaps thousands, of years in its original condition, it was combined into an entirely heterogeneous mass—that variegated mixture which we find in the works of Kazwini, Ulug Bekh, and others.

When the Arabs in their fanatic zeal for the spread[119] of Mohammed's doctrines had conquered a great part of Asia, Africa, and Europe, and established in the heart of the ancient world a mighty empire, they adopted from the Greeks, with whom they had now

come in contact, their astronomy among other sciences, and with it the Greek constellations and their method of distinguishing the stars according to their position in the figures.[15]

Their astronomers now generally discriminated between the two classes of names in attributing the one to the Arabs, the other to the astronomers.

Abdelrahman Sufi, in the preface to his work on the constellations, says there are two kinds of heavens to become acquainted with—that of the astronomers and that of the Arabs. In the work itself he first describes the constellations used by the astronomers, i. e., the Greek ones, and then the old constellations of the Arabs. Kazwini in every case mentions a genuine Arabic star-name when he speaks of the Arabic, which is the case with almost every constellation.

Our early astronomers had very false notions of this relation of the nomadic heavens of the ancient Arabs to the mythological one of the Greeks adopted by their descendants. Schickard, in his Astroscopium, says: “Instead of the Dragon the Arabs depict two wolves and five dromedaries.” He means the two jackals and the family of camels which the[120] nomads represented under the five stars on the head of the Dragon. The Arab astronomers drew the Greek dragon on their charts and globes just as we do. They only looked on the old jackals and camels as names for some of its stars. In Golius and Hyde we find a more correct view of the case. FOOTNOTES:

[15] Already in the ancient book of Job, whose hero has quite the characteristics of a Nomadic Emir, we find some astronomical terms whose analogy with the true Arabic star-names is unmistakable. See Job, ix. 9; xxxviii. 31, 32. ASTRONOMY WITHOUT A TELESCOPE.—J. E. Gore

It must be remembered that astronomy was studied ages before the invention of the telescope, and that the ancient astronomers gained, without any optical assistance, a considerable amount of knowledge respecting the heavenly bodies.

Let us first consider the stars visible to the naked eye. The number of these down to the sixth magnitude—about the faintest that average eyesight can see—is, for both hemispheres, about 6,000. The number, therefore, visible at one time from any given place is about 3,000. Possibly double this number might be seen by those gifted with exceptionally keen eyesight; but even this is a comparatively small number, scattered as it is over so large an area. Those who do not possess the power of effective enumeration estimate the number visible to the naked eye as considerably greater than is really the case. This is partly due to the irregular distribution of the lucid stars over the celestial vault, and partly to the effect which the aspect of the starry sky produces on the imagination; the fact of the stars increasing in number as they diminish in brightness inducing us to suspect[121] the presence of points of light which we do not actually see. An attempt to count those visible with certainty in any selected portion of the sky will, however, convince any intelligent person that the number, far from being large, is really very small, and that the idea, which some entertain, of a countless multitude is merely an optical illusion, and a popular fallacy which has no foundation in fact. Of course, the number visible in telescopes is very considerable. Perhaps with the largest telescopes 100,000,000 could be seen; but even this large number is very far from being “countless.” The present population of the earth is about 1,400,000,000, or about fourteen times the number of the visible stars!

The first thing to be done in studying the heavens with the naked eye is to learn the positions and names of the brighter stars; and from these the fainter ones may easily be identified by means of a star atlas. Those who study the stars in this way have probably a more intimate knowledge of the starry heavens than professional astronomers, who generally find the stars—at least the fainter ones—by referring to a catalogue of stars, and then setting their telescope to the place indicated by the figures given in the catalogue. Although the famous astronomer Sir William Herschel possessed several large telescopes, he also studied the stars with the naked eye, and it is related of this great observer that he could without hesitation identify any star he could see in this way by its name, letter, or number! Such an exhaustive knowledge of the heavens is, of course, very rare; but an acquaintance with all the brighter[122] stars can easily be acquired by any person of ordinary intelligence.

The “Plow,” or Great Bear,[16] is familiar to most people. This remarkable group of seven stars will be found very useful in identifying some of the brighter stars. The two stars furthest from the “tail” are called “pointers,” as they point nearly to the Pole Star, or star to which the axis of the earth nearly points. I say “nearly,” for the Pole Star is not exactly at the pole, but distant from it about three diameters of the moon. The northern of these stars is known to astronomers by the Greek letter Alpha and the southern as Beta. The others, following the order of the figure, are known by the letters Gamma, Delta (the faintest of the seven), Epsilon, Zeta, and Eta.[17] Now, if the curve formed by the three stars in the tail, Epsilon, Zeta, and Eta, is continued on, it will pass near a very bright star. This is Arcturus (Alpha of the constellation Boötes), one of the brightest stars visible. Again, if we draw an

imaginary line from Gamma to Beta, and produce it, it will pass near another bright star. This is Capella (Alpha of Auriga, “the Charioteer” referred to by Tennyson).

Again, if we draw a line from Delta to Beta, and produce it, it will pass near the tolerably bright stars, Castor and Pollux (Alpha and Beta of the constellation Gemini, or the Twins), the northern of[123] the two being Castor. Another line from Delta to Gamma produced will pass near a bright star called Regulus (Alpha of Leo, the Lion). Another line from Beta to Eta will pass near a group called Corona Borealis, or the Northern Crown. Photo of Orion Constellation of Orion, showing the Belt and Sword

On the opposite side of the Pole Star from the Plow, a group of five conspicuous stars will be found, forming a figure shaped somewhat like a W. This is Cassiopeia’s Chair. Commencing with the most westerly of the five, these stars are known as Beta, Alpha, Gamma, Delta, and Eta. Like the stars of the Plow, those of Cassiopeia’s Chair may be used to find other stars. For instance, a line drawn from Beta to Alpha passes close to a star known as Gamma in Andromeda; and the same line produced in the opposite direction will pass a little north of the bright star Vega (Alpha Lyræ), one of the brightest stars in the northern heavens. A line from Gamma to Alpha produced will pass through the well-known “Square of Pegasus.”

To the east of Vega lies Cygnus, or the Swan, a well-known northern constellation. It may be recognized by the long cross formed by its principal stars, Alpha, Beta, Gamma, Delta, and Epsilon; Alpha, or Deneb, being the most northern and brightest, and Beta the most southern and faintest of the five.

To the southeast of Cassiopeia’s Chair lies the constellation Perseus, distinguished by its well-known festoon, or curve, of stars. South of this lies the constellation Taurus or the Bull, which contains the well-known groups or clusters, the Pleiades and[124] the Hyades. The Pleiades form perhaps the most remarkable group of stars in the heavens, and are easily found, when above the horizon. To ordinary eyesight the cluster consists of six stars. Some persons gifted with exceptionally keen eyesight have, however, seen eleven or twelve. A map of the Pleiades made in the sixteenth century shows eleven stars very correctly. This was drawn, of course, from observations made with a measuring instrument, but without the aid of a telescope. The observer (I think it was Möstlin, Kepler’s tutor) must have possessed wonderfully sharp eyesight. The Hyades form a V-shaped figure, and contain the bright reddish star Aldebaran.

South of Taurus and Gemini will be found the splendid constellation of Orion, perhaps the most brilliant group of stars visible in either hemisphere. A remarkable quadrilateral figure is formed by its four stars, Betelgeuse (Alpha) and Gamma[18] on the north, and Rigel (Beta) and Kappa on the south. Of these Betelgeuse and Rigel are bright stars of the first magnitude. Betelgeuse is distinctly reddish and also slightly variable in its light. Rigel is a beautiful white star. In the middle of the quadrilateral are three stars of the second magnitude, nearly in a straight line, known as Delta, Epsilon, and Zeta, Delta being the northern of the three. These form Orion’s “belt.” South of these are three faint stars, also in a straight line, forming the “sword” of Orion. Surrounding the central star of the “sword” is “the[125] great nebula of Orion,” one of the finest objects in the heavens. It is barely visible to the naked eye, but may be seen with a good opera-glass.

To the southeast of Orion will be found Sirius, the brightest star in the heavens. It is the chief star of the constellation Canis Major, or the Great Dog, and has been well termed “the monarch of the skies,” from its great brilliancy.

The bright star Regulus, referred to above, is situated in a remarkable group of stars shaped like a sickle, and known as “the Sickle in Leo.” Regulus lies at the extremity of the handle. Leo is well placed for observation in April and May.

The famous group called the Southern Cross forms a conspicuous object in the southern heavens. It has formed a subject of interest since the earliest ages of antiquity. Its component stars, are, however, not so brilliant as some suppose, the two brightest being between the first and second magnitudes, the next of the second, and one between the third and fourth magnitudes. Near the Southern Cross are two bright stars known as Alpha[19] and Beta of the Centaur.

Among the stars are many objects known as “double stars.” These consist of two stars very close together, but which appear to the naked eye only as single stars. Some are triple, and even quadruple. Of these double stars there are now about 10,000 known to astronomers, but they are only visible with a telescope. Some, indeed, are so close that the highest powers of the very largest telescopes are necessary[126] to see them as anything but single stars. Of the naked-eye stars there are, however, some apparently so close that they present very much the appearance of real double stars as seen in a telescope. These, although not recognized by astronomers as double stars, have been termed “naked-eye doubles.” Houzeau found that the brighter the stars are the easier it is to separate them; and that for small stars, about 15′ of arc, or half the moon’s apparent diameter, is about the limit

below which the naked eye can not see a faint star double. Drawing of Great Bear Fig. 15.—Constellation of the Great Bear

Of the “naked-eye doubles,” perhaps the most remarkable is Mizar, the middle star in the “tail” of the Great Bear. Close to it is a small star, sometimes called “Jack on the Middle Horse.” It was known to the ancient astronomers as Alcor, or “the test,” as[127] it was then considered a test of excellent eyesight. Whether it has really brightened seems doubtful, but at present it is perhaps visible to ordinary eyesight. Some, however, fail to see it, while to others with keener vision it seems as plain as the proverbial “pike-staff.” The star Alpha Capricorni consists of two stars which, although closer than Mizar and Alcor, are more equal in brightness, and may be easily seen with the naked eye on a clear night. Nu Sagittarii may also be seen double in this way. Theta Tauri, in the Hyades, is another object which some eyes can see distinctly double; also Kappa Tauri, a little to the north of the Hyades; Omicron Cygni, a little to the west of Alpha Cygni (Deneb), is another example. On a very fine night two stars may be seen in Iota Orionis, the most southern star in the “sword.” Near Gamma Leonis, one of the brightest stars in the “sickle,” is a star of the sixth magnitude, which some can see without optical aid.

The most severe test is, however, Epsilon Lyræ, the northern of two small stars which form a little triangle with the brilliant Vega. This, to some eyes, appears double. The famous German astronomer Bessel is said to have seen it at thirteen years of age. To most people, however, it will perhaps appear only elongated. This is a very remarkable star, as each of the components is seen to be a close double when examined with a good telescope; and between the pairs are several fainter stars.

Among those interesting objects, the variable stars, are several which may be well observed without optical assistance. Of these may be mentioned Algol, of[128] which all the fluctuations of light may be easily observed with the naked eye; Mira Ceti, which may be well observed when at its brightest; Lambda Tauri, a variable star of the Algol type; Betelgeuse (Alpha Orionis), which is slightly variable; Zeta Geminorum, a fourth magnitude star, which varies about three-quarters of a magnitude in a period of about ten days; R. Hydræ, which is visible to the naked eye at maximum; Beta Lyræ, period about thirteen days; Eta Aquilæ, period about seven days; and Delta Cephei, which varies about one magnitude in a period of a little over five days. Of all these stars useful observations may be made without optical assistance of any sort.

Observations, and even discoveries, of new or “temporary” stars may also be made with the naked eye. This occurred in the case of the “temporary” stars of 1572, 1604, 1670, 1866, and 1870, but, of course, these were bright objects at the time of their discovery. Hind’s “new star” of 1848 in Ophiuchus was, however, only of the fifth magnitude when it appeared, and it might have escaped detection with the naked eye. A star of this magnitude might, however, be easily detected by an observer who is familiar with the principal stars of a constellation.

The Milky Way may, perhaps, be better seen with the naked eye than with any instrument, although an opera-glass brings out well, in some places, its more delicate details. A mere passing glance might lead a casual observer to suppose that the Galaxy stretched as a band of nearly uniform brightness across the heavens. But good eyesight, careful attention, and[129] a clear sky will soon disclose numerous details previously unsuspected; streams and rays of different brightness, intersected by rifts of darkness, and interspersed with spots and channels of comparatively starless spaces. An excellent drawing of the Milky Way—the result of five years’ observations with the naked eye alone—has recently been completed by Dr. Otto Boeddicker at Lord Rosse’s observatory in Ireland. This beautiful picture is exquisitely drawn, and shows a wonderful amount of detail. A writer in the Saturday Review of November 30, 1889, says: “His maps are in many respects a completely new disclosure. Features barely suspected before come out in them as evident and persistent; every previous representation appears, by comparison, structureless.” This shows what can be done with the naked eye in the study of this wonderful zone.

Among the nebulæ and clusters there are not many objects visible to the naked eye. A hazy appearance about the middle star in Orion’s “sword” indicates the presence of the “great Nebula,” one of the finest objects in the heavens. The “great Nebula in Andromeda,” aptly termed “the Queen of the Nebulæ,” is distinctly visible to the naked eye on a very clear night. It lies near the four and a half magnitude star, Nu Andromedæ (a few degrees north of Beta Andromedæ), and may be well seen in the early evening hours in the month of January, when it is high in the sky. It somewhat resembles a small comet. This nebula was known long before the invention of the telescope, and it was described by one of the earlier astronomers as resembling “a[130] candle shining through horn,” a not inapt description.

Of star clusters visible without optical aid may be mentioned the double cluster Chi Persei, which appears to the eye as a luminous spot in the Milky Way; the cluster known as 35 Messier, a little north of Eta Geminorum, just visible to the naked eye on a very clear night; and there are others in the Southern Hemisphere, notably the globular cluster known as Omega in the Centaur, which shines

as a hazy star of the fourth magnitude. Among the clusters may perhaps be included the Præsepe, or the “Beehive,” in Cancer, which has a nebulous appearance to the naked eye.

Coming now to the Solar System, the sun and moon, of course, first attract attention. Cases of sun-spots visible to the naked eye are recorded, but, of course, spots of such enormous size are of rare occurrence. Of lunar detail little can be seen without a telescope of some sort, but the larger markings are sufficiently distinct to good eyesight to convince the observer that they do not alter perceptibly, thus showing clearly that the moon always turns the same side to the earth.

Of the planets, nothing of their appearance in the telescope can, of course, be seen with the naked eye, but it is easy to identify the brighter planets. Mercury, owing to its proximity to the sun, is rarely visible in Europe and North America, but when favorably situated, it may sometimes be detected near the sun shortly after sunset or a little before sunrise. Notwithstanding the difficulty of seeing it, it was[131] well known to the ancients, an observation of the planet dating back to 264 B. C. It is easier, however, to see in more southern latitudes, and I have frequently observed it as bright as a star of the first magnitude in the clear air of the Punjab sky. I have also seen it on several occasions in Ireland, and the Rev. S. S. Johnson, F.R.A.S., tells me he has seen it with the naked eye no less than one hundred times in the south of England. The brilliant planet Venus can hardly be mistaken when seen in the morning or evening sky. When at its brightest it considerably exceeds Jupiter and Mars, and far surpasses Sirius, the brightest star in the heavens.

If a very bright planet is seen rising at sunset, it can not be Venus, which is never seen beyond a limited distance from the sun. The observer may, therefore, conclude with certainty that the planet is either Jupiter or Mars. The latter, which occasionally rivals Jupiter in brilliancy, may be easily distinguished from the “giant planet” by its distinctly reddish color. Saturn shines with a yellowish light, and is never so bright as Mars or Jupiter when at their brightest. The planet Uranus is just visible to the naked eye, and may be found without optical assistance when its position is accurately known.

Some observers think that they can see the crescent of Venus with the naked eye when the planet is in that phase, but this seems very doubtful. Cases have been recorded of one or two satellites of Jupiter having been seen with the unaided eyesight, but few are gifted with such keen vision.

Occultations of bright stars may be well seen with[132] the naked eye, especially when they pass behind the moon’s dark limb, and as the disappearance of a star is practically instantaneous, really valuable observations may be made without a telescope, by merely noting the exact time at which the star vanishes.

Most of the comets discovered by astronomers are small and faint, and only visible in good telescopes. At intervals, however, a brilliant visitor appears on the scene, and its path among the stars may be watched from night to night with the naked eye. Before the invention of the telescope, bright comets were watched in this way, and their course recorded so carefully that it has been found possible to calculate their orbits with some approach to accuracy. In these days of large telescopes and instruments of almost mathematical precision, such a method of observation is, of course, superseded; but we may still watch the movements of a bright comet with interest, and note its apparent path across the sky with pleasure and profit. Shooting stars and fire-balls may be best observed with the naked eye, and the excellent work done in this way by Mr. W. F. Denning, F.R.A.S., should encourage others to take up this interesting branch of astronomy.

Another object which may be well seen with the naked eye—indeed, it may best be observed in this way—is the Zodiacal Light. This is a lenticular or cone-shaped beam of light, which makes its appearance at certain times of the year, above the eastern horizon before the dawn, and above the western horizon after sunset, when the sky is clear and the moon absent. In the tropics it is much more easily[133] seen, the twilight being shorter, and I have often observed it in India shining with great brilliancy.

From the above sketch my readers will see how much may be learned of astronomy without optical assistance of any kind, and I hope that those who do not possess a telescope will use their eyes instead, and thus gain some knowledge of the wonders and beauties of the starry heavens. The knowledge thus gained will stimulate their curiosity and will give them keener interest in reading books which describe the still greater wonders revealed by the telescope. FOOTNOTES:

[16] Also known as the Dipper and Charles’s Wain.—E. S.

[17] The Arabian names Dubhe (Alpha), Merak (Beta), Phecda (Gamma), Megrez (Delta), Alioth (Epsilon), Mizar (Zeta), and Alkaid (Eta).—E. S.

[18] Bellatrix.

[19] This is the nearest star to the earth.—E. S. THE MILKY WAY.—Richard A. Proctor

To those who rightly appreciate its meaning the Milky Way is the most magnificent of all astronomical phenomena. However opinions may vary as to the configuration of the star-streams composing this object, no doubt now exists among astronomers that the Milky Way consists really of suns, some doubtless falling short of our own sun in brilliancy, but many probably surpassing it. Around these suns, we may fairly conceive, there revolve systems of dependent orbs, each supporting its myriads of living creatures. We have afforded to us a noble theme for contemplation in the consideration of the endless diversities of structure, and of arrangement, which must prevail throughout this immensity of systems.

The Galaxy traverses the constellation Cassiopeia. Thence it throws off a branch toward Alpha Persei[134] (Mirfak), prolonged faintly toward the Pleiades. The main stream, here faint, passes on through Auriga, between the feet of Gemini and the Bull's horns, over Orion's club to the neck of Monoceros. Thence, growing gradually brighter, the stream passes over the head of Canis Major, in a uniform stream, until it enters the prow of Argo, where it subdivides. One stream continues to Gamma Argus, the other diffuses itself broadly, forming a fan-like expanse of interlacing branches, which terminate abruptly on a line through Lambda and Gamma Argus. Here there is a gap beyond which the Milky Way commences in a similar fan-shaped grouping, converging on the brilliant (and in other respects remarkable) star Eta Argus. Thence, it enters the Cross by a narrow neck, and then directly expands into a broad, bright mass, extending almost to Alpha Centauri. Within this mass is a singular cavity known as the Coal-Sack. At Alpha Centauri the Milky Way again subdivides, a branch running off at an angle of 20°, and losing itself in a narrow streamlet. The main stream increases in breadth, until, "making an abrupt elbow," it subdivides into one continuous but irregular stream, and a complicated system of interlacing streams covering the region around the tail and following claw of Scorpio. A wide interval separates this part of the Galaxy from the great branch on the northern side, terminating close on Beta Ophiuchi.

The main stream, after exhibiting several very remarkable condensations, passes through Aquila, Sagitta, and Vulpecula to Cygnus. In Cygnus there is a "confused and patchy" region marked by a broad[135] vacancy, not unlike the Coal-Sack. From this region there is thrown off the offset to Beta Ophiuchi, already mentioned; the main stream is continued to Cassiopeia. Star map Fig. 16.—The Midnight Sky, with Milky Way

There only remains to be noticed "a considerable offset or protuberant appendage," thrown from the head of Cepheus directly toward the pole. Galileo was the first to prove, though earlier astronomers had entertained the notion, that the Milky Way was composed of a vast number of stars crowded closely together. But no attempt was made to offer a theory of its structure until, in 1754 Thomas[136] Wright, in his Theory of the Universe, propounded views closely according with those entertained later by Sir W. Herschel. Wright, having examined a portion of the Galaxy with a reflecting telescope, only one foot in focal length, came to the conclusion that our sun is in the midst of a vast stratum of stars; that it is when we look along the direction in which this stratum extends that we see the zone of light constituting the Milky Way; and that as the line of sight is inclined at a greater and greater angle to the mean plane of the stratum, the apparent density of the star-grouping gradually diminishes.

But it is to Sir W. Herschel, and the supplementary labors of Sir J. Herschel, that we owe the more definite views now commonly entertained respecting the Via Lactea. The elder Herschel, whose nobly speculative views of nature were accompanied by practical common-sense, and a wonderful power of patient observation, applied to the heavens his celebrated method of gauging. He assumed as a first principle, to be modified by the results of observation, that there is a tolerable uniformity in the distribution of stars through space. Directing his twenty-foot reflector successively toward different parts of the heavens, he counted the number of stars which were visible at any single view. The field of view of this reflector was fifteen minutes in diameter, so that the portion of the sky included in any one view was less than one-fourth of that covered by the moon. He found the number of stars visible in different parts of the heavens in a field of view of this size to be very variable. Sometimes there were but two[137] or three stars in the field;[20] indeed, on one occasion he counted only three stars in four fields. In other parts of the heavens the whole field was crowded with stars. In the richer parts of the Galaxy as many as four hundred or five hundred stars would be visible at once, and on one occasion he saw as many as five hundred and eighty-eight. He calculated that in one-quarter of an hour 116,000 stars traversed the field of his telescope, when the richest part of the Galaxy was under observation. Now, on the assumption above named, the number of stars visible when the telescope was pointed in any given direction was a criterion of the depth of the bed of stars in that direction. Thus, by combining a large number of observations, a conception—rough, indeed, but instructive—might be formed of the figure of that stratum of stars within which our sun is situated.

Sir J. Herschel, during his residence at the Cape of Good Hope, carried out an extensive series of observations of the southern heavens. Applying his father's methods of gauging with a telescope of equal power, he obtained a result agreeing, in a most remarkable manner, with those obtained by Sir William Herschel. It appeared, however, that the Southern Hemisphere is somewhat richer in stars than the Northern—a result which has been accepted as indicating that our system is probably somewhat nearer the southern than the northern part of the galactic nebula. Moreover, Sir J. Herschel was led to believe that the sidereal system forms a cloven flat ring rather than a disk.

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I think no one who has attentively examined the glories of Orion, the richly jeweled Taurus, the singular festoon of stars in Perseus, and the closely set stars of Cassiopeia, but must have felt that the association of splendor along this streak of the heavens is not wholly accidental. The stars here seem to form a system, and a system which one can hardly conceive to be wholly unconnected with the neighboring stream of the Milky Way. But in the southern portion the arrangement is yet more remarkable and significant. From Scorpio, over the feet of the Centaur, over the keel of Argo, to Canis Major, there is a clustering of brilliant stars, which it seems wholly impossible not to connect with the background of nebulous light. It is noteworthy, also, that this stream of stars merges into the stream commencing with the group of Orion, already noticed. Nor is this all. It is impossible not to be struck by the marked absence of bright stars in the region of the heavens between Algol, Crux, and Corvus. One has the impression that the stars have been attracted toward the region of the stream indicated, so as to leave this space comparatively bare.

Now, this last circumstance would appear less remarkable if the paucity of stars here noticed were common also in parts of the heavens far removed from the Milky Way. But this is not the case. Beyond this very region, which we find so bare of stars, we come to a region in which stars are clustered in considerable density, a region including Crater, Corvus, and Virgo, with the conspicuous stars Algores, Alkes, and Spica. But what is very remarkable,[139] while we can trace a connection between the stream of bright stars over the Milky Way and the stream of nebulous light in the background, it is obvious that the two streams are not absolutely coincident in direction.

The stream lies on one side of the Milky Way near Scorpio, crosses it in the neighborhood of Crux, and passes to the other side along Canis Major, Orion, and Taurus. Does the stream return to the Milky Way? It seems to me that there is clear evidence of a separation near Aldebaran, one branch curving through Auriga, Perseus, and Cassiopeia, the other proceeding (more nearly in the direction originally observed) through Aries (throwing out an outlier along the band of Pisces), over the Square of Pegasus, and along the streams which the ancients compared to water from the urn of Aquarius (but which in our modern maps are divided between Aquarius and Grus). The stream-formation here is very marked, as is evident from the phenomenon having attracted the notice of astronomers so long ago. But modern travels have brought within our ken the continuation of the stream over Toucan, Hydrus, and Reticulum (the two latter names being doubtless suggested by the convolutions of the stream in this neighborhood). Here the stream seems to end in a sort of double loop, and it is not a little remarkable that the Nubecula Major lies within one loop, the Nubecula Minor within the other. It is also noteworthy that from the foot of Orion there is another remarkable stream of stars, recognized by the ancients under the name of the River Eridanus, which[140] proceeds in a sinuous course toward this same region of the Nubeculæ.

Having thus met with evidence—striking at least, if not decisive—of a tendency to aggregation into streams, let us consider if, in any other parts of the heavens, similar traces may not be observable. We traced a stream from Scorpio toward Orion, and so round in a spiral to the Nubeculæ. Let us now return to Scorpio, and trace the stream (if any appear) in the contrary direction. Now, although over the Northern Hemisphere star-streams are not nearly so marked as over the Southern, yet there appears a decided indication of stream-formation along Serpens and Corona over the group on the left hand of Boötes to the Great Bear. A branch of this stream, starting from Corona, traverses the body of Boötes, Berenice's Hair, the Sickle in Leo, the Beehive in Cancer, passing over Castor and Pollux in Gemini, toward Capella. A branch from the feet of Gemini passes over Canis Minor, along Hydra (so named doubtless from the obvious tendency to stream-formation along the length of this constellation), and so to the right claw of Scorpio.

One other remarkable congeries of stars is to be mentioned. From the northern part of the Milky Way there will be noticed a projection toward the North Pole from the head of Cepheus. This projection seems to merge itself in a complex convolution of stars, forming the ancient constellation Draco, which doubtless included the ancient (but probably less ancient) constellation Ursa Minor. After following the convolutions of Draco, we reach the[141] bright stars Alwaid and Etanin (Beta and Gamma) of this constellation, and thence the stream passes to Lyra, where it seems to divide into two, one passing through Hercules, the other along Aquila,

curving into the remarkable group Delphinus.

The streams here considered include every conspicuous star in the heavens. But the question will at once suggest itself, whether we have not been following a merely fanciful scheme, whether all these apparent streams might not very well be supposed to result from mere accident. Now, from experiments I have made, I am inclined to believe that in any chance distribution of points over a surface, the chance against the occurrence of a single stream as marked as that which lies (in part) along the back of Grus, or as the curved stream of bright stars along Scorpio, is very great indeed; I am certain that the occurrence of many such streams is altogether improbable. And wherever one observes a tendency to stream-formation in objects apparently distributed wholly by chance, one is led to suspect, and thence often to detect, the operation of law. I will take an illustration, very homely perhaps, but which will serve admirably to explain my meaning. In soapy water, left in a basin after washing, there will often be noticed a tendency to the formation of spiral whorls on the surface. In other cases there may be no definite spirality, but still a tendency to stream-formation. Now, in this case, it is easy to see that the curved bottom of the basin has assisted to generate streams in the water, either circulating in one direction or opposing and modifying each other's effects,[142] according to the accidental character of the disturbance given to the water in the process of washing.[21] Here, of course, there can be no doubt of the cause of the observed phenomena; and I believe that in every case in which even a single marked stream is seen in any congeries of spots or points, a little consideration will suggest a regulating cause to which the peculiarity may be referred.

It is hardly necessary to say that, if the stream-formation I have indicated is considered to be really referable to systematic distribution, the theory of a stratum of stars distributed with any approach to uniformity, either as respects magnitude or distance, must be abandoned. It seems to me to be also quite clear that the immense extent of the Galaxy, as compared with the distances of the lucid stars from us, could no longer be maintained. On this last point we have other evidence, which I will briefly consider.

First, there is the evidence afforded by clusterings in the Milky Way. I will select one which is well known to every telescopist, namely, the magnificent cluster on the sword-hand of Perseus. No doubt can be entertained that this cluster belongs to the galactic system, that is, that it is not an external cluster: the evidence from the configuration of the spot and from the position it occupies is conclusive[143] on this point. Now, within this spot, which shows no stars to the naked eye, a telescope of moderate power reveals a multitude of brilliant stars, the brightest of which are of about the seventh magnitude. Around these there still appears a milky unresolved light. If a telescope of higher power be applied, more stars are seen, and around these there still remains a nebulous light. Increase power until the whole field blazes with almost unbearable light, yet still there remains an unresolved background. "The illustrious Herschel," says Professor Nichol, "penetrated, on one occasion, into this spot, until he found himself among depths whose light could not have reached him in much less than 4,000 years; no marvel that he withdrew from the pursuit, conceiving that such abysses must be endless." It is precisely this view that I wish to controvert. And I think it is no difficult matter to show at least a probability against the supposition that the milky light in the spot is removed at a vast distance behind the stars of the seventh magnitude seen in the same field.

The supposition amounts, in fact, to the highly improbable view that we are looking here at a range of stars extending in a cylindrical stratum directly from the eye—a stratum whose section is so very minute in comparison with its breadth that, whereas the whole field within which the spot is included is but small, the distance separating the nearest parts of the group from the furthest is equivalent to the immense distance supposed to separate the sphere of seventh magnitude stars from the extreme limits of our Galaxy. And the great improbability of this[144] view is yet further increased when it is observed that within this spot there is to be seen a very marked tendency to the formation of minor streams, around which the milky light seems to cling. It seems, therefore, wholly improbable that the cluster really has that indefinite longitudinal extension suggested by Professor Nichol. In fact, it becomes practically certain that the milky light comes from orbs really smaller than the seventh magnitude stars in the same field, and clustering round these stars in reality as well as in appearance.

The observations applied to this spot may be extended to all clusters of globular form; and where a cluster is not globular in form, but exhibits, on examination, either (1) any tendency within its bounds to stream-formation, or (2) a uniform increase in density as we proceed from any part of the circumference toward the centre, it appears wholly inconceivable that the apparent cluster is not really a cluster, but a long range of stars extending to an enormous distance directly from the eye of the observer. When, in such a case, many stars of the higher magnitudes appear within the cluster, we seem compelled to admit the probability that they belong to it; and, in any case, we can not assign to the furthest parts of the cluster a distance greatly exceeding (proportionally) that of the nearest parts.

Of a like character is the evidence afforded by narrow streams and necks within the Galaxy itself. If we consider the convolutions over Scorpio, it will seem highly improbable that in each of these we see, not a real convolution or stream, but the edge of a[145] roll of stars. For instance, if a spiral roll of paper be viewed from any point taken at random, the chances are thousands to one against its appearing as a spiral curve, and, of course, the chance against several such rolls so appearing is very much greater. The fact that we are assumed to be not very far from the supposed mean plane of the Milky Way would partly remove the difficulty here considered, if it were not that the thickness and extent of the stratum, as compared with the distances of the lucid stars, must necessarily be supposed very great, on the assumption of any approach to uniformity of distribution.

Evidence pointing the same way is afforded by circular apertures in the Galaxy, or indeed by apertures of other forms. Another peculiarity of these cavities is also noticeable; whereas on the borders of every one there are many lucid stars, or in some cases two or three very bright stars, within the cavity there is a marked paucity of stars. This phenomenon seems to indicate a much closer connection between the brighter stars and the milky light beyond than is supposed on the stratum theory. One can hardly conceive the phenomenon to be wholly accidental.

There are some other points on which I fain would dwell, but space will not permit me. I will merely note that there are peculiarities in the distribution of red double and multiple stars, in the position in which temporary stars have made their appearance, and in the distribution of nebulæ, which seem very worthy of notice.

One point, however, immediately connected with my subject remains to be mentioned. I have traced[146] streams of stars more conspicuous than those forming the Milky Way. We have also evidence of streams of light yet more delicate and evanescent than the light of our own Galaxy. In Sir John Herschel's great work on the southern skies, he notes the frequent recurrence of "an exceedingly delicate and uniform dotting, or stippling, of the field of view by points of light too small to admit of any one being steadily or fully examined, and too numerous for counting, were it possible so to view them." In thirty-seven places he detected this remarkable and significant phenomenon; a phenomenon so faint that he says, "The idea of illusion has continually arisen subsequently"; an idea well befitting the modesty of the philosophic observer, but which those who appreciate Sir John Herschel's skill as an observer will be very unwilling to accept. As Professor Nichol remarks, "It is enough to read from Herschel's notebook—'I feel satisfied the stippling is no illusion, for its dark mottling moves with the stars as I move the tube to and fro'—to feel convinced that the phenomenon is real." Now a remarkable fact connected with those observations is, that when Sir J. Herschel marked down in a star-chart the places in which he had detected this nebulous appearance, he found that, "with the exception of three which appeared outlying and disconnected, they formed several distinct but continuous streams."

[147] FOOTNOTES:

[20] Field means the actual space covered by the lens.—E. S.

[21] Sometimes a singular regularity of curvature is noticed, and a spiral is formed closely resembling in configuration some of the great spiral nebulæ, as drawn by Lord Rosse, so that one is tempted to see in the centrifugal tendency of the disturbed water, and the centripetal effects caused by reflection from the basin's surface, causes which may in some sense illustrate the laws operating in wider domains of space. THE MAGELLANIC CLOUDS—ZODIACAL LIGHT—STAR GROUPS.—Amédée Guillemin

When we look on the region of the celestial vault which surrounds the South Pole, we can not help being struck with the contrast presented by the small quantity of stars which it contains, with the brilliant zone which borders the Milky Way, from Orion and Argo to the Centaur, passing by the Southern Cross. One solitary star of the first magnitude, Achernar, more distant from the pole than are the beautiful stars of the Centaur and of the Cross, shines in this part of the sky.

But even this circumstance renders the singular aspect of the two nebulous spots, which seem two detached pieces of the great galactic zone, still more striking. These half-stellar, half-nebulous systems, unequal in magnitude and brightness, but easily seen with the naked eye on a clear, moonless night, are situated, one, the larger and more brilliant, between the pole and Canopus, in the constellation of Doradus; the other, the smaller and less brilliant, ordinarily visible during the full moon, in Hydrus, between Achernar and the pole.

Both are known by astronomers and navigators under the name of "Cape Clouds," or again, "Magellanic Clouds." And, to distinguish them, we have again the Great Cloud (Nebecula Major) and the Small Cloud (Nebecula Minor).

The Clouds of Magellan are distinguished from[148] all other nebulæ by their great apparent dimensions, and by their physical structure; this last character distinguishes them from most of the branches and offshoots of the Milky Way, with which, we may also

add, they do not appear connected in any way.

The Great Cloud extends over a space which embraces not less than forty-two square degrees—about two hundred times the apparent surface of the lunar disk. The Small Cloud occupies in extent four times less than the other; according to Humboldt, it is surrounded “with a kind of desert,” where, it is true, shines the magnificent stellar cluster of Toucan. If the exterior aspect of these two remarkable nebulæ, and their situation in a celestial region poor in stars, give to the southern sky a peculiar appearance, their real structure makes them one of the wonders of the heavens.

In the Great Cloud, Herschel has counted 582 single stars, among which one only is of the fifth magnitude; six others are of the order immediately inferior, and would doubtless be visible to the naked eye if their light were not effaced by the general glare.

In the Small Cloud, the single stars are proportionally more numerous, since 200 have been counted, among which three are of the sixth magnitude, while it only includes thirty-seven of the nebulæ and seven star-clusters. These immense aggregations, the elements of which are themselves swarms of suns, remind us of the largest, in appearance at least, of all the clusters which the eye contemplates in the depths of the sky—the Milky Way.

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In the evenings, about the time of the vernal equinox—in March and April, when in our climate the twilight is of short duration—if we examine the horizon toward the west, a little after sunset, we may perceive a faint light that rises in the form of a cone among the starry constellations.

This is what astronomers call the Zodiacal Light. Those unfamiliar with it, or little accustomed to the ordinary aspect of the sky, might confuse the glimmering either with the Milky Way or with the ordinary twilight, or even with an aurora. But, with a little attention, it is impossible to mistake it.

The triangular form of this luminous cone, its elevation and its inclined position to the horizon, make it a thing apart, and one eminently deserving particular mention.

As the days lengthen, and with them the duration of twilight, the Zodiacal Light disappears; it becomes invisible, at least in our climate. But it may again be seen in the morning, in the east, about the time of the autumnal equinox, in September and October, when the dawn has an equally short duration—again, however, to disappear during the period of long nights and long twilights.

It is needless to add that the sky must be clear and the night moonless for observations of the Zodiacal Light to be possible.

Among the explanations that have been given, the most probable one is that which likens the Zodiacal Light to a flattened nebulous ring surrounding the sun at some distance. It is to be remarked that the direction of the axis of the cone, or of the pyramid,[150] prolonged below the horizon, always passes through the sun.

It was believed at first that this direction precisely coincided with the solar equator; but it seems more certain that it coincides with the plane of the earth’s orbit, or the ecliptic.

Now, what is the nature of this luminous mass? Must it be considered as a zone of vapors thrown off by the sun, when in the process of consolidation, when our central star passed from a nebulous state to that of a condensed fluid sphere? This was the opinion of Laplace.

Another hypothesis, also connected with the first, is that the Zodiacal Light is formed of myriads of solid particles, analogous to the aerolites, possessing a general movement, but traveling separately around the focus of our solar world. The light of the ring would be thus produced by the accumulation of this multitude of brilliant points, reflecting toward us the light borrowed by each of them from the sun.

This explanation accounts for the intensity of the Zodiacal Light at different epochs; it would suffice to admit that the condensation of the particles or the density of the ring is not the same throughout its extent, and that its movement of circulation round the sun presents successively different parts to the earth. In this case, it becomes a question whether this lenticular ring of matter is distinct from the zone of aerolites.

Lastly, some astronomers regard the Zodiacal Light as a vaporous ring which belongs to the earth, surrounding it at some distance. But this is[151] an opinion which appears somewhat wild, and is utterly at variance with observation.

Are the stars that are visible to the naked eye spread orderless on the celestial vault? or is there not between those apparently most closely connected some real or physical connection which requires us to rank them in natural groups?

These questions have been already partly solved by what is known of the double and multiple star systems. Soon, exploring the regions of the sky visible by means of the telescope, we shall have to pass in review a multitude of stellar associations, in which suns are found so compact and so numerous, and the form of the groups so regular, that it is impossible to deny their reciprocal dependence.

But long before the discovery of these islands, these archipelagos as worlds, scattered with such astonishing profusion over the infinite, the naked eye had already distinguished a certain number of groups, the stars composing which were so near together that it was impossible to doubt their physical connection.

Such, for example, is the group of the Pleiades. Such, again, are the groups known under the names of the Hyades, of Præsepe, and of Berenice's Hair. All are visible to the naked eye, and good eyes distinguish without difficulty the principal stars of the first-named groups. The Pleiades are situated in the constellation of the Bull, which we can distinguish so easily to the northwest of Orion and Aldebaran.

Of about eighty stars which form the group of the Pleiades, six are visible without the help of telescopes.[152] Formerly, the Latin poet tells us, seven were counted, which may be held to prove that one of them is variable, and has diminished in brightness, or else has disappeared.

The most brilliant, Alcyone, is of the third magnitude; Electra and Atlas are of the fourth; Merope, Maïa, and Taygete of the fifth. Three others again have received particular names, although they are below the limit of ordinary vision; these are Pleione, Celeno, and Asterope, from the sixth to the eighth magnitude. All the others are only visible by the aid of a telescope; but with an ordinary glass it is possible to distinguish a large number. The Pleiades are known under the name of the Hen-coop, doubtless because Alcyone appears in the group as a hen surrounded with her chickens.

The Hyades, which are near the Pleiades, form a less numerous and more scattered group. The bright light of Aldebaran, which is, as is known, of the first magnitude, renders them more difficult to distinguish with the naked eye.

They appear in the rainy season. Hence their name of Hyades, from the Greek word which signifies to rain.

The connection of the stars which compose this group is not so striking as in the case of the Pleiades. Nevertheless, it seems difficult to admit that they are quite independent of each other's attraction. In examining the position of these two groups in the vicinity of the Milky Way, and observing that both are situated in the prolongation of a branch of the great zone, we are almost entitled to consider them as two[153] clusters of stars, belonging to the immense stellar stratum which surrounds us, and in the midst of which the sun himself is placed.

In Berenice's Hair, most of the stars are visible to the naked eye, and are perfectly distinguished in the sky, a little to the east of the Lion. No very brilliant star in the vicinity inconveniences the eye by effacing their light.

The next group is situated in the Crab, and is known under the name of Præsepe: it is visible to the unassisted sight; but it is impossible to distinguish the separate stars without the help of a telescope. Nevertheless, an instrument of moderate power easily separates them.

The groups which we have just described form a transition between the stars scattered over the celestial vault and the more condensed clusters, the undefined aspect of which caused them formerly to be designated under the general name of nebulæ.

Doubtless, if we could place ourselves in space, and contemplate from a sufficiently distant standpoint the whole of the stars which appear to us isolated, we should see them condensed into one or several distinct groups, analogous to those of the Pleiades; while, were we to penetrate into the midst of one of those compact clusters, we should see the stars of which it is formed separated and scattered over the celestial vault in such a way as to give it the aspect of our own heavens.

[154] THE NEBULÆ AND SWARMS OF SUNS.—J. E. Gore

We will now consider the nebulæ, properly so called, that is to say, objects which the spectroscope shows to consist of glowing gas. These are sometimes large and irregular in form, like the great nebula in the "Sword" of Orion, sometimes with spiral convolutions, and sometimes of a definite shape, like the planetary and annular nebulæ.

Of the large and irregular nebulæ, one of the most remarkable is that known as “the great nebula in Orion.” It surrounds the multiple star, Theta Orionis. It is a curious fact that it escaped the searching eye of Galileo, although he gave special attention to the constellation of Orion, for even with a good opera-glass a nebulous gleam is distinctly visible round the central star of the “Sword.” The nebula seems to have been discovered by Cysat, a Swiss astronomer, in the year 1618, and it was sketched by Huygens in 1656. It has been called the “fish-mouth” nebula, from the fancied resemblance of the centre portion to the mouth of a fish. A number of small stars are visible over the surface of the nebula, and at one time Lord Rosse thought it showed indications of resolution into stars when examined with his giant telescope; but this is now known to have been a mistake, for Dr. Huggins finds, with the spectroscope, that it consists of nothing but glowing gas.

The brightest line in the nebular spectrum—the[155] “chief nebular line,” as it is called—has not yet been identified with that of any terrestrial substance.

Mr. W. H. Pickering and Dr. Max Wolf have photographed another nebula surrounding the star Zeta Orionis—the southern star of the “Belt,” which seems to be connected with the nebula in the “Sword”; and Professor Barnard, using the “lens of a cheap oil lantern” of 1½ inches aperture and 3½ inches focal length, has photographed “an enormous curved nebulosity” stretching over nearly the whole of the constellation of Orion, and involving the “great nebula.”

Professor Keeler found, with the spectroscope, that the Orion nebula is apparently receding from the earth at the rate of nearly eleven miles a second, but this motion may be, in part at least, due to the sun’s motion in space in the opposite direction. Professor Pickering considers that the parallax of the nebula is probably not more than 0.″003, which corresponds to a thousand years’ journey for light!

In the southern constellation, Argo is a magnificent nebula, somewhat similar in appearance to the great nebula in Orion. It surrounds the famous variable star Eta Argûs. It is sometimes spoken of as the “keyhole” nebula, owing to a curious opening of that shape near its centre. It was carefully drawn by Sir John Herschel at the Cape of Good Hope in the years 1834-38. It lies in a very brilliant portion of the Milky Way, and Sir John Herschel thus describes it: “It is not easy for language to convey a full impression of the beauty and sublimity of the spectacle which the nebula offers as it enters the field[156] of view of a telescope, fixed in right ascension, by the diurnal motion, ushered in as it is by so glorious and innumerable a procession of stars, to which it forms a sort of climax, and in a part of the heavens otherwise full of interest,” and he adds: “In no part of its extent does this nebula show any appearance of resolvability into stars, being, in this respect, analogous to the nebula of Orion. It has, therefore, nothing in common with the Milky Way, on the ground of which we see it projected, and may therefore be, and not improbably is, placed at an immeasurable distance behind that stratum.” Sir John Herschel’s conclusion as to its physical constitution has been fully confirmed by the spectroscope, which shows it to consist of luminous gas. As in the Orion nebula, there are numerous stars scattered over it. Some of these may possibly have a physical connection with the nebula, while others may belong to the Milky Way. The nebula is of great extent, covering an apparent space about five times the area of the full moon, and its real dimensions must be enormous. It was photographed by Mr. Russell, director of the Sydney Observatory, in July, 1890, and the photograph shows that “one of the brightest and most conspicuous parts of the nebula”—the swan-shaped form near the centre of Herschel’s drawing—has “wholly disappeared,” and its place is now occupied by “a great, dark oval.” Mr. Russell first missed the vanished portion of the nebula in the year 1871, while examining it with a telescope of 11½ inches aperture, and the photograph now confirms the disappearance, which is very remarkable, and shows that changes are[157] actually in progress in these wonderful nebulæ, changes which may be detected after a comparatively short interval of time.

Smaller than the nebula in Argo, but somewhat similar in general appearance, is that known as 30 Doradus, which forms one of the numerous and diverse objects which together constitute the greater Magellanic Cloud. Sir John Herschel drew it carefully at the Cape of Good Hope, and describes it as “one of the most singular and extraordinary objects which the heavens present,” and he says “it is unique even in the system to which it belongs, there being no other object in either nubecula to which it bears the least resemblance.” It is sometimes called the “looped nebula,” from the curious openings it contains. One of these is somewhat similar to the “key-hole” opening in the Argo nebula. Near its centre is a small cluster of stars, and scattered over the nebula are many faint stars, of which Sir John Herschel gives a catalogue of 105, ranging from the ninth to the seventeenth magnitude. I do not know whether this nebula has been examined with the spectroscope, but its appearance would suggest that it is gaseous. It is remarkable as being the only object of its class which is found outside the zone of the Milky Way.

Among the nebulæ of irregular shape, although its spectrum is said to be not gaseous, may be mentioned that known as the “trifid nebula,” or 20 Messier. It lies closely north of the star 4 Sagittarii in a magnificent region of the heavens. In the drawing made by Sir

John Herschel at the Cape of[158] Good Hope, the principal portion consists of three masses of nebulous matter separated by dark “lanes” or “rifts.” Near the junction of the three “rifts” is a triple star. A beautiful drawing of this nebula has also been made by Trouvelot. It agrees fairly well with that of Sir John Herschel, but shows more detail.

Among other gaseous nebulæ may be mentioned that called by Sir John Herschel the “dumb-bell” nebula. It lies a little south of the sixth magnitude star 14 Vulpeculæ, and was discovered by Messier in 1779, while observing Bode’s comet of that year. In small telescopes it has the appearance of a dumb-bell, or hour-glass, but in larger telescopes the outline is filled in with fainter nebulous light, giving to the whole an elliptical form. Several faint stars have been seen in it, but these probably belong to the Milky Way, as Dr. Huggins finds the spectrum gaseous. Dr. Roberts has photographed it, and he thinks that “the nebula is probably a globular mass of nebular matter which is undergoing the process of condensation into stars, and the faint protrusions of nebulosity in the south following and north preceding ends are the projections of a broad ring of nebulosity which surrounds the globular mass. This ring, not being sufficiently dense to obscure the light of the central region of the globular mass, is dense enough to obscure those parts of it that are hidden by the increased thickness of the nebulosity, thus producing the ‘dumb-bell’ appearance. If these inferences are true, we may proceed yet a step, or a series of steps, further, and predict that the consummation[159] of the life-history of this nebula will be its reduction to a globular cluster of stars.”

Among the gaseous nebulæ may also be included those known as “annular nebulæ.” These are very rare objects, only a few being known in the whole heavens. The most remarkable is that known as 57 Messier, which lies between the stars Beta and Gamma Lyræ, south of the bright star Vega. It was discovered by Darquier, at Toulouse, in 1779, while following Bode’s comet of that year. Lord Rosse thought it resolvable into stars, and so did Chacornac and Secchi, but no stars are perceptible with the great American telescopes, and Dr. Huggins finds it to be gaseous. The central portion is not absolutely dark, but contains some faint nebulous light. Examined with the great telescope of the Lick Observatory, Professor Barnard finds that the opening of the ring is filled in with fainter light “about midway in brightness between the brightness of the ring and the darkness of the adjacent sky. The aperture was more nearly circular than the outer boundary of the nebula, so that the ends of the ring were thicker than the sides.” The entire nebula was of a milky color. A central star, noticed by some observers, was usually seen by Professor Barnard, but was never a conspicuous object. He found the extreme dimensions of the nebula about 81″ in length by about 59″ in width, or more than double the apparent area of Jupiter’s disk. It has been beautifully photographed by Dr. Roberts, and he says “the photograph shows the nebula and the interior of the ring more elliptical than the drawings and descriptions indicate;[160] and the star of the following side is nearer to the ring than the distance given. The nebulosity on the preceding and following ends of the ring protrudes a little, and is less dense than on the north and south sides. This probably suggested the filamentous appearance which Lord Rosse shows. Some photographs of the nebula have been taken between 1887 and 1891, and the central star is strongly shown on some of them, but on others it is scarcely visible, which points to the star being variable.” On a photograph taken by MM. Androyer and Montaugerand of the Toulouse Observatory, with an exposure of nine hours (in multiple exposures), about 4,800 stars are visible on and near the nebula in an area of three square degrees.

Another object of the annular class will be found a little to the southwest of the star Lambda Scorpii. It is thus described by Sir John Herschel: “A delicate, extremely faint, but perfectly well defined, annulus. The field crowded with stars, two of which are on the nebula. A beautiful, delicate ring of a faint, ghost-like appearance, about 40″ in diameter in a field of about 150 stars, eleven and twelve magnitude and under.”

Near the stars 44 and 51 Ophiuchi is another object of the annular class, which Sir John Herschel describes as “exactly round, pretty faint, 12″ diameter, well terminated, but a little cottony at the edge, and with a decided darkness in the middle, equal to a tenth magnitude star at the most. Few stars in the field, a beautiful specimen of the planetary annular class of nebula.”

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The Planetary Nebulæ form an interesting class. They were so named by Sir William Herschel from their resemblance to the disks of the planets, but, of course, much fainter. They are generally of uniform brightness, without any nucleus or brighter part in the centre. There are numerous examples of this class, one of the most remarkable being that known as 97 Messier, which is situated about two degrees southeast of Beta Ursæ Majoris—the southern of the two “pointers” in the Plow. It is of considerable apparent size, and even supposing its distance to be not greater than that of 61 Cygni, its real dimensions must be enormous. Lord Rosse observed two openings in the centre with a star in each opening, and from this appearance he called it the “owl nebula.” One of the stars seems to have disappeared since 1850, and a photograph recently taken by Dr. Roberts confirms the disappearance.

Another fine object of the planetary class is one which lies close to the pole of the ecliptic. Webb saw it “like a considerable star out of focus.” Smyth found it pale blue in color. Dr. Huggins finds a gaseous spectrum, the first discovery of the kind made. Professor Holden, observing it with the great Lick telescope, finds its structure extraordinary. He says it “is apparently composed of rings overlying each other, and it is difficult to resist the conviction that these are arranged in space in the form of a true helix,” and he ranks it in a new class which he calls “helical nebulæ.”

A somewhat similar nebula lies a little to the west of the star Nu Aquarii. Secchi believed it to be in[162] reality a cluster of small stars, but Dr. Huggins finds its spectrum gaseous. A small nebula on each side gives it an appearance somewhat similar to the planet Saturn, with the rings seen edgewise. The great Lick telescope shows it as a wonderful object—“a central ring lies upon an oval of much fainter nebulosity.” Professor Holden says “the color is a pale blue,” and he compares the appearance of the central ring “to that of a footprint left in the wet sand on a sea beach.”

About two degrees south of the star Mu Hydræ is another planetary nebula, which Smyth describes as resembling the planet Jupiter in “size, equable light and color.” Webb saw it of “a steady, pale blue light,” and Sir John Herschel, at the Cape of Good Hope, speaks of its color as “a decided blue—at all events, a good sky-blue,” a color which seems characteristic of these curious objects. Although Sir William Herschel, with his large telescopes, failed to resolve it into stars, Secchi thought he saw it breaking up into stars with a “sparkling ring.” Dr. Huggins, however, finds the spectrum to be gaseous, so that the luminous points seen by Secchi could not have been stellar.

Sir John Herschel, in his Cape Observations, describes a planetary nebula which lies between the stars Pi Centauri and Delta Crucis. He says it is “perfectly round, very planetary, color fine blue ... very like Uranus, only about half as large again, and blue.... It is of the most decided independent blue color when in the field by itself, and with no lamplight and no bright star. About 10′ north of it[163] is an orange-colored star, eighth magnitude. When this is brought into view, the blue color of the nebula becomes intense ... color, a beautiful rich blue, between Prussian blue and verditer green.”

There are some rare objects called “nebulous stars.” The star Epsilon Orionis—the centre star of Orion’s Belt—is involved in a great nebulous atmosphere. The triple star Iota Orionis is surrounded by a nebulous haze. The star Beta in Canes Venatici is a 4½ magnitude star surrounded by a nebulous atmosphere.

The term elliptical nebulæ has been applied to those of an elliptical or elongated shape. This form is probably due in many cases to the effect of perspective, their real shape being circular, or nearly so. Perhaps the most remarkable object of this class is the well-known “nebula in Andromeda,” known to astronomers as 31 Messier. It can be just seen with the naked eye, on a clear moonless night, as a hazy spot of light near the star Nu Andromedæ, and it is curious that it is not mentioned by the ancients, although it must have been very visible to their keen eyesight in the clear Eastern skies. It was, however, certainly seen so far back as 905 A. D., and it is referred to as a familiar object by the Persian astronomer, Al-Sûfi, who wrote a description of the heavens about the middle of the Tenth Century. Tycho Brahe and Bayer failed to notice it, but Simon Marius saw it in December, 1612, and described it “as a light seen from a great distance through half-transparent horn plates.” It was also observed by Bullialdus, in 1664, while following the comet of[164] that year. It has frequently been mistaken for a comet by amateur observers in recent years. Closely northwest of the great nebula is a smaller one discovered by Le Gentil in 1749, and another to the south, detected by Miss Caroline Herschel in 1783. The great nebula is of an elliptical shape and considerable apparent size. The American astronomer, Bond, using a telescope of 15 inches aperture, traced it to a length of about four degrees, and a width of two and a half degrees. A beautiful photograph taken by Dr. Roberts in December, 1888, shows an extension of nearly two degrees in length, and about half a degree in width, or considerably larger than the apparent size of the full moon. Bond could not see any symptom of resolution into stars, but noticed two dark rifts or channels running nearly parallel to the length of the nebula. In Dr. Roberts’s photograph these rifts are seen to be really dark intervals between consecutive nebulous rings into which the nebula is divided. Dr. Roberts says: “A photograph which I took with the 20-inch reflector on October 10, 1887, revealed for the first time the true character of the great nebula, and one of the features exhibited was that the dark bands, referred to by Bond, formed parts of divisions between symmetrical rings of nebulous matter surrounding the large diffuse centre of the nebula. Other photographs were taken in 1887, November 15; 1888, October 1; 1888, October 2; 1888, December 29; besides several others taken since, upon all of which the rings of nebulosity are identically shown, and thus the photographs confirm the accuracy of each other, and the[165] objective reality of the details shown of the structure of the nebula.” Dr. Roberts adds: “These photographs throw a strong light on the probable truth of the Nebular Hypothesis, for they show what appears to be the progressive evolution of a gigantic stellar system.”

The largest telescopes have hitherto completely failed to resolve this wonderful object into stars. Dr. Huggins, however, finds that the spectrum is not gaseous, so that if the nebula really consists of stellar points, they must be of very small dimensions.

The question may be asked, What is the probable size and distance of this wonderful nebula? and could it be an external universe?

The temporary star which appeared near the nucleus of the nebula in August, 1885, was of the seventh magnitude. I find that our sun, if placed at the distance indicated by a parallax of 1/200th of a second, would be reduced to a star of about the eleventh magnitude, or four magnitudes fainter than the temporary star appeared to us. That is to say, the star would have been—with the assumed distance—about forty times brighter than the sun. With any greater distance, the star would have been proportionately brighter, compared with the sun. This seems improbable, and tends to the conclusion that the nebula is not an external galaxy, but a member of our own sidereal system, a system which probably includes all the stars and nebulæ visible in our largest telescopes. Dr. Common, indeed, suggests that it may be comparatively near our system. He says: “It is difficult to imagine that such an enormous object,[166] as the Andromeda nebula must be, is not very near to us; perhaps it may be found to be the nearest celestial object of all beyond the Solar System. It is one that offers the best chance of the detection of parallax, as it seems to be projected on a crowd of stars, and there are well-defined points that might be taken as fiducial points for measurement,” and he adds: “Apart from the great promise this nebula seems to give of determining parallax, there is a fair presumption that in the course of time the rotation of the outer portion may perhaps be detected by observation of the positions of the two outer detached portions in relation to the neighboring stars.”

The spiral nebulæ are wonderful objects, and were discovered by the late Lord Rosse with his great six-foot telescope. Their character has been fully confirmed by photographs taken by Dr. Roberts. One of the most remarkable of these extraordinary objects is that known as 51 Messier. It lies about three degrees southwest of the bright star Eta Ursæ Majoris—the star at the end of the Great Bear’s tail. It was discovered by Messier while comet-hunting on October 13, 1773. Telescopes of moderate power merely show two nebulæ nearly in contact, but Lord Rosse saw it as a wonderful spiral, and his drawing agrees fairly well with a photograph taken by Dr. Roberts in April, 1889. The nebula has also been photographed by Dr. Common. Dr. Roberts says: “The photograph shows both nuclei of the nebula to be stellar, surrounded by dense nebulosity, and the convolutions of the spiral in this as in other spiral nebulæ are broken up into star-like condensations[167] with nebulosity around them. Those stars that do not conform to the trends of the spiral have nebulous trails attached to them, and seem as if they had broken away from the spirals.” A tendency to a spiral structure in the smaller nebula is also visible on the original negative. Dr. Huggins finds that the spectrum is not gaseous.

The nebula known as 99 Messier is of the spiral form. It lies on the borders of Virgo and Coma Berenices, near the star 6 Comæ. In large telescopes it somewhat resembles a “Catherine wheel.” D’Arrest and Key thought it resolvable into stars. It has been photographed by M. Von Gothard.

Among the clusters and nebulæ, we may class the Magellanic Clouds, or Nubeculæ in the Southern Hemisphere, as they consist of stars, clusters, and nebulæ.

Among the so-called nebulæ are many objects which, when examined with telescopes of adequate power, are seen to be resolved into myriads of small stars; their comparative isolation from surrounding objects impresses us forcibly with the idea that they form, as it were, families of stars connected by some physical bond of union. Of these clusters, as they are called, we have naked-eye examples in the Pleiades and the “Bee-Hive” in Cancer. Others may be partially seen with a good opera-glass or binocular, but most of them require telescopes of considerable power to view them to advantage. They are of various forms and of all degrees of condensation. Some are comparatively large and irregular, others small and compressed, with the[168] component stars densely crowded. Many are of such uniform shape as to have received the name of globular clusters. These have been aptly termed “balls of stars,” and are among the most interesting objects in the stellar heavens.

The most remarkable object of this class visible in the Northern Hemisphere is that known as 13 Messier. It lies between the tolerably bright stars Zeta and Eta Herculis, nearer the latter star. It may be seen with an opera-glass as a hazy-looking star of about the sixth magnitude, with a star on each side of it. Examined with a powerful telescope, it is resolved into numerous small stars. Sir William Herschel estimated them at 14,000, but the real number is probably much less. Assuming the average magnitude of the components at twelve and a half, I find that an aggregation of 14,000 stars of this brightness would shine as a star of about the second magnitude, or a little fainter.

Another object of the globular class, but less resolvable, is that known as 92 Messier, which lies between the stars Eta and Iota in Hercules, nearer the latter. Sir William Herschel's telescopes showed it as seven or eight minutes of arc in diameter. It is considerably brighter at the centre. The larger components are easily visible in moderate-sized telescopes, but even Lord Rosse's giant instrument failed to resolve the central blaze. There is no doubt, however, that it consists wholly of small stars, as the unerring eye of the spectroscope shows a stellar spectrum, similar to that of the neighboring 13 Messier.

[169] Drawing of star regions Fig. 17.—The Region of Boötes and Hercules

Another fine example of the globular class is 5 Messier, which lies closely north, preceding the fifth magnitude star, 5 Serpentis. It is considerably compressed at the centre. Sir William Herschel counted 200 stars, but failed to resolve the central nebulosity. Messier, its discoverer, found it visible with a telescope only one foot long.

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Another fine object is 3 Messier, in Boötes. Admiral Smyth describes it as "a brilliant and beautiful globular aggregation of not less than 1,000 small stars." It is beyond the power of small telescopes, but it was resolved by Buffham, even in the centre, with a 9-inch reflector.

Numerous fine examples of the globular class are found in the Southern Hemisphere, which indeed seems to be richer in these marvelous objects than the northern sky. Of these the most interesting are those known as Omega Centauri and 47 Toucani. Omega Centauri, from its great apparent size—about two-thirds of the moon's diameter—and its visibility to the naked eye, may perhaps be considered as the most remarkable object of its kind in the heavens. It shines as a hazy star of the fourth magnitude, and I have often so seen it in the Punjab sky. Its large size and globular form are clearly visible in a binocular field-glass, but, of course, its component stars are far beyond the reach of such an instrument. Sir John Herschel, observing it with his large telescope at the Cape of Good Hope, found it a "truly astonishing object. All clearly resolved into stars of two magnitudes, viz., thirteen and fifteen, the larger lying in lines and ridges over the smaller;... the larger form rings like lace-work on it." If we take the average magnitude of the components at thirteen and a half, the apparent brightness of the cluster would imply that it contains about 15,000 stars. Photo of Nebula The Great Nebula in the Constellation Cygnus

The other wonderful cluster is that known as 47 Toucani, which lies close to the smaller Magellanic[171] Cloud. It is smaller in apparent size than Omega Centauri, but Dr. Gould, observing it at Cordoba, speaks of it as "one of the most impressive and perhaps the grandest of its kind in either hemisphere," and he estimates its magnitude at four and a half, as seen with the naked eye. It is thus described by Sir John Herschel: "A most magnificent globular cluster. It fills the field with its outskirts, but within its more compressed part I can insulate a tolerably defined, circular space, of 90″ diameter, wherein the compression is much more decided, and the stars seem to run together, and this part, I think, has a pale pinkish or rose color, which contrasts, evidently, with the white light of the rest. The stars are equal, fourteen magnitude, immensely numerous and compressed.... Condensation in three distinct stages.... A stupendous object." Sir John Herschel's drawing of this cluster reminds one of a swarm of bees, and perhaps suggested to Tennyson the lines: "Clusters and beds of worlds, and bee-like swarms Of suns and starry streams."

There are other interesting specimens of the globular class in the Southern Hemisphere, but not of such large apparent dimensions as those already described. Of these may be mentioned 22 Messier, which lies about midway between the stars Mu and Sigma Sagittarii. It is described by Sir John Herschel as a fine globular cluster, with stars of two magnitudes, namely eleven or twelve, and fifteen or sixteen, the larger being visibly reddish, and he suggested that it consists of "two layers, or one shell[172] over another." Owing to the comparative brightness of the larger components, this cluster forms a good object for small telescopes. I saw the brighter stars well with a 3-inch refractor in the Punjab sky, but, of course, the greater portion of the cluster has a nebulous appearance in a telescope of this size.

Between Alpha and Beta Scorpii there is a condensed globular cluster. With small telescopes it very much resembles a telescopic comet, but with larger instruments its true character is revealed. Sir William Herschel considered it "the richest and most condensed mass of stars in the firmament." In May, 1860, a "temporary star" of the seventh magnitude suddenly appeared in the centre, almost blotting out the cluster by its superior light. The star faded away before the end of June of the same year, and has not been seen with any certainty since. It has been suggested that this temporary star lay between the cluster and the earth, but it seems to me much more probable that the outburst took place in the cluster itself, and that it was possibly caused by a collision between two of the component stars, or by a swarm of meteors rushing with a high velocity through the cluster.

The beauty and sublimity of the spectacle presented by these globular clusters, when viewed with a powerful telescope, is such as can not be adequately described, and it has been said that when seen for the first time, “few can refrain from a shout of rapture.” The component stars, although distinctly visible as points of light, defy all attempts at counting them, and seem literally innumerable. Placed[173] like a mass of glittering diamond-dust on the dark background of the heavens, they impress us forcibly with the idea that if each of these lucid points is a sun, the thousands which seem massed together in so small a space must be in reality either relatively close and individually small, or else the system of suns must be placed at a distance almost approaching the infinite.

The distance of these globular clusters from the earth is, however, certainly very great. Attempts to accurately determine their position in space have not been attended with success. As the component stars are at practically the same distance from the eye, we have no comparison stars to measure from, and their exact distance, therefore, remains unknown. We may, however, estimate their probable distance with some show of plausibility. We may assume that the stars of the Hercules cluster would, if concentrated in a point, shine as a star of about the fourth magnitude. As the components are of about the twelfth and thirteenth magnitudes, this would imply that the cluster consists of about 2,500 stars. With the data assumed, we may therefore conclude that the components of the Hercules cluster are suns of comparatively small size, separated by considerable distances, but apparently massed together by the effect of distance.

Among less condensed star clusters there are many interesting objects. The Pleiades have been already referred to. On a photograph of this remarkable group, taken at the Paris Observatory, over 2,000 stars can be counted of all degrees of brilliancy, from[174] those visible without optical aid down to points of light so faint as to be invisible to the eye in the telescope with which they were photographed. Here we have a cluster of probably larger size than that in Hercules, probably at a greater distance from the earth, and with its larger components of considerably greater mass than our sun.

Near the bright star Pollux, I see a small cluster of stars of about the seventh and eight magnitudes, which, with a binocular field-glass, very much resembles the Pleiades as seen with the naked eye. A smaller cluster (known as 39 Messier) may be seen near the star Pi Cygni.

The well-known Chi Persei may be also seen with an opera-glass, but a telescope is necessary to show the component stars to advantage, and the larger the telescope the greater the number of faint stars in these wonderful objects.

The cluster known as 35 Messier, a little north of the star Eta Geminorum, is visible in an opera-glass, but a small telescope is required to see the component stars. A well-marked clustering tendency is visible among the brighter stars of the group, two, three, four, and sometimes five stars being grouped together in subordinate collections. Admiral Smyth says: “It presents a gorgeous field of stars from the ninth to the sixteenth magnitude, but with the centre of the mass less rich than the rest. From the small stars being inclined to form curves of three or four, and often with a large one at the root of the curve, it somewhat reminds one of the bursting of a sky-rocket.” This tendency to “stream” formation in[175] the components of star clusters is also well marked in a photograph of the cluster 38 Messier (kindly sent to me by MM. Henry of the Paris Observatory). It was described by Webb as “a noble cluster arranged in an oblique cross,” and Smyth says: “The very unusual shape of this cluster recalls the sagacity of Sir William Herschel’s speculations upon the subject, and very much favors the idea of an attractive power lodged in the brightest part. For although the form is not globular, it is plainly to be seen that there is a tendency toward sphericity, by the swell of the dimensions as they draw near the most luminous part, denoting, as it were, a stream or tide of stars, setting toward the centre.”

Sir W. Herschel, speaking of a compressed cluster in Perseus, says “the large stars are arranged in lines like interwoven letters,” and Webb says “it is beautifully bordered by a brighter foreshortened pentagon.”

Observing with a 3-inch telescope in India, I noticed a beautiful cluster of stars, about 4° north of Gamma and Upsilon Scorpii, resembling in shape a bird’s foot, with remarkable streams of stars. This cluster is visible to the naked eye as a star of about the fifth magnitude.

Although these loosely associated star clusters do not show such evidence in favor of family connection as the more closely compacted globular clusters, still we can hardly escape from the conviction that their apparent aggregation is really due to some physical bond of union, and not merely the result of a fortuitous scattering of stars at different distances in the line of sight.

[176] THE GREAT NEBULA OF ORION.—Sir Robert S. Ball

The telescope, ever an ally in the study of the heavens, is in this part of the science absolutely indispensable. In other branches of astronomy we can learn something without its aid. Indeed, many great astronomical discoveries were made long before the telescope was invented. But ere this memorable event in the history of science it was impossible for us to know anything of the existence of the nebulæ. It is indeed true that there is one of these objects which can be just detected by the naked eye. It lies in the constellation of Andromeda, where, on a clear and dark night, a faint spot of light can just be discerned by a good eye. But a mere glimpse gives us really no adequate notion of the true character of the object. It might only, so far as the naked eye discloses its nature, be a cluster of stars like that we have already discerned in Perseus, or like the similar group that, under the name of the Beehive, is comparatively familiar in the constellation of Cancer. With the single exception of the nebula in Andromeda, all the objects so called are entirely telescopic, yet how important a constituent the nebulæ form in the contents of the heavens will be shown by a look at some of the lists of these objects. There are now several thousands of nebulæ known, and their positions in the sky, as well as the details of their appearances, are set forth in the catalogues.

The most glorious constellation of stars in the[177] firmament is undoubtedly that of Orion. This splendid group is seen in the south during the winter months, and toward the close of January it is situated in a very convenient position for observing early in the evening. The group is specially characterized by the number of unusually bright stars which it includes, and the three stars in the centre, forming the so-called Belt of Orion, is as well known a celestial figure as the sky contains. Directly under the belt are three much smaller stars nearly in a line, which points straight upward to the middle star of the belt. These three lower stars are usually known as the sword handle of Orion, this being the position which they occupied in the fanciful old sketches of the constellation. The three stars of the sword handle of Orion are plunged in the Great Nebula. This object can not be seen by the unassisted eye, though doubtless around the central star a little haziness is perceptible, and even the slightest telescopic aid will suffice to indicate that the central star of the sword handle is attended by a surrounding glow of light, which renders it quite unlike other stars. This can indeed be sufficiently shown with an ordinary opera-glass, one glance through which will awaken in the beholder a keen desire to study the object under more favorable conditions. But to do justice to the object, telescopes of large power are desirable.

To realize fully the magnificence of the Great Nebula, the observer who is being introduced to the object for the first time should not, strange to say, direct the telescope at the nebula; the instrument should rather be pointed at the heavens, just a little[178] to the west of the nebula. The clock driving the equatorial should not be started, and the observer should take his seat and look through the eye-piece before the nebula has entered the field. He will see, no doubt, a few stars on the black background, which gradually pass in procession across his field of view. This is merely the ordinary diurnal journey of the heavens, by which all the objects move slowly from east to west; I ought rather to say appear to move, for, of course, the motion on the heavens is only apparent, the fact being that it is the earth which is turning round.

After the observer’s eye for a minute or so has become familiarized with the dark aspect of the heavens under ordinary circumstances, he will begin to perceive on the eastern side (it will appear in the telescope no doubt as on the western side) a faint dawn of light. Gradually there will steal across his field of view a sort of ghostlike luminosity that is in marked contrast to the darkness in the rest of the field; as the seconds move on, this object will disclose itself until the full splendor of the Great Nebula comes into view; then the entire field will be filled with the light, and then it will gradually advance and gradually pass away again to emphasize the contrast between the brilliance of the nebula and the darkness of the sky. Unless this method is adopted, the full interest of a telescopic view of the Great Nebula is not attained, for when the entire field is full of the glow the beginner will hardly recognize the nebula. He will be apt to think that the fainter part of the field he sees is the ordinary[179] groundwork of the sky, and this illusion can only be dispelled by enabling him to witness the actual contrast in the way I have described. The central portions of the nebula are, however, so brilliant and so wonderfully marked with interesting detail, that even a small instrument will suffice to reveal much of its beauties.

In the centre of the nebula is the star known to astronomers at Theta Orionis, the most prominent star of the sword handle. To the eye this looks like an ordinary star, but the telescope speedily dispels that notion. Theta Orionis is found to consist of four, or rather six, stars all so close together that the unaided eye fails to distinguish them separately. A structure so complex gives to this star quite a special, indeed a unique, interest, wholly apart from the marvelous nebula of which it is the focus. We must dwell a little on the peculiarities of this star. We are familiar with stars which are called double; there are indeed some ten thousand objects so designated known to astronomers and duly registered in catalogues.

Many of these double stars are objects of extreme telescopic beauty; sometimes they offer to our admiration a delightful contrast of colors; perhaps one will be topaz color and the other bluish, or on rare occasions a pair of emerald gems will be seen with an invisible band of mutual connection. Sometimes triple stars are found, in which three stars are obviously in alliance; but multiple

stars of greater complexity are comparatively rare; and so marvelous a spectacle as Theta Orionis, in which no fewer[180] than six stars are obviously an allied group, is almost unique. It is not a little remarkable that we find the most exquisite multiple star which the sky can show, beautifully framed or set in the centre of the grandest of the nebulæ. Of course it might conceivably happen that the apparent concourse of these objects was fortuitous. The actual phenomenon could be accounted for by the belief that the Great Nebula was either very much nearer or very much further than the multiple star, and that they chanced to lie in the same line of sight, and had no other connection. But to me it appears that this view is quite at variance with every reasonable probability; that the most wondrous multiple star should have happened to lie in line with the very centre of the most wondrous nebula would have been a coincidence against the occurrence of which the probabilities were almost infinite. There can scarcely be any doubt that the multiple star and the Great Nebula are part of the same system, and that the star is, in truth, placed in the middle of the nebula, as it actually appears to be.

And now as to the composition of this mysterious object.

The word nebula means, of course, a little cloud, but the expression is apt to be a misleading one. In a sense no doubt they are little, inasmuch as the patch of the sky which a nebula covers would be small compared with one of our ordinary clouds. Indeed, a nebula which covered as large an apparent part of the sky as the size of the moon would be ranked as a large object of its class, while even the greatest of[181] them is perhaps not more than ten or twelve times as great. Nor is the word cloud, as applied to nebula, an appropriate one. What we mean by a cloud is only a vast mass of watery vapor raised by the sun from the sea, and poised aloft until such time as it shall be again dispersed into invisible water, or until it shall descend to the earth as rain. Such clouds are, of course, within the limits of our atmosphere, and are rarely more than a few miles above the earth's surface. The light which renders clouds visible only comes from reflected sunbeams, and consequently at night clouds become invisible, though the astronomer is often only too unpleasantly made acquainted with their presence by the opacity with which they shut out the stars from his view.

Utterly different in all respects are the nebulæ. They are not masses of watery vapor. It may no doubt possibly be that water in some form is there, but it is not water which we see. We are looking at some gaseous material of a bluish hue. The light with which it glows is no reflected sunlight. The nebula is indeed indebted to no foreign source for that weird—I had almost said ghostlike—radiance which it gives forth. The light comes from the nebula itself. But how, it may well be asked, should a purely gaseous substance be able to radiate forth light? It is easy for us to comprehend how stars or suns or comparatively solid bodies can, in virtue of their tremendous temperature, glow with heat like red-hot or white-hot iron. It is true that flame is gas in an incandescent state, but in flame a vehement chemical union of oxygen with some other substance[182] is in progress, and this is the source of the heat and the light that flame gives forth. We can not regard the Great Nebula in Orion as originating in anything resembling flame.

We can, however, in our physical laboratories arrange an experiment which seems to throw some light on the composition of the nebula. Into a glass tube a small quantity of hydrogen gas is admitted, the air having been previously extracted. Then, by means of two wires, one at each end of the tube, an electric current is transmitted through the gas. Here there is no combustion; the gas is merely the vehicle by which the electricity flows from one pole to the other. In doing so the gas instantly begins to glow with an intense bluish light, and a very beautiful effect is produced, which can be renewed or terminated at will by simply making or breaking the electric current. It would seem as if the gas we see in the nebula were in a condition somewhat analogous to the gas in the tube. I do not mean that the passage of electricity through the nebula is the source of its luminosity. There is, indeed, no ground for such a supposition. It is the property of electricity when passing through a conductor to warm that conductor; thus we know that if a powerful current be transmitted through a wire of the most infusible of all metals, platinum, the wire will not only get warm, but it may become red hot, white hot, and even melt under the influence of the heat which is generated. In those beautiful incandescent electric lamps which are now happily coming into extensive use a current of electricity flows through a filament of carbon, and[183] kindles that exquisite incandescence which is maintained while the current flows. It would appear that so long as the electricity is flowing through the glass tube its action on the gas is to impart a very high temperature. It is in consequence of this temperature that the gas glows. Now we can offer a reasonable account of the luminosity of the Great Nebula in Orion. The particles of gaseous or vaporous material of which it is formed are of an extremely high temperature, sufficient to enable them to glow with the brilliancy which renders them visible.

It is now almost twenty years since a marvelous accession to our knowledge of such objects as the Great Nebula in Orion was made by Dr. Huggins. I have used our gas hydrogen as an illustration in describing the character of the nebula, but I have now to add that the presence of hydrogen is no mere fiction but a substantial verity. Truly we here open up one of the most marvelous

chapters which science has to disclose. The chemist can analyze the different substances on the earth with his test tubes, and he can tell the elements of which they are composed. But in this old-fashioned chemistry it was at least reasonable for the chemist to demand a portion of the substance he was expected to analyze. Unless he were provided with a sample, how could it be possible for him to grind it up or submit it to the various operations of his laboratory? In these modern days the chemist can perform operations of which his predecessors never even dreamed. No doubt the old method is still used—nay, is indeed at this moment cultivated with greater skill and means than[184] in any previous age—but side by side with the old method, and as an invaluable supplement thereto, the new method of chemical research, called spectrum analysis, has been created, and has already conducted to many profoundly interesting discoveries in the most varied branches of science.

In the application of the spectroscopic method it is not indispensably necessary that we actually have a fragment of the substance; all we require is a beam of light which that substance can be made to yield when heated to a sufficiently high temperature.

When a beam of the nebular light is transmitted through the prisms, it declares at once that the object from which that light has come is totally different from a star like the sun. Instead of the beautifully colored band, decked in all the glowing hues of the rainbow, the nebular beam is seen to be composed simply of six or seven widely separated strips. It is important to test the character of the light in these strips. Fortunately this can be done in a way that is completely satisfactory. We can produce artificial lights from known sources, and observe them through the spectroscope simultaneously with the light of the nebula.

There are in the composition of this globe some sixty or seventy different elementary substances, and under suitable conditions each one of these substances can afford a perfectly characteristic spectrum. Thus the way of making the comparison with the nebula is to try the different elements one after another, until one can be discovered which pours forth a light that behaves under the prism as does the light[185] from the nebula. Pursuing this inquiry, Dr. Huggins found that when hydrogen gas was ignited to incandescence by the passage of electricity, it emitted light which, after passage through the prisms, came to coincidence with one of the lines in the spectrum of nebula; and the hydrogen character of two of the other lines has been since demonstrated. It was thus established that hydrogen is one of the constituents of the Great Nebula in Orion. Further confirmation of this important discovery was forthcoming when the photographs of the spectrum of the Great Nebula were subsequently obtained. On these photographs lines were present which are constituted by light of such a nature as to be wholly invisible to the eye, though perceptible on the photographic plate. It is of the greatest interest to discover that these invisible rays from the nebula are also indicative of the presence of hydrogen. Thus we obtain a beautiful confirmation of the fact that the nebula is partly composed of glowing hydrogen.

There are, however, some remaining lines, the character of which has not yet been ascertained.

It would be a little premature to assert that there must be some substance in the Great Nebula not at present known to us on the earth. This would be, no doubt, one interpretation of the facts. We must, however, admit the possibility of another explanation. It is frequently found that the lines yielded by an incandescent material vary to some extent when the physical conditions of temperature and of pressure are modified. It is, therefore, not impossible[186] that the unknown lines in the spectrum of the Great Nebula may be due to some element known to us, but which has not yet been tested under the conditions which would make it yield the particular rays we are speaking of.

The composition of a nebula as disclosed to us by these researches is very instructive. Here we are looking at an object which seems to lie at the very limits of the visible universe—an object so remote that our attempts to fathom its distance are quite unsuccessful; yet in this inconceivably distant part of our system we find at least one ingredient which we know well on the earth. Previous to actual trial no one would have expected, I think, to find the Great Nebula largely constituted from such a familiar element as hydrogen. This gas enters into the composition of water, and is thus an element of extreme abundance on the earth. That an element so common with us here should also be abundant in these awfully distant regions of the universe is one of the most astonishing facts that modern science has revealed.

As the eye follows these ramifications of the Great Nebula, ever fading away in brightness until it dissolves in the blackness of the sky; as we look at the multitudes of bright stars which sparkle out from the depths of the great glowing gas; as we ponder on the marvelous outlines of a portion of the nebula, we are tempted to ask what the true magnitude of this object must really be. Here, again, we have to confess that science is unable to satisfy this very legitimate curiosity. The only means of learning[187] the true length and breadth of a celestial object depends upon our first having discovered the distance from us at which the object is situated. Unhappily we are, as I have said, entirely ignorant of what this distance may be in the case of the Great Nebula in Orion.

Our ordinary methods of conducting such an inquiry are hardly applicable to such an object, and its position so near the Equator introduces fresh difficulties into the problem. We shall, however, certainly not err on the side of exaggeration if we assert that the Great Nebula must be many millions of times larger than that group of bodies which we call the Solar System. COLORED, DOUBLE, MULTIPLE, BINARY, VARIABLE AND TEMPORARY STARS.—J. E. Gore

On a clear night a careful observer will notice a marked difference in the colors of the brighter stars. The brilliant white or bluish-white light of Sirius, Rigel, and Vega contrasts strongly with the yellowish color of Capella, the deeper yellow, or orange, of Arcturus, and the ruddy light of Aldebaran and Betelgeuse. These colors are, however, limited to various shades of yellow and red. No star of a decided blue or green color is known, at least among those visible to the naked eye in the Northern Hemisphere. The third magnitude star Beta Libræ is described by Webb as of a "beautiful pale green hue," but probably such a tint in the light of this star will to most people prove quite imperceptible. Dr.[188] Gould, observing it in the Southern Hemisphere—under, of course, more favorable conditions—says: "There is a decidedly greenish tinge to the light of Beta Libræ, although its color can not properly be called conspicuous."

Among the ruddy stars visible to the naked eye, Mu Cephei, Herschel's "garnet star," is generally admitted to be the reddest, but it is not sufficiently bright to enable its color to be well distinguished without the aid of an opera-glass. With such an instrument, however, its reddish hue is striking and beautiful, and very remarkable when compared with other stars in its vicinity. Like so many of the red stars, Mu Cephei is variable in its light, but seems to have no regular period, and often remains for many weeks without perceptible change. It may be seen near the zenith in the early evening hours toward the end of October, and when in this position its ruddy color is very conspicuous.

Among the brightest stars, Betelgeuse is perhaps the reddest, and the contrast between its ruddy tint and the white color of Rigel in the same constellation (Orion) is very noticeable. Like Mu Cephei, Betelgeuse is irregularly variable in its light, but not to such an extent, and, like the "garnet star," it frequently remains for protracted periods nearly constant in brightness. There are other cases of reddish color among the naked-eye stars. Among these may be mentioned Antares (Alpha Scorpii), Alphard (Alpha Hydræ), noted as red by the Persian astronomer Al-Sûfi, in the Tenth Century, and called by the[189] Chinese "The Red Bird"; Eta and Mu Geminorum; Mu and Nu Ursæ Majoris; Delta and Lambda Draconis; Beta Ophiuchi; Gamma Aquilæ, and others in the Southern Hemisphere.

But it is among the stars below the limit of naked-eye vision that we meet with the finest examples of the red stars. Some of these are truly wonderful objects. The small star, No. 592 of Birmingham's Catalogue of Red Stars (No. 713 of Espin's edition), which lies a little south of the 5½ magnitude star 79 Cygni, was described as "splendid red" by Birmingham, "very deep red" by Copeland and Dreyer, and "orange vermilion" by Franks. The star 248 Birmingham, which lies about 5° south of Gamma Hydræ, is another fine specimen. Birmingham described it as "fine red" and "ruby"; Copeland as "brown red"; Dreyer as "copper red"; and Espin as "magnificent blood red." This star is variable in light, as the estimates of magnitude range from 6.7 to below 9. About 3° to the northeast of this remarkable object is another highly-colored star, known as R Crateris. It is easily found, as it lies in the same telescopic field of view with Alpha Crateris, a 4½ magnitude star. Sir John Herschel described it as "scarlet, almost blood-color; a most intense and curious color." Birmingham called it "crimson"; and Webb "very intense ruby." Observing it with a 3-inch refractor in India in 1875, I noted it as "full scarlet." It varies in light from above the eighth magnitude to below the ninth, and has near it a star of the ninth magnitude of a paler blue tint.

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Another very red star is No. 4 of Birmingham's Catalogue, which will be found about 5° north, preceding the great nebula in Andromeda. It is of about the eighth magnitude, and may be well seen with a 3-inch refractor. Krüger describes it as "intensiv roth"; Birmingham as "fine red" and "crimson"; Franks as "fine color, almost vermilion"; and Espin as "intense red color, most wonderful."

Another fine object is R Leporis, which forms roughly an equilateral triangle with Kappa and Mu Leporis. This is also variable from 6½ to 8½ magnitude. It was discovered by Hind in 1845, and described by him as "of the most intense crimson, resembling a blood-drop on the background of the sky; as regards depth of color, no other star visible in these latitudes could be compared with it." Schönfeld called it "intensiv blutroth," but Dunér, observing its spectrum in 1880, gives its color as a less intense red than that of other stars. Possibly it may vary in color as well as in light.

The variable star U Cygni, which lies between Omicron and Omega Cygni, is also very red. Webb described it as showing "one of the loveliest hues in the sky." It varies from about the seventh to 11½ magnitude, with a period of about 461 days.

Another deeply colored star is the well-known variable R Leonis. Hind says: “It is one of the most fiery-looking variables on our list—fiery in every stage from maximum to minimum, and is really a fine telescopic object in a dark sky about the time of greatest brilliancy, when its color forms a striking contrast with the steady white light of the sixth magnitude[191] a little to the north.” This latter star is 19 Leonis.

In the Southern Hemisphere there are some fine examples of red stars. Epsilon Crucis, one of the stars in the Southern Cross, is very red. Mu Muscæ is described by Dr. Gould as of “an intense orange red.” Delta2 Gruis is a very reddish star of about the fourth magnitude. Pi1 Gruis was observed by Gould as “deep crimson,” and forming a striking contrast with its white neighbor Pi2 Gruis, which he notes as “conspicuously white.” The variable L2 Puppis is described as “red in all its stages, and remarkably so when faint.” Miss Clerke, observing—at the Cape of Good Hope—R Doradûs, another southern variable, says: “This extraordinary object strikes the eye with the glare of a stormy sunset,” and with reference to the variable R Sculptoris, described by Gould as “an intense scarlet,” she says: “The star glows like a live coal in the field,” a description I have found myself very applicable to other small red stars.

An eighth magnitude star about 5° north of Beta Pictoris is noted by Sir John Herschel, in his Cape Observations, as “vivid sanguine red, like a blood-drop. A superb specimen of its class.” With reference to a star of about 8½ magnitude in the field with Beta Crucis, Herschel says: “The fullest and deepest maroon red; the most intense blood-red of any star I have seen. It is like a drop of blood when contrasted with the whiteness of Beta Crucis.”

Of stars of other colors, the asserted green tint of Beta Libræ has already been referred to. Among[192] the brighter stars of the Southern Hemisphere, Theta Eridani, Epsilon Pavonis, Upsilon Puppis, and Gamma Tucanæ are said to be decidedly blue. The wonderful cluster surrounding the star Kappa Crucis contains several bluish, greenish and red stars, and is described by Sir John Herschel as resembling “a superb piece of fancy jewelry.”

Among the double stars we find many examples of colored suns. Of these may be mentioned Epsilon Boötis, of which the colors are “most beautiful yellow” and “superb blue,” according to Secchi; Beta Cephei, “yellow and violet”; Beta Cygni, “golden yellow and smalt blue”; Gamma Delphini, of which I noted the colors in 1874 as “reddish yellow and grayish lilac”; Alpha Herculis, “orange and emerald or bluish green,” and described by Admiral Smyth as “a lovely object, one of the finest in the heavens”; Zeta Lyræ, “pale yellow and lilac” (Franks); and Beta Piscis Australis, of which I observed the colors in India as white and reddish lilac.

Some distant telescopic companions to red stars have been described as blue. This may be in some case due, partly at least, to the effect of contrast. In others the blue color seems to be real. This has been shown spectroscopically to be the case with the bluish companions of Beta Cygni.

The physical cause of the difference of color is still more or less a matter of mystery. Although we can not consider it proved that the red stars are cooling and “dying out” suns, as has been suggested, we may, I think, conclude that their temperature, although doubtless very high, must be lower than that[193] of the white stars. We know that a bar of iron when heated to redness is not so hot as when raised to “white heat,” and although the analogy between hot iron and stellar photospheres may not be a perfect one, it seems probable that the higher the temperature of a star, the whiter its color will be. Most of the white stars, as Sirius, Vega, and those only yellow or slightly colored, show spectra of Secchi’s first and second types, while the great majority of the red stars exhibit banded spectra of the third and fourth types.

To this rule there are, however, like other rules, some notable exceptions. For instance, Aldebaran, Alpha Hydræ, Xi Cygni, and 31 Orionis, although distinctly reddish stars, show well-marked spectra of the second or solar type. On the other hand, Rho Ursæ Majoris and Omega Virginis, which, according to Dunér, are only slightly yellow, have well-marked spectra of the third type.

An apparent change of color seems in some cases to be well established. The supposed red color of Sirius in ancient times is well known. A certain established change is found in the case of the famous variable star Algol, which is distinctly described as red by Al-Sûfi in the Tenth Century. It is now pure white, or nearly so, and this is probably the best attested instance on record of change of color in a bright star.

Schmidt’s Nova Cygni of 1876 was noted as “golden yellow” on the night of its discovery. When it had faded to the eighth magnitude, Dr. Copeland called it “decided red,” but when examined at Lord[194] Crawford’s observatory in September, 1877, its color was recorded as “faint blue”! The new star in the Andromeda nebula was considered to be yellowish or reddish by most observers when near its maximum, but about a month later its color was noted as “bluish.”

Among the red and variable stars, there are many suspected cases of color variation. Espin and other observers have noted that the wonderful variable Mira Ceti is much less red at maximum than at minimum. My own observations confirm this. When at its maximum brightness, Mira does not seem to me a very highly-colored star, while at one of its minima I noted it as “fiery red.” Possibly, however, the great difference between its maximum and minimum brilliancy may have an influence on estimations of its color. The remarkable variable Chi Cygni is said to be “strikingly variable in color.” Espin’s observations in different years show it “sometimes quite red, at others only pale orange red.” The star Birmingham 118 was described by Schjellerup in 1863 as “decided red,” but it was found yellow by Secchi in 1868; “bluish” by Birmingham, 1873-76; “no longer red” by Schjellerup in March, 1876; and “white” by Franks in 1885. Espin omits it from his revised edition of Birmingham’s Catalogue.

Birmingham 169 was found red by Struve, blue or bluish-white by Birmingham in 1874, and white at Greenwich in the same year. Espin also saw it white in March, 1888. The star Birmingham 30, which lies close to Phi Persei (54 Andromedæ), was described[195] by Schweizer as a “red star with a little disk” in January, 1843; Birmingham noted it as “light red” in December, 1875; Copeland “deep red” in January, 1876; and Dreyer “reddish” in September, 1878; but Espin, in November and December, 1887, found it “certainly not red, and nothing peculiar in the star’s appearance.” It might be expected that these curious changes of color, if real, would be accompanied by corresponding changes in the star’s spectrum. Such may be the case, and observations in this direction would probably lead to some interesting results.

There seems to be some law governing the distribution of the colored stars. The white stars appear to be most numerous, as a rule, in those constellations where bright stars are most abundant, for instance, in Orion, Cassiopeia, and Lyra; yellow and orange stars in large and ill-defined constellations, such as Cetus, Pisces, Hydra, Virgo, etc. The very reddish stars are most numerous in or near the Milky Way, and one portion of the Galaxy—between Aquila, Lyra, and Cygnus—was termed by Birmingham “the red region in Cygnus.”

Many of the stars when examined with a good telescope are seen to be double, some triple, and a few quadruple, and even multiple. These when viewed with the naked eye, or even a powerful binocular, seem to be single, and show no sign of consisting of two components. These telescopic double stars should be carefully distinguished from those which appear very close together with the naked eye, and which in opera-glasses or telescopes[196] of small power might be mistaken for wide double stars by the inexperienced observer. These latter stars, such as Mizar—the middle star in the tail of the Great Bear—and its small companion, Alcor, have been called “naked-eye doubles,” but they are not, properly speaking, double stars at all. Telescopic double stars are far closer, and even the widest of them could not possibly be seen double without optical aid, even by those who are gifted with the keenest vision. Of these so-called “naked-eye doubles,” we may mention Alpha Capricorni, which on a very clear night may be seen with the naked eye to consist of two stars. On a very fine night two stars may be seen in Iota Orionis, the most southern star in Orion’s Sword. The star Zeta Ceti has near it a fifth magnitude star, Chi, which may be easily seen with the unaided vision. The star Epsilon Lyræ (near Vega) is a severe test for naked-eye vision. Bessel, the famous German astronomer, is said to have seen it when thirteen years of age. Omicron Cygni (north of Alpha and Delta Cygni) forms another naked-eye double, and other objects of this class may be noticed by a sharp-eyed observer.

The star Mizar, already referred to, is itself a wide telescopic double, and it seems to have been the first double star discovered with the telescope (by Riccioli in 1650). It consists of two components, of which one is considerably brighter than the other. It will give an idea of the closeness of even a “wide” telescopic double when we say that the apparent distance between Mizar and Alcor is nearly forty times[197] the distance which separates the close components of the bright star. From this it will be seen that even a powerful binocular field-glass would fail to show Mizar as anything but a single star. The components may, however, be well seen with a 3-inch telescope, or even with a good 2-inch. The colors of the two stars are pale green and white. Between Mizar and Alcor is a star of the eighth magnitude, and others fainter. Mizar was the first double star photographed by Bond.

The Pole Star has a small companion at a little greater distance than that which separates the components of Mizar, but owing to the faintness of this small star, the object is not so easy as Mizar.

The star Beta Cygni is composed of a large and small star, of which the colors are described as “golden yellow and smalt blue.” This is a very wide double, and may be seen with quite a small telescope. Another fine double star is that known to astronomers as Gamma Andromedæ. The magnitudes of the components are about the same as those of Mizar, but a little closer. Their colors are beautiful (“gold and blue”). This is one of the prettiest double stars in the heavens. It is really a triple star, the fainter of the pair being a very close double star; but this is beyond the reach of all but the largest telescopes. The star Gamma Delphini is another beautiful object, the components being a little more unequal in magnitude, but the distance between them about the same as in

Gamma Andromedæ. I have noted the colors with a 3-inch telescope as “reddish yellow and grayish lilac.” Gamma Arietis, the faintest of the[198] three well-known stars in the head of Aries, is another fine double star, a little closer than Gamma Delphini. This is an interesting object, from the fact that it was one of the first double stars discovered with the telescope—by Hooke, in 1664, when following the comet of that year.

Another beautiful double star is Eta Cassiopeiæ, the components being about equal in brightness to those of Gamma Delphini, but the distance less than one-half. The colors are, according to Webb, yellow and purple; but other observers have found the smaller star garnet or red. This is a very interesting object, the components revolving round each other, and forming what is called a binary star.

Another fine double star is Castor, which is composed of two nearly equal stars separated by a distance about half that between the components of Gamma Andromedæ. This is also a binary, or revolving double star, but the period is long. Gamma Virginis is another fine double star, with components at about the same distance as those of Castor, and the colors very similar. It is also a remarkable binary star.

Among double stars of which the components are closer than those mentioned above, but which are within the reach of a good 3-inch telescope—a common size with amateur observers—the following may be noticed: Alpha Herculis, colors, orange or emerald green; the light of this star is slightly variable. Gamma Leonis, another binary star with a long period; colors, pale yellow and purple. Epsilon Boötis, a lovely double star, the colors of which[199] Secchi described as “most beautiful yellow, superb blue.”

For observers in the Southern Hemisphere, the following fine double stars may be seen with a 3-inch telescope: Alpha Centauri; this famous star, the nearest of all the fixed stars to the earth, is also a remarkable binary; its period, as recently computed by Dr. See, is eighty-one years. Theta Eridani is a splendid pair, but closer than Alpha Centauri. It is, however, an easy object with a 3-inch telescope, and with a telescope of this size I noted the colors in India as light yellow and dusky yellow. The star known as *ƒ* Eridani is a very similar double to Theta, but the components are fainter. I noted the colors in India as yellowish-white and very light green.

Of triple, quadruple, and multiple stars, there are several which may be well seen with a small telescope. Of these may be mentioned Iota Orionis, the lowest star in the Sword of Orion, which consists of a bright star accompanied by two small companions. In Theta Orionis, the middle star of the Sword, four stars may be seen forming a quadrilateral figure, known to observers as the “trapezium.” There are two fainter stars in this curious object, which lie in the midst of the Orion nebula, but a somewhat larger telescope is required to see them. Within the trapezium are two very faint stars, which are only visible in the largest telescopes. In Sigma Orionis—a star closely south of Zeta, the lowest star in Orion’s Belt—six stars may be seen with a 3-inch telescope.

Double and multiple stars may be either optical or real. Optical double stars are those in which the[200] component stars are merely apparently close together, owing to their being seen in nearly the same direction in space. Two stars may seem to be close together, while, in reality, one of them may be placed at an immense distance behind the other. Just as two lighthouses at sea may, on a dark night, appear close together when viewed from a certain point, whereas they may be really miles apart. In the case of double stars it is, of course, always difficult to determine whether the apparent closeness of the stars is real or merely optical. But when, from a long series of observations of their relative position, we find that one is apparently moving round the other, we know that the stars must be comparatively close, and linked together by some physical bond of union. These most interesting objects are known to astronomers as binary, or revolving double stars. The probable existence of such objects was predicted from abstract reasoning by Mitchell in the Eighteenth Century; but the discovery of their actual existence was made by Sir William Herschel, while engaged on an attempt to determine the distance of some of the double stars from the earth. Unlike the planetary orbits, which are nearly circular, at least those of the larger planets of the Solar System, it is found that the orbits of these double stars differ, in many cases, widely from the circular form, in some cases, indeed, approaching in shape more the orbit of a comet than a planet.

The binary stars are among the most interesting objects in the heavens. The number now known probably amounts to nearly one thousand. In most[201] of them, however, the motion is very slow, and in only about seventy cases has the change of position, since their discovery, been sufficient to enable an orbit to be computed.

Savary, in 1830, was the first astronomer who attempted to compute the orbit of a binary star, namely, the star Xi Ursæ Majoris. This remarkable pair was discovered by Sir William Herschel in 1780, and as the period of revolution is about sixty-one years, a considerable portion of the ellipse had been described in 1830, when it was attacked by Savary.

The binary star with the shortest period known at present seems to be the fourth magnitude star Kappa Pegasi. It was discovered as a wide double star by Sir William Herschel in 1786, the companion star being of the ninth magnitude. In August, 1880, Mr. Burnham, the famous American double star observer, examining the star with the 18½-inch refractor of the Dearborn Observatory, found the brighter star to be a very close double, with a distance between the components of only a quarter of a second of arc. A few years' observations showed that this pair were in rapid motion round each other (about eleven years).

Another binary star, with a period of about the same length, is Delta Equulei, which was discovered to be a close double by Otto Struve in 1851. Next in order of shortness of period comes the southern binary star Zeta Sagittarii, for which an orbit was first computed in the year 1886 by the present writer. The orbit of this star will, I think, require still further[202] revision, but the period of about eighteen years is probably not far from the truth.

Another remarkably rapid binary star is 85 Pegasi. Next in order of rapidity of motion we have the southern binary star 9 Argûs.

The star 42 Comæ Berenices has a period of about 25¾ years, according to Otto Struve. The orbit is remarkable from the fact that its plane passes through, or nearly through, the earth, and is, therefore, projected into a straight line, the companion star oscillating backward and forward on each side of its primary.

The star Beta Delphini—the most southern of the four stars in the "Dolphin's Rhomb"—is also a fast-moving binary, discovered by Burnham in 1873. Burnham thinks the period will prove to be about twenty-eight years. The spectrum of the light of Beta Delphini is similar to that of our sun, so that the two bodies should be comparable in intrinsic brilliancy.

Another remarkable binary star with a comparatively short period is Zeta Herculis. This pair have now performed three complete revolutions since their discovery in 1782 by Sir William Herschel. Several orbits have been computed, but Dr. See's period of thirty-five years is probably the best. The companion is, however, rather faint, being only 6½ magnitude, while the primary star is of the third.

In the case of the binary star, Eta Coronæ Borealis, it was, some forty years ago, uncertain whether its period was forty-three or sixty-six years, but now that two complete revolutions have been performed[203] since its discovery by Sir William Herschel in 1781, the question has been finally decided in favor of the shorter period.

The brilliant star Sirius is also an interesting binary star. The companion, which is relatively very faint—about tenth magnitude—was discovered by Alvan Clark in 1862. The existence of some such disturbing body was previously suspected by astronomers, owing to observed irregularities in the proper motion of Sirius. Several orbits, giving periods of about fifty years, have been computed. The great brilliancy of Sirius, the brightest star in the heavens, naturally suggests a sun of great size. Recent investigations do not favor this idea. Its spectrum is, however, of the first type, and the star is therefore not comparable with the sun in brilliancy. The above result would indicate that stars of the first, or Sirian type, are intrinsically brighter than our sun.

Sirius is about eleven magnitudes brighter than its faint companion. This makes the light of Sirius about 25,000 times the light of the small star. The two bodies must, therefore, be differently constituted, and, indeed, the companion must be nearly a dark body. If Sirius has any planets revolving round it—like those of our solar system—they must forever remain invisible in our largest telescopes. This remark, of course, applies to all the fixed stars, single and double. They may possibly have attendant families of planets, like our sun, but if so, the fact can never be ascertained by direct observation.

The star Zeta Cancri is a well-known triple star, the close pair revolving in a period of about sixty[204] years. Nearly two revolutions have now been completed since its discovery by Sir William Herschel in 1781. All three stars probably form a connected system, but the motion of the third star round the binary pair is very slow and irregular. Drawing of binary star Fig. 18.—System of the Double Sun Alpha Centauri

Another interesting binary star is Xi Ursæ Majoris. As already stated, this was the first pair for which an orbit was computed. More than a complete revolution has now been performed since its discovery by Sir William Herschel in 1780. The period has, therefore, been well determined, and seems to be about sixty years.

The bright southern star, Alpha Centauri, the nearest of all the fixed stars to the earth, so far as[205] is known at present, is also a remarkable binary star. It seems to have been first noticed as a double star by Richaud in 1690.

Assuming my value of the sun's stellar magnitude (about 27), I find that the sun, if placed at the distance of Alpha Centauri, would appear of about the same brightness as the star does to us. As, according to Professor Pickering, the spectrum of Alpha Centauri is

of the second or solar type, it would seem that in mass, brightness, and physical condition the star closely resembles our sun.

We next come to another very interesting binary star, known to astronomers as 70 Ophiuchi. It is a very fine double star, the magnitudes of the components being about four and six, and the colors yellow and orange. More than a complete revolution has now been described by the components since its discovery by Sir William Herschel in 1779. Placed at the distance indicated by Krüger's parallax, I find that our sun would be reduced to a star of about magnitude 3½, which shows that the sun and star are of about equal brightness. The spectrum is of the solar type, according to Vogel.

A very famous binary star is that known to astronomers as Gamma Virginis. Its history is a very interesting one. It lies close to the celestial equator, about one degree to the south and about fifteen degrees to the northwest of the bright star Spica (Alpha of the same constellation), with which it forms the stem of a Y-shaped figure formed by the brightest stars of the constellation Virgo, or the Virgin, Gamma being at the junction of the two upper[206] branches. The brightness of Gamma Virginis is a little greater than an average star of the third magnitude. Variation of light has, however, been suspected in one or both components. The Persian astronomer, Al-Sûfi, in his description of the heavens, written in the Tenth Century, rates it of the third magnitude, and describes it as "the third of the stars of al-auvâ, which is a mansion of the moon," the first and second stars of this "mansion" being Beta and Eta Virginis, the fourth star Delta, and the fifth Epsilon, these five stars forming the two upper branches of the Y-shaped figure above referred to. Gamma was called Zawiyah-al-auvâ, "the corner of the barkers!" perhaps from its position in the figure, which formed the thirteenth Lunar Mansion of the old astrologers. It was also called Porrima and Postvarta in the old calendars. The fact that Gamma Virginis really consists of two stars very close together seems to have been discovered by the famous astronomer, Bradley, in 1718. The rapid decrease in the apparent distance from 1780-1834 indicated that the apparent orbit is very elongated, and that possibly the two stars might "close up" altogether, and appear as a single star even in telescopes of considerable power. This actually occurred in the year 1836, or, at least, the stars were then so close together that the most powerful telescopes of that day failed to show Gamma Virginis as anything but a single star. Of course, it would not have been beyond the reach of the giant telescopes of our day. From the year 1836 the pair began to open out again.

Another interesting binary star is Eta Cassiopeiæ.[207] Periods ranging from 149 to 222½ years have been found by different computers. The most recent computation makes it about 196 years.

The bright star Gamma Leonis, situated in the well-known "Sickle in Leo," is also a binary star, but only a small portion of the orbit has been described since its discovery by Sir William Herschel in 1782. Dr. Doberck finds a period of 407 years. It is remarkable for its very high "relative brightness." This pair forms a fine object for a small telescope.

The star known as 12 Lyncis is a triple star, the components being 5, 6, and 7½ magnitude. The close pair forms a binary system, for which an orbit has been computed by the present writer, who finds a period of about 486 years. Sir John Herschel predicted in 1823 that the angular motion of the pair would "bring the three stars into a straight line in 57 years." This prediction was fulfilled in 1887, when measures by Tarrant showed that the stars were then exactly in a straight line.

The bright star Castor is a famous double star, and has been known since the year 1718, when it was observed by Bradley and Pond. It was also observed by Maskelyne in 1759, and frequently by Sir William Herschel from 1799 to 1803. Numerous orbits have been computed, with periods ranging from 199 years by Mädler and 1,001 years by Doberck. I find that the mass of the system of Castor is only 1/19th of the sun's mass, a result which would imply that the components are masses of glowing gas! Dr. Bélopolsky has found, with the spectroscope,[208] that the brighter component is a close binary star with a dark companion, like Algol. The period of revolution is about three days, and the relative orbital velocity about 20¾ miles a second. Dr. Bélopolsky's observations show that the system is receding from the earth at the rate of about 4½ miles per second.

With reference to the colors of the components of binary stars, the following relation between color and relative brightness has been established:

(1) When the magnitudes of the components are equal, or approaching equality, the colors are generally the same, or similar.

(2) When the magnitudes of the components differ considerably, there is also a considerable difference in color.

A new class of binary stars has been discovered within the last few years by means of the spectroscope. These have been called "spectroscopic binaries," and the brighter component of Castor, referred to above, is an example of the class. They are supposed to consist of two component stars, so close together that the highest powers of the largest telescopes fail to show them as anything but single stars. Indeed, the velocities indicated by the spectroscope show that they must be so close that the components must

forever remain invisible by the most powerful telescopes which could ever be constructed by man. In some of these remarkable objects, the doubling of the spectral lines indicates that the components are both bright bodies, but in others, as in Algol, the lines are merely shifted from their normal position, not doubled, thus denoting that one of the components is[209] a dark body. In either case, the motion in the line of sight can be measured by the spectroscope, and we can, therefore, calculate the actual dimensions of the system in miles, and thence its mass in terms of the sun's mass, although the star's distance from the earth remains unknown. Judging, however, from the brightness of the star, and the character of its spectrum, we can make an estimate of its probable distance from the earth.

The bright star Spica has also been found by the spectroscope to be a close binary star. Vogel finds a period of four days with a distance between the components of about 6¼ millions of miles, and assuming that the components have equal mass and are moving in a circular orbit, he finds the mass of the system about 2.6 times the mass of our sun. In addition to its orbital motion, Vogel finds that Spica is approaching the sun at the rate of over nine miles per second.

To ordinary observers, the light of the stars seems to be constant. Even to those who are familiar with the constellations, the stars appear to maintain their relative brilliancy unchanged. To a great extent this is, of course, true; the great majority of the stars remaining of the same brightness from day to day, and from year to year. There are, however, numerous exceptions to this rule. Many of the stars, when carefully watched, are found to fluctuate in their light, being sometimes brighter and sometimes fainter. These are known as "variable stars"—one of the most interesting class of objects in the heavens. Some of these have been known for a great number[210] of years, and their variations having been carefully watched, the laws governing their light changes have been well determined.

We will first consider the variable stars with long periods of variation, as these generally show the largest fluctuations of light. Among these, the first star in which variation of light seems to have been noticed is the extraordinary object, Omicron Ceti, popularly known as Mira, or the "wonderful" star. It appears to have been first noticed by David Fabricius in the year 1596. He observed that the star now called Omicron, in the constellation Cetus, was of the third magnitude on April 13 of that year, and that in the following year it had disappeared. Bayer saw it again in 1603, when forming his maps of the constellations, and assigned to it the Greek letter Omicron, but does not seem to have noticed the fact that it was the same star which had been observed by Fabricius seven years previously. No further attention seems to have been paid to it until 1638 and 1639, when it was observed at Francker by Professor Phocylides Holwarda to be of the third magnitude in December, 1638, invisible in the following summer, and again visible in October, 1639. From 1648 to 1662 it was carefully observed by Hevelius, and in subsequent years by several observers. Its variations are now regularly followed from year to year, and it forms one of the most interesting objects of its kind in the heavens. Its light varies from about the second magnitude to the ninth, but its brightness at maximum is variable to a considerable extent.

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Perhaps the long period variable star next in order of interest—at least to observers in the Northern Hemisphere—is that known as Chi Cygni. It was discovered by Kirch in 1686. The star varies at maximum from 4 to 6½ magnitude, and at the minimum it sinks to below the thirteenth magnitude. At some maxima, therefore, it is easily visible to the naked eye, and at others it is just below the limit of ordinary vision. At the maximum of 1847, it was visible to the naked eye for a period of 97 days. The average period is about 406 days; but according to Schönfeld—a well-known authority on the variables—observations indicate a small lengthening of the period. Chi Cygni is said to be "strikingly variable in color." Espin's observations in different years show it "sometimes quite red, at others only pale orange-red." In the spectroscope, its light shows a splendid spectrum of the third type (or banded spectrum, very characteristic of these long period variables), in which bright lines were observed by Espin in May, 1889.

R Leonis is another remarkable variable star, which is sometimes visible to the naked eye at maximum. It lies closely south of the star known as 19 Leonis. It was discovered by Koch in 1782. At the maximum, its brightness varies from 5.2 to 7 magnitude, and at minimum it fades to about the tenth magnitude. The mean period is about 313 days. The star is red in all phases of its light, and forms a fine telescopic object. Close to it are two small stars, which form, with the variable, an isosceles triangle.

There is a very remarkable variable star in the[212] Southern Hemisphere known as Eta Argûs. It lies in the midst of the great nebula in Argo, and the history of its fluctuations in light is very interesting. Observed by Halley in 1677 as a star of the fourth magnitude, it was seen of the second magnitude by Lacaille in 1751. After this, it must have again faded, for Burchell found it of only the fourth magnitude from 1811 to 1815. From 1822 to 1826 it was again of the second magnitude, as observed by Fallows

and Brisbane; but on February 1, 1827, it was estimated of the first magnitude by Burchell. It then faded again, for on February 29, 1828, Burchell found it of the second magnitude. From 1829 to 1833 Johnson and Taylor rated it of the second magnitude; and it was still of this magnitude, or a little brighter, when Sir John Herschel commenced his observations at the Cape of Good Hope in 1834. It does not seem to have varied much in brightness from that time until December, 1837, when Herschel was astonished to find its light "nearly tripled." He says: "It very decidedly surpassed Procyon, which was about the same altitude, and was far superior to Aldebaran. It exceeded Alpha Orionis, and the only star (Sirius and Canopus excepted) which could at all be compared with it was Rigel."

From this time its light continued to increase. On the 28th December it was far superior to Rigel, and could only be compared with Alpha Centauri, which it equaled, having the advantage of altitude, but fell somewhat short of it as the altitudes approached equality. The maximum of brightness[213] seems to have been obtained about the 2d of January, 1838, on which night, both stars being high and the sky clear and pure, it was judged to be very nearly matched, indeed, with Alpha Centauri. In 1843 it again increased in brightness, and in April of that year it was observed by Maclear to be brighter than Canopus, and nearly equal to Sirius! It then faded slightly, but seems to have remained nearly as bright as Canopus until February, 1850, since which time its brilliancy gradually decreased. It was still of the first magnitude in 1856, according to Abbott, but was rated a little below the second magnitude by Powell in 1858. Tebbutt found it of the third magnitude in 1860; Abbott a little below the fourth in 1861. Ellery rated it fifth magnitude in 1863, and Tebbutt sixth magnitude in 1867. In 1874 it was estimated 6.8 magnitude at Cordoba, and only 7.4 in November, 1878. Tebbutt's observations from 1877-86 show that it did not rise above the seventh magnitude in those years, and in March, 1886, it was rated 7.6 magnitude by Finlay at the Cape of Good Hope. This seems to have been the minimum of light, for in May, 1888, Tebbutt found that it "had increased fully half a magnitude" since April, 1887. The star is very reddish in color.

We will now consider the variables of short period, which are particularly interesting objects, owing to the comparative rapidity of their light changes. The periods vary in length from about 17¼ days down to a few hours. Perhaps the most interesting of these short period variables, at least to the amateur observer, is the star Beta Lyræ, which[214] is easily visible to the naked eye in all phases of its light. It can be readily identified, as it is the nearest bright star to the south of the brilliant Vega, and one of two stars of nearly the same magnitude, the second being Gamma Lyræ. The variability of Beta Lyræ was discovered by Goodricke in the year 1784. The period is about 12 days, 21 hours, 46 minutes, 58 seconds. Recent observations with the spectroscope indicate that the star is a very close double or "spectroscopic binary," although it does not seem certain that an actual eclipse of one component by the other takes place, as in the case of Algol. Bright lines were detected in the star's spectrum by Secchi so far back as 1866. In 1883 M. Von Gothard noticed that the appearance of these bright lines varied in appearance, and from an examination of photographs taken at Harvard Observatory in 1891, Mrs. Fleming found displacements of bright and dark lines in a double spectrum, the period of which agreed fairly well with that of the star's light changes.

Another interesting star of short period is Delta Cephei, which is one of three stars forming an isosceles triangle a little to the west of Cassiopeia's Chair, the variable being at the vertex of the triangle, and the nearest of the three to Cassiopeia. Its variability was also discovered by Goodricke in 1784. It varies from 3.7 to 4.9 magnitude, with a period of 5 days, 8 hours, 47 minutes, 40 seconds. The amount of the variation is, therefore, the same as in the case of Algol, the star's light at maximum being about three times its light at minimum. The observations[215] also show that Delta Cephei is approaching the earth at the rate of about 8¾ miles a second. The color of the star is yellow, and it has a distant bluish companion of about the fifth magnitude, which may possibly have some physical connection with the brighter star, as both stars have a common proper motion through space.

Another remarkable star of short period is Eta Aquilæ, the variability of which was discovered by Pigott in 1784. It varies from magnitude 3.5 to 4.7, with a period of 7 days, 4 hours, 14 minutes, but Schönfeld found marked deviations from a uniform period. Its color is yellow, and its spectrum, like that of Delta Cephei, of the second or solar type.

A remarkable variable star of short period was discovered in 1888 by Mr. Paul in the southern constellation Antlia. It varies from magnitude 6.7 to 7.3, with the wonderfully short period of 7 hours, 46 minutes, 48 seconds, all the light changes being gone through no less than three times in twenty-four hours! It was for some years believed that the variation was of the Algol type, but recent measures made at the Harvard College Observatory show that it belongs to the same class as Delta Cephei and Eta Aquilæ.

A telescopic variable with a wonderfully short period was discovered by Chandler in 1894. It lies a little to the west of the star Gamma Pegasi, and has been designated U Pegasi. It varies from magnitude 8.9 to 9.7, and was first supposed to be of the Algol type with a period of about two days, but further observations showed that the period was[216] much shorter, and only 5 hours, 31 minutes, 9 seconds. The remarkable rapidity of its light changes, which are gone through four times in less than twenty-four hours,

make this remarkable star a most interesting object. Possibly there may be other stars in the heavens with a similar rapidity of variation which have hitherto escaped detection.

Unlike the variable stars of long period which seemed scattered indifferently over the surface of the heavens, the great majority of the short period variables are found in a zone which nearly coincides with the course of the Milky Way. The most notable exceptions to this rule are W Virginis with the comparatively long period of 17¼ days, and U Pegasi, above described, which has the shortest known period of all the variable stars. Another peculiarity is that most of them are situated in what may be called the following hemisphere, that is between 12 hours and 24 hours of right ascension. The most remarkable exception to this rule is Zeta Geminorum.

Algol, or Beta Persei, is a famous variable star, and the typical star of the class to which it belongs. Its name, Algol, is derived from a Persian word, meaning the “demon,” which suggests that the ancient astronomers may have detected some peculiarity in its behavior. The real discovery of its variation was, however, made by Montanari in 1667, and his observations were confirmed by Maraldi in 1692. Its fluctuations of light were also noticed by Kirch and Palitzsch, but the true character of its variations was first determined by the English astronomer, Goodricke, in 1782. Its fluctuations of[217] light are very curious and interesting. Shining with a constant, or nearly constant, brightness for a period of about 59 hours as a star of a little less than the second magnitude, it suddenly begins to diminish in brightness, and in about 4½ hours it is reduced to a star of about magnitude 3½. In other words, its light is reduced to about one-third of its normal brightness. If we suppose three candles placed side by side at such a distance that their combined light is merged into one, and equal to the usual brightness of Algol, then, if two of these candles are extinguished, the remaining candle will represent the light of Algol at its minimum brilliancy. The star remains at its minimum, or faintest, for only about 15 minutes. It then begins to increase, and in about 5 hours recovers its normal brightness, all the light changes being gone through in a period of about 10 hours out of nearly 69 hours, which elapse between successive minima. These curious changes take place with great regularity, and the exact hour at which a minimum of light may be expected can be predicted with as much certainty as an eclipse of the sun.

Goodricke, comparing his own observations with one made by Flamsteed in the year 1696, found the period from minimum to minimum to be 2 days, 20 hours, 48 minutes, 59½ seconds, and he came to the conclusion that the diminution in the light of the star is probably due to a partial eclipse by “a large body revolving round Algol.” This hypothesis was fully confirmed in the years 1888-89 by Professor Vogel with the spectroscope. As no close[218] companion to Algol is visible in the largest telescopes, we must conclude that either the satellite is a dark body, or else so close to the primary that no telescope could show it. Now, if the diminution in Algol’s light is due to a dark body revolving round it, and periodically coming between us and the bright star, it follows that both components will be in motion, and both will revolve round the common centre of gravity of the pair. A little before a minimum of light takes place, the dark companion should therefore be approaching the eye, and, consequently, the bright companion will be receding. During the minimum there will be no apparent motion in the line of sight, as the motion of both bodies will be at right angles to the visual ray. After the minimum is over, the motion of the two bodies will be reversed, the bright one approaching the eye, and the dark one receding. Now, this is exactly what Vogel found. Before the diminution in the light of Algol begins, the spectroscope showed that the star is receding from the earth and after the minimum that it is approaching the eye. That the companion is dark and not bright, like the primary, is evident from the fact that the spectral lines are merely shifted from their normal position and not doubled, as would be the case were both components bright, as in the case of some of the “spectroscopic binaries”—for example, Beta Aurigæ. Vogel found that before the minimum of light, Algol is receding from the earth with the velocity of 24½ miles a second, and after the minimum it is approaching at the rate of 28½ miles a second. The difference between the observed[219] velocities indicates that the system is approaching the earth with a velocity of about 2 miles a second. Knowing, then, the orbital velocity, which is evidently about 26½ miles a second, and assuming the orbit to be circular, it is easy, with the observed period of revolution, or the period of light variation, to calculate the diameter of the orbit in miles, although the star’s distance from the earth remains unknown. Further, comparing its period of revolution and the dimensions of the orbit with that of the earth round the sun, it is easy to calculate, by Kepler’s third law of motion, the mass of the system in terms of the sun’s mass, and the probable size of the component bodies. Calculating in this way, Vogel computes that the diameter of Algol is about 1,061,000 miles, and that of the dark companion 830,300 miles, with a distance between their centres of 3,230,000 miles, and a combined mass equal to two-thirds of the sun’s mass, the mass of Algol being four-ninths, and that of the companion two-ninths, of the mass of the sun. Taking the diameter of the sun as 866,000 miles, and its density as 1.44 (water being unity), I find that the above dimensions give a mean density for the components of Algol of about one-third that of water, so that the components are probably gaseous bodies, as Hall has already concluded. Sun spot Portion of the Sun’s Surface. Sunspot nearly 60,000 Miles Across

It is a curious fact that Al-Sûfi, the Persian astronomer, in his Description of the Heavens, written in the Tenth Century, speaks distinctly of Algol as a red star (étoile, brillant; d'un éclat, rouge), while at present it is white or at the most of a yellow[220] color. A similar change of color is supposed to have taken place in the case of Sirius, but the change in Algol seems more certain, as Al-Sûfi's descriptions are generally most accurate and reliable.

Stars of the Algol type of variable are very rare objects, only a dozen or so having been hitherto discovered in the whole heavens. Those visible to the naked eye, when at their normal brightness, are: Algol, Lambda Tauri, Delta Libræ, R Canis Majoris, and U Ophiuchi.

A remarkable peculiarity about the variable stars in general is that none of them has any considerable proper motion. As a large proper motion is generally considered to indicate proximity to the earth, we may conclude, with great probability, that the variable stars, as a rule, lie at a great distance from our system. In other words, it appears that the sun does not lie in a region of variable stars, and, with the exception of Alpha Cassiopeiæ and Alpha Herculis, a measurable parallax has not yet been found, so far as I know, for any known variable star.

We now come to the interesting and mysterious class of objects known as "new" or "temporary" stars. These phenomena are of very rare occurrence, and but few undoubted examples of the class are recorded in the annals of astronomy. Possibly in some cases they have been merely variable stars, of irregular period and fitful variability; but others may have been due to a real catastrophe, such as the collision of two dark bodies in space, or, possibly, the passage of a bright or dark body through a gaseous nebula.

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The earliest temporary star of which we have any reliable information seems to be one which is recorded in the Chinese annals of Ma-tuan-lin, as having appeared in the year 134 B. C. in the constellation Scorpio. Its position seems to have been somewhere between the stars Beta and Rho of Scorpio. Pliny informs us that it was the sudden appearance of a new star which induced the famous astronomer Hipparchus to form his catalogue of stars, the first ever constructed. As the date of Hipparchus's catalogue is 125 B. C., it seems highly probable that the new star referred to by Pliny was the same as that recorded by the Chinese astronomer as having appeared nine years previously.

A new star is said to have appeared in the year 76 B. C. between the stars Alpha and Delta in the Plow, but the accounts are vague.

In 101 A. D., a small "yellowish-blue" star is said to have appeared in the "sickle" in Leo, but its exact position is not known. In 107 A. D., a new star is mentioned near Delta, Epsilon and Eta in Canis Major, three bright stars southeast of Sirius. In 123 A. D., another new star is recorded by Ma-tuan-lin to have appeared between Alpha Herculis and Alpha Ophiuchi.

The Chinese annals record that on December 10, 173 A. D., a brilliant star appeared between Alpha and Beta Centauri in the Southern Hemisphere. It remained visible for eight months, and is described as resembling "a large bamboo mat!"—a curious description. There is at present, close to the spot indicated, a known variable star—R Centauri—of[222] which the period seems to be long and the variation of light irregular. Possibly an unusually bright maximum of this variable star formed the star of the Chinese annals, or perhaps the variable star is the remnant of the outburst which took place in the First Century. The variable is a very reddish star, and at present varies from about the sixth to the tenth magnitude.

A new star is recorded in the year 386 A. D. as having appeared between Lambda and Phi Sagittarii. Near the position indicated, Flamsteed observed a star, No. 65 of his catalogue, which is now missing; and it has been conjectured that the star seen by Flamsteed may possibly have been a return of the star mentioned in the Chinese annals.

Cuspianus relates that a star as bright as Venus appeared near Altair in 389 A. D., during the reign of the Emperor Honorius, and that he had himself seen it. There is some doubt, however, about the exact date, as other accounts give the year 388 or 398. The star seems to have disappeared in about three weeks.

In the year 393 A. D., another strange star is recorded in the tail of Scorpio. An extraordinary star is said to have been seen near Alpha Crateris in 561 A. D. Here again a known variable and red star—R Crateris—is close to the position indicated by the ancient records.

The Chinese annals record a new star in 829 A. D., somewhere in the vicinity of the bright star Procyon, and in this locality there are several known variable stars.

[223]

The Bohemian astronomer, Cyprianus Leoviticus, mentions the appearance of new stars in Cassiopeia in the years 945 A. D. and 1264, and it has been conjectured that perhaps these were apparitions of Tycho Brahe's famous star of 1572 (to be presently described), forming a variable star with a period of over 300 years. Lynn and Sadler, however, have shown that the supposed stars of 945 and 1264 were, in all probability, comets.

Extraordinary stars are recorded near Zeta Sagittarii in 1011 A. D., near Mu Scorpii in 1203, and near Pi Scorpii on July 1, 1584. It is remarkable how many of these objects seem to have appeared in this portion of the heavens.

A very brilliant star is mentioned by Hepidannus as having appeared in Aries in May, 1012. He describes it as "dazzling the eye." Other temporary stars are mentioned in 1054 A. D., near Zeta Tauri, and in 1139 near Kappa Virginis; but the accounts of these are very vague, and it seems by no means certain that they were really new stars.

No possible doubt, however, can be entertained with reference to the appearance of the object which suddenly blazed out in Cassiopeia's Chair in November, 1572. It was called the "Pilgrim Star," and was observed by the famous astronomer, Tycho Brahe, who has left us a very elaborate account of its appearance, position, etc. Although usually spoken of as Tycho Brahe's star, it seems to have been really discovered by Cornelius Gemma on the evening of November 9. That its appearance was very sudden may be inferred from Cornelius Gemma's[224] statement that it was not visible on the preceding night in a clear sky. Tycho Brahe's attention was first attracted to it on November 11. His description of the new star is as follows—as quoted by Humboldt: "On my return to the Danish islands from my travels in Germany, I resided for some time with my uncle, Steno Bille, in the old and pleasantly situated monastery of Herritzwadt, and here I made it a practice not to leave my chemical laboratory until the evening. Raising my eyes, as usual, during one of my walks, to the well-known vault of heaven, I observed with indescribable astonishment, near the zenith in Cassiopeia, a radiant fixed star of a magnitude never before seen. In my amazement, I doubted the evidence of my senses. However, to convince myself that it was no illusion, and to have the testimony of others, I summoned my assistants from the laboratory, and inquired of them, and of all the country people that passed by, if they also observed the star that had thus suddenly burst forth. I subsequently heard that in Germany, wagoners and other common people first called the attention of astronomers to this great phenomenon in the heavens—a circumstance which, as in the case of non-predicted comets, furnished fresh occasion for the usual raillery at the expense of the learned. This new star I found to be without a tail, not surrounded by any nebula, and perfectly like all other fixed stars, with the exception that it scintillated more strongly than stars of the first magnitude. Its brightness was greater than that of Sirius, Alpha Lyræ, or Jupiter. For splendor, it was only comparable to Venus when[225] nearest to earth (that is, when only a quarter of her disk is illuminated). Those gifted with keen sight could, when the air was clear, discern the new star in the daytime, and even at noon. At night, when the sky was overcast, so that all other stars were hidden, it was often visible through the clouds, if they were not very dense (nubes non admodum densas). Its distances from the nearest stars of Cassiopeia, which throughout the whole of the following year I measured with great care, convinced me of its perfect immobility. Already in December, 1572, its brilliancy began to diminish, and the star gradually resembled Jupiter, but by January, 1573, it had become less bright than that planet. Toward the month of November the new star was not brighter than the eleventh in the lower part of Cassiopeia's Chair. The transition to the fifth and sixth magnitudes took place between December, 1573, and February, 1574. In the following month the new star disappeared, and, after having shone seventeen months, was no longer discernible to the naked eye." (The telescope was not invented until thirty-seven years afterward.) Humboldt adds: "At its first appearance, as long as it had the brilliancy of Venus and Jupiter, it was for two months white, and then passed through yellow into red. In the spring of 1573, Tycho Brahe compared it to Mars; afterward he thought it nearly resembled Betelgeuse, the star in the right shoulder of Orion. The color for the most part was like the red tint of Aldebaran. In the spring of 1573, and especially in May, its white color returned (albedinam quandam sublividam induebat,[226] qualis Saturni stellæ subesse videtur). So it remained in January, 1574; being, up to the time of its entire disappearance in the month of March, 1574, of the fifth magnitude, and white, but of a duller whiteness, and exhibiting a remarkably strong scintillation in proportion to its faintness."

Ma-tuan-lin speaks of a star in 1578 "as large as the sun" (!) but does not state its position.

The star known as P (34) Cygni is sometimes spoken of as a "Nova," or new star; but it is still visible to the naked eye as a star of the fifth magnitude. It was observed of the third magnitude by Jansen in 1600 and by Kepler in 1602. After the year 1619 it appears

to have diminished in brightness, and is said to have vanished in 1621; but it may merely have become too faint to be seen with the naked eye. It was again observed of the third magnitude by Dominique Cassini in 1655, and it afterward disappeared. It was again seen by Hevelius in November, 1655. In 1667, 1682, and 1715 it is recorded as of the sixth magnitude, and there is no further record of any marked increase in its light. A period of about 18 years was assumed by Pigott; but this is now disproved, and it seems probable that the star is a variable of irregular period and fitful variability, and not, properly speaking, a temporary star. Its present color is yellow, and bright lines have been seen in its spectrum.

A new star of the third magnitude was observed near Beta Cygni by the Carthusian monk Anthelmus in 1670. It remained visible for about two years, and is said to have increased and diminished several[227] times before its final disappearance. Schönfeld computed its exact position from observations made by Hevelius and Picard. Quite close to the spot indicated, a star of the eleventh magnitude has been observed at the Greenwich Observatory, and fluctuations of light were suspected in this small star by Hind and others.

A very remarkable star, sometimes called the “Blaze Star,” suddenly appeared in Corona Borealis, in May, 1866. It was first seen by the late Mr. Birmingham, at Tuam, Ireland, about midnight on the evening of May 12, when it was of the second magnitude, and equal to Alphecca, “the gem of the coronet.” Its appearance must have been very sudden, for Schmidt, the Director of the Athens Observatory, stated that he was observing the constellation on the same evening, about two and one-half hours previous to Birmingham’s discovery, and observed nothing unusual. He was certain that no star, of even the fifth magnitude, could possibly have escaped his notice. On the following night it was seen by several observers in different parts of the world.

A remarkable and very interesting temporary star was discovered in 1892 in the constellation Auriga.

It is a remarkable fact that the great majority of the temporary stars appeared in or near the Milky Way. The chief exceptions to this rule are: the star of 76 B. C., in the Plow, the star recorded by Hepidannus in Aries, 1012 A. D., and the “Blaze Star” of 1866 in Corona Borealis.

[228] A WORLD ON FIRE—NOVA PERSEI.—Alexander W. Roberts

In the small hours of the morning of 22d February, 1901, Dr. Anderson of Bonnington, Edinburgh, saw a bright star shining in the constellation of Perseus, where he knew no such star was ever seen before. The circumstances connected with this discovery afford another striking instance of how Nature keeps her secrets for her true amateur, using the word in its highest sense.

The evening of 21st February was cloudy, and nine out of ten astronomers would have gone to bed when there seemed little prospect of the night clearing; but Dr. Anderson was the tenth man. At twenty minutes to three in the morning the clouds rolled away from over the old gray Scottish capital, and the trained eye of the patient observer saw right in the heart of Perseus a new star. Never before had its light, blue-white, like an unpolished diamond, shone down on this strange earth of ours.

Next day the news of the wonderful discovery was flashed to all the great observatories of the world, and telescopes and spectroscopes, cameras and photometers, were directed toward the strange phenomenon, and by testing, measuring, examining, sought to wrest its secrets from it.

Much is still a mystery; but what has been ascertained during the period that the rhythm of its light-waves beat upon our shores is of great interest and importance as bearing directly on the life-history[229] of each individual star in the heavens, and of our own sun and planet among them.

The first and simplest question that arises for settlement is the date when the new star blazed forth in our terrestrial sky. The curious reader will notice the reservation: in our terrestrial sky. When the star actually burst forth into resplendent light is another matter, as we shall discover later on. It was certainly before Dr. Anderson was born, and probably before another Scotsman—Ferguson by name—combined, like many another sage, counting and watching sheep with counting and watching stars.

With regard to the date of the appearance in our sky of the new star, Nova Persei, as it is called in astronomical literature, when Dr. Anderson discovered it at twenty minutes to three o’clock on the morning of 22d February, it was bright enough to be straightway evident to a trained astronomer. In these later days of strenuous scientific activities every portion of the sky is constantly being examined and charted, and no sooner was the discovery of Nova Persei announced than a searching of records began, in order to ascertain if, at any time, the star had ever been seen before. Drawing of Perseus region Fig. 19.—Chart Showing Position of Nova

Persei

It so chanced that on the evenings of 18th and 19th February two photographs of the very spot where three days later the new star appeared were taken at Harvard Observatory. On neither of these photographs is there the slightest evidence of the star's existence. It was, therefore, on these dates non-existent so far as our earth was concerned. On the evening of 20th February a well-known English observer,[230] Mr. Stanley Williams, had also taken a photograph of the same portion of the sky; and again there was no trace of the star. Mr. Williams's photograph was taken twenty-eight hours before Dr. Anderson saw it. Still more strange is the fact that on the evening of 21st February three observers on the Continent testify that they had the constellation Perseus under[231] observation from seven o'clock to eleven, and had the new star then been visible they could not have failed to see it. The star, therefore, blazed out some time between eleven o'clock and three on the night of its discovery.

Now, what does this mean? It means this: that by some cause a star, quite dark before, or so faint that it could not be seen even by means of a powerful telescope, in a few hours, or perhaps in a few minutes, blazed forth as a star of conspicuous brightness. In this brief space of time a dark and probably chill globe became a seething mass of fire, a million times hotter than it was before. Fierce, fervent heat lit up the orb with a glow that reached from rim to rim of the stellar universe. We have here a catastrophe that goes beyond our wildest conceptions: the conflagration of a world, the ruin of a star. What guarantee have we for an assumption of this kind? What of certitude is there in our vision of such a Day of Doom for any part of our universe? Let us consider the salient facts regarding the recent changes in the appearance and structure of this star. We shall relate only those facts that are beyond controversy, as far as our present knowledge goes.

Nova Persei did not reach its maximum brightness till the evening of 25th February, when it was probably the most conspicuous object in the midnight sky. It was then at least six times brighter than at the time of its discovery. After this date it began to wane slowly. At intervals there were spurts of brightness lasting for two or three days, as if the fires had not exhausted themselves. On the whole,[232] however, the light of the star waned, and by the end of the year its enfeebled light was just bright enough to be evident to the naked eye; twelve months after its appearance it could only be seen with the aid of a telescope.

Now, one of the most powerful instruments of research in the new astronomy is the spectroscope. It takes hold of the rays of light that come to us from a star, and makes these rays reveal the condition of things in the world they come from. One of the spectroscopes turned on the new star in Perseus was Professor Copeland's magnificent instrument at Blackford Hill Observatory, Edinburgh. Professor Copeland described the new star as "a feebly developed" sun. As the star, however, increased in brightness the spectroscope chronicled the fact that great physical changes were taking place in its composition and structure. The star soon ceased to be a feebly developed sun, for development had gone on apace with the increase of light. Round the solid or semi-molten mass there was rapidly aggregating an ocean of fiery gases, probably thrown up from the nucleus.

Put simply, Nova Persei, for long ages a cold, dark, solid globe, was in the brief space of a few days transformed from circumference to core into a luminous, heated gaseous sphere. By what chance or circumstance this vast change came about may be inquired into later on. We only note here that this was the story spelled out by those skilled in deciphering the observations recorded by the spectroscope. In July, 1901, Professor Pickering of Harvard[233] Observatory announced that the star had become a nebula; that, indeed, its once solid globe had practically dissolved into thinnest air. Not only had its elements become molten with fervent heat, but they had become transformed into shimmering wisps of matter more diaphanous than a gossamer web.

Everything connected with the history of this star is of exceptional interest; but all that had already been ascertained was completely overshadowed by the astonishing discovery made in November, 1902, that nebulous prominences were observed darting out from the star with a velocity of at least 100,000 miles every second of time. These astonishing changes have been confirmed at the two great American observatories, the Yerkes and the Lick.

Whence and how had destruction come upon this particular star? At one hour the star is dark, cold, solid. A few hours later this dark, solid, cold body is a blazing world, its solid mass blown apparently into countless fragments; from every fragment, big or little, there pour streams of fiery vapor; for millions of miles round the star there is a whirlpool of fire, a tempest of flame; and from end to end of this great universe of ours the brightness of the burning star pulsates. Three explanations have been given.

The one that naturally arises in our mind is that it was struck by another star. Two worlds, each moving at the rate of twenty miles a second, come into collision, and the result is the annihilation of both. The force of their impact, changed into heat, drives their elements into vapor. Such a catastrophe is quite possible in a universe like ours, where stars[234] and worlds, millions and millions in number, sweep down the great avenues of space with a velocity far beyond our comprehension.

We take it that when the crack of doom comes to this earth of ours it will be in this fashion. Some great dark star will strike our sun fair and square, and then in the twinkling of an eye, before the inhabitants of earth know what has taken place, sun and moon and planet will be wrapped up and dissolved in an atmosphere of fire.

We can in a certain rough way compute the increase in temperature that would arise from the collision of two great orbs. Thus, let us suppose that Nova Persei was moving onward through space with a velocity of ten miles a second—a moderate velocity, be it noted, for a star—when it collided with the body that wrought its destruction. The impact would be terrific, and the result of it would be not only the complete disintegration of both stars, but a sudden rise in temperature of about five hundred thousand degrees, an increase sufficient to vaporize the hardest adamant.

The second theory which has been suggested as explanatory not only of Nova Persei, but of all new stars, is a modification of the foregoing. This theory is that the new star in its flight through space suddenly plunged into a nebula, or into some portion of space denser than that through which it had already passed. This explanation is not only intelligible but reasonable. If the new star plunged into a region filled with matter even as rare as air, the friction would immediately set the star on fire. We see[235] the same phenomenon every night when a meteor hustles through our atmosphere. The meteoric rocks, with the chill of empty space in and around them, dash into our upper air. A few seconds are ample for the practical annihilation of most of them: in that brief space of time they have been subjected to a heat many times greater than that of a Bessemer furnace.

We can imagine Nova Persei as some monster meteor, a meteor larger than the sun, plunging into a gaseous mass somewhat like our air. In a few hours its temperature would be increased a million-fold. This increase would fill the surrounding space with fire, and there would be an immense and ever-increasing area at fervent heat.

To the mind of the writer this explanation has most to commend it. It is the one that is most in harmony with the information which has been gathered by hundreds of observers aided by the finest of modern scientific equipment. But there are other explanations. There will always be other explanations so long as the world lasts.

One of these explanations is of more interest than the rest, inasmuch as it makes a link of connection between the recent terrible volcanic eruption in the West Indies and the sudden appearance of a new star like Nova Persei. It is suggested that Nova Persei is, or rather was, a world somewhat like our own, only vastly larger—that is, there was an inner core of molten matter and an outer shell of solid material. One day, according to the explosion theory, this outer shell burst, and the interior fires[236] rushed hither and thither like a devouring flood all over the stellar globe. Vast chemical changes went on as the lambent flames turned everything solid into streams of lava. Great electrical disturbances took place all round the star. The whole phenomenon of Nova Persei, according to this theory, is just the destruction of St. Pierre on a sidereal scale.

Such a doom, of course, is possible in any star or planet whose interior is still molten. At any moment the imprisoned fires might break their barriers and change a cold, fruitful, life-bearing earth into a furnace; but it is far from probable that any such fate will ever be meted out to our planet or to any other, and, at any rate, destruction did not come to Nova Persei in this manner. No explosion could account for an access of heat and light any way comparable to that which was observed. Neither could any interior disruption be violent enough to hurl the star into fragments. The gravitational hold of the star would prevent this dismemberment. Yet during the ages the mind of man has been irresistibly drawn to this conception of the world's end, so much so that perhaps, after all, our instinct is right and our science wrong, and the vision of the Minorite Celano of the Dies iræ, dies illa Solvet sæculum in favilla,

is a vision of those things that will be in the later days.

We have already touched on one strange circumstance connected with the appearance of Nova[237] Persei. Dr. Anderson saw it for the first time at a few minutes to three o'clock on the morning of 22d February—that is, the news of the strange occurrence reached our planet then; but when did the event actually take place?

At Greenwich and at some of the other foremost observatories attempts have been made directly and indirectly to determine the distance of Nova Persei. And yet this distance defies measurement. The star is so far away that we have no instruments refined enough to deal with the problem. But we know that the sudden blazing up of Nova Persei was over and done with before our great-grandfathers were born. It happened more than two hundred years ago—perhaps two thousand years ago. All this time the news was swiftly traveling earthward, traveling on and on and on, two hundred thousand miles every second of the clock, past star and nebula and system, never halting, never faltering—yet it took hundreds of years to come to us; and beyond us lie countless worlds that will not see the new star for centuries to come. Hundreds of years hence in their sky will appear suddenly in the

constellation of Perseus a strange star; it will increase in brightness for a few days just as it did in ours; it will fade away intermittently just as it did in ours. There is no imagination here; only sober facts.

We may be allowed, in closing our narrative of this wonderful star, to make one excursion into the region of imagination. As the news of the star passes on through space, are there any beings beyond ourselves who will take record of its appearance? It[238] has taken centuries to come to us. Did any other creatures in some far-off world lift their eyes to the stars and wonder, as we do, what all this meant? Will some mortal, like ourselves, in some remoter world, in a day yet to come, see the sight, and have the intelligence to say, “Lo! a new star?” We have room enough here for the most extravagant fancy. Perhaps there is so much room that we shall lose ourselves if we venture to stray in such directions. TELESCOPES.—A. Fowler

The Refracting Telescope.—The function of a telescope is twofold. First, to magnify the heavenly bodies, or, what comes to the same thing, to make them look as if they were nearer to us, so that we can see them better. Second, to collect a much greater number of rays of light than the unassisted eye alone can grasp, so that objects too dim to be otherwise perceptible are brought within our range of vision.

There are two forms of telescope, distinguished as Refractors and Reflectors. The simplest form of refracting telescope is exemplified by the common opera-glass, and large refractors are not essentially different. Such instruments depend for their action upon the formation of an image by a lens. One can easily illustrate this by producing upon the wall of a room an inverted image of a candle or gas flame with a spectacle lens (one adapted for a long-sighted person), or with one of the larger lenses from an opera-glass. Having such an image, it may be magnified[239] by means of another lens, just as one may magnify a photograph with an ordinary reading glass. Technically, the lens which forms the primary image is called the object-glass of the telescope, and that which is used to magnify this image is called the eye-piece. The object-glass is usually a large lens, which is placed at one end of a tube, while the eye-piece is a much smaller lens, placed at the other end. Means are provided for adjusting the distance between the two lenses so as to admit of distinct vision.

Matters are, however, not quite so simple as has been stated. There is a very great difficulty introduced by the fact that a lens made out of a single piece of glass gives an image which is surrounded by fringes of color, so that some device has to be adopted in order to destroy, as far as possible, this enemy of good definition. In the early history of the telescope, this so-called chromatic aberration was considerably reduced by making small object-glasses of very great focal length.[22]

Lenses of 100-foot focus, however, are not easy to employ as object-glasses, and astronomy was, therefore, greatly benefited by Dollond’s invention of the achromatic lens in 1760. This is a compound lens, usually consisting of a double convex crown-glass lens and a concavo-convex, or double concave, lens of flint glass. The curvatures of the lenses, and the optical properties of the two kinds of glass composing[240] them, are such that the color due to one of them is practically neutralized by that due to the other acting in opposition. A section of such an object-glass, with the “cell” in which it rests, is shown in Fig. 20. Drawing of double lens Fig. 20.—The Achromatic Object-Glass

In this way the focal length of the lens, and, therefore, the length of the telescope tube, can be kept within reasonable dimensions, while the definition is improved. There is, however, usually a little outstanding color, due to the imperfect matching of the two lenses, and if one looks through a large refractor, even of a good quality, a purple fringe will be noticed round all very bright objects. This only affects a few of the brighter objects, while millions of others which are dimmer may be seen free from spurious color.

It may be remarked that the curved surfaces of the lenses forming telescopic object-glasses must not[241] be parts of spheres. If they are, the images will be rendered indistinct by spherical aberration, and the optician has to design his curves to get rid of this defect at the same time as chromatic aberration.

A new form of telescopic objective, consisting of three lenses, which has many important advantages, has been invented by Mr. Dennis Taylor, of the well-known firm of T. Cooke & Sons, York, England.

Such a lens as this illustrates the perfection which the optician’s art has now attained. Six surfaces of glass have to be so accurately figured that every ray of light falling upon the surface of the lens shall pass through the finest pin-hole at a distance of eighteen times the diameter of the lens.

The Reflector.—In a reflecting telescope, the object-glass of the refractor is replaced by a concave mirror. In order that such a mirror may reflect all the rays from a star to a single point, its concave surface must be part of a paraboloid of revolution, that is, a surface produced by the revolution of a parabola on its axis. If a spherical surface be employed, all the rays will not be reflected to a

single point and the images which it gives will be ill-defined. Yet it is astonishing to find that the difference between a parabolic and spherical surface, even in the case of a large mirror, is exceedingly small. Sir John Herschel states that in the case of a mirror four feet in diameter, and forming an image at a distance of forty feet, the parabolic only departs from the spherical form at the edges by less than a twenty-one thousandth part of an inch. Drawing of a telescope Fig. 21.—The Newtonian Reflector

An image being formed by a mirror, it is next to[242] be viewed with an eye-piece just as in the case of a refracting telescope. Here there is a little difficulty, for if the eye-piece be applied in the direct line of the mirror, the interposition of the observer's head will block out the light. Several ways of overcoming this have been devised, but the plan most generally followed is that which Newton adopted in the first reflecting telescope which was ever constructed. With his own hands Newton made a small reflector, 6¼ inches long and having an aperture of 1■ inches, with which he was able to study the phases of Venus and the phenomena of Jupiter's satellites. This precious little instrument is now one of the greatest treasures in the collection of the Royal Society of London. The general design of this telescope is shown in Fig. 21. The concave mirror is at the bottom of the telescope tube, and normally it would form an image of a star near the end of the tube. A plane mirror, however, of small size intercepts the rays and reflects them to the side, where they converge to a focus. This image is observed and magnified by an eye-piece, as in the refractor.[243] It is true that in this arrangement the plane mirror, or flat, renders the central part of the principal mirror ineffective, but the loss of light is very much less than would be the case if the eye-piece were placed in position to view the image centrally.

In the hands of Sir William Herschel the reflecting telescope was greatly developed. The great telescope with which he enriched astronomical science had a mirror four feet in diameter, and its tube was forty feet in length. With the view of utilizing the whole surface of the mirror and dispensing with a second reflecting surface, the 4-foot mirror was placed at a small angle to the bottom of the tube, so that its principal focal point was no longer at the centre, but at the side of the tube.

In practice, however, it is found that the Herschelian form of reflector does not give the best definition, and it is now very seldom seen.

Among other forms, the "Cassegrain" is perhaps the most important. During the last years this form has received a great deal of attention, more especially in regard to its special adaptability for photographic purposes.

In the Cassegrain telescope, the plane mirror of the Newtonian form is replaced by a small convex mirror which is part of a hyperboloid of revolution, its axis and focal point being coincident with those of the primary mirror. The rays are in this way reflected back to the mirror at the bottom of the tube, and in order that the image may be seen, it is necessary to cut out the middle part of the mirror to admit the eye-piece.

[244]

Although the small mirror must theoretically be hyperbolic, tolerable definition is obtained even if it be spherical or ellipsoidal, and its actual departure from these forms is so slight as to be beyond detection by measurement, so that the figuring of such mirrors can only be tested in the telescope. For photographic purposes this telescope has the very important advantage that a short telescope is equivalent to a very long one of the Newtonian form, or refracting telescope, so that the image of sun, moon, or planets formed at the focus is very large in comparison with the size of the telescope. A modification of this form of telescope, in which the small mirror is out of the path of the rays falling upon the larger one, and no longer obstructing the central part, has been revived by Dr. Common, and has become generally known as the "Skew Cassegrain."

In reflecting telescopes the mirrors were formerly made of speculum metal (an alloy of copper and tin), and the word speculum is even now commonly employed to signify a telescopic mirror, although it is usual to make the mirror of glass, with the concave surface silvered and highly polished.

One is frequently asked for an opinion as to which is the better form of telescope, the reflector or refractor, and it is a question that one finds some little difficulty in answering. On one point, however, all are agreed, namely, that the reflector has the advantage in regard to its achromatism; it is indeed perfectly achromatic, while the so-called "achromatic" refractor is at best only a compromise. For the rest, one can not do better than quote the evidence of Dr.[245] Isaac Roberts before the International Astrophotographic Congress: "The reflector requires the exercise of great care and patience, and a thorough personal interest on the part of the observer using it. In the hands of such a person it yields excellent results, but in other hands it might be a bad instrument. The reflector gives results at least equal, if not superior, to those obtained with the refractor, if the observer be careful of the centring, and of the polish of the mirror, and keeps the instrument in the highest state of efficiency; but when intrusted to an ordinary

assistant the conditions necessary for its best performance can not be so well fulfilled as the same could be in the case of the refractor." One great practical advantage of the reflector is that there are fewer optical surfaces, so that a large reflector may be obtained for the price of a much smaller refractor. Drawing of a telescope Fig. 22.—The Cassegrain Reflector

Eye-Pieces.—So far we have regarded the eye-piece of a telescope as a simple lens, but it is evident that the spherical and chromatic aberration of such a lens will interfere with its performance. For occasional[246] use, however, even a simple lens is very serviceable if the object observed is brought to the centre of the field of view.

Compound eye-pieces are of various forms, each having certain advantages, the desiderata being freedom from color and "flatness of field"—that is, stars in different parts of the field are to be equally well in focus. Those most commonly employed are the Ramsden and Huyghenian eye-pieces. The former consists of two plano-convex lenses of equal focal lengths, having their curved faces toward each other, and being placed at a distance apart equal to two-thirds of the focal length of either lens. Such an eye-piece can be used as a magnifying-glass, and it is therefore placed outside the focal image formed by the telescope with which it is used; on this account it is called a positive eye-piece. This kind of eye-piece is not quite achromatic, but its flat field of view gives it a special value for many purposes.

In the Huyghenian eye-piece there are again two lenses, made of the same kind of glass. That which comes nearest to the eye has a focal length of only one-third that of the field lens, and the distance between the two lenses is half the sum of the focal lengths. This form of eye-piece can not be used as a magnifying-glass in the ordinary sense, and as the field lens must be placed on the object-glass or mirror side of the focus, it is called a negative eye-piece. The Huyghenian eye-piece is more achromatic than the Ramsden, and is more widely used when it is only required to view the heavenly bodies. In instruments employed for purposes of measurement, a positive[247] eye-piece is essential in order that the spider threads may be placed at the focus of the telescope. The images formed by an astronomical telescope are upside down, and neither of the eye-pieces described reinverts them.

A special form of eye-piece is therefore used when a telescope is employed for terrestrial sight-seeing. The desired result is obtained by the introduction of additional lenses, but there is a corresponding reduction of brightness.

For viewing the sun some device is necessary to reduce the quantity of light entering the eye. To look at the sun directly, even with a small instrument, is very dangerous. The arrangement usually adopted is a solar diagonal, in which the light is reflected from a piece of plane glass before entering the eye-piece; the piece of glass is wedge-shaped, so that the reflection from one surface only is effective; if the glass had parallel sides, the solar image would be double.

Magnifying Power.—The magnifying power of a telescope depends upon the focal length of the object-glass, or speculum, and that of the eye-piece. Optically, it is equal to the former divided by the latter, so that the greater the focal length of an object-glass, or the smaller the focal length of the eye-piece, the greater will be the magnifying power. In a given telescope, the object-glass, or speculum, is a constant factor and the magnifying power can only be varied by changing the eye-piece. The focal length of the Lick telescope, for example, is about 600 inches; with an eye-piece which is equivalent to a lens of one-inch focus, the magnifying power[248] would be 600; with a lens of half an inch focus, it would be 1,200, and so on.

The magnifying power which can be effectively employed, however, depends upon a great variety of circumstances. First, the clearness and steadiness of the air; then there is the quality of the object-glass, or speculum, to be considered; and also the brightness of the object to be observed, for when the object is very dim, its light will be spread out into invisibility if too high a power be used.

In practice, good refractors perform well with powers ranging up to 80 or 100 for each inch in the diameter of the object-glass. Thus, on sufficiently bright objects, a six-inch telescope will work well with a power of about 500, while a 30-inch may be effectively employed with powers between 2,000 and 3,000.

Illuminating Power.—It has already been pointed out that magnification is not the only function of a telescope. As a matter of fact, the most powerful telescopes in the world fail to produce the slightest increase in the apparent size of a star, for even if these objects be brought to apparently a 3,000th part of their real distances, they are still too far away to have any visible size. But although a star can not be magnified, it can be rendered more visible by the telescope, for the reason that the object-glass collects a greater number of rays than the naked eye. The pupil of the eye may be taken to have a diameter of one-fifth of an inch; a lens one-inch in diameter will have twenty-five times the area of the pupil, and will therefore collect twenty-five times[249] the amount of light from a star; a two-inch lens will grasp one hundred times, and a 36-inch 32,400 times as much light as the pupil alone.

Practically all these rays collected by the object-glass, or speculum, of a telescope can not be brought into the eye; some are lost through the imperfect transparency of the glass, or the imperfect reflecting power of the speculum. Still, allowing a considerable percentage for loss, there is an enormous concentration of light when a large telescope is employed.

The Altazimuth Mounting.—Having got a telescope, we have next to see how it can be best supported, for unless it be a very small instrument indeed, it will be impossible to hold it in the hand like a spy-glass. However a telescope be mounted, provision must be made for turning it to any part of the sky whatsoever. Very frequently one of the axes on which the instrument turns is vertical, while the other is horizontal. Such a stand for a telescope is called an altazimuth mounting, for the reason that it permits the instrument to be moved in altitude and in azimuth.

As a rule, one finds only small telescopes mounted in this manner. The objection to it is that, as one continues to observe a heavenly body, two independent movements must be given to the telescope in order to follow the body in its diurnal movement across the heavens. If we commence observing a star newly risen, for example, the telescope must trace a star-like path in order to follow it as it ascends into the heavens.

The Equatorial Telescope.—A much more convenient[250] method of setting up a telescope is to mount it as an equatorial. The essential feature of this instrument is that one of the axes of movement, instead of being vertical, is placed parallel to the axis of the earth. This is called the polar axis, and, when the telescope is turned around such an axis, it traces out curves in the sky which are identical with those described by the stars in their diurnal motions. If, then, the telescope be directed to a star or other heavenly body, it can be made to follow the object and keep it in view by a single movement. The axis at right angles to the polar axis is called the declination axis, and is necessary in order that the telescope may be moved toward and from the poles so that all the heavenly bodies above the horizon may be included in its sweep.

One very important advantage of the equatorial is that, as only one motion is required to keep a star in view, so long as it is above the horizon, the necessary movement may be furnished by clockwork. A good equatorial is accordingly provided with a driving-clock, which is regulated so that it would drive the telescope through a whole revolution once a day. Unlike an ordinary clock, the driving-clock of a telescope is regulated by a governor, in order that the instrument may have a continuous and not a jerky movement.

The telescope is also provided with clamps and fine adjustments, one each in R. A. and declination, in order that it may be under the control of the observer. It is evident that the telescope must be capable of moving independently of the driving-gear, so[251] that it may first be placed in the desired direction; when this is accomplished, the R. A. clamp is used to put the telescope in gear with the clock. The declination clamp is then made to fix the telescope firmly to the declination axis. Fine adjustments in both directions are necessary, because it is impossible to sight a large instrument with such precision as to bring an object exactly to the centre of the field of view.

Some of the driving-clocks fitted to equatorials are very elaborate. As clocks regulated by governors are not such reliable timekeepers as those regulated by pendulums, arrangements are made by which the accuracy of a pendulum can be electrically communicated to a governor clock. One of the best forms of electrically controlled clocks is that devised by Sir Howard Grubb.

Another important feature of an equatorial is that it can be provided with circles which enable the telescope to be pointed to any desired object of known right ascension and declination. One of these is the declination circle, attached to the declination axis and read by a vernier fixed to the sleeve in which the axis turns; this is adjusted so as to read 0° when the telescope points to any part of the celestial equator, and 90° when it is directed to the pole. The other circle is attached to the polar axis, and determines the position of the telescope with regard to the meridian; this is called the hour circle, and is divided into twenty-four hours. When the telescope is on the meridian, the hour circle reads zero, so that its reading in any other position gives the hour angle[252] of the telescope. Having given the right ascension and declination of a heavenly body which it is desired to observe, the telescope is turned until the declination circle reads the proper angle, and the hour circle indicates the hour angle which is calculated for the particular moment of pointing the telescope. [The hour angle is the difference between the right ascension of the object and the sidereal time of observation.] In this way it is easy to find objects of known position which are invisible to the naked eye, and one can even pick up the planets and brighter stars in full sunshine. Conversely, one can determine from the circles the right ascension and declination of any object under observation, but for various reasons only approximate results can be obtained in this way. The chief use of the circles on an equatorial is therefore to provide a means of pointing the telescope.

Telescopes of four inches aperture and upward are usually provided with a smaller companion called a finder. This has a larger field of view than the main telescope, so that objects which are of sufficient brightness can readily be picked up and brought to the centre of the finder, the adjustments being such that the object is then also at the centre of the field of the large telescope.

There are, of course, many practical details connected with the working of an equatorial with which space does not permit us to deal. It may be remarked, however, that the adjustment of the polar axis is very simply performed by first inclining it at an angle approximately equal to the latitude of the[253] place where it is set up, and setting it as nearly as possible in the meridian by means of a compass or by observations of the sun at noon. The final adjustment is then made by a series of observations of stars of known position.

Some of the World's Great Telescopes.—Thanks to the wide public interest taken in astronomical matters, a large number of powerful telescopes have been set up in various parts of the world. To the British Islands belongs the honor of possessing the largest telescope in the world. This is the giant reflector erected by Lord Rosse, in 1842, at Parsonstown, the mirror being six feet in diameter, and the focal length sixty feet. Many very valuable observations were made with this instrument in its early days, but of late years it seems to have fallen into disuse. One reason may be that the mounting is not of the most convenient form, and makes the telescope unsuitable for photographic work.

Coming next in point of size to the Rosse telescope is the reflector erected at Ealing by Dr. A. A. Common. The glass mirror of this telescope is five feet in diameter, five inches thick, and weighs more than half a ton. Dr. Common aimed specially at constructing the largest possible telescope which could be equatorially mounted and provided with a driving-clock, and he was only limited to an aperture of five feet by the impossibility of obtaining a glass disk of larger size. He has attained such great skill in this work that he was able to produce a perfect mirror five feet in diameter in three months' time, although[254] no less than 410,000 strokes of the polishing machine were required.

The telescope is of the Newtonian form, and the mounting is quite unique. The polar axis consists of an iron cylinder, made up of boiler plate, seven feet eight inches in diameter, and about fifteen feet long. From the top of the cylinder, near its outer edge, two horns, each six feet long, project outward, and the tube of the telescope swings on trunnions attached to the ends of the horns. The main part of the telescope tube is square, built up of steel angle iron, and carries the mirror at its lower end; the upper part of the tube, which carries the "flat" and eye-piece, is round, and of tinned steel strengthened by a skeleton framework.

It is evident that such an enormous instrument as this can not be made to travel by clockwork with the necessary uniformity without some very efficient arrangement for reducing friction. Dr. Common's plan—and it is here that his instrument is unlike others—is to make the hollow polar axis watertight, and to fix it in a tank of water. At the bottom of the polar axis is a ball and socket joint to keep it in position, and at the top is another bearing, which can be adjusted so that the polar axis lies truly in the meridian. It was found necessary to introduce nine tons of iron into the bottom of the hollow polar axis in order to sink it to the proper angle, and to put sufficient weight on the bearings to give stability to the instrument. In this way the great mass is brought into the region of manageability, and the driving-clock, which is driven by a weight of one and a half[255] tons, is able to do its work efficiently. Such, in general outline, is this wonderful telescope, which, although not so large as Lord Rosse's famous instrument, is undoubtedly its superior in light-grasping power and general utility, and more especially in its adaptability for photographing the heavens.

Among other large reflecting telescopes now in use are the 4-foot reflectors at Melbourne and Paris, and the 3-foot reflectors at South Kensington and the Lick Observatory, California.

The largest refracting telescope yet constructed is one of forty inches aperture for the Yerkes Observatory of the University of Chicago. It is interesting to note here that Professor Keeler, in his report as an expert upon the performance of the object-glass, considers that there is "evidence for the first time that we are approaching the limit of size in the construction of great objectives." Unlike a mirror, a lens can be supported only upon its circumference, and it is the bending by its own weight that proves detrimental to its defining power. If the lens be made thicker with a view of overcoming this defect, the absorption of light by the glass increases, so that there is in the end no special gain by increasing the size.

The length of the Yerkes telescope is 62 feet, and is provided with all accessories pertaining to astrophysical research. The world-renowed Lick Telescope is of thirty-six inches aperture. The story of the foundation of this monster instrument is not much less wonderful than the telescope itself.[256] Brought up in poor circumstances, with few opportunities for intellectual development, James Lick, nevertheless, amassed a fortune in business, and having few relations, he was anxious to dispose of his wealth in such a way as to bring him that fame which he had failed to achieve in other directions. Although it is very probable that he had

never looked through a telescope in his life, the idea of a large telescope had taken a very firm hold upon his mind, and, thanks to the influence of his advisers, it was definitely announced in 1873 that Mr. Lick's bid for immortality was to take this form. Several sites were examined by experts, and finally Mount Hamilton, California, 4,200 feet above sea-level, was selected. An excellent road, twenty-six miles in length, made at the cost of the county authorities, connects the observatory with the nearest town, San José, thirteen miles distant.

Owing to various delays, operations were not commenced until 1880, and five years were consumed in clearing away 72,000 tons of rocks and in erecting the buildings.

Mr. Lick had stipulated for the erection of "a telescope superior to and more powerful than any telescope yet made," and Messrs. Alvan Clark & Co. contracted to supply a lens of thirty-six inches aperture for the sum of $50,000. It turned out, however, that it was much easier to make such a contract than to fulfil it. To produce large disks of optically perfect glass, even in the rough, requires the greatest possible skill and patience, and this part of the work was undertaken by Feil & Co. of Paris. The flint[257] glass disk was safely delivered in America in 1882, but the crown disk was cracked in packing. The elder Feil having retired from business, the duty of providing a new block of crown glass devolved upon his sons, who, after two years spent in vain attempts, ended in bankruptcy, and it was only through the elder Feil again resuming business that the much-required disk was finally completed in 1885. After the lapse of another year, the rough disks were fashioned, in the workshops of the Clarks, into the most marvelous of telescopic lenses.

The mounting of the object-glass is worthy of the occasion. The tube is no less than thirty-seven feet long, and four feet in diameter in the middle part. An iron pier, thirty-eight feet high, beneath which lie the remains of Mr. Lick, supports the equatorial head, and a winding staircase enables the observer to reach the setting circles. Inside the hollow pier is the powerful driving-clock which turns the telescope to follow the heavenly bodies in their apparent movements. Finders of six, four, and three inches diameter, rods for the manipulation of the instrument, and all necessary accessories, complete what must long remain one of the most perfect instruments at the service of astronomical science. The $200,000 expended upon it have already been amply justified by the work accomplished, while Mr. Lick's dream of immortality has become a reality.

The following list indicates some of the large refractors now doing active service:

[258] Aperture Observatory 36 inch [Lick] California. 30 ” Pulkowa, Russia. 30 ” [Bischoffeim] Nice. 28 ” Greenwich. 27 ” Vienna. 26 ” Washington. 25 ” [Newall] Cambridge. 24 ” [Lowell] Mexico. 23 ” Princeton, New Jersey.

It is right to add, however, that opinion is still greatly divided as to whether these telescopes of large aperture really repay the expense and labor involved in their erection and use. On the very rare occasion when the "seeing" is practically perfect—which occurs perhaps only a few hours in a year—it is probable that the superiority of a large telescope is very marked, but under average conditions there seems to be little advantage over instruments of moderate size for many classes of observations.

Certain it is that a great deal of valuable work is done with comparatively small telescopes, ranging from six to fifteen inches aperture, and this in all departments of astronomical research. Hence, some of the most active observatories do not figure in the above list; among them may be mentioned the observatories of Harvard College, Potsdam, Paris, Heidelberg, Cape of Good Hope, Edinburgh, South Kensington, Stonyhurst College, and the observatory of Dr. Isaac Roberts at Crowborough, England.

Housing of Equatorials.—The building which accommodates an equatorial telescope must evidently be designed to admit of giving a clear opening to any part of the sky. Usually this is accomplished[259] by making the roof, or dome, with a circular base, provided with wheels, which run on rails. It is then only necessary to open a narrow portion of the dome, extending from top to base, and to turn the dome until this aperture is in the required direction. One of the most elaborate domes now in existence is that built by M. Eiffel for the great refractor of the Nice Observatory. The lower part of the building is in the form of a square, having a side of about eighty-seven feet and a height of about thirty feet. The dome itself is seventy-four feet in diameter, and the moving parts alone weigh ninety-five tons.

There are two shutters, each a little wider than half the possible opening; these run on short rails, and are moved simultaneously by means of an endless rope. The whole of the dome is built up of steel angle iron, covered with very thin sheet steel. In order to facilitate the manipulation of the dome, its great weight is buoyed up by means of a float attached to its base and immersed in a circular tank of water of a little greater size than the base of the dome. If any mishap occurs with this gigantic tank, the dome rests on wheels which run on a circular rail, so that the work need not be interrupted. The whole arrangement is very easily turned with

the aid of a winch by one man when the dome is floating, but when resting on the wheels several men are required at the winch.

This brief description will serve to illustrate some of the problems which confront the possessor of a very large telescope. For smaller instruments, the observatories follow pretty nearly the same plan, except[260] that it is unnecessary to provide an arrangement for floating the dome.

The observatory which shelters a reflecting telescope need not differ very greatly from one which contains a refractor. If the instrument be a Newtonian, it is generally convenient to sink the polar axis below the level of the floor in order that the observer may not be at too great a height from the ground, and in that case, the dome, or its equivalent, is all that is necessary. For his five-foot reflector, Dr. Common designed an observatory which is not of the ordinary form, but gives the necessary opening partly by means of large shutters and partly by a revolution of the whole house. It is not every one who is able to lay out $40,000 on such a dome as that erected at Nice by M. Bischoffeim.

The varying position of the eye end of a telescope, when it is turned to different parts of the sky, makes it necessary to provide comfortable and safe seating accommodation for the observer, more especially when the telescope is a very large one. In the case of the Yerkes telescope, the eye-piece is thirty feet higher when observing near the horizon than when observing near the zenith, and the observer must necessarily follow the telescope. The most convenient arrangement in such a case is to raise or lower the floor of the observatory as occasion demands. The floor of the Yerkes Observatory is seventy-five feet in diameter, and by means of electric motors it can be given a vertical motion of twenty-two feet. A similar arrangement was provided for the Lick telescope from the designs of Sir Howard[261] Grubb. With smaller instruments, observing ladders and adjustable chairs of various forms are employed.

The Equatorial Coudé.—A form of equatorial telescope which has possibly a great future before it is one introduced at Paris under the name of the equatorial coudé, or elbowed telescope. Its practical advantage is that the observer remains in a constant and comfortable position, so that revolving domes and elevating floors, or other arrangements serving similar purposes, are no longer necessary. The telescope tube is of two parts of nearly equal length, and what is ordinarily the lower half of the tube forms part of the polar axis, while the other half is attached to it at right angles. At the point of intersection of the two halves of the tube is a plane mirror, and there is another mirror in front of the object-glass. If the latter mirror were removed, such a telescope would only enable the observer to see objects lying along the celestial equator, but by its means objects in all parts of the heavens can be brought within range to an observer gazing down the hollow polar axis. The largest instrument is that at the Paris Observatory, which has an object-glass 23½ inches in diameter for visual observations, and another of the same size for photographic purposes.

Fixed Telescopes.—There is still another method of using a telescope. The telescope itself may be fixed, and the light of the heavenly bodies may be reflected into it by means of a mirror which is made to revolve so as to keep pace with their movements. Foucault devised an instrument called the siderostat[262] for this purpose, and although it is not largely employed for telescopic observations, it is very widely utilized for spectroscopic work, where the spectroscope is of a kind not readily attached to a telescope.

Another instrument used for the same purpose has recently been brought forward under the name of the cœlostat. This is simply a mirror which is made to turn on a polar axis in its own plane, and since a reflected ray of light moves through twice the angle that the reflecting surface turns through, the mirror is made to revolve at the rate of one revolution in two days. As the name indicates, the whole heavens appear stationary in such an instrument, whereas in a siderostat only one star at a time appears at rest, while its neighbors slowly revolve round it.

Photographic Telescopes.—The application of photography to the study of the heavenly bodies marks one of the greatest advances of the present century. The instruments which are employed for this purpose range from the ordinary tourist camera to the largest telescope. Unlike a person sitting for a portrait, the heavenly bodies can not be made to stand still for the purpose, and as instantaneous photographs can only be obtained in the case of the sun and moon, it is usually necessary to make the camera follow the stars very exactly during the time of exposure in order that the images may fall on precisely the same parts of the photographic plate.

Some guiding arrangement is, therefore, essential, and generally the photographic camera or telescope is attached to an ordinary equatorial which is driven[263] by clockwork, or very carefully by hand if the camera be a small one. In the guiding telescope are two spider-threads at right angles to each other, and it is by constantly keeping the image of a star at the intersection of these “wires” that the operator ensures the images remaining in a constant position upon the sensitive plate.

An ordinary portrait camera, in the hands of a skilled observer, yields very beautiful pictures, but they are naturally on a small scale. The field of view of such an instrument is so large that a whole constellation may be photographed with a single exposure.

Portrait lenses of six inches aperture in the hands of Dr. Max Wolf and Professor Barnard have given magnificent delineations of the Milky Way, and of the extremely faint nebulosities which are to be found in many parts of the heavens.

For many purposes, however, telescopes of greater power are required, and here it may be remarked that the distance between the images of any two adjacent stars will vary in direct proportion to the focal length of the telescope. In the same way the size of the image of a planet, the moon, or a comet, increases as the focal length of the objective is increased.

Refracting telescopes which are employed for photography require object-glasses which are specially “corrected” for the photographic rays. White light is compounded of light of all colors, but it is the blue and violet constituents which are effective in producing photographic action on an ordinary[264] sensitive plate. Now, an object-glass which is intended for visual purposes is made to focus at the same point as many as possible of the rays which are most effective to the human eye, that is the green, yellow, and red, and usually there is a blue or purple halo round the images of the brighter objects, which is, however, too feeble as a rule to interfere with visual observations. This blue halo will evidently result in defective definition if the lens be employed for photography. By putting the plate at the point where the blue rays are most nearly focused, a better image is obtained; but for really good work a photographic object-glass must be so designed that all the blue and violet rays are brought to one and the same focus. Such a lens will consequently be a very poor one for visual observations.

The new “photo telescopic” object-glass now manufactured by Messrs. Cooke appears to be full of promise. In this lens all the colors of the spectrum are brought to almost exactly the same focal point, so that it serves equally well for photographic or visual purposes.

This difficulty in regard to achromatism does not exist in the case of the reflecting telescope, since rays of light of every color are reflected at precisely the same angles. For this reason reflectors, when properly managed, give the best photographic results. Dr. Isaac Roberts and Dr. Common are especially identified with the application of the reflecting telescope for celestial photography. The instrument employed by the former consists of a 20-inch reflector and a 7-inch guiding telescope of[265] the refracting form. The two telescopes are mounted on the extreme ends of the declination axis of an equatorial.

Dr. Common does not employ a guiding telescope at all. The photographic plate which he places at the focus of the reflector is smaller than the field of view, so that by means of an eye-piece fitted with a cross wire at the side of the dark slide, he is able to watch a star near the edge of the field. Both eye-piece and dark slide are attached to a frame which can be controlled by two screws at right angles to each other. If the guiding star leaves the cross wire through errors in driving, or other causes, the eye-piece and dark slide are bodily moved after it by means of the adjusting screws. This method not only has the advantage of saving the cost of a guiding telescope, but reduces the effects of vibration consequent upon the correction of errors by moving the whole telescope.

For photographing the sun a special instrument called a photoheliograph is usually employed. This differs only from an ordinary photographic telescope in being provided with a secondary magnifier, by which means the focal image formed by the object-glass is amplified before falling upon the photographic plate. On a bright, clear day pictures of the sun eight inches in diameter can be taken with an exposure of about 1/500th of a second, and such a photograph will frequently record more facts as to the state of the solar surface than a whole day’s observation. Lenses or mirrors of very long focus are also occasionally employed in solar photography,[266] and in this way a large image is obtained without the use of a secondary magnifier.

Photographs of the moon and planets may be taken either with or without a secondary magnifier, but in either case the exposures are longer than for the sun.

Finally, it may be added that the sensitive plates and processes used in astronomical photography do not differ from those employed by ordinary photographers. FOOTNOTES:

[22] The focal length of a lens is the distance from its centre at which an image of a very distant object, such as the sun, is formed. METEORS.—Sir Robert S. Ball

Our present knowledge as to the natural history of the shooting stars has been mainly acquired during the last hundred years. The first important step in the comprehension of these bodies was to recognize that the brilliant flash of light was caused by some object

which came from without and plunged into our air. This was known at the end of the Eighteenth Century, largely by the labors of the philosopher Chladni in 1794. Photo of a moon region A Portion of the Moon's Disk Where Four Mountain Ranges Meet

Could an ordinary shooting star tell us its actual history, the narrative would run somewhat as follows:

"I was a small bit of material, chiefly, if not entirely, composed of substances which are formed from the same chemical elements as those you find on the earth. Not improbably I may have had some iron in my constitution, and also sodium and carbon, to mention only a few of the most familiar elements. I only weighed an ounce or two, perhaps more, perhaps less—but you could probably have held me in[267] your closed hand, or put me into your waistcoat pocket. You would have described me as a sort of small stone, yet I think you would have added that I was very unlike the ordinary stones with which you were familiar. I have led a life of the most extraordinary activity; I have never known what it was to stay still; I have been ever on the move. Through the solitudes of space I have dashed along with a speed which you can hardly conceive. Compare my ordinary motion with your most rapid railway trains; my journey will be done ere the best locomotive ever built could have drawn the train out of the station. Pit me against your rifle bullets, against the shots from your one-hundred-ton guns; before the missile from the mightiest piece of ordnance ever fired shall have gone ten yards I have gone 1,000 yards. I do not assert that my speed has been invariable—sometimes it has been faster, sometimes it has been slower; but I have generally done my million miles a day at the very least. Such has been my career, not for hours or days, but for years and for centuries, probably for untold ages. And the grand catastrophe in which I vanished has been befitting to a life of such transcendent excitement and activity; I have perished instantly, and in a streak of splendor. In the course of my immemorial wanderings I have occasionally passed near some of the great bodies in the heavens; I have also not improbably in former years hurried by that globe on which you live. On those occasions you never saw me, you never could have seen me, not even if you had used the mightiest telescope that has ever been directed to the heavens. But too close[268] an approach to your globe was at last the occasion of my fall. You must remember that you live on the earth buried beneath a great ocean of air. Viewed from outside space, your earth is seen to be a great ball, everywhere swathed with this thick coating of air. Beyond the appreciable limits of the air stretches the open space, and there it is that my prodigious journeys have been performed. Out there we have a freedom to move of which you who live in a dense atmosphere have no conception. Whenever you attempt to produce rapid motion on the earth, the resistance of your air largely detracts from the velocity that would be otherwise attainable. Your quick trains are impeded by air, your artillery ranges are shortened by it. Movements like mine would be impossible in air like yours.

"And this air it is which has ultimately compassed my destruction. So long as I merely passed near your earth, but kept clear of that deadly net which you have spread, in the shape of your atmosphere, to entrap the shooting stars, all went well with me. I felt the ponderous mass of the earth, and I swerved a little in compliance with its attraction; but my supreme velocity preserved me, and I hurried past unscathed. I had many narrow escapes from capture during the lapse of those countless ages in which I have been wandering through space. But at last I approached once too often to the earth. On this fatal occasion my course led me to graze your globe so closely that I could not get by without traversing the higher parts of the atmosphere. Accordingly, a frightful catastrophe immediately occurred. Not[269] to you; it did you no harm; indeed, quite the contrary. My dissolution gave you a pleasing and instructive exhibition. It was then, for the first time, that you were permitted to see me, and you called me a shooting star or a meteor.

"When from the freedom of open space I darted into the atmosphere, I rubbed past every particle of air which I touched in my impetuous flight, and in doing so I experienced the usual consequence of friction—I was warmed by the operation.

"You can readily comprehend the immense quantity of heat that will have been produced ere friction could deprive me of a speed of twenty miles a second. That heat not merely warmed me, but I rapidly became red-hot, white-hot, then I melted, even though composed of materials of a most refractory kind. Still friction had much more to do, and it actually drove me off into vapor, and I vanished. You, standing on your earth many miles below, never saw me—never could have seen me—until this supreme moment, when, glowing with an instantaneous fervor, I for a brief second became visible.

"Nature knows no annihilation, and though I had been driven off into vapor and the trial by fire had scattered and dispersed me, yet in the lofty heights of the atmosphere those vapors cooled and condensed. They did not, they never could again reunite and reproduce my pristine structure. Here and there in wide diffusion I repassed from the vaporous to the solid form, and in this state I wore the appearance of a streak of minute granules distributed all along the highway I had followed. These granules[270] gradually subsided through the air to the earth. On Alpine snows, far removed from the haunts of men and from contamination of chimneys, minute particles have been gathered, many of which have unquestionably been derived from the scattered remains of shooting

stars. Into the sea similar particles are forever falling, and they have been subsequently dredged up from profound depths, having subsided through an ocean of water after sinking through an ocean of air."

Those splendid shooting stars which are often called fire-balls move in every direction. They come from the east, and from the west, from the north, and from the south. There is no hour of the night at which they have not occasionally been seen. Even in daylight it has happened not once or twice, but on several occasions, that a brilliant meteor has forced itself upon our astonished notice. They generally first make their appearance at a height which is between fifty and one hundred miles above the ground. They hurry down their inclined path, but generally become extinguished while still at least twenty miles aloft. In their more ambitious flights meteors have been known to span a kingdom. Nor are even greater strides unrecorded. The length of a continent may be compared with the track of that terrific meteor of 5th September, 1868, which broke into visibility at an appalling height above the Black Sea, and had not expended its stupendous energy until it passed over the smiling vineyards of France.

Great fire-balls are much more numerous than any[271] one would suppose who had not paid attention to the subject. Nor need this be a matter for surprise if it be remembered that when a fire-ball does arrive it is only by a favorable combination of circumstances that any particular individual is privileged to witness the exhibition. As a random example of the yearly crop of fire-balls, I take from the middle of 1877 to the middle of 1878. A list of the fire-balls noticed during this period will be found in that store-house of valuable information, the Reports of the British Association. In the year referred to I see that eighty-six great fire-balls have been recorded. They have appeared in various localities, both in the old hemisphere and in the new. The most arduous observer may think himself fortunate if he has even seen one of them.

As to the brilliant light from some of these great fire-balls, there are numerous statements. We are not infrequently told that even the beams of the full moon are ineffectual in comparison with the blaze of the meteor; and we find a high authority asserting that one of these bodies displayed a flash as "blinding as the sun." On the 29th July, 1878, a fire-ball was seen which created so splendid an illumination that "the smallest objects were visible at Manchester."

Fortunate, indeed, would the astronomer have been who, guided by some miraculous prescience, had gone to the ancient city of York on the evening of the 23d of February, 1879, and on the tower of the glorious minster spent the night in observation of the heavens. It would have been his privilege to[272] witness a majestic meteor under circumstances of almost unique magnificence.

It was at seven minutes before three that such few stragglers as the streets of York still contained saw a pear-shaped ball of fire traveling across the sky. It drenched the ancient city with a flood of light. The superb front of the minster never before glowed with a more romantic illumination. The unwonted brilliancy streamed through every aperture in every window in the city; every wakeful eye was instantly on the alert; every light sleeper started up suddenly to know what was the matter. Even those whom the blaze of midnight light had failed to awaken were only permitted to protract their slumbers for another minute and a half—only until an awful crash, like a mighty peal of thunder, burst over the town, shaking the doors, the windows, and even the houses themselves. The whole city was thus alarmed. Every one started at the noise. But that noise was not a clap of thunder. Nor was it produced by an earthquake. It was merely the explosion of the fire-ball which flung itself against the atmosphere after its immeasurable voyage through space.

Perhaps the most remarkable instance of the explosion of a meteor is recorded in the case of the great fire-ball so widely observed in America on the 21st of December, 1876. The movements of this superb object have been carefully studied by Professor H. A. Newton and Professor D. Kirkwood. For the prodigious span of a thousand miles this meteor tore over the American continent with a speed[273] of some ten or fifteen miles a second. It first appeared over Kansas at a height of seventy-five miles. Thence it glided over the Mississippi, over the Missouri; it passed to the south of Lake Michigan; it made a short voyage over Lake Erie, and it can not have been very far from the Falls of Niagara, when by becoming invisible all further traces of its movements were lost. While passing a point midway between Chicago and St. Louis a frightful explosion shivered the meteor into a cluster of brilliant balls of fire, which seemed to chase each other across the sky. This cluster must have been about forty miles long and five miles wide. The detonation by which the explosion was accompanied was a specially notable incident of this meteor. It was not only heard with terrific intensity in the neighborhood, but the volume of sound was borne to great distances.

The glory of a meteor is often so evanescent that we just get a glimpse and it is gone. The sky resumes its ordinary aspect; the familiar stars are there, and even the very situation of the brilliant streak has become unrecognizable. But this is not always so; it sometimes happens that the brief career of the meteor leaves a notable trace behind it, so that for seconds and for minutes the sky is diversified by an unwonted spectacle. The path of the meteor leaves a stain of pearly light on the sky to mark the highway

pursued by our celestial visitor.

In its fearful career the meteor is often rent to fragments, reduced to dust, dissolved into vapor. The glowing atoms of the wreck lie strewn along the path, just as the ghastly remnants of Napoleon's[274] mighty army limned out the awful retreat from Moscow.

A pencil-shaped cloud of meteoric débris, perhaps eighty or a hundred miles in length, and four or five miles in diameter, thus hangs poised in air. It is at night. The sun has sunk so far below the horizon that there is no trace of the feeblest twilight glow. An ordinary cloud would, of course, be invisible except as concealing the stars; no beams of light fall upon it; there is nothing to render it luminous. So, too, the meteoric streak will often pass instantly into invisibility, but, as I have said, this is not always the case. There is a well-authenticated instance in which the trail of a superb meteor remained visible for nearly an hour. I have endeavored up to the present to explain the various phenomena presented to us in the fall of a meteor, but here, for the first time, we have to note a circumstance for which it is not easy to account. We can explain why it is that the long meteoric cloud should be there, but we can not so easily explain why we should be able to see it. Whence comes this beautiful pearly luminosity? It seems that the meteoric dust must glow with some intrinsic luminosity.

We have spoken of dazzling fire-balls which generate for a brief moment a light which eye-witnesses, with possibly a pardonable exaggeration, have ventured to compare with the beams of the sun himself. Other meteors are described as being as bright as the full moon. Descending still lower in the scale of splendor, we read of fire-balls as bright as Venus or Jupiter, as bright as Sirius, or as a star of the first[275] magnitude. With each step downward in brilliancy we find the meteors to increase in numerical abundance. Shooting stars as bright as the stars of the second or third magnitude are comparatively frequent; they are still more numerous of the fourth and fifth magnitudes. Every night brings its tale of shooting stars whose brightness is just sufficient to impress the unaided eye. Nor do the shooting stars which even the most attentive eye can detect represent a fraction of their entire number. As there are telescopic stars which the unaided eye can not see, so it might fairly be conjectured that, as we can trace meteors of successive stages of brightness down to the limit of unaided eye visibility, so there may be meteors still and still smaller which would be detected could we only direct a telescope toward them.

If we reflect that for every one that is seen there must be thousands which dart in unseen, we obtain an imposing idea of the myriads of shooting stars that daily rain in upon our globe.

The world is thus pelted on all sides day and night, year after year, century after century, by troops and battalions of shooting stars of every size, from objects not much larger than grains of sand up to mighty masses which can only be expressed in tons. In the lapse of ages our globe must thus be gradually growing by the everlasting deposit of meteoric débris. Looking back through the vistas of time past, it becomes impossible to estimate how much of the solid earth may not owe its origin to this celestial source.

The first and most important truth with regard to[276] the recurrence of the meteors is their occasional appearance in what are known as "meteoric showers." During such displays it sometimes happens that shooting stars in shoals break forth simultaneously, so as to produce a spectacle which we now regard as of the utmost beauty and interest, but which in earlier times has often been the source of the direst terror and dismay.

Let me, for the sake of illustration, give some account of one of these great showers of shooting stars.

In the year 1866 I occupied the position of astronomer to the late Earl of Rosse. The memorable night between November 13th and 14th, 1866, was a very fine one; the moon was absent—a very important consideration in regard to the effectiveness of the display. The stars shone out clearly, and I was diligently examining some faint nebulæ in the eye-piece of the great telescope, when a sudden exclamation from the attendant caused me to look up from the eye-piece just in time to catch a glimpse of a fine shooting star, which, like a great sky-rocket, but without its accompanying noise, shot across the sky over our heads. The great shooting star which had already appeared was merely the herald announcing the advent of a mighty host. At first the meteors came singly, and then, as the hours wore on, they arrived in twos and in threes, in dozens, in scores, in hundreds. Our work at the telescope was forsaken; we went to the top of the castellated walls of the great telescope and abandoned ourselves to the enjoyment of the gorgeous spectacle.

To number the meteors baffled all our arithmetic;[277] while we strove to count on the one side many of them hurried by on the other. The vivid brilliance of the meteors was sharply contrasted with the silence of their flight. We heard on that marvelous night no sounds save those with which we were familiar. The flights of the celestial rockets were attended with no noises that we could hear. The meteors were no doubt somewhat various as to size, but the characteristic feature of this shower, as contrasted with another

great shower I have also seen, was the remarkable brilliance of the shooting stars. It was their exceptional splendor even more than their innumerable profusion that gave to the shower its peculiarity. As to the actual brilliancy of the meteors, I am enabled to give the accurate estimate made by Mr. Baxendell at Manchester, where the shower was well seen. Out of every hundred of these meteors ten were brighter than a first magnitude star, and two or three of them were brighter than Sirius. Fifteen out of each hundred were between the first and second magnitudes, and twenty-five were between the second and third magnitudes, while the remainder were smaller.

Some important facts with regard to ancient shooting-star showers have survived the thousand and one casualties to which historical records are exposed. A careful discussion of those which are sufficiently accurate to be intelligible discloses to us the startling fact that in general every thirty-three years a grand shooting-star shower has rained down on our earth. It sometimes happens that two consecutive years are rendered memorable by great showers. At present[278] the day of the year on which this particular shower is wont to appear is about the 13th November; but in earlier ages we find the date to shift slowly toward the commencement of the year. Thus the display which took place in A. D. 1698 was on the 9th of November; while, looking back still further to one of the very earliest records, viz., that of the year 934, we find the date has receded to October 14th. This change of the day on which the shower occurs is of profound theoretical importance in connection with the discovery of the orbit which these meteors pursue. The advance of the date is, however, so slow that for the past few generations, as well as for the next, we may sufficiently define this particular shower by the meteors which enliven the skies between the 12th and the 14th of November. In fact, the poetaster has parodied the well-known lines for the days of the month by a similar effort, which will serve to remind us also of another periodic shower of shooting stars which occurs in August. He writes: “If you November’s stars would see, From twelfth to fourteenth watching be. In August too stars shine from heaven, On nights between nine and eleven.”

These lines are intended to imply that the days named will usually bring, in every November, a few meteors at all events belonging to the grand shower. These are stragglers, as it were, from the mighty host which visits us three times in the century.

Astronomers have a special name for this group of November meteors. They are called the “Leonids.” To explain why this name has been given, and why it[279] is appropriate, we must dwell on an important part of the phenomena of the shower. Star map of Leo region Fig. 23.—Position of Leo, Source of the Leonids

Among the constellations there is a fine sickle-shaped group, forming a part of Leo, one of the signs of the Zodiac. That part of the sky defined by Leo is curiously related to the meteors of the 12th to the[280] 14th of November. Every shooting star truly belonging to that great shower pursued a track across the heavens, the direction of which, if carried back far enough, was always found to pierce through the sickle of Leo. Indeed, the paths of all the meteors formed a set of rays spreading away from that one point in the constellation. An invariable characteristic of this particular shower is its connection with the constellation of Leo, hence the appropriateness of the name of Leonids.

It must be borne in mind that we can never see the meteors until the fatal moment when they dive into our atmosphere. We could, indeed, at any time point our telescope to the spot in the heavens where we know the great shoal must certainly be located. But the mightiest telescope in the world does not disclose the shoal to us. In fact, we would never have seen these Leonids at all, we would never have become conscious that such a shoal of meteors existed, had it not been for a certain circumstance, which, for want of a better expression, I must speak of as accidental.

Our globe pursues a certain definite track around the sun. Year after year, with undeviating regularity, the earth performs the stages of its journey. If it reaches certain points on the 1st of January and the 12th of October in one year, then it reaches the same points on the 1st of January and the 12th of October respectively on next year, or any other year.

The Leonids and the earth have each a certain track. It might of course have happened that one of these tracks lay quite outside or quite inside the[281] other. In the case of the Leonids, it has chanced that their orbit does intersect the orbit of the earth, and to this circumstance we are indebted for the glorious displays every thirty-three years.

There are many other periodic showers of shooting stars besides those notable Leonids. None of the other showers, however, possess the same importance as the Leonids, nor do they ever manifest celestial splendor comparable with that of those of the 13th of November. The Perseids, for example, which appear from the 9th to the 11th of August, are tolerably constant in their appearance, but have little spectacular interest. There is also another shower called the Andromedes, which occurs on the 27th of November. It has produced certain displays, one of the most remarkable of which took place in 1872. The meteors were excessively numerous on that occasion, but they were so short in their paths, and so insignificant as to brilliance, that the

spectacle, though of great scientific interest, could not be compared as to splendor with that of the Leonids in 1866.

There are also several other showers which appear with greater or less regularity. Each of these possesses two distinct characteristics by which its meteors can be identified. One of these characters is the date on which the shower appears. The other is the constellation or point on the heavens from which all the meteors appear to radiate. Thus when we speak of the Andromedes on the 27th of November, we express that the shower on the 27th November comes from the part of the heavens marked by the constellation of Andromeda.

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A striking discovery has been made which points to a curious connection between comets and shooting stars. It has been found that the track followed by a great shower of meteors is often identical with the track pursued by a comet. It is wholly beyond the province of mere chance that an orbit such as that of the Leonids should, both as to its size and its position in space, be likewise that of a comet, unless the comet and the meteor swarm were objects related to each other.

The great sun guides our world through its long annual journey. The mighty mass of the earth yields compliance to the potent sway of the ruler of our system. But the sun does not merely exercise a control over the vast planets which circulate around him. The supreme law of gravitation constrains the veriest mote that ever floated in a sunbeam, with the same unremitting care that it does the mightiest of planets. Thus it is that each little meteor is guided in its journeys for untold ages. Each of these little objects hurries along, deflected at every moment, to follow its beautifully curved path by the incessant attraction of the sun. At last, however, the fatal plunge is taken. The long wanderings of the meteor have come to an end and it vanishes in a streak of splendor.
COMETS.—Sir John Herschel

The extraordinary aspect of comets, their rapid and seemingly irregular motions, the unexpected manner in which they often burst upon us, and the imposing magnitudes which they occasionally[283] assume, have in all ages rendered them objects of astonishment, not unmixed with superstitious dread to the uninstructed, and an enigma to those most conversant with the wonders of creation and the operations of natural causes. Even now, that we have ceased to regard their movements as irregular, or as governed by other laws than those which retain the planets in their orbits, their intimate nature, and the offices they perform in the economy of our system, are as much unknown as ever. No distinct and satisfactory account has yet been rendered of those immensely voluminous appendages which they bear about with them, and which are known by the name of their tails (though improperly, since they often precede them in their motions), any more than of several other singularities which they present.

The number of comets which have been astronomically observed, or of which notices have been recorded in history, is very great, amounting to several hundreds, and when we consider that in the earlier ages of astronomy, and indeed in more recent times, before the invention of the telescope, only large and conspicuous ones were noticed; and that, since due attention has been paid to the subject, scarcely a year has passed without the observation of one or two of these bodies, and that sometimes two and even three have appeared at once; it will be easily supposed that their actual number must be at least many thousands. Multitudes, indeed, must escape all observation, by reason of their paths traversing only that part of the heavens which is above the horizon in the daytime. Comets so circumstanced[284] can only become visible by the rare coincidence of a total eclipse of the sun—a coincidence which happened, as related by Seneca, sixty-two years before Christ, when a large comet was actually observed very near the sun. Several, however, stand on record as having been bright enough to be seen with the naked eye in the daytime, even at noon and in bright sunshine. Such were the comets of 1402, 1532 and 1843, and that of 43 B. C. which appeared during the games celebrated by Augustus in honor of Venus shortly after the death of Cæsar, and which the flattery of poets declared to be the soul of that hero taking its place among the divinities.

Comets consist for the most part of a large and more or less splendid but ill-defined nebulous mass of light called the head, which is usually much brighter toward its centre, and offers the appearance of a vivid nucleus, like a star or planet. From the head, and in a direction opposite to that in which the sun is situated from the comet, appear to diverge two streams of light, which grow broader and more diffused at a distance from the head, and which most commonly close in and unite at a little distance behind it, but sometimes continue distinct for a great part of their course; producing an effect like that of the trains left by some bright meteors, or like the diverging fire of a sky-rocket (only without sparks or perceptible motion). This is the tail. This magnificent appendage attains occasionally an immense apparent length. Aristotle relates of the tail of the comet of 371 B. C., that it occupied a third of the[285] hemisphere, or 60°; that of A. D. 1618 is stated to have been attended by a train no less than 104° in length. The comet of 1680, the most celebrated of modern times, and on many accounts the most remarkable of all, with a head not exceeding in brightness a

star of the second magnitude, covered with its tail an extent of more than 70° of the heavens, or, as some accounts state, 90°; that of the comet of 1769 extended 97°, and that of the comet of 1843 was estimated at about 65° when longest.

The tail is, however, by no means an invariable appendage of comets. Many of the brightest have been observed to have short and feeble tails, and a few great comets have been entirely without them. Those of 1585 and 1763 offered no vestige of a tail; and Cassini describes the comets of 1665 and 1682 as being as round and as well defined as Jupiter. On the other hand, instances are not wanting of comets furnished with many tails or streams of diverging light. That of 1744 had no less than six, spread out like an immense fan, extending to a distance of nearly 30° in length. The small comet of 1823 had two, making an angle of about 160°, the brighter turned as usual from the sun, the fainter toward it, or nearly so. The tails of comets, too, are often somewhat curved, bending, in general, toward the region which the comet has left, as if moving somewhat more slowly, or as if resisted in their course.

The smaller comets, such as are visible only in telescopes, or with difficulty by the naked eye, and which are by far the most numerous, offer very frequently no appearance of a tail, and appear only[286] as round or somewhat oval vaporous masses, more dense toward the centre, where, however, they appear to have no distinct nucleus, or anything which seems entitled to be considered as a solid body. This was shown in a very remarkable manner in the case of the comet discovered by Miss Mitchell in 1847, which on the 5th of October in that year passed centrally over a star of the fifth magnitude: so centrally that with a magnifying power of 100 it was impossible to determine in which direction the extent of the nebulosity was greatest. The star's light seemed in no degree enfeebled; yet such a star would be completely obliterated by a moderate fog, extending only a few yards from the surface of the earth. And since it is an observed fact that even those larger comets which have presented the appearance of a nucleus have yet exhibited no phases, though we can not doubt that they shine by the reflected solar light, it follows that even these can only be regarded as great masses of thin vapor, susceptible of being penetrated through their whole substance by the sun-beams, and reflecting them alike from their interior parts and from their surfaces. Nor will any one regard this explanation as forced, or feel disposed to resort to a phosphorescent quality in the comet itself, to account for the phenomena in question, when we consider the enormous magnitude of the space thus illuminated, and the extremely small mass which there is ground to attribute to these bodies. It will then be evident that the most unsubstantial clouds which float in the highest regions of our atmosphere, and seem at sunset to be drenched in light, and to[287] glow throughout their whole depth as if in actual ignition, without any shadow or dark side, must be looked upon as dense and massive bodies compared with the filmy and all but spiritual texture of a comet. Accordingly, whenever powerful telescopes have been turned on these bodies, they have not failed to dispel the illusion which attributes solidity to that more condensed part of the head which appears to the naked eye as a nucleus; though it is true that in some a very minute stellar point has been seen, indicating the existence of something more substantial. Fig. 24.—Head of Comet

That the luminous part of a comet is something in the nature of a smoke, fog, or cloud, suspended in a transparent atmosphere, is evident from a fact which has been often noticed, viz., that the portion of the tail where it comes closest to and surrounds the head is yet separated from it by an interval less luminous, as if sustained and kept off from contact by a transparent stratum, as we often see one layer of clouds over another with a considerable clear space between. These, and most of the other facts observed in the history of comets, appear to indicate that the structure of a comet, as seen in section in the direction of its length, must be that of a hollow envelope, of a parabolic form, inclosing near its vertex the[288] nucleus and head, something as represented in the preceding figure. This would account for the apparent division of the tail into two principal lateral branches, the envelope being oblique to the line of sight at its borders, and therefore a greater depth of illuminated matter being there exposed to the eye. In all probability, however, they admit great varieties of structure, and among them may very possibly be bodies of widely different physical constitution, and there is no doubt that one and the same comet at different epochs undergoes great changes, both in the disposition of its materials and in their physical state.

We come now to speak of the motions of comets. These are apparently most irregular and capricious. Sometimes they remain in sight only for a few days, at others for many months; some move with extreme slowness, others with extraordinary velocity; while not infrequently the two extremes of apparent speed are exhibited by the same comet in different parts of its course. The comet of 1472 described an arc of the heavens of 40° of a great circle in a single day. Some pursue a direct, some a retrograde, and others a tortuous and very irregular course; nor do they confine themselves, like the planets, within any certain region of the heavens, but traverse indifferently every part. Their variations in apparent size, during the time they continue visible, are no less remarkable than those of their velocity; sometimes they make their first appearance as faint and slow-moving objects, with little or no tail; but by degrees accelerate, enlarge, and throw out from them this appendage,[289] which increases in length and brightness till (as always

happens in such cases) they approach the sun, and are lost in his beams. After a time they again emerge on the other side, receding from the sun with a velocity at first rapid, but gradually decaying. It is for the most part after thus passing the sun that they shine forth in all their splendor, and that their tails acquire their greatest length and development; thus indicating plainly the action of the sun's rays as the exciting cause of that extraordinary emanation. As they continue to recede from the sun, their motion diminishes and the tail dies away, or is absorbed into the head, which itself grows continually feebler, and is at length altogether lost sight of, in by far the greater number of cases never to be seen more.

Without the clew furnished by the theory of gravitation, the enigma of these seemingly irregular and capricious movements might have remained forever unresolved. But Newton, having demonstrated the possibility of any conic section whatever being described about the sun, by a body revolving under the dominion of that law, immediately perceived the applicability of the general proposition to the case of cometary orbits; and the great comet of 1680, one of the most remarkable on record, both for the immense length of its tail and for the excessive closeness of its approach to the sun (within one-sixth of the diameter of that luminary), afforded him an excellent opportunity for the trial of his theory. The success of the attempt was complete. From that time it became a received truth, that the motions of comets are[290] regulated by the same general laws as those of the planets. Drawing of comet orbit Fig. 25.—Orbit of Newton's Comet (1680)

Now calculations lead to the surprising fact, that the comets are by far the most voluminous bodies in our system. The following are the dimensions of some of those which have been made the subjects of such inquiry.

The tail of the great comet of 1680, immediately after its perihelion passage, was found by Newton to have been no less than 20,000,000 of leagues in length, and to have occupied only two days in its emission from the comet's body! a decisive proof[291] this of its being darted forth by some active force, the origin of which, to judge from the direction of the tail, must be sought in the sun itself. Its greatest length amounted to 41,000,000 leagues, a length much exceeding the whole interval between the sun and earth. The tail of the comet of 1769 extended 16,000,000 leagues, and that of the great comet of 1811, 36,000,000. The portion of the head of this last, comprised within the transparent atmospheric envelope which separated it from the tail, was 180,000 leagues in diameter. It is hardly conceivable that matter once projected to such enormous distances should ever be collected again by the feeble attraction of such a body as a comet—a consideration which accounts for the surmised progressive diminution of the tails of such as have been frequently observed.

The most remarkable of those comets which have been ascertained to move in elliptic orbits is that of Halley, so called from the celebrated Edmund Halley, who, on calculating its elements from its perihelion passage in 1682, when it appeared in great splendor, with a tail 30° in length, was led to conclude its identity with the great comets of 1531 and 1607, whose elements he had also ascertained. The intervals of these successive apparitions being 75 and 76 years, Halley was encouraged to predict its reappearance about the year 1759. So remarkable a prediction could not fail to attract the attention of all astronomers, and, as the time approached, it became extremely interesting to know whether the attractions of the larger planets might not materially[292] interfere with its orbital motion. The computation of their influence from the Newtonian law of gravity, a most difficult and intricate piece of calculation, was undertaken and accomplished by Clairaut, who found that the action of Saturn would retard its return by 100 days, and that of Jupiter by no less than 518, making in all 618 days, by which the expected return would happen later than on the supposition of its retaining an unaltered period—and that, in short, the time of the expected perihelion passage would take place within a month, one way or other, of the middle of April, 1759. It actually happened on the 12th of March in that year. Its next return was calculated by several eminent geometers, and fixed successively for the 4th, the 7th, the 11th, and the 26th of November, 1835; the two latter determinations appearing entitled to the higher degree of confidence, owing partly to the more complete discussion bestowed on the observations of 1682 and 1759, and partly to the continually improving state of our knowledge of the methods of estimating the disturbing effect of the several planets. The last of these predictions, that of M. Lehmann, was published on the 25th of July. On the 5th of August the comet first became visible in the clear atmosphere of Rome as an exceedingly faint telescopic nebula, within a degree of its place as predicted by M. Rosenberger for that day. On or about the 20th of August it became generally visible, and, pursuing very nearly its calculated path among the stars, passed its perihelion on the 16th of November; after which, its course carrying it south, it ceased to be[293] visible in Europe, though it continued to be conspicuously so in the Southern Hemisphere throughout February, March, and April, 1836, disappearing finally on the 5th of May. Drawing of conic paths Fig. 26.—Forms of Cometary Orbits

Its first appearance, while yet very remote from the sun, was that of a small round or somewhat oval nebula, quite destitute of tail, and having a minute point of more concentrated light eccentrically situated within it. It was not before the 2d of October that the tail began to be developed, and thenceforward[294] increased pretty rapidly, being already 4° or 5° long on the 5th. It attained its

greatest apparent length (about 20°) on the 15th of October. From that time, though not yet arrived at its perihelion, it decreased with such rapidity that already on the 29th it was only 3°, and on November the 5th 2½° in length. There is every reason to believe that before the perihelion, the tail had altogether disappeared, as, though it continued to be observed at Pulkowa up to the very day of its perihelion passage, no mention whatever is made of any tail being then seen.

Reflecting on these phenomena, and carefully considering the evidence afforded by the numerous and elaborately executed drawings which have been placed on record by observers, it seems impossible to avoid the following conclusions: 1st. That the matter of the nucleus of a comet is powerfully excited and dilated into a vaporous state by the action of the sun's rays, escaping in streams and jets at those points of its surface which oppose the least resistance, and in all probability throwing that surface or the nucleus itself into irregular motions by its reaction in the act of so escaping, and thus altering its direction.

2. That this process chiefly takes place in that portion of the nucleus which is turned toward the sun; the vapor escaping chiefly in that direction.

3. That when so emitted, it is prevented from proceeding in the direction originally impressed upon it by some force directed from the sun, drifting it back and carrying it out to vast distances behind the nucleus, forming the tail or so much of the tail as[295] can be considered as consisting of material substance.

4th. That this force, whatever its nature, acts unequally on the materials of the comet, the greater portion remaining unvaporized, and a considerable part of the vapor actually produced remaining in its neighborhood, forming the head and coma.

5th. That the force thus acting on the materials of the tail can not possibly be identical with the ordinary gravitation of matter, being centrifugal or repulsive, as respects the sun, and of an energy very far exceeding the gravitating force toward that luminary. This will be evident if we consider the enormous velocity with which the matter of the tail is carried backward, in opposition both to the motion which it had as part of the nucleus and to that which it acquired in the act of its emission, both which motions have to be destroyed in the first instance, before any movement in the contrary direction can be impressed.

6th. That unless the matter of the tail thus repelled from the sun be retained by a peculiar and highly energetic attraction to the nucleus, differing from and exceptional to the ordinary power of gravitation, it must leave the nucleus altogether; being in effect carried far beyond the coercive power of so feeble a gravitating force as would correspond to the minute mass of the nucleus; and it is therefore very conceivable that a comet may lose, at every approach to the sun, a portion of that peculiar matter, whatever it be, on which the production of its tail depends, the remainder being of course less excitable[296] by the solar action, and more impassive to his rays, and therefore, pro tanto, more nearly approximating to the nature of the planetary bodies.

7th. That, considering the immense distances to which at least some portion of the matter of the tail is carried from the comet, and the way in which it is dispersed through the system, it is quite inconceivable that the whole of that matter should be reabsorbed—that therefore it must lose during its perihelion passage some portion of its matter, and if, as would seem far from improbable, that matter should be of a nature to be repelled from, not attracted by, the sun, the remainder will, by consequence, be, pro quantitate inertiæ, more energetically attracted to the sun than the mean of both. If then the orbit be elliptic, it will perform each successive revolution in a shorter time than the preceding, until, at length, the whole of the repulsive matter is got rid of. Drawing of the orbit Fig. 27.—Halley's Comet

Besides the comet of Halley, several other of the great comets recorded in history have been surmised with more or less probability to return periodically, and therefore to move in elongated ellipses around the sun. Such is the great comet of 1680, whose period is estimated at 575 years, and which has been considered, with at least a high prima facie probability, to be identical with a magnificent comet observed at Constantinople and in Palestine, and referred by contemporary historians, both European and Chinese, to the year A. D. 1106; with that of A. D. 531, which was seen at noonday close to the sun; with the comet of 43 B. C., already spoken of as having appeared[297] after the death of Cæsar, and which was also observed in the daytime; and finally with two other comets, mention of which occurs in the Sibylline Oracles, and in a passage of Homer, and which are referred, as well as the obscurity of chronology and the indications themselves will allow, to the years 618 and 1194 B. C. It is to the assumed near approach of this comet to the earth, about the time of[298] the Deluge, that Whiston ascribed that overwhelming tide-wave to whose agency his wild fancy ascribed that great catastrophe—a speculation, it is needless to remark, purely visionary. These coincidences of time are certainly remarkable, especially when it is considered how very rare are the appearances of comets of this class. Professor Encke, however, has discussed, with all possible care, the observations recorded of the comet of 1680, taking into consideration the perturbations of the planets (which are of trifling importance, by reason of the great inclination of its orbit to the

ecliptic), and his calculations show that no elliptic orbit, with such a period as 575 years, is competent to represent them within any probable or even possible limits of error, the most probable period assigned by them being 8814 Julian years. Independent of this consideration, there are circumstances recorded of the comet of A. D. 1106 incompatible with its motion in any orbit identical with that of the comet of 1680, so that the idea of referring all these phenomena to one and the same comet, however seducing, must be relinquished.

Another great comet, whose return about the year 1848 had been considered by more than one eminent authority in this department of astronomy highly probable, is that of 1556, to the terror of whose aspect some historians have attributed the abdication of the Emperor Charles V. This comet is supposed to be identical with that of 1264, mentioned by many historians as a great comet, and observed also in China.

In 1661, 1532, 1402, 1145, 891, and 243 great comets appeared—that of 1402 being bright enough to[299] be seen at noonday. A period of 129 years would conciliate all these appearances, and should have brought back the comet in 1789 or 1790 (other circumstances agreeing). That no such comet was observed about that time is no proof that it did not return, since, owing to the situation of its orbit, had the perihelion passage taken place in July it might have escaped observation.

We come now, however, to a class of comets of short period, respecting whose return there is no doubt, inasmuch as two at least of them have been identified as having performed successive revolutions round the sun; have had their return predicted already several times; and have on each occasion scrupulously kept to their appointments. The first of these is the comet of Encke, so called from Professor Encke of Berlin, who first ascertained its periodical return. It revolves in an ellipse of great eccentricity (though not comparable to that of Halley's), the plane of which is inclined at an angle of about 13° 22′ to the plane of the ecliptic, and in the short period of 1,211 days, or about 3■ years. This remarkable discovery was made on the occasion of its fourth recorded appearance, in 1819. From the ellipse then calculated by Encke, its return in 1822 was predicted by him, and observed at Paramata, in New South Wales, by M. Rümker, being invisible in Europe: since which it has been repredicted and reobserved in all the principal observatories, both in the Northern and Southern Hemispheres, as a phenomenon of regular occurrence.

Another comet of short period is that of Biela,[300] so called from M. Biela of Josephstadt, who first arrived at this interesting conclusion on the occasion of its appearance in 1826. It is considered to be identical with comets which appeared in 1772, 1805, etc., and describes its very eccentric ellipse about the sun in 2,410 days, or about 6¾ years; and in a plane inclined 12° 34′ to the ecliptic. It appeared again, according to the prediction, in 1832 and in 1846.

This comet is small and hardly visible to the naked eye, even when brightest. Nevertheless, as if to make up for its seeming insignificance by the interest attaching to it in a physical point of view, it exhibited, at its appearance in 1846, a phenomenon which struck every astronomer with amazement, as a thing without previous example in the history of our system. It was actually seen to separate itself into two distinct comets, which, after thus parting company, continued to journey along amicably through an arc of upward of 70° of their apparent orbit, keeping all the while within the same field of view of the telescope pointed toward them. The first indication of something unusual being about to take place might be, perhaps, referred to the 19th of December, 1845, when the comet appeared to Mr. Hind pear-shaped, the nebulosity being unduly elongated in a direction inclining northward. But on the 13th of January, at Washington, in America, and on the 15th and subsequently in every part of Europe, it was distinctly seen to have become double; a very small and faint cometic body, having a nucleus of its own, being observed appended to it, at a distance of about 2′ (in arc) from its centre, and[301] in a direction forming an angle of about 328° with the meridian, running northward from the principal or original comet. From this time the separation of the two comets went on progressively, though slowly. On the 30th of January the apparent distance of the nucleus had increased to 3′, on the 7th of February to 4′, and on the 13th to 5′, and so on, until on the 5th of March the two comets were separated by an interval of 9′ 19″, the apparent direction of the line of junction all the while varying but little with respect to the parallel.

During this separation, very remarkable changes were observed to be going on, both in the original comet and its companion. Both had nuclei, both had short tails, parallel in direction and nearly perpendicular to the line of junction; but whereas at its first observation, on January 13th, the new comet was extremely small and faint in comparison with the old, the difference both in point of light and apparent magnitude diminished. On the 10th of February they were nearly equal, although the day before the moonlight had effaced the new one, leaving the other bright enough to be well observed. On the 14th and 16th, however, the new comet had gained a decided superiority of light over the old, presenting at the same time a sharp and star-like nucleus, compared by Lieutenant Maury to a diamond spark. But this state of things was not to continue. Already, on the 18th, the old comet had regained its superiority, being nearly twice as bright as its companion, and offering an unusually bright and star-like nucleus. From this period

the new companion began to fade[302] away, but continued visible up to the 15th of March. On the 24th the comet appeared again single, and on the 22d of April both had disappeared.

While this singular interchange of light was going forward, indications of some sort of communication between the comets were exhibited. The new or companion comet, besides its tail, extending in a direction parallel to that of the other, threw out a faint arc light which extended as a kind of bridge from the one to the other; and after the restoration of the original comet to its former pre-eminence, it, on its part, threw forth additional rays, so as to present the appearance of a comet with three faint tails forming angles of about 120° with each other, one of which extended toward its companion.

On the 22d of August, 1844, Signor de Vico, director of the observatory of the Collegio Romano, discovered a comet, the motions of which, a very few observations sufficed to show, deviated remarkably from a parabolic orbit. It passed its perihelion on the 2d of September, and continued to be observed until the 7th of December. Elliptic elements of this comet, agreeing remarkably well with each other, were accordingly calculated by several astronomers, from which it appears that the period of revolution is about 1,990 days, or 5½ (5.4357) years, which (supposing its orbit undisturbed in the interim) would bring it back to the perihelion on or about the 13th of January, 1850, on which occasion, however, by reason of its unfavorable situation with respect to the sun and earth, it could not be observed.

This comet, when brightest, was visible to the[303] naked eye, and had a small tail. It is especially interesting to astronomers from the circumstance of its having been rendered exceedingly probable by the researches of M. Leverrier, that it is identical with one which appeared in 1678, with some of its elements considerably changed by perturbation. This comet is further remarkable from having been concluded, by Messrs. Laugier and Mauvais, to be identical with the comet of 1585 observed by Tycho Brahe, and possibly also with those of 1743, 1766, and 1819.

By far the most remarkable comet, however, which has been seen during the present century, is that which appeared in the spring of 1843, and whose tail became visible in the twilight of the 17th of March in England as a great beam of nebulous light, extending from a point above the western horizon, through the stars of Eridanus and Lepus, under the belt of Orion. This situation was low and unfavorable; and it was not till the 19th that the head was seen, and then only as a faint and ill-defined nebula, very rapidly fading on subsequent nights. In more southern latitudes, however, not only the tail was seen, as a magnificent train of light extending 50° or 60° in length; but the head and nucleus appeared with extraordinary splendor, exciting in every country where it was seen the greatest astonishment and admiration. Indeed, all descriptions agree in representing it as a stupendous spectacle, such as in superstitious ages would not fail to have carried terror into every bosom. In tropical latitudes in the Northern Hemisphere, the tail appeared on the 3d of[304] March, and in Van Diemen's Land so early as the 1st, the comet having passed its perihelion on the 27th of February.

There is abundant evidence of the comet in question having been seen in full daylight, and in the sun's immediate vicinity. It was so seen on the 28th of February, the day after its perihelion passage, by every person on board the H.E.I.C.S. "Owen Glenndower," then off the Cape, as a short dagger-like object close to the sun a little before sunset. On the same day at 3h 6m P. M., and consequently in full sunshine, the distance of the nucleus from the sun was actually measured with a sextant by Mr. Clarke of Portland, United States, the distance centre from centre being then only 3° 50′ 43″. Drawing of orbits Fig. 28.—Orbits of the Nine Comets Captured by Jupiter Scale: 5 millimetres = 1 radius of the Earth's orbit

It is by no means merely as a subject of antiquarian interest, or on account of the brilliant spectacle which comets occasionally afford, that astronomers attach a high degree of importance to all that regards them. Apart even from the singularity and mystery which appertains to their physical constitution, they have become, through the medium of exact calculation, unexpected instruments of inquiry into points connected with the planetary system itself, of no small importance. We have seen that the movements of the comet Encke, thus minutely and perseveringly traced by the eminent astronomer whose name is used to distinguish it, have afforded ground for believing in the presence of a resisting medium filling the whole of our system. Similar inquiries, prosecuted in the cases of other periodical comets, will extend, confirm, or modify our conclusions[305] on this head. The perturbations, too, which comets experience in passing near any of the planets, may afford, and have afforded, information as to the magnitude of the disturbing masses, which could not well be otherwise obtained. Thus the approach of this comet to the planet Mercury in 1838 afforded an estimation of the mass of that planet the more precious, by reason of the great uncertainty under which all previous determinations of that element labored. Its approach to the same planet in the[306] year 1848 was still nearer. On the 22d of November their mutual distance was only fifteen times the moon's distance from the earth.

It is, however, in a physical point of view that these bodies offer the greatest stimulus to our curiosity. There is, beyond question, some profound secret and mystery of nature concerned in the phenomenon of their tails. Perhaps it is not too much to hope that future observation, borrowing every aid from rational speculation, grounded on the progress of physical science generally (especially those branches of it which relate to the ethereal or imponderable elements), may ere long enable us to penetrate this mystery, and to declare whether it is really matter in the ordinary acceptation of the term which is projected from their heads with such extravagant velocity, and if not impelled, at least directed, in its course by a reference to the sun, as its point of avoidance. In no respect is the question as to the materiality of the tail more forcibly pressed on us for consideration than in that of the enormous sweep which it makes round the sun in perihelio, in the manner of a straight and rigid rod, in defiance of the law of gravitation, nay, even of the received laws of motion, extending (as we have seen in the comets of 1680 and 1843) from near the sun's surface to the earth's orbit, yet whirled round unbroken: in the latter case through an angle of 180° in little more than two hours. It seems utterly incredible that in such a case it is one and the same material object which is thus brandished. If there could be conceived such a thing as a negative shadow, a momentary impression[307] made upon the luminiferous ether behind the comet, this would represent in some degree the conception such a phenomenon irresistibly calls up. But this is not all. Even such an extraordinary excitement of the ether, conceive it as we will, will afford no account of the projection of lateral streamers; of the effusion of light from the nucleus of a comet toward the sun; and its subsequent rejection; of the irregular and capricious mode in which that effusion has been seen to take place; none of the clear indications of alternate evaporation and condensation going on in the immense regions of space occupied by the tail and coma—none, in short, of innumerable other facts which link themselves with almost equally irresistible cogency to our ordinary notions of matter and force. LIFE IN OTHER WORLDS.—J. E. Gore

The question is often asked, Are the stars inhabited? To this we can confidently answer, No. The stars themselves are certainly not habitable by any forms of life with which we are familiar. That the stars are luminous incandescent bodies, similar to the sun, seems almost self-evident. That they shine by their own inherent light, and not by light reflected from another body, like the planets of the Solar System, is a fact which scarcely needs demonstration. There are no bright objects near them from which they could derive their light, and they are too far from the sun to obtain any illumination[308] from that source. But if any proofs were necessary, we have the evidence of the spectroscope, which shows unmistakably that their light emanates from incandescent bodies. Many of the stars show spectra very similar to that of the sun. The light of others, although differing somewhat in quality when analyzed by the prism, indicates clearly that they are at a very high temperature—in many cases, indeed, suggesting that they are actually hotter than the sun. It may be objected, however, that in the case of binary or revolving double stars, the smaller component may possibly shine by light reflected from the brighter star. Indeed, this has been suggested in the case of Sirius and its faint companion. But, if the companion of Sirius shone merely by reflected light from its primary, it would be much fainter than it is, and, indeed, would be utterly invisible in our largest telescopes. Further, in some double stars, spectroscopic observations suggest that the component stars have different spectra. This is, of course, conclusive evidence against the hypothesis of borrowed light; for were the smaller star to shine by reflected light from the larger, the spectra of both would be identical, as in the case of the sun and moon. We may therefore conclude that all the visible stars are suns, and totally unfit for the habitation of living creatures.

But may not the stars have planets revolving round them, forming solar systems similar to our own? As they are evidently suns shining by inherent light, may they not form centres of planetary systems? In the case of those stars having spectra differing from[309] the solar spectrum, we can not speak with any confidence; but for those which show spectra similar to that of our sun, and having, therefore, probably a similar chemical constitution, the existence of planets revolving round them seems from analogy very probable. I refer to single stars, that is stars which have no telescopic close companion; for the double stars may, perhaps, form systems differently constituted. In any case these binary systems would not be strictly comparable with ours, for the sun is certainly a single star.

Whether systems of planets really revolve round the stars referred to, is a question which, unfortunately, can not be decided by observation. If a planet equal in size to the "giant planet," Jupiter, were revolving round the nearest star—Alpha Centauri—at the same distance from that star that Jupiter is from the sun, it would be utterly invisible in our largest telescopes. The invisibility of planets circling round the stars is therefore no proof whatever of their non-existence. Each star of the solar type may possibly be attended by a retinue of planets which may, perhaps, remain forever invisible in the largest telescopes which man can construct. We can, therefore, draw our conclusions only from analogy. If other suns exist resembling our own sun in chemical constitution, which we know to be a fact, is it not reasonable to suppose that they also form centres of planetary systems similar to the Solar System? "Consult with reason, reason will reply, Each lucid point which glows in yonder sky, Informs a system in the boundless space, And fills with glory its appointed place; [310] With beams unborrowed brighten other skies, And worlds to the unknown with heat and light supplies."

The suns, which we call stars, were clearly not created for our benefit. They are of very little practical use to the earth's inhabitants. They give us very little light; an additional small satellite—one considerably smaller than the moon—would have been much more useful in this respect than the millions of suns revealed by the telescope. They must, therefore, have been formed for some other purpose.

On Laplace's Nebular Hypothesis, the condensation of an original nebulous mass endowed with a motion of rotation would result not only in the formation of a sun, similar to ours, but also in a system of planets revolving round the central body. If, indeed, the primitive nebula had no rotation or motions of any kind, the result would be a sun without planets or satellites; but the motions with which all the stars seem to be animated lead us to suppose that this would be a case of very rare occurrence. We may therefore conclude, with a high degree of probability, that the stars—at least those with spectra of the solar type—form centres of planetary systems somewhat similar to our own.

This being surmised, let us consider the conditions necessary for the existence of life on these planets. There are various conditions which must be complied with before we can imagine life, as we know it, to be possible on any planet. Perhaps the most important of these is the question of temperature. We know that in the universe a great range of temperature[311] exists, from the cold of interstellar space—estimated at about 460° below the freezing-point of water—to the intense heat which rages in the solar photosphere. In this long thermal scale life is, at least on the earth, restricted within rather narrow limits. Below a certain low temperature life can not exist. The point is, however, far above the temperature of space. On the other hand, above a certain high temperature—a low one, however, compared with the intense heat of the solar surface—life is also impossible, at least for highly organized beings like man and the larger animals. For minute microscopic organisms the scale may, perhaps, be somewhat extended; but even in its widest limits, the range of temperature within which life is possible is, so far as we know, certainly a narrow one.

For the support of life and vegetation, light is also necessary, for without it no flowers would bloom, nor corn grow and ripen to maturity. To obtain this supply of light and heat it is necessary that a life-bearing planet should revolve at a suitable distance from, and in a nearly circular orbit round, a central sun. These conditions, it is hardly necessary to say, are fulfilled in the case of the earth. Were we much nearer to the sun than we are, we should suffer from excessive heat, and were we much further away, we should probably perish from the cold. For this reason the existence of life on the other planets of the Solar System seems very doubtful. Mercury is probably too hot, and the other planets are certainly too cold, so far as heat from[312] the sun is concerned, unless, indeed, their internal heat is sufficient to raise the temperature of their surface to a point sufficient for the maintenance of life. Indeed, there is good reason to suppose that in the planets Jupiter, Saturn, Uranus, and Neptune, this internal heat is still so great that life would be quite impossible on their surface. Venus, inside the earth's orbit, and Mars, outside, are the two planets which seem to approach nearest to the required conditions. We know that both these planets possess atmospheres somewhat similar to ours, and, in Mars at least, land and water most probably exist on its surface. Venus is, of course, much hotter than the earth, and Mars much colder, but possibly the polar regions of Venus and the equatorial regions of Mars may form suitable abodes for some forms, at least, of animal and vegetable life.

Let us proceed, however, to consider some other conditions necessary for the existence of life on a planet. A suitable temperature is, of course, indispensable, but this is not all. There are other conditions which must be complied with. The planet must have a rotation on its axis, so that every portion shall in turn receive its due share of light and heat. Each point on its surface must have its day and night, the day for work and the night for rest. The axis of rotation must not lie in the plane of the planet's orbit, but must have a suitable inclination, so that each hemisphere may enjoy its seasons, summer and winter, "seed-time and harvest," in due course. Further the velocity of rotation on its axis must not be too rapid. If the earth rotated in a period of one[313] and a quarter hours, bodies at the equator would have no weight, and life would be impossible in those regions.

The planet must also possess a mass sufficient to retain bodies on its surface by the force of gravity. In the case of very small bodies, such as the moons of Mars and some of the minor planets between Mars and Jupiter, objects thrown into the air would pass away into space never to return.

The planet should also have a mean density greater than that of water, otherwise the seas would possess no stability, and destructive waves would quickly destroy all life on its surface. All these conditions are fulfilled in the case of Mars as well as on the earth. In the planet Saturn, however, the density is less than that of water, and in Uranus and Neptune only slightly greater.

The planet must also possess a suitable atmosphere. This is an all-important condition for the support of animal life—at least for the existence of man and the higher orders of animals. This atmosphere must consist—so far as we know—of oxygen and nitrogen gases mechanically mixed in proper proportions, and with a small quantity of carbonic acid gas. Were the oxygen in smaller quantity than it exists in the earth's atmosphere, life could not be supported. On the other hand, were it much in excess of its present amount, a fever would be produced in the blood which would very soon put an end to animal life. The presence of other gases in excessive quantities would also render the air unfit for breathing. We see, therefore, that a comparatively slight[314] change in the composition of a planet's atmosphere would—so far as our experience goes—render the planet uninhabitable by any of the higher forms of life with which we are familiar.

For the support of life on a planet, water is also absolutely necessary. Without this useful fluid the world would soon become a desert, and life and vegetation would speedily vanish from its surface.

Geological conditions must also be considered. It is clearly necessary for the welfare of human beings at least that the surface soil and rocks should contain coal, iron, lime, and other minerals, substances almost indispensable for the ordinary wants of civilized existence. Drawings of a Martian region Nine Views of the Hour-Glass Sea on Mars 1, Nov. 26, 1864; 2, June 29, 1873; 3, Oct. 28, 1879; 4, June 2, 1888; 5, June 20, 1890; 6, Aug. 6, 1892; 7, Oct., 1894; 8, Dec. 3, 1896; 9, Dec. 7, 1896

That all or any of the conditions considered would be complied with in the case of a planet revolving round a star it is, of course, impossible to say. But when we find stars showing by their spectra that they contain chemical elements identical with those which exist in the sun and the earth, analogy would lead us to suppose that very possibly a planet resembling our earth may revolve round each of these distant suns. I say a planet, for evidently there would be only one distance from the central luminary—a distance depending on its size—at which the temperature necessary for the support of life would exist, as in the case of the earth, over the whole of the planet's surface. For other planets of the stellar system, life would be, if it existed at all, most probably confined to restricted regions of the planet's surface. There would, therefore, be in each system one planet, and only one,[315] especially suitable for the support of animal life as we know it. This is with reference to light and heat. If the other conditions were not complied with, then life would probably not exist even on this one planet. In the case of a star larger than the sun, the planet should be placed at a greater distance than the earth is from the sun, but in this case the length of the year and the seasons would be longer than ours.

The star which more nearly resembles the sun in the character of the light which it emits is the bright star Capella. Arcturus has a somewhat similar spectrum. But these are probably suns of enormous size, if any reliance can be placed on the measures of their distance from the earth. Other bright stars with spectra of the solar type are Pollux, Aldebaran, Beta Andromedæ, Alpha Arietis, Alpha Cassiopeiæ, Alpha Cygni, and Alpha Ursæ Majoris. Another star is Eta Herculis. The magnitude of this star as measured with the photometer is about 3½. A parallax found by Bélopolsky and Wagner places it at a distance of 515,660 times the sun's distance from the earth. If the sun were placed at this distance, I find that it would be reduced to a star of the third magnitude. This result would imply that Eta Herculis is a slightly smaller sun than ours; and a planet placed a little nearer to the star than the earth is to the sun might, perhaps, fulfil the conditions of a life-bearing world.

The number of stars visible in our largest telescopes is usually estimated at 100,000,000. Of these we may perhaps assume that 10,000,000 have a spectrum of the solar type, and therefore closely resemble[316] our sun in their chemical constitution. If we suppose that only one in ten of these is similar in size to the sun, and has a habitable planet revolving round it, we have a total of 1,000,000 worlds in the visible universe fitted for the support of animal life.

We may therefore conclude, with a high degree of probability, that among the "multitudinous" stellar hosts there are probably many stars having life-bearing planets revolving round them. THE SUN—WHAT WE LEARN FROM IT.—Richard A. Proctor

The Sun, the central and ruling body of the planetary system, and the source of light and heat to our earth and all the members of that system, is a globe about 852,900 miles in diameter. So far as observation extends, his figure is perfectly spherical, no difference having been observed between his polar and spherical diameters. It has been well remarked, indeed, by Sir G. Airy, that if any observer could by ordinary modes of measurement satisfy himself that a real difference existed between the diameters, that observer would have proved the inexactness of his own work; for the absence of any measurable compression comes out as the result of comparisons between thousands of observations of the sun's limbs made at Greenwich and other leading observatories. The volume of the sun exceeds the earth's 1,252,700 times. His mean density is almost exactly one-fourth of the earth's, and his mass exceeds hers about 316,000 times. Gravity at the[317] surface of the sun exceeds terrestrial gravity about 27.1 times, so that

a body dropped from rest near the sun's surface would fall through 436 feet in the first second, and have acquired a velocity of 872 feet per second.

Let the reader consider a terrestrial globe three inches in diameter, and search out on that globe the tiny triangular speck which represents Great Britain. Then let him endeavor to picture the town in which he lives as represented by the minutest pin-mark that could possibly be made upon this speck. He will then have formed some conception, though but an inadequate one, of the enormous dimensions of the earth's globe, compared with the scene in which his daily life is cast. Now, on the same scale, the sun would be represented by a globe about twice the height of an ordinary sitting-room. A room about twenty-six feet in length, and height, and breadth, would be required to contain the representation of the sun's globe on this scale, while the globe representing the earth could be placed in a moderately large goblet.

Such is the body which sways the motions of the Solar System. The largest of his family, the giant Jupiter, though of dimensions which dwarf those of the earth or Venus almost to nothingness, would yet only be represented by a thirty-two inch globe, on the scale which gives to the sun the enormous volume I have spoken of. Saturn would have a diameter of about twenty-eight inches, his ring measuring about five feet in its extreme span. Uranus and Neptune would be little more than a foot in diameter,[318] and all the minor planets would be less than the three-inch earth. It will thus be seen that the sun is a worthy centre of the great scheme he sways, even when we merely regard his dimensions. Drawing of a sun spot Fig. 29.—Sun Spot seen in 1870

The sun outweighs fully seven hundred and forty times the combined mass of all the planets which circle around him, so that, when we regard the energy of his attraction, we still find him a worthy ruler of the planetary scheme.

Viewed with the naked eye, the sun appears only as a luminous mass of intense and uniform brightness; but when examined with the telescope, his surface is frequently observed to be mottled over with a number of dark spots, of irregular and ill-defined forms, constantly varying in appearance, situation,[319] and magnitude. These spots are occasionally of immense size, so as to be visible even without the aid of the telescope; and their number is frequently so great that they occupy a considerable portion of the sun's surface. Sir W. Herschel observed one in 1779 the diameter of which exceeded 50,000 miles, more than six times the diameter of the earth; and Scheiner affirms that he has seen no less than fifty on the sun's disk at once. Most of them have a deep black nucleus, surrounded by a fainter shade, or umbra, of which the inner part, nearest to the nucleus, is brighter than the exterior portion. The boundary between the nucleus and umbra is in general tolerably well defined; and beyond the umbra[320] a stripe of light appears more vivid than the rest of the sun. Drawing of a sun spot Fig. 30.—Phase of Spot

The discovery of the sun's spots has been attributed to Fabricius, Galileo, and Scheiner, and has been claimed for the English astronomer Harriot. Amid these conflicting pretensions it is perhaps impossible to arrive at the truth; but the matter is of little importance; the discovery is one which followed inevitably that of the telescope, and an accidental priority of observation can hardly be considered as establishing any claim to merit.

The study of solar physics may be said to have commenced with the discovery of the sun spots, about two hundred and sixty years ago. These spots were presently found to traverse the solar disk in such a way as to indicate that the sun turns upon an axis once in about twenty-six days. Nor will this rotation appear slow, when we remember that it implies a motion of the equatorial parts of the sun's surface at a rate exceeding some seventy times the motion of our swiftest express train.

Next came the discovery that the solar spots are not surface stains, but deep cavities in the solar substance. The changes of appearance presented by the spots as they traverse the solar disk led Dr. Wilson to form this theory so far back as 1779; but, strangely enough, it is only in comparatively recent times that the hypothesis has been finally established, since even within the last ten years a theory was put forward which accounted satisfactorily for most of the changes of appearance observed in the spots, by supposing them to be due to solar clouds[321] hanging suspended at a considerable elevation above the true photosphere.

Sir William Herschel, reasoning from terrestrial analogies, was led to look on the spot-cavities as apertures through a double layer of clouds. He argued that, were the solar photosphere of any other nature, it would be past comprehension that vast openings should form in it, to remain open for months before they close up again. Whether we consider the enormous rapidity with which the spots form and with which their figure changes, or the length of time that many of them remain visible, we find ourselves alike perplexed, unless we assume that the solar photosphere resembles a bed of clouds. Through a stratum of terrestrial clouds openings may be formed by atmospheric disturbances, but while undisturbed the clouds will retain any form once impressed upon them, for a length of time corresponding to the weeks and months during which the solar spots endure.

And because the solar spots present two distinct varieties of light, the faint penumbra and the dark umbra or nucleus, Herschel saw the necessity of assuming that there are two beds of clouds, the outer self-luminous and constituting the true solar photosphere, the inner reflecting the light received from the outer layer, and so shielding the real surface of the sun from the intense light and heat which it would otherwise receive.

But while recent discoveries have confirmed Sir William Herschel's theory about the solar cloud-envelopes, they have by no means given countenance[322] to his view that the body of the sun may possibly be cool. The darkness of the nucleus of a spot is found, on the contrary, to give proof that in that neighborhood the sun is hotter, because it parts less readily with its heat. We shall see presently how this is. Meantime let it be noticed, in passing, that a close scrutiny of large solar spots has revealed the existence of an intensely black spot in the midst of the umbra. This black spot must be regarded as the true nucleus.

The circumstance that the spots appear only on two bands of the sun's globe, corresponding to the sub-tropical zones on our own earth, led the younger Herschel to conclusions as important as those which his father had formed. He reasoned, like his father, from terrestrial analogies. On our own earth the sub-tropical zones are the regions where the great cyclonic storms have their birth, and rage with their chief fury. Here, therefore, we have the analogue of the solar spots, if only we can show reason for believing that any causes resembling those which generate the terrestrial cyclone operate upon those regions of the sun where the solar spots make their appearance.

We know that the cyclone is due to the excess of heat at the earth's equator. It is true that this excess of heat is always in operation, whereas cyclones are not perpetually raging in sub-tropical climates. Ordinarily, therefore, the excess of heat does not cause tornadoes. Certain aerial currents are generated whose uniform motion suffices, as a rule, to adjust the conditions which the excess of[323] heat at the equator would otherwise tend to disturb. But when through any cause the uniform action of the aerial currents is either interfered with or is insufficient to maintain equilibrium, then cyclonic or whirling motions are generated in the disturbed atmosphere, and propagated over a wide area of the earth's surface.

Now we recognize the reason of the excess of heat at the earth's equator in the fact that the sun shines more directly upon that part of the earth than on the zones which lie in higher latitudes. Can we find any reason for suspecting that the sun, which is not heated from without as the earth is, should exhibit a similar peculiarity? Sir John Herschel considers that we can. If the sun has an atmosphere extending to a considerable distance from his surface, then there can be little doubt that, owing to his rotation upon his axis, this atmosphere would assume the figure of an oblate spheroid, and would be deepest over the solar equator. Here, then, more of the sun's heat would be retained than at the poles, where the atmosphere is shallowest. Thus, that excess of heat at the solar equator which is necessary to complete the analogy between the sun spots and terrestrial cyclones seems satisfactorily established.

It must be remarked, however, that this reasoning, so far as the excess of heat at the sun's equator is concerned, only removes the difficulty a step. If there were indeed an increased depth of atmosphere over the sun's equator sufficing to retain the requisite excess of heat, then the amount of heat we receive[324] from the sun's equatorial regions ought to be appreciably less than the amount emitted from the remaining portions of the solar surface. This is not found to be the case, so that either there is no such excess of absorption, or else the solar equator gives out more heat, in other words, is essentially hotter, than the rest of the sun. But this is just the peculiarity of which we want the interpretation.

It may be taken for granted, however, that there is an analogy between the sun spots and terrestrial cyclonic storms, though as yet we are not very well able to understand its nature.

Then next we come to one of the most interesting discoveries ever made respecting the sun—the discovery that the spots increase and diminish in frequency in a periodic manner. We owe this discovery to the laborious and systematic observations made by Herr Schwabe of Dessau.

Schwabe found, in the course of about ten and a half years, the solar spots pass through a complete cycle of changes. They become gradually more and more numerous up to a certain maximum, and then as gradually diminish. At length the sun's face becomes not only clear of spots, but a certain well-marked darkening around the border of his disk disappears altogether for a brief season. At this time the sun presents a perfectly uniform disk. Then gradually the spots return, become more and more numerous, and so the cycle of changes is run through again.

The astronomers who have watched the sun from the Kew Observatory have found that the process of[325] change by which the spots sweep in a sort of “wave of increase” over the solar disk is marked by several minor variations. As the surface of a great sea wave will be traversed by small ripples, so the gradual increase and diminution in the number of the solar spots are characterized by minor gradations of change, which are sufficiently well marked to be distinctly cognizable. Heavenly bodies Fig. 31.—Ptolemaic System

There seems every reason for believing that the periodic changes thus noticed are due to the influence of the planets upon the solar photosphere, though in what way that influence is exerted is not at present perfectly clear. Some have thought that the mere attraction of the planets tends to produce tides of some sort in the solar envelopes. Then, since the height of a tide so produced varies as the cube or[326] third power of the distance, it has been thought that a planet when in perihelion would generate a much larger solar tide than when in aphelion. So that, as Jupiter has a period nearly equal to the sun-spot period, it has been supposed that the attractions of this planet are sufficient to account for the great spot period. Venus, Mercury, the Earth, and Saturn have, in a similar manner, been rendered accountable for the shorter and less distinctly marked periods.

Without denying that the planets may be, and probably are, the bodies to whose influence the solar-spot periods are to be ascribed, I yet venture to express very strong doubts whether the attraction of Jupiter is so much greater in perihelion than in aphelion as to account for the fact that, whereas at one season the face of the sun shows many spots, at another it is wholly free from them.[23]

However, we are not at present concerned so much with the explanation of facts as with the facts themselves. We have to consider rather what the sun is and what he does for the Solar System than why these things are so.

Let us note, before passing to other circumstances of interest connected with the sun, that the variable condition of his photosphere must cause him to change in brilliancy as seen from vast distances. If Herr Schwabe, for instance, instead of observing the[327] sun’s spots from his watch-tower at Dessau, could have removed himself to a distance so enormous that the sun’s disk would have been reduced, even in the most powerful telescope, to a mere point of light, there can be no doubt that the only effect which he would have been able to perceive would have been a gradual increase and diminution of brightness, having a period of about ten and a half years.

Our sun, therefore, viewed from the neighborhood of any of the stars, whence undoubtedly he would simply appear as one among many fixed stars, would be a “variable,” having a period of ten and a half years. And further, if an observer, viewing the sun from so enormous a distance, had the means of very accurately measuring its light, he would undoubtedly discover that, while the chief variation of the sun takes place in a period of ten and a half years, its light is subjected to minor variations having shorter periods.

The discovery that the periodic changes of the sun’s appearance are associated with the periodic changes in the character of the earth’s magnetism is the next that we have to consider.

It had long been noticed that, during the course of a single day, the magnetic needle exhibits a minute change of direction, taking place in an oscillatory manner. And, when the character of this vibration came to be carefully examined, it was found to correspond to a sort of effort on the needle’s part to turn toward the sun. For example, when the sun is on the magnetic meridian, the needle has its mean position. This happens twice in a day,[328] once when the sun is above the horizon and once when he is below it. Again, when the sun is midway between these two positions—which also happens twice in the day—the needle has its mean position, because the northern and the southern ends make equal efforts (so to speak) to direct themselves toward the sun. Four times in the day, then, the needle has its mean position, or is directed toward the magnetic meridian. But, when the sun is not in one of the four positions considered, that end of the needle which is nearest to him is slightly turned away from its mean position toward him. The change of position is very minute, and only the exact modes of observation made use of in the present age would have sufficed to reveal it. There it is, however, and this minute and seemingly unimportant peculiarity has been found to be full of meaning.

The minute vibrations of the magnetic needle, thus carefully watched—day after day, month after month, year after year—were found to exhibit a yet more minute oscillatory change. They waxed and waned within narrow limits of variation, but yet in a manner there was no mistaking. The period of this oscillatory change was not to be determined, however, by the observations of a few years. Between the time when the diurnal vibration was least until it had reached its greatest extent, and thence returned to its first value, no less than ten and a half years elapsed, and a much longer time passed before the periodic character of the change was satisfactorily determined.

The reader will at once see what these observations[329] tend to. The sun spots vary in frequency within a period of ten and a half years, and the magnetic diurnal vibrations vary within a period of the same duration. It might seem fanciful to associate the two periodic series of changes together, and doubtless when the idea first occurred to Lamont, it was not with any great expectation of finding it confirmed that he examined the evidence bearing on the point. Judging from known facts, we may see reasons for such an expectation in the correspondence of the needle's diurnal vibration with the sun's apparent motion, and the law which has been found to associate the annual variations of the magnet's power with the sun's distance. But undoubtedly when the idea occurred to Lamont it was an exceedingly bold one, and the ridicule with which the first announcement of the supposed law was received, even in scientific circles, suffices to show how unexpected that relation was which is now so thoroughly established. For a careful comparison between the two periods has demonstrated that they agree most perfectly, not merely in length, but maximum for maximum, and minimum for minimum. When the sun spots are most numerous, then the daily vibration of the magnet is most extensive, while, when the sun's face is clear of spots, the needle vibrates over its smallest diurnal arc.

Then the intensity of the magnetic action has been found to depend upon solar influences. The vibrations by which the needle indicates the progress of those strange disturbances of the terrestrial magnetism which are known as magnetic storms have[330] been found not merely to be most frequent when the sun's face is most spotted, but to occur simultaneously with the appearance of signs of disturbance in the solar photosphere. For instance, during the autumn of 1859, the eminent solar observer, Carrington, noticed the apparition of a bright spot upon the sun's surface. The light of this spot was so intense that he imagined the dark glass which protected his eye had been broken. By a fortunate coincidence, another observer, Mr. Hodgson, happened to be watching the sun at the same instant, and witnessed the same remarkable appearance. Now it was found that the self-registering magnetic instruments of the Kew Observatory had been sharply disturbed at the instant when the bright spot was seen. And afterward it was learned that the phenomena which indicate the progress of a magnetic storm had been observed in many places. Telegraphic communication was interrupted, and in some cases, telegraphic offices were set on fire; auroras appeared both in the Northern and Southern Hemisphere during the night which followed; and the whole frame of the earth seemed to thrill responsively to the disturbance which had affected the great central luminary of the Solar System. Heavenly bodies Fig. 32.—Copernican System: Facsimile of the Drawing in the Volume by Copernicus Published in 1543

The reader will now see why I have discussed relations which hitherto he may perhaps have thought very little connected with my subject. He sees that there is a bond of sympathy between our earth and the sun; that no disturbance can affect the solar photosphere without affecting our earth to a greater or less degree. But if our earth, then also the other[331] planets. Mercury and Venus, so much nearer the sun than we are, surely respond even more swiftly and more distinctly to the solar magnetic influences. But beyond our earth, and beyond the orbit of moonless Mars, the magnetic impulses speed with the velocity of light. The vast globe of Jupiter is thrilled from pole to pole as the magnetic wave rolls in upon it; then Saturn feels the shock, and then the vast[332] distances beyond which lie Uranus and Neptune are swept by the ever-lessening yet ever-widening disturbance wave. Who shall say what outer planets it then seeks? or who, looking back upon the course over which it has traveled, shall say that planets alone have felt its effects? Meteoric and cometic systems have been visited by the great magnetic wave, and upon the dispersed members of the one and the subtle structure of the other effects even more important may have been produced than those striking phenomena which characterize the progress of the terrestrial or planetary magnetic storms.

When we remember that what is true of a relatively great solar disturbance, such as the one witnessed by Messrs. Carrington and Hodgson, is true also (however different in degree) of the magnetic influences which the sun is at every instant exerting, we see that a new and most important bond of union exists between the members of the solar family. The sun not only sways them by the vast attraction of his gravity, not only illumines them, not only warms them, but he pours forth on all his subtle yet powerful magnetic influences. A new analogy between the members of the Solar System is thus introduced to reinforce those other analogies which have been held so strikingly to indicate that the ends for which our earth has been created are not different from those which the Creator had in view when He planned the other members of the Solar System.

The real end and aim of the telescope, as applied by the astronomer to the examination of the celestial objects, is to gather together the light which streams[333] from each luminous point throughout space. We may regard the space which surrounds us on every side as an ocean without bounds or limits, an ocean across which there are ever sweeping waves of light, either emitted directly from the various bodies subsisting throughout space, or else reflected from their surfaces. Other forms of waves also speed across those limitless depths in all directions, but the light-waves are those which at present concern us. Our earth is as a minute island placed within the ocean of space, and to the shores of this tiny isle the light-waves bear their message from the orbs which lie like other isles amid the fathomless depths around us. With the telescope the astronomer gathers together portions of

light-waves which else would have traveled in diverging directions. By thus intensifying their action, he enables the eye to become cognizant of their true nature. Precisely as the narrow channels around our shores cause the tidal wave, which sweeps across the open ocean in almost insensible undulations, to rise and fall through a wide range of variation, so the telescope renders sensible the existence of light-waves which would escape the notice of the unaided eye.

The telescope, then, is essentially a light-gatherer.

The spectroscope is used for another purpose. It might be called the light-sifter. It is applied by the astronomer to analyze the light which comes to him from beyond the ocean of space, and so to enable him to learn the character of the orbs from which that light proceeds.

The principle of the instrument is simple, though[334] the appliances by which its full powers can alone be deduced are somewhat complicated.

A ray of sunlight falling on a prism of glass or crystal does not emerge unchanged in character. Different portions of the ray are differently bent, so that when they emerge from the prism they no longer travel side by side as before. The violet part of the light is bent most, the red least; the various colors from violet through blue, green, and yellow, to red being bent gradually less and less.

The prism then sorts, or sifts, the light-waves.

But we want the means of sifting the light-waves more thoroughly. The reader must bear with me while I describe, as exactly as possible in the brief space available to me, the way in which the first rough work of the prism has been modified into the delicate and significant work of the spectroscope. It is well worth while to form clear views on this point, because so many of the wonders of modern science are associated with spectroscopic analysis.

If, through a small round hole in a shutter, light is admitted into a darkened room, and a prism be placed with its refracting angle downward and horizontal, a vertical spectrum, having its violet end uppermost, will be formed on a screen suitably placed to receive it.

But now let us consider what this spectrum really is. If we take the light-waves corresponding to any particular color, we know, from optical considerations, that these waves emerge from the prism in a pencil exactly resembling in shape the pencil of white light which falls on the prism. They therefore form[335] a small circular or oval image on their own proper part of the spectrum. Hence the spectrum is in reality formed of a multitude of overlapping images, varying in color from violet to red. It thus appears as a rainbow-tinted streak, presenting every gradation of color between the utmost limits of visibility at the violet and red extremities.

If we had a square aperture to admit the light, we should get a similar result. If the aperture were oblong, there would still be overlapping images; but if the length of the oblong were horizontal, then, since each image would also be a horizontally placed oblong, the overlapping would be less than when the images were square. Suppose we diminish the overlapping as much as possible? in other words, suppose we make the oblong slit as narrow as possible? Then, unless there were in reality an infinite number of images distributed all along the spectrum from top to bottom, the images might be so narrowed as not to overlap; in which case, of course, there would be horizontal dark spaces or gaps in our spectrum. Or, again, if we failed in finding gaps of this sort by simply narrowing the aperture, we might lengthen the spectrum by increasing the refracting angle of the prism, or by using several prisms, and so on.

The first great discovery in solar physics, by means of the analysis of the prism (though the discovery had little meaning at the time), consisted in the recognition of the fact that, by means of such devices as the above, dark gaps or cross-lines can be seen in the solar spectrum. In other words, light-waves of the various gradations corresponding[336] to all the tints of the spectrum from violet to red do not travel to us from the great central luminary of our system. Remembering that the effect we call color is due to the length of the light-waves, the effect of red corresponding to light-waves of the greatest length, while the effect of violet corresponds to the shortest light-waves, we see that in effect the sun sends forth to the worlds which circle around him light-waves of many different lengths, but not of all. Of so complex and interesting a nature is ordinary daylight.

But spectroscopists sought to interpret these dark lines in the solar spectrum, and it was in carrying out this inquiry—which even to themselves seemed almost hopeless, and to many would appear an utter waste of time—that they lighted upon the noblest method of research yet revealed to man.

They examined the spectra of the light from incandescent substances (white-hot metals and the like), and found that in these spectra there are no dark lines.

They examined the spectra of the light from the stars, and found that these spectra are crossed by dark lines resembling those in the solar spectrum, but differently arranged.

They tried the spectra of glowing vapors, and they obtained a perplexing result. Instead of a number of dark lines across a rainbow-tinted streak, they found bright lines of various colors. Some gases would give a few such lines, others many, some only one or two.

Then they tried the spectrum of the electric spark,[337] and they found here also a series of bright lines, but not always the same series. The spectrum varied according to the substances between which the spark was taken and the medium through which it passed.

Lastly, they found that the light from an incandescent solid or liquid, when shining through various vapors, no longer gives a spectrum without dark lines, but that the dark lines which then appear vary in position, according to the nature of the vapor through which the light has passed.

Here were a number of strange facts, seemingly too discordant and too perplexing to admit of being interpreted. Yet one discovery only was wanting to bring them all into unison.

In 1859, Kirchhoff, while engaged in observing the solar spectrum, lighted on the discovery that a certain double dark line, which had already been found to correspond exactly in position with the double bright line forming the spectrum of the glowing vapor of sodium, was intensified when the light of the sun was allowed to pass through that vapor. This at once suggested the idea that the presence of this dark line (or, rather, pair of dark lines) in the spectrum of the sun is due to the existence of the vapor of sodium in the solar atmosphere, and that this vapor has the power of absorbing the same order of light-waves as it emits. It would of course follow from this that the other dark lines in the solar spectrum are due to the presence of other absorbent vapors in its atmosphere, and that the identity of these would admit of being established in the same way, supposing this general law to hold,[338] that a vapor emits the same light-waves that it is capable of absorbing.

Kirchhoff was soon able to confirm his views by a variety of experiments. The general principles to which his researches led—in other words, the principles which form the basis of spectrum analysis—are as follows:

1. An incandescent solid or liquid gives a continuous spectrum.

2. A glowing vapor gives a spectrum of white lines, each vapor having its own set of bright lines, so that, from the appearance of a bright-line spectrum, one can tell the nature of the vapor or vapors whose light forms the spectrum.

3. An incandescent solid or liquid shining through absorbent vapors gives a rainbow-tinted spectrum crossed by dark lines, these dark lines having the same position as the bright lines belonging to the spectra of the vapors; so that, from the arrangement of the dark lines in such a spectrum, one can tell the nature of the vapor or vapors which surround the source of light.[24]

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The application of the new method of research to the study of the solar spectrum quickly led to a number of most interesting discoveries. It was found that, besides sodium, the sun’s atmosphere contains the vapors of iron, calcium, magnesium, chromium, and other metals. The dark lines corresponding to these elements appear unmistakably in the solar spectrum. There are other metals, such as copper and zinc, which seem to exist in the sun, though some of the corresponding dark lines have not yet been recognized. As yet it has not been proved that gold, silver, mercury, tin, lead, arsenic, antimony, or aluminium exist in the sun—though we can by no means conclude, nor indeed is it at all probable, that they are absent from his substance. The dark lines belonging to hydrogen are very well marked indeed in solar spectrum, and, as we shall see presently, the study of these lines has afforded most interesting information respecting the physical constitution of the sun.

Now we notice at once how importantly these researches into the sun’s structure bear upon the subject[340] of this treatise. It would be indeed interesting to consider the actual condition of the central orb of the planetary scheme, to picture in imagination the metallic oceans which exist upon his surface, the continual evaporation from those oceans, the formation of metallic clouds, and the downpour of metallic showers upon the surface of the sun. But apart from such considerations, and viewing Kirchhoff’s discoveries

simply in their relation to the subject of other worlds, we have enough to occupy our attention.

If it could have been shown that, in all probability, the substance of the sun consists of materials wholly different from those which exist in this earth, the conclusion obviously to be drawn from such a discovery would be that the other planets also are differently constituted. We could not find any just reason for believing that in Jupiter or Mars there exist the elements with which we are acquainted, when we found that even the central orb of the planetary system exhibits no such feature of resemblance to the earth. But now that we know, quite certainly, that the familiar elements, iron, sodium, and calcium, exist in the sun's substance, while we are led to believe, with almost perfect assurance, that all the elements we are acquainted with also exist there, we see at once that, in all probability, the other planets are constituted in the same way. There may of course be special differences: in one planet the proportionate distribution of the elements may differ, and even differ very markedly, from that which prevails in some other planet. But the general conclusion[341] remains, that the planets are formed of the elements which have so long been known as terrestrial; for we can not recognize any reason for believing that our earth alone, of all the orbs which circle around the sun, resembles that great central orb in general constitution.

Now, we have in this general law a means of passing beyond the bounds of the Solar System, and forming no indistinct conceptions as to the existence and character of worlds circling around other suns. For these orbs, like our sun, contain in their substance many of the so-called terrestrial elements, while it may not unsafely be asserted that all, or nearly all, those elements, and few or no elements unknown to us, exist in the substance of every single star that shines upon us from the celestial concave. Hence we conclude that round those suns also there circle orbs constituted like themselves, and therefore containing the elements with which we are familiar. And the mind is immediately led to speculate on the uses which those elements are intended to subserve. If iron, for example, is present in some noble orb circling around Sirius, we speculate not unreasonably respecting the existence on that orb—either now or in the past, or at some future time—of beings capable of applying that metal to the useful purposes which man makes it subserve. The imagination suggests immediately the existence of arts and sciences, trades and manufactures, on that distant world. We know how intimately the use of iron has been associated with the progress of human civilization, and though we must ever remain in ignorance[342] of the actual condition of intelligent beings in other worlds, we are yet led, by the mere presence of an element which is so closely related to the wants of man, to believe, with a new confidence, that for such beings those worlds must in truth have been fashioned.

I would fain dwell longer on the thoughts suggested by the researches of Kirchhoff. Gladly too would I enter at length on an account of those interesting discoveries which have been made in connection with the total eclipses of the sun. One point, however, remains which is too intimately connected with my subject to be passed over.

I refer to the sun's corona.

It has been proved that the solar prominences consist of glowing vapors, hydrogen being their chief constituent. It has been found also, by comparing Mr. Lockyer's observations of the prominence-spectra with Dr. Frankland's elaborate researches into the peculiarities presented by the spectrum of hydrogen at different pressures, that even in the very neighborhood of the solar photosphere these vapors probably exist at a pressure so moderate as to indicate that the limits of the sun's vaporous envelope can not lie very far (relatively) from the outer solar cloud-layer.

Now, the solar corona has been seen, during total eclipses of the sun, to extend to a distance at least equal to the sun's diameter from the eclipsed orb. So that, assuming the corona to be a solar atmosphere, it would have a depth of about eight hundred and fifty thousand miles, and being also drawn toward[343] the sun by his enormous attractive energy (exceeding more than twenty-seven times that of the earth), it could not fail to exert a pressure on his surface exceeding many thousand-fold that of our air upon the earth. In fact, such an atmosphere, let its outermost layers be as rare as we can conceive, would yet have its lower layers absolutely liquefied, if not solidified, by the enormous pressure to which they would be subjected. We can not, then, believe this corona to be a solar atmosphere. Heavenly bodies Fig. 33.—Tychonic System

Yet it is quite impossible to dissociate the corona, either wholly or in part, from the sun. I am aware that physicists of eminence have attempted to do this, and not only so, but to make of the zodiacal light a terrestrial phenomenon. But they have overlooked considerations which oppose themselves irresistibly to such a conclusion.

In the first place, the mere fact that, during a total eclipse, the moon looks black, in the very heart[344] of the corona, affords, when properly understood, the most conclusive evidence that the light of the corona comes from behind the moon. If the glare of our atmosphere could by any possibility account for the corona (which is not the case), then that glare should appear over the moon's

disk also. That this is so is proved by the fact that, when the glare really does cover the moon, as while the sun is but slightly eclipsed, the moon is not projected as a black disk on the background of the sky, though, where her outline crosses the sun, it appears black, by contrast with the intensity of his light.[25] The point seems, however, too obvious to need discussion.

And, secondly, as Mr. Baxendell has pointed out, during totality the part of the earth's atmosphere between the eye and the corona is not illuminated by the sun. Over a wide space all round the sun we are looking through an atmosphere which is completely dark. In fact, if the earth's atmosphere alone were in question, we ought to see a dark or negative corona around the sun, the illuminated atmosphere only beginning to be faintly visible at a considerable angular distance from the sun. This argument, rightly understood, is altogether decisive of the question.[26]

[345]

But the spectroscope has given certain very perplexing evidence respecting the light of the corona, and it remains that we should endeavor to see how that evidence bears on the interesting problem which the corona presents to our consideration.

During the total eclipse of 1868 the American observers found that the spectrum of the corona is continuous, but crossed by certain bright lines. If we accept the absence of dark lines as established by the evidence (which is doubtful), this result seems at first sight very difficult to explain. Referring to the principles of spectroscopic analysis stated on pp. 338-339, it will be seen that we should be led to infer that the corona consists of incandescent matter surrounded by certain glowing gases. It is difficult to suppose that this is the real explanation of the phenomenon.

Mr. Lockyer suggests that, if the corona shone by[346] reflecting the solar light, the continuous spectrum might be accounted for by supposing the light from the glowing vapors around the sun to supply the part wanting where the solar dark lines are, and that some of these vapors shining yet more brightly would exhibit their bright lines upon the continuous background of the spectrum. This view, as applied by Mr. Lockyer to the theory that the corona is a terrestrial phenomenon, is untenable, for the reasons already adduced. But, independently of those reasons, there are others which render such a solution of the difficulty unavailable.

Now, remembering that we have two established facts for our guidance—(1) the fact that the corona can not be a solar atmosphere, and (2) the fact that it must be a solar appendage—I think a way may be found toward a satisfactory explanation.

Let it be premised that the bright lines of the coronal spectrum correspond in position to those seen in the spectrum of the aurora, and that the same lines are seen in the spectrum of the Zodiacal Light, and in that of the phosphorescent light occasionally seen over the heavens at night.

Since we have every reason to believe that the light of the aurora is due to electrical discharges taking place in the upper regions of the air, we are invited to the belief that the coronal light may be due to similar discharges taking place between the particles (of whatever nature) constituting the corona.

Now, though the appearance of an aurora is due to some special terrestrial action (however excited),[347] yet the material substances between which the discharges take place must be assumed to be at all times present in the upper regions of air. In all probability, they are the particles of those meteors which the earth is continually encountering. And since we know that meteor-systems must be aggregated in far greater numbers near the sun than near the earth, we may regard the coronal light as due to electrical discharges excited by the sun's action, and taking place between the members of such systems. Besides this light, however, there must necessarily be a large proportion of light reflected from these meteoric bodies. In this way the peculiar character of the coronal spectrum may be readily accounted for. We know, from the auroral spectrum, that the principal bright lines due to the electrical discharges would be precisely where we see bright lines in the coronal spectrum. But, besides these, there would be fainter bright lines corresponding to the various elements which exist in the meteoric masses. These elements, we know, are the same as those in the substance of the sun. Thus the bright lines would correspond in position with the dark lines of the solar spectrum. Hence, as light reflected by the meteors would give the ordinary solar spectrum, there would result from the combination a continuous spectrum, on which the bright lines first mentioned would be seen, as during the American eclipse.

What the polariscope has told us respecting the corona is in accordance with this view.

In the same way the quality of the Zodiacal Light[348] admits of being perfectly accounted for, without resorting to the hypothesis that this phenomenon is a terrestrial one.

The explanation thus put forward has at least the advantage of being founded on well-established relations. We know that the auroral light is associated with the earth's magnetism, and that meteoric bodies are continually falling upon the earth's atmosphere. We know, also, that the sun exerts magnetic influences a thousand-fold more intense than those of the earth, and that in his neighborhood there must be many million times more meteoric systems.

But we have other and independent reasons, which must not be overlooked, for considering the corona to be of some such nature as I have suggested. Leverrier has shown that there probably exists in the neighborhood of the sun a family of bodies whose united mass suffices appreciably to affect the motions of the planet Mercury. It would not be safe to neglect considerations thus vouched for.

Mr. Baxendell also has shown that certain periodic variations in the earth's magnetism point to the existence of such a family of bodies; and he has been able to assign to them a position according well with that determined by Leverrier.

Now, whatever opinion we form as to the exact character of the system of bodies pointed to by the researches of Leverrier and Baxendell—whether we suppose that system to form a zone around the sun, or that (as I believe) the system is merely due to the aggregation of meteoric perihelia in the sun's[349] neighborhood—we may be quite certain of this, that during a total solar eclipse the system could not fail to become visible. Hence there is a double objection to the view put forward by Mr. Lockyer and others. In the first place, it fails to account for the appearance presented by the corona; in the second place, it fails to render an account of the implied non-appearance of the system which, according to the researches of Leverrier and Baxendell, circles around the sun. Relative sizes Fig. 34.—Scale of Planets Jupiter and Saturn are shown in their true axial positions, Uranus and Neptune in the axial positions inferred from the motions of their satellites

We know that the sun is the sole source whence light and heat are plentifully supplied to the worlds which circle around him. The question immediately suggests itself—Whence does the sun derive[350] those amazing stores of force from whence he is continually supplying his dependent worlds? We know that, were the sun a mass of burning matter, he would be consumed in a few thousand years. We know that, were he simply a heated body, radiating light and heat continually into space, he would in like manner have exhausted all his energies in a few thousand years—a mere day in the history of his system. Whence, then, comes the enormous supply of force which he has afforded for millions on millions of years, and which also our reason tells us he will continue to afford while the worlds which circle around him have need of it—in other words, for countless ages to come?

Now, there are two ways in which the solar energies might be maintained. The mere contraction of the solar substance, Helmholtz tells us, would suffice to supply such enormous quantities of heat that, if the heat actually given out by the sun were due to this cause alone, there would not, in many thousands of years, be any perceptible diminution of the sun's diameter. But, secondly, the continual downfall of meteors upon the sun would cause an emission of heat in quantities vast enough for the wants of all the worlds circling round him; while his increase of mass from this cause would not be rendered perceptible in thousands of years, either by any change in his apparent size or by changes in the motions of his family of worlds.

It seems far from unlikely that both these processes are in operation at the same time. Certainly the latter is, for we know, from the motions of the[351] meteoric bodies which reach the earth, that myriads of these bodies must continually fall upon the sun. And if the corona and Zodiacal Light really be due to the existence of flights of meteoric systems circling around the sun, or to the existence in his neighborhood of the perihelia of many meteoric systems, then there must be a supply of light and heat from this source very nearly if not quite sufficient to account for the whole solar emission.

It is well worthy of notice, too, that the association between meteors and comets has an important bearing on this question. We know that the most remarkable characteristic of comets is the enormous diffusion of their substance. Now, in this diffusion there resides an enormous fund of force. The contraction of a large comet to dimensions corresponding to a very moderate mean density would be accompanied by the emission of a vast supply of heat. And the question is worth inquiring into, whether we can indeed assume that the meteors which reach our atmosphere are solid bodies, and not rather of cometic diffusion; since it is difficult otherwise to account for the light and heat which they emit. Friction through the rarer upper strata of our atmosphere will certainly not account for these phenomena; nor, I think, will the compression of the atmosphere in front of the meteors; on the other hand, the sudden contraction of a diffused vapor would be accompanied by precisely such results. But, be this as it may, it is certain that a large portion of the substance of every comet is in a singularly diffused state. And since the meteoric systems[352] circling in countless millions round the sun are, in all probability, associated in the most intimate manner with comets, we may recognize in this diffusion, as well as in the mere downfall of meteors, the source of an enormous supply of light and heat.

And lastly, turning from our sun to the other suns which shine in uncounted myriads throughout space, we see the same processes at work upon them all. Each star-sun has its coronal and its zodiacal disks, formed by meteoric and cometic systems; for otherwise each would quickly cease to be a sun. Each star-sun emits, no doubt, the same magnetic influences which give to the Zodiacal Light and to the solar corona their peculiar characteristics. And thus the worlds which circle round those orbs may resemble our own in all those relations which we refer to terrestrial magnetism, as well as in the circumstance that on them also there must be, as on our own earth, a continual downfall of minute meteors. In those worlds, perchance, the magnetic compass directs the traveler over desert wastes or trackless oceans; in their skies, the aurora displays its brilliant streamers; while, amid the constellations which deck their heavens, meteors sweep suddenly into view, and comets extend their vast length athwart the celestial vault, a terror to millions, but a subject of study and research to the thoughtful.

[353] FOOTNOTES:

[23] Professor Kirkwood has published a most interesting series of inquiries, going far to prove that the real secret or the planetary influences lies in the fact that the sun's surface is not uniform, and that on a certain solar longitude the planetary influences are more effective than elsewhere.

[24] To these may be added the following law:

4. Light reflected from any opaque body gives the same spectrum as it would have given before reflection.

5. But if the opaque body be surrounded by vapors, the dark lines corresponding to these vapors make their appearance in the spectrum with a distinctness proportioned to the extent to which the light has penetrated those vapors before being reflected to us.

6. If the reflecting body be itself luminous, the spectrum belonging to it is superadded to the spectrum belonging to the reflected light.

7. Glowing vapors surrounding an incandescent source of light may cause bright lines or dark lines to appear in the spectrum, according as they are more or less heated; or, they may emit just so much light as to make up for what they absorb, in which case there will remain no trace of their presence.

8. The electric spark presents a bright-line spectrum, compounded of the spectra belonging to the vapors of those substances between which, and of those through which, the discharge takes place. According to the nature of these vapors and of the discharge itself, the relative intensity of the component parts of the spectrum will be variable.

Lastly, the appearance of the spectrum belonging to any element will vary according to the circumstances of pressure and temperature under which the element may emit light.

[25] It is also shown most conclusively, by a photograph of the eclipse of August, 1868, taken an instant before the totality. Here we see the glare trenching upon the moon's disk (elsewhere black), as it should theoretically. So soon as totality commenced, the glare had reached the moon's limb, whence it must immediately have passed quickly away.

[26] In fact, if we take the mode of reasoning by which Mr. Lockyer has endeavored to get over certain physical difficulties presently to be mentioned, we shall be able to point definitely to the place where his argument fails. He says, conceive a tiny moon placed so as to appear coincident with the centre of the sun's disk. There will be atmospheric glare as well as direct sunlight. Now, conceive this small moon to expand until it all but covers the sun. Still there will be glare and a certain small proportion of direct sunlight. So far his reasoning is most just. But when he allows his expanding moon to cover the sun, and to extend beyond the solar disk as in total eclipse, the atmospheric glare can no longer be assumed to exist all round the expanding moon: at the moment when the moon just hides the sun, the glare begins to leave the moon, a gradually expanding black ring being formed round that body. It is only necessary to consider where the glare comes from to see that this must be so.

I have taken no account of diffraction here, because it has been abundantly proved that no corona of appreciable width could be formed around the moon during total eclipse by the diffraction of the rays of light as they pass near the moon's limb.
MERCURY.—William F. Denning

Mercury is the nearest known planet to the sun. It is true that a body, provisionally named Vulcan, has been presumed to exist in the space inferior to the orbit of Mercury; but absolute proof is lacking, and every year the idea is losing strength in the absence of any confirmation of a reliable kind. Not one of the regular and best observers of the sun has recently detected any such body during

its transits (which would be likely to occur pretty frequently), and there is other evidence of a negative character; so that the ghost of Vulcan may be said to have been laid, and we may regard it as proven that no major planet revolves in the interval of 36,000,000 miles separating Mercury from the sun.

Copernicus, amid the fogs of the Vistula, looked for Mercury in vain, and complained in his last hours that he had never seen it. Tycho Brahe, in the Island of Hueen, appears to have been far more successful. The planet is extremely fugitive in his appearances, but is not nearly so difficult to find as many suppose. Whenever the horizon is very clear, and the planet well placed, a small sparkling object, looking more like a scintillating star than a planetary body, will be detected at a low altitude and may be followed to the horizon.

Mercury revolves round the sun in 87 days, 23 hours, 15 minutes, and 44 seconds in an eccentric orbit, so that his distance from that luminary varies[354] from 43,350,000 to 28,570,000 miles. When in superior conjunction the apparent diameter of the planet is 4″.5; at inferior conjunction it is 12″.9, and at elongation 7″. His real diameter is 3,000 miles.

Being situated so near to the sun, it is obvious that to an observer on the earth he must always remain in the same general region of the firmament as that body. His orbital motion enables him to successively assume positions to the east and west of the sun, and these are known as his elongations, which vary in distance from 18° to 28°. He becomes visible at these periods either in the morning or evening twilight, and under the best circumstances may remain above the horizon two hours in the absence of the sun. The best times to observe the planet are at his E. elongations during the first half of the year, or at his W. elongations in the last half; for his position at such times being N. of the sun's place, he remains a long while in view.

Occasionally he presents quite a conspicuous aspect on the horizon, as in February, 1868, when I thought his lustre vied with that of Jupiter, and in November, 1882, when he shone brighter than Sirius. The planet is generally most conspicuous a few mornings after his W. elongations and a few evenings before his E. elongations.

In the course of his orbital round, Mercury exhibits all the phases of the moon. Near his elongations the disk is about half illuminated, and similar in form to that of our satellite when in the first or third quarter. But the phase is not to be distinctly made out unless circumstances are propitious. Galileo's[355] telescope failed to reveal it, and Hevelius, many years afterward, found it difficult. This is explained by the small diameter of the planet and the rarity with which his disk appears sharply defined. The phase is sometimes noted to be less than theory indicates; for the planet has been seen crescented when he should have presented the form of a semicircle. Several observers have also remarked that his surface displays a rosy tint, and that the terminator is more deeply shaded and indefinite than that of Venus.

The atmosphere of Mercury is probably far less dense than that of Venus. The latter being furthest from the sun might be expected to shine relatively more faintly than the former, but the reverse is the case. Mercury has a dingy aspect in comparison with the bright white lustre of Venus. On May 12, 1890, when the two planets were visible as evening stars, and separated from each other by a distance of only 2°, I examined them in a 10-inch reflector, power 145. The disk of Venus looked like newly polished silver, while that of Mercury appeared of a dull leaden hue. A similar observation was made by Mr. Nasmyth on September 28, 1878. The explanation appears to be that the atmosphere of Mercury is of great rarity, and incapable of reflection in the same high degree as the dense atmosphere of Venus.

As a naked-eye object, Mercury must necessarily be looked for when near the horizon; but there is no such need in regard to telescopic observation, which ought to be only attempted when the planet[356] surmounts the dense lower vapors and is placed at a sufficient elevation to give the instrument a fair chance of producing a steady image. The presence of sunshine need not seriously impair the definition, or make the disk too faint for detail.

I have occasionally seen Mercury, about two or three hours after his rising, with outlines of extreme sharpness and quite comparable with the excellent views obtained of Venus at the time of sunrise or sunset. Those who possess equatorials should pick up the planet in the afternoon and follow him until after sunset, when the horizontal vapors will interfere. Others who work with ordinary altazimuth stands will find it best to examine the planet at his western elongations during the last half of the year, when he may be found soon after rising by the naked eye or with an opera-glass, and retained in the telescope for several hours after sunrise if necessary.

Mercury was displayed under several advantages in the morning twilight of November, 1882, and I made a series of observations with a 10-inch reflector, power 212. Several dark markings were perceived, and a conspicuous white spot. The general appearance

of the disk was similar to that of Mars, and I forwarded a summary of my results to Professor Schiaparelli of Milan, who favored me with the following interesting reply:

“I have myself been occupied with this planet during the past year (1882). You are right in saying that Mercury is much easier to observe than Venus, and that his aspect resembles Mars more than any other of the planets of the Solar System. It has[357] some spots which become partially obscured and sometimes completely so; it has also some brilliant white spots in a variable position.”

Professor Schiaparelli used an 8½-inch refractor in this work, and was able under some favorable conditions to apply a power of 400. The outcome of his researches, encouraged since 1882 by the addition of an 18-inch refractor to the appliances of his observatory, was announced in the curious fact that the rotation of Mercury is performed in the same time that the planet revolves round the sun! If this conclusion is just, Mercury constantly presents one and the same hemisphere to the sun, and the behavior of the moon relatively to the earth has found an analogy.

Spots or markings of any kind have rarely been distinguished on Mercury. On June 11, 1867, Prince recorded a bright spot, with faint lines diverging from it northeast and south. The spot was a little south of the centre. Birmingham on March 13, 1870, glimpsed a large white spot near the planet’s east limb, and Vögel, at Bothkamp, observed spots on April 14 and 22, 1871. These instances are quoted by Webb, and they, in combination with the markings seen by Schiaparelli at Milan and by the author at Bristol in 1882, sufficiently attest that this object deserves more attentive study.

One of the most interesting phenomena, albeit a somewhat rare event, in connection with Mercury, is that of a transit across the sun. The planet then appears as a black circular spot. Observers have noticed one or two very small luminous points on the[358] black disk, and an annulus has been visible round it. These features are probably optical effects. THE PLANET VENUS.—Camille Flammarion

Revolving round the sun in 224 days, Venus has its motion combined with ours in such a manner that it passes its inferior conjunction, between the sun and us, every 584 days; but the plane in which it revolves is inclined 3° 23′ to that in which the earth itself moves. When Venus attains its greatest elongations from the sun it shines in the west in the evening, then in the morning in the east, with a splendid brightness which eclipses that of all the stars. It is, without comparison, the most magnificent star of our sky. Its light is so vivid that it casts a shadow. Sometimes, even, it pierces the azure of the sky, in spite of the presence of the sun above the horizon, and shines in full daylight.

The maximum visibility of Venus is produced by its greatest phase, by its greatest elongation from the sun, and by the clearness of our atmosphere.

The brilliant Venus was certainly the first planet noticed by the ancients, as much on account of its brightness as its rapid motion. Hardly is the sun set than it sparkles in the twilight; from evening to evening it removes further from the west and increases in brightness; during several months it reigns sovereign of the skies, then plunges into the solar fires and disappears. It was pre-eminently the star of the evening, the shepherd’s star, the star of sweet[359] confidences. It was the first of celestial beauties, and the names conferred upon it correspond to the direct impression which it produced on contemplative minds. Homer called it “Callistos,” the Beautiful; Cicero named it Vesper, the evening star, and Lucifer, the morning star, a name likewise given in the Bible and the ancient mythologies to the chief of the celestial army.

The most ancient astronomical observation we have of Venus is a Babylonian record of the year 685 B. C. It is written on a brick and preserved in the British Museum.

The best hours for examining Venus in a telescope are those of daylight. In the night the irradiation produced by the brilliant light of this beautiful planet prevents us from distinguishing clearly the outlines of its phases.

When Venus occupies the region of its orbit behind the sun, with reference to us—which is called the point of superior conjunction—it is at its greatest distance, and is reduced to a disk of 9½ seconds in diameter. It comes imperceptibly toward us, and when it passes its quadrature, at its mean distance, it presents the aspect of a half-moon. It soon attains its most brilliant light, at the epoch when it shines at a distance of 39° from the sun, and shows the third phase 69 days before its inferior conjunction. Its apparent diameter is then 40 seconds, and the width of its illuminated part is scarcely 10 seconds. In this position we see the fourth of the disk illuminated; but this quarter emits more light than the more complete phases. Finally, when it reaches[360] the region of its orbit nearest to the earth, it shows us nothing more than an excessively thin crescent, since it is then between the sun and us, and presents to us, so to say, its dark hemisphere. This is the position where its apparent size is greatest, and it then measures 62

seconds in diameter. After passing its inferior conjunction the phases are reproduced, in inverse order, as a morning star.

Venus is constantly visible in full daylight in astronomical instruments, even at the moment of its superior conjunction. It is then round and quite small. At the epochs of its inferior conjunction it presents itself under the form of a very thin crescent.

We sometimes notice that the interior of the crescent of Venus, the remainder of the disk, is less black than the background of the sky. This has been called the ashy light (lumière cendrée) of Venus, although it has no satellite to produce it. It seems to me that this visibility, rather subjective than objective, arises from clouds on the planet, which whiten its disk and vaguely reflect the stellar light scattered through space. The eye instinctively continues the outline of the crescent, and imagines, rather than sees, the rest.

The revolution of Venus round the sun is performed in an orbit almost exactly circular, and without perceptible eccentricity (0.0068), in a period of 224 days, 16 hours, 49 minutes, 8 seconds.

The days of Venus, also, are a little more rapid than ours, but not much. Since the year 1666 attentive observation of the planet led Cassini to conclude that it turns on itself in 23 hours, 15 minutes.[361] This observation is extremely difficult, on account of the brightness of the planet and the faintness of the irregularities visible on its disk.

The year of Venus, composed of 224 terrestrial days, consequently contains 231 of its own, since the day is a little shorter there than here.

These same observations show that the axis of rotation of this planet is much more inclined than ours, and that this inclination is 55 degrees. It follows that the seasons, although each lasting but 56 terrestrial days, or 58 Venusian days, are much more intense on this world than on ours. They pass, without transition, from summer to winter.

The inclination of the world of Venus being more than twice as great as ours, we have only to take a terrestrial globe and incline it by the same quantity to understand the climates and seasons which will result. We may easily see that the torrid zone extends, in this case, up to the frigid zone, and even beyond it; and, reciprocally, the frigid zone extends to the torrid zone, and even encroaches on it; so that no place remains for a temperate zone. There is not, then, on Venus any temperate climate, but all latitudes are both tropical and arctic.

It follows, then, from all these circumstances, that the seasons and climates are much more violent and more varied than ours. This neighboring world shows nearly the same dimensions as ours. Thus this planet is truly the twin sister of ours.

The resemblance will be still more complete if we add that this world is certainly surrounded by an atmosphere.

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When we examine with the spectroscope the light reflected by this planet we first find the lines of the solar spectrum (and this is natural, since the planets have no light of their own, and merely reflect that of the sun); but we notice besides several absorption lines similar to those which the terrestrial atmosphere gives, and particularly those of clouds and water vapor.

We may also add that attentive observation of the indentations visible on the crescent of Venus has shown that the surface of this planet is quite as uneven as that of the earth, and even more so; that there are there Andes, Cordilleras, Alps, and Pyrenees, and that the most elevated summits attain a height of 44,000 metres (27 miles). It has even been ascertained that the Northern Hemisphere is more mountainous than the Southern.

Even the study of the geography of Venus has already been commenced. But it is extremely difficult to draw, and the hours of sufficiently pure atmosphere and possible observation are very rare. This difficulty will be easily understood if we reflect that it is exactly when Venus arrives at its nearest to us that it is least visible, since, its illuminated hemisphere being always turned toward the sun, it is its dark hemisphere which is presented to us. The nearer it approaches us, the narrower the crescent becomes. Add to this its vivid light and its clouds, and you may imagine what difficulty astronomers have in dealing with it. Drawings of Jupiter Twelve Views of Jupiter Taken at Intervals within Six Consecutive Weeks

However, by observing it in the daytime to avoid the glare, and not waiting till the crescent becomes[363] too thin, by choosing the quadratures, and making use of moments of great atmospherical purity, observers succeed, from time to time, in perceiving grayish spots, which may indicate the place of its seas.

Of what nature are the inhabitants of Venus? Do they resemble us in physical form? Are they endowed with an intelligence analogous to ours? Do they pass their life in pleasure, as Bernardin de St. Pierre said, or, rather, are they so tormented by the inclemency of their seasons that they have no delicate perception, and are incapable of any scientific or artistic attention? These are interesting questions, to which we have no reply. All that we can say is, that organized life on Venus must be little different from terrestrial life, and that this world is one of those which resembles ours most. The imaginary travelers to these worlds of the sky have always carried with them their terrestrial ideas. The only scientific conclusion which we can draw from astronomical observation is that this world differs little from ours in volume, in weight, in density, and in the duration of its days and nights; that it differs a little more in the rapidity of its years, the intensity of its climates and seasons, the extent of its atmosphere, and its greater proximity to the sun. It should, then, be inhabited by vegetable, animal, and human races but little different from those which people our planet. As to imagining it desert or sterile, this is a hypothesis which could not arise in the brain of any naturalist. The action of the divine sun must be there, as in Mercury, still more fertile than his terrestrial[364] work, already so wonderful. We may add that Venus and Mercury, having been formed after the earth, are relatively younger than our planet.

The inhabitants of Venus see us shining in their sky like a magnificent star of the first magnitude, soaring in the zodiac, and showing motions similar to those which the planet Mars presents to us; but instead of showing a reddish brightness, the earth shines in the sky as a bluish light. It is from Venus that we are most luminous. The inhabitants of Venus with the naked eye see our moon shining beside the earth and revolving round it in twenty-seven days. They form a magnificent couple. Our planet seen from there measures 65″, and the moon nearly 18″; the moon seen from Venus shows the same diameter as the earth seen from the sun. Mercury is brilliant, and comes immediately after the earth in brightness. Mars, Jupiter, and Saturn are also visible as from here, but a little less luminous. The constellations of the whole sky show exactly the same aspect as seen from the earth. THE EARTH AS A PLANET.—Élisée Reclus

The earth on which we dwell is one of the lowest in rank among the heavenly bodies. If an astronomer in some other planet were exploring the immensity of space, our earth, owing to its small size, might readily elude his intelligent view. A mere satellite of the sun, the volume of which is 1,255,000 times greater, the earth is but a point as[365] compared with the immense tract of ether traversed by the planets in their courses round their central globe. The sun itself is only a spark, which seems lost amid the eighteen millions of stars which Herschel's telescope discerned in the Milky Way; the latter, an immense agglomeration of suns and planets, which looks to us like a broad streak of light round the whole universe, is in reality nothing but a nebula. Beyond our own sky, other skies stretch far away into infinity, and others beyond these, so that light notwithstanding its prodigious rapidity, takes eternities to cross them. How small the earth seems in this fathomless abyss of stars!

In the form of its orbit, in its movements round the sun and on its own axis, in the succession of days and seasons, and in all the phenomena governed by the great law of attraction, the earth becomes the representative of all the other planets; in studying it, we study all the heavenly bodies.

Our planet is a spheroid; that is, a sphere flattened at the two poles and enlarged at the equator, so that all the circles passing through the extremity of the polar axis form ellipses. The presumed depression of each pole is about thirteen miles, nearly a three-hundredth part of the radius of the earth; but it is not altogether certain that the two poles are equally flattened. Perhaps a contrast exists between the two hemispheres, not only in the features of their continents and the distribution of seas, but also in their geometrical shape. Be this as it may, it appears to be proved that the curvature is not exactly the same at all points of the earth at an equal distance[366] from the poles; the meridians appear without exception to be irregular ellipses.

The dimensions of the earth, as we have already seen, are almost as nothing compared with the larger celestial bodies, and especially with the extent of space which can be explored by the telescope. If light, the speed of which has been adopted in astronomy as a term of comparison, could be diffused in a curved line, it would travel seven times round the globe in a second of time; this standard of measurement, therefore, the only one suited to the stellary field, is completely inapplicable to the surface of our globe.

The isolated globule in the immensity of space which we call the earth is not motionless, as the ancients necessarily supposed, looking upon it, as they did, as the immovable base of the firmament of heaven. Hurried on in the vortex of universal vitality, our globe is ever actuated by ceaseless motion, describing in ether a series of elliptic spirals so complicated that astronomers have not yet been able to calculate their various curves. Besides rotating on its own axis, the earth describes an ellipse round the sun, and, under the influence of this body, is drawn along from one heaven to another toward distant constellations. It also oscillates and rocks on its axis, and deviates more or less from its path, to salute, as it were, every heavenly body which meets it. It is probable

that it never passes a second time through the same regions of the air; yet, if it has again to traverse the spiral line of ellipses it has already described, it would be after a cycle of so many thousands[367] of millions of years, that the earth itself, completely transformed, would be no longer the same planet.

The motion of the earth, the immediate effects of which are the most obvious to the notice of men, is the daily rotation which takes place round an ideal axis passing through the two poles. The globe turns from right to left, or from west to east—that is, in a contrary direction to the apparent motion of the sun and stars, which seem to rise in the east and to set in the west. As the earth's axis terminates at each pole, there is least surface-motion at those points, and the motion is the more rapid in any part of the surface of the globe the further it is from the central axis. At St. Petersburg, in 60° latitude, the speed of rotation is about nine miles a minute; in Paris, it exceeds eleven and a half miles during the same brief time; on the equatorial line, which may be looked upon as the ring of an immense wheel, the speed of the earth is twice as great as it is at 60° of latitude—that is, about eighteen miles a minute, or 528 yards a second—a rapidity equal to the flight of a 26-pound cannon-ball impelled by thirteen pounds of powder. By means of this rotatory motion, the earth presents toward the sun each of its faces alternately, and each also in turn toward the comparatively darker regions of space; the succession of day and night is thus constituted. In addition to this, the rotation of the earth is an important fact which must always be taken into account in determining the direction of fluids in motion on the surface of the globe, such as streams and rivers, also marine and atmospheric currents.

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The annual revolution which the earth performs round the sun follows the line of an ellipse, one of the foci of which is occupied by the central star; the eccentricity of the ellipse is nearly equal to 17/1000th of the great axis. The distance between the sun and the earth always varies according to the particular point of its orbit which the latter is traveling over. At its aphelion, that is, at its greatest remoteness, this distance is about 93¾ millions of miles; at the period of its perihelion, when the two heavenly bodies are nearest to each other, it is approximately 90,259,000 miles. The mean distance, as estimated by astronomers since the corrections of Encke, Hansen, Foucault, and Hind, is 91,839,000 miles. This extent of space is traversed by the solar rays in 8 minutes, 16 seconds; sound would take fifteen years in passing through the same distance.

As Kepler has laid down in his celebrated laws, our planet moves with an increased rapidity as it approaches nearer to the sun and travels more slowly in proportion to its distance from that luminary; but its mean speed may be estimated at nearly nineteen miles a second, or sixty times the rapidity of a ball from the cannon's mouth. This speed, which makes one dizzy to think of, is to be added, as regards each point in the surface of the earth, to the rotatory motion which impels it round the polar axis.

After having turned round 366 times on its axis, our planet has terminated its orbicular course, and is in the same position relatively to the sun as at its starting-point; it has then accomplished its year.

This daily rotation of the earth round its axis[369] produces the succession of days and nights, and, in the same way, its annual revolution round the sun causes the alternations of the seasons. If the axis of the earth, that is the ideal line which passes through its two poles, were perpendicular to the plane of its annual orbit, it is evident that the portion of the globe lighted by the sun would invariably extend from one pole to the other, and that in both hemispheres the days and nights would always consist of twelve hours each. But this is not the case. The earth performs its revolutionary movements in an inclined position; its ideal polar axis is sloped about 23° 28′ from a perpendicular to its plane, and this position is so far maintained that as regards the comparatively rapid succession of days and seasons it may be looked upon as invariable. This obliquity of axis causes continued changes in the phase presented to the sun. The portion of the earth illumined by the rays of the sun varies every day; for, although the planetary axis may appear to maintain its extremity in a fixed position as regards some point in infinite space, in respect to the sun it presents a constantly varying degree of inclination, in consequence of the continual motion of the earth. Twice during the course of the year it so happens that the solar rays fall perpendicularly upon the equator of the earth; at every other period in the annual revolution, sometimes the Northern and sometimes the Southern Hemisphere receives the greatest amount of light.

The astronomical year commences on the 20th of March, at the exact moment when the sun illumines the equator in a vertical direction, and the line of[370] separation between light and shade passes through the two poles. The period of darkness is then equal to that of light, and admits of exactly twelve hours at all points of the earth. Hence the name of "equinox" (equality of nights). But after this day, which in the Northern Hemisphere serves as the starting-point of spring, the earth continues its translatory movement. In consequence of the inclination of its axis, the Northern Hemisphere, being turned toward the sun, receives a greater quantity of light, while the southern half of the globe is less vividly lighted. The vertical rays of the sun now fall more and more to the

north of the equator, and the circle of light, far from arresting its progress at the poles, where the day of six months' duration is commencing to dawn, extends far beyond it over the regions of the north. On the 21st of June, the day of the first solstice, the axis of the earth being deeply inclined toward the sun, this luminary shines on the zenith of the tropic of Cancer at 23½° north of the equator, and its light illumines the whole of the arctic zone, that is, the portion of the earth's surface extending to 23½° round the North Pole. Then spring ceases and summer begins as regards the Northern Hemisphere. In the Southern Hemisphere, on the contrary, autumn is giving place to winter. Above the equator long days are prevailing, interrupted by short nights; while in the south it is the nights which last the longest. In the arctic zone the sun performs its apparent course of diurnal rotation entirely above the horizon. The six months' day, which spring inaugurated at the North Pole, attains its high noon[371] on the first day of summer. At the same moment midnight arrives in the darkness which is oppressing its antipodes.

Immediately after the 21st of June all the phenomena which took place during the preceding season are directly reversed. The sun appears to retrograde toward the southern horizon; its vertical rays cease to fall on the line of the northern tropic, and constantly approach the equator. The zone of light in the northern pole and of shade in the southern equally diminish, and the days shorten in the Northern Hemisphere in the same proportion as they lengthen in the Southern; an equilibrium is gradually being re-established between the two halves of the earth. On the 22d of September the position of the sun is again exactly above the equator, and its light just reaches both poles. The equinox, or the absolute equality of day and night in every part of the globe, occurs for the second time in the year; but this moment of equilibrium is, so to speak, but a mathematical point between the two seasons. The axis of the earth which, during the six months past, turned the North Pole toward the sun, now presents to him the South Pole; the vertical rays of the central luminary fall to the south of the earth's equator, and the Southern Hemisphere, in its turn, is the best endowed of the two halves of the globe in the amount of light it receives and in the length of its days. In the Southern Hemisphere spring is commencing; in the Northern, autumn. Three months afterward, on the 21st of December, the sun comes directly over the southern tropic, or the tropic[372] of Capricorn, 23½° south of the equator, and the whole of the antarctic zone is presented to the solar rays. Summer has begun in the Southern Hemisphere, and at the same time winter commences in that of the north. Then, as the globe moves on, these two seasons follow each other in their course, until at length the earth attains a position similar to that from which it started; the March equinox, the first day of spring in Europe, and the first day of autumn in Australia, commences anew the astronomical year.

The elliptical form of the earth's orbit and the unequal pace of the globe in the various points of its course cause some considerable variations in the duration of the seasons. In fact, from the 20th of March to the 22d of September, that is, during the spring and summer of the Northern Hemisphere, the earth takes 186 days to travel over the first and largest half of its orbit, while during the winter period, from the 22d of September to the 20th of March, only 179 days are required to accomplish the second half of its journey. The summer period of the Northern Hemisphere actually exceeds by seven or eight days, or about 187 hours, the corresponding period in the southern half of the globe; added to this, in consequence of the longer space of time during which the Arctic Pole remains inclined toward the sun in the regions north of the equator, the hours of daylight exceed the hours of night, while in the south the hours of darkness predominate. This is, however, to some extent compensated for; as, although in the southern regions of the earth the summer lasts a shorter time, our planet is then closer[373] to the sun; it is at its perihelion, and consequently receives a larger proportion of heat. There is, however, no doubt about the fact—as it is proved by a direct observation, both of the winds and currents, and also of their various temperatures—that, taking an equal distance from the equator, the southern regions are colder than those of the north.

If an equality of seasons between the two halves of the world does not at present exist, it will not fail to be established after a long series of centuries by means of a slow terrestrial movement, which has been known by the name of the precession of the equinoxes. Just as a top (if we may be allowed to avail ourselves of so old an illustration) turns round on the ground and bends over successively in every direction, thus describing with its axis an ideal cone, so the earth revolves in space, and slowly sways the line of its poles. This line, which is always sloped at an angle of 66° 32′ to the plane of the terrestrial orbit, turns round with a slight lateral motion, so as always to point to a new region of the sky; if it were prolonged indefinitely it would describe a circle amid the distant stars. As the axis of the earth is constantly changing its direction in this way, the plane of the equator must vary exactly to the same extent in its position as regards the sun. In fact, every year the exact moment of the March equinox anticipates by about twenty minutes the time at which the corresponding equinox fell in the year preceding. Each revolution of the earth round the sun brings a fresh advance of twenty minutes in the determination of the equinox; and as, during the long[374] course of ages, the axis of the earth does not intermit in this swaying motion, the time must come, after a period of 12,900 years, that the conditions of the seasons will be altogether changed. The hemisphere which hitherto received the larger proportion of heat will receive the lesser share, and that half of the globe which has endured the larger number of wintry days will now, in its turn, enjoy the more lengthened

period of summer. Then, after a second period of 12,900 years, during which the relation between the seasons of the two hemispheres is being gradually modified, the axis of the earth completes its round of swaying, which has lasted for 258 centuries, and the position of the globe in respect to the sun being nearly the same as at its starting-point, a second cycle of seasons will then commence.

We might call this period the earth's great year, if, at the end of it, the earth were in an identical position to that which it occupied at the commencement; but this is not the case. The attraction of the moon, and the disturbances caused by the vicinity of certain planets, are incessantly modifying the curve described in the starry fields of space by the earth's axis, and complicate it with a multitude of spirals, the various periods of which do not coincide with the great period of the swaying of the axis. The successive undulations form a continuous system of interwoven spirals. "It is a manifestation of the infinite."

But even this is not all. In addition to all the motions of the globe which we have already pointed out—its diurnal rotation, its annual revolution round[375] the sun, the rhythmical swaying of its axis, proved by the precession of the equinoxes, the nutation or more rapid swaying which is caused by the attraction of the moon—we must now notice the enormous translatory movement which is dragging it through endless tracks of space in the train of the sun. Not many years ago, this motion was entirely unknown to astronomers, and yet it is going on with inconceivable rapidity—a rapidity more than double that of the course of the planet round its central luminary. In one second of time the earth moves about forty-four miles toward the point of the heavens where we find the constellation of Hercules. During one year only she travels 1,382 millions of miles in this direction. Our own little earth itself is carried on from space to space, and never closes the cycle of its revolutions. Ever since the time when its particles were first grouped together, it has been describing in space the infinite spiral of its ellipses, and thus will it go on turning and oscillating in ether until the moment when it will exist no longer as an independent planet. For the earth, too, must have an end; like every other body in the universe, it comes into existence, and lives only to die when its turn comes. Already its annual motion of rotation is diminishing in speed; certainly this slackening of pace is not very observable, since no astronomer from Hipparchus to Laplace has yet exactly defined it. But, unless some cosmical force acting in a contrary direction compensates for the loss of speed caused by the friction of the tides against the bed and the shores of the ocean, the impetus of[376] our planet will every century diminish. After various catastrophes which it is impossible to foresee, the earth will eventually completely change its course of action, and lose its independent existence, either uniting itself with other planetary bodies or breaking up into fragments; or it will perhaps terminate its course by falling like a mere aerolite upon the surface of the sun. THE MOON.—Thomas Gwyn Elger

We know, both by tradition and published records, that from the earliest times the faint gray and light spots which diversify the face of our satellite excited the wonder and stimulated the curiosity of mankind, giving rise to superstitions more or less crude and erroneous as to their actual nature and significance. It is true that Anaxagoras, five centuries before our era, and probably other philosophers preceding him—certainly Plutarch at a much later date—taught that these delicate markings and differences of tint, obvious to every one with normal vision, point to the existence of hills and valleys on her surface; the latter maintaining that the irregularities of outline presented by the "terminator," or line of demarcation between the illumined and unillumined portion of her spherical superficies, are due to mountains and their shadows; but more than fifteen centuries elapsed before the truth of this sagacious conjecture was unquestionably demonstrated. Selenography, as a branch of observational astronomy, dates from the spring of 1609, when[377] Galileo directed his "optic tube" to the moon, and in the following year, in the Sidereus Nuncius, or the "Intelligencer of the Stars," gave to an astonished and incredulous world an account of the unsuspected marvels it revealed.

The bright and dusky areas, so obvious to the unaided sight, were found by Galileo to be due to a very manifest difference in the character of the lunar surface, a large portion of the Northern Hemisphere, and no inconsiderable part of the southeastern quadrant, being seen to consist of large gray monotonous tracts, often bordered by lofty mountains, while the remainder of the superficies was much more conspicuously brilliant, and, moreover, included by far the greater number of those curious ring-mountains and other extraordinary features whose remarkable aspect and peculiar arrangement first attracted his attention.

Before the close of the century when selenography first became possible, Hevel of Dantzig, Scheiner, Langrenus (cosmographer to the King of Spain), Riccioli, the Jesuit astronomer of Bologna, and Dominic Cassini, the celebrated French astronomer, greatly extended the knowledge of the moon's surface, and published drawings of various phases and charts, which, though very rude and incomplete, were a clear advance upon what Galileo, with his inferior optical means, had been able to accomplish. Langrenus, and after him Hevel, gave distinctive names to the various formations, mainly derived from terrestrial physical features, for which Riccioli subsequently substituted those of philosophers,[378] mathematicians, and other celebrities; and Cassini determined by actual measurement the relative position of many of the principal objects on the disk, thus laying the foundation of an accurate system of lunar topography; while the labors of T. Mayer and Schröter in the Eighteenth Century, and of Lohrmann, Mädler, Neison (Nevill),

Schmidt, and other observers in the Nineteenth, have been mainly devoted to the study of the minuter detail of the moon and its physical characteristics.

As was manifest to the earliest telescopic observers, its visible surface is clearly divisible into strongly contrasted areas, differing both in color and structural character. Somewhat less than half of what we see of it consists of comparatively level dark tracts, some of them many thousands of square miles in extent, the monotony of whose dusky superficies is often unrelieved for great distances by any prominent object; while the remainder, everywhere manifestly brighter, is not only more rugged and uneven, but is covered to a much greater extent with numbers of quasi-circular formations differing widely in size, classed as walled-plains, ring-plains, craters, craterlets, crater-cones, etc. (the latter bearing a great outward resemblance to some terrestrial volcanoes), and mountain ranges of vast proportions, isolated hills and other features.

Though nothing resembling sheets of water, either of small or large extent, has ever been detected on the surface of the moon, the superficial resemblance, in small telescopes, of the large gray tracts to the appearance which we may suppose our terrestrial[379] lakes and oceans would present to an observer on the moon, naturally induced the early selenographers to term them Maria, or "seas"—a convenient name, which is still maintained, without, however, implying that these areas, as we now see them, are, or ever were, covered with water.

There are twenty-three of these dusky areas which have received distinctive names; seventeen of them are wholly, or in great part, confined to the northern and to the southeastern quarter of the Southern Hemisphere—the southwestern quadrant being to a great extent devoid of them. By far the largest is the vast Oceanus Procellarum, extending from a high northern latitude to beyond latitude 10° in the southeastern quadrant, and, according to Schmidt, with its bays and inflections, occupying an area of nearly two million square miles, or more than that of all the remaining Maria put together. Next in order of size come the Mare Nubium, or about one-fifth the superficies, covering a large portion of the southeastern quadrant, and extending considerably north of the equator, and the Mare Imbrium, wholly confined to the northeastern quadrant, and including an area of about 340,000 square miles. These are by far the largest lunar "seas". The Mare Fœcunditatis, in the Western Hemisphere, the greater part of it lying in the southwestern quadrant, is scarcely half so big as the Mare Imbrium; while the Maria Serenitatis and Tranquilitatis, about equal in area (the former situated wholly north of the equator and the latter only partially extending south of it), are still smaller. The arctic Mare Frigoris, some[380] 100,000 square miles in extent, is the only remaining large sea; the rest, such as the Mare Vaporum, the Sinus Medii, the Mare Crisium, the Mare Humorum, and the Mare Humboldtianum, are of comparatively small dimensions, the Mare Crisium not greatly exceeding 70,000 square miles, the Mare Humorum (about the size of England) 50,000 square miles, while the Mare Humboldtianum, according to Schmidt, includes only about 42,000 square miles, an area which is approached by some formations not classed with the Maria.

Among the Maria which exhibit the most remarkable arrangement of ridges is the Mare Humorum, in the southeastern quadrant. Here, if it be observed under a rising sun, a number of these objects will be seen extending from the region north of the ring-mountain Vitello in long undulating lines, roughly concentric with the western border of the "sea," and gradually diminishing in altitude as they spread out, with many ramifications, to a distance of 200 miles or more toward the north. At this stage of illumination they are strikingly beautiful in a good telescope, reminding one of the ripple-marks left by the tide on a soft, sandy beach. Like most other objects of their class, they are very evanescent, gradually disappearing as the sun rises higher in the lunar firmament, and ultimately leaving nothing to indicate their presence beyond here and there a ghostly streak or vein of a somewhat lighter hue than that of the neighboring surface.

The Maria, like almost every other part of the visible surface, abound in craters of a minute type,[381] which are scattered here and there without any apparent law or ascertained principle of arrangement.

Walled-plains, approximating more or less to the circular form, though frequently deviating considerably from it, are among the largest inclosures on the moon. They vary from upward of 150 to 160 miles or under in diameter, and are often encircled by a complex rampart of considerable breadth, rising in some instances to a height of 12,000 feet or more above the inclosed plain. This rampart is rarely continuous, but is generally interrupted by gaps, crossed by transverse valleys and passes and broken by more recent craters and depressions. As a rule, the area within the circumvallation (usually termed "the floor") is only slightly, if at all, lower than the region outside: it is very generally of a dusky hue, similar to that of the gray plains of Maria, and, like them, is usually variegated by the presence of hills, ridges, and craters, and is sometimes traversed by delicate furrows, termed clefts or rills.

Ptolemæus, in the third quadrant and not far removed from the centre of the disk, may be taken as a typical example of the class. Here we have a vast plain, 115 miles from side to side, encircled by a massive but much broken wall, which at one peak towers more than 9,000 feet above a level floor, which includes details of a very remarkable character. The adjoining Alphonsus is another, but somewhat smaller object of the same type, as are also Albategnius and Arzachel; and Plato, in a high northern latitude, with its noble, many-peaked rampart and its variable steel-gray interior, Grimaldi, near the[382] eastern limb (perhaps the darkest area on the moon), Schickard, nearly as big on the southeastern limb, and Bailly, larger than either (still further south in the same quadrant), although they approach some of the smaller “seas” in size, are placed in the same category. The conspicuous central mountain, so frequently associated with other types of ringed inclosures, is by no means invariably found within the walled-plains; though, as in the case of Petavius, Langrenus, Gassendi, and several other noteworthy examples, it is very prominently displayed. The progress of sunrise on all these objects affords a magnificent spectacle. Very often when the rays infringe on their apparently level floor at an angle of from 1° to 2°, it is seen to be coarse, rough grained, and covered with minute elevations, although an hour or so afterward it appears as smooth as glass.

The more massive and extended mountain ranges of the moon are found in the Northern Hemisphere, and (what is significant) in that portion of it which exhibits few indications of other superficial disturbances. The most prominently developed systems, the Alps, the Caucasus, and the Apennines, forming a mighty western rampart to the Mare Imbrium and giving it all the appearance of a vast walled-plain, present few points of resemblance to any terrestrial chain. The former include many hundred peaks, among which Mont Blanc rises to a height of 12,000 feet, and a second, some distance west of Plato, to nearly as great an altitude; while others ranging from 5,000 to 8,000 feet are common. They extend in a southwest direction from Plato to the[383] Caucasus, terminating somewhat abruptly, a little west of the central meridian in about N. lat. 42°. One of the most interesting features associated with this range is the so-called great Alpine valley, which cuts through it west of Plato.

The Caucasus consist of a massive wedge-shaped mountain land, projecting southward, and partially dividing the Mare Imbrium from the Mare Serenitatis, both of which they flank. Though without peaks so lofty as those pertaining to the Alps, there is one, immediately east of the ring-plain Calippus, which, towering to 19,000 feet, surpasses any of which the latter system can boast. The Apennines, however, are by far the most magnificent range on the visible surface, including as they do some 3,000 peaks, and extending in an almost continuous curve of more than 400 miles in length from Mount Hadley, on the north, to the fine ring-plain Eratosthenes, which forms a fitting termination, on the south. The great headland Mount Hadley rises more than 15,000 feet, while a neighboring promontory on the southeast of it is fully 14,000 feet, and another, close by, is still higher above the Mare. Mount Huyghens, again in N. lat. 20°, and the square-shaped mass Mount Wolf, near the southern end of the chain, include peaks standing 18,000 and 12,000 feet respectively above the plain to which their flanks descend with a steep declivity. The counterscarp of the Apennines, in places 160 miles in width from east to west, runs down to the Mare Vaporum, with a comparatively gentle inclination. It is everywhere traversed by winding valleys of a very intricate type,[384] all trending toward the southwest, and includes some very bright craters and mountain-rings.

Whether variations in the visibility of lunar details, when observed under apparently similar conditions, actually occur from time to time from some unknown cause, is one of those vexed questions which will only be determined when the moon is systematically studied by experienced observers using the finest instruments at exceptionally good stations; but no one who examines existing records of rills by Gruithuisen, Lohrmann, Mädler, Schmidt, and other observers, can well avoid the conclusion that the anomalies brought to light therein point strongly to the probability of the existence of some agency which occasionally modifies their appearance or entirely conceals them from view. In short, the more direct telescopic observations accumulate, and the more the study of minute detail is extended, the stronger becomes the conviction that, in spite of the absence of an appreciable atmosphere, there may be something resembling low-lying exhalations from some parts of the surface which from time to time are sufficiently dense to obscure, or even obliterate, the region beneath them.

Sir John Herschel maintained that “the actual illumination of the lunar surface is not much superior to that of weathered sandstone rock in full sunshine. I have,” he says, “frequently compared the moon setting behind the gray perpendicular façade of the Table Mountain, illumined by the sun just risen in the opposite quarter of the horizon when it has been scarcely distinguishable in brightness from[385] the rock in contact with it. The sun and moon being at nearly equal altitudes, and the atmosphere perfectly free from cloud or vapor, its effect is alike on both luminaries.” Zöllner’s elaborate researches on this question are closely in accord with the above observational result. Though he considers that the brightest parts of the surface are as white as the whitest objects with which we are acquainted, yet, taking the reflected light as a whole, he finds that the moon is more nearly black than white. The most brilliant object on the surface is the central peak of the ring-plain Aristarchus, the darkest the floor of Grimaldi, or perhaps a

portion of that of the neighboring Riccioli. Between these extremes there is every gradation of tone. Proctor, discussing this question on the basis of Zöllner's experiments respecting the light reflected by various substances, concludes that the dark area just mentioned must be notably darker than the dark gray syenite which figures in his tables, while the floor of Aristarchus is as white as newly fallen snow. MARS.—Agnes M. Clerke

The furthest terrestrial planet from the sun is Mars, the "star of strength." No other heavenly body, except the moon, is so well placed for observation from our position in space.

The diameter of Mars is 4,200 miles; its surface is equal to two-sevenths, its volume to one-seventh those of the earth. But, in consequence of its inferior mean density, nine such spheres would go to[386] make up the mass of our world. The superficial force of gravity on Mars, compared with its terrestrial value, is as thirty-eight to a hundred. A man could leap there a wall eight feet four inches in height with no more effort than it would cost him here to spring over a two-foot fence.

The planet's rotation is performed in 24 hours, 37 minutes, on an axis deviating from the vertical by 24° 50′. Hence its seasons resemble our own, except in being nearly twice as long, for the Martian year is of 687 days.

The disk of Mars is diversified with three shades of color—reddish, or dull orange, dark grayish-green, and pure white. The last shows mainly in two diametrically opposite patches. Each pole is surrounded by a brilliant cap, suggesting the deposition of ice or snow over the chilly spaces corresponding to our arctic and antarctic regions. Nor is this all. Each of the polar hoods shrinks to a mere remnant as the local summer advances, but regains its original size when wintry influences are again in the ascendant. Here, and nowhere else in the planetary system, we meet evidence of seasonal change; and seasonal change is associated with vital possibilities. Again, a globe upon which snow visibly melts must contain water; hence the green markings can not but image to our minds seas and inlets subdividing continents, the blond complexion of which may be caused by some native peculiarity of the soil. It is in no way connected with vegetation, since it neither fades nor flushes with the advent of spring; and an atmospheric origin is excluded by the circumstance[387] that it becomes effaced by a whitish haze near the limb, just where the densest atmospheric strata are traversed by the line of sight.

The spots on Mars are by no means so sharply defined as lunar craters and maria; yet they are fundamentally permanent. Some can be recognized from drawings made over two hundred years ago; and these antique records have served modern astronomers to determine with minute accuracy the rotation-period of the planet. Continents are somewhat vaguely outlined. Great tracts of them are of an uncertain and variable hue, as if subject to inundations. This peculiarity, thoroughly certified during the favorable opposition of 1892, makes a strong distinction between Mars and the Earth. Terrestrial oceans keep within the limits assigned to them. On the neighboring planet—as M. Faye observed in 1892—"water seems to march about at its ease," flooding from time to time regions as wide as France. The imperfect separation of the two elements recalls the conditions prevailing during the terrestrial carboniferous era.

The main part of the land of Mars is situated in the Northern Hemisphere. It covers two-thirds of the entire globular surface. Rather than land, indeed, it should be called a network of land and water. The great continental block—so its orange tint declares it to be—is cut up in all possible directions by an intricate system of what appear to be waterways, running in perfectly straight lines—that is, along great circles of the globe—for distances varying from 350 to upward of 4,000 miles. They are frequently[388] seen in duplicate, strictly parallel companions developing thirty to three hundred miles apart from the original formations. This mysterious phenomenon is evanescent, or rather periodical.

The canals invariably connect two bodies of water; hence they need no locks or hydraulic machinery; their course is on a dead level. The broadest of them are comparable with the Adriatic; those at the limit of visibility, stretching like the finest spider-threads across the disk, have a width of eighteen miles. "The canals," Schiaparelli says, "may intersect among themselves at all possible angles, but by preference they converge toward the small spots to which we have given the name of lakes. For example, seven are seen to converge in Lacus Phœnicis, eight in Trivium Charontis, six in Lunæ Lacus, and six in Ismenius Lacus."

These "lakes" evidently form an integral part of the canal system. They resemble huge railway junctions; and the largest of them—the "Eye of Mars" (Schiaparelli's Lacus Solis)—seems, in Mr. Lowell's phrase, like the hub of a five-spoked wheel. Mr. W. H. Pickering in 1892, and Mr. Percival Lowell in 1894, were amazed at their extraordinary abundance.

"Scattered over the orange-ochre groundwork of the continental regions of the planet," the latter wrote, "are any number of dark, round spots. How many there may be it is not possible to state, as the better the seeing, the more of them there seem to be. In

spite, however, of their great number, there is no instance of one occurring unconnected with a canal. What is more, there is apparently none which does[389] not lie at the junction of several canals. Reversely, all the junctions appear to be provided with spots."

Most of these foci are about 120 miles in diameter, and appear most precisely circular when most clearly seen. "Plotted upon a globe," Mr. Lowell continues, "they and their connecting canals make a most curious network over all the orange-ochre equatorial parts of the planet, a mass of lines and knots, the one marking being as omnipresent as the other. Indeed, the spots are as peculiar and distinctive a feature of Mars as the canals themselves."

Like the canals, too, they emerge periodically, and in the same but a retarded succession. They "are, therefore, in the first place, seasonal phenomena, and, in the second place, phenomena that depend for their existence upon the prior existence of the canals."

Mr. Lowell terms them "oases," and does not shrink from the full implication of the term.

The most important result of the numerous observations of Mars, made during the oppositions of 1892 and 1894, was the recognition of a regular course of change dependent upon the succession of its seasons. Schiaparelli had long anticipated this result; he is commonly in advance of his time. These changes, moreover, when closely watched, are really self-explanatory. The alternate melting of the northern and southern snow-caps initiates and to some extent determines them. As summer advances in either hemisphere, the wasting of the corresponding white calotte can be followed in every minute particular. "The snowy regions are then seen to be successively notched at their edges; black holes and huge fissures[390] are formed in their interiors; great isolated fragments many miles in extent stand out from the principal mass, dissolve, and disappear a little later. In short, the same divisions and movements of these icy fields present themselves to us at a glance that occur during the summer of our own arctic regions."

Indeed, glaciation on Mars is much less durable than on the earth. In 1894 the southern snow-cap vanished to the last speck 59 days after the solstice and the remnant usually left looks scarcely enough to make a comfortable cap for Ben Nevis. An immense quantity of water is thus set free. The polar seas overflow; gigantic inundations reinforced, doubtless, from other sources, spread to the tropics; Syrtis regions of marsh or bog deepen in hue, and become distinctly aqueous; canals dawn on the sight, and grow into undeniable realities. We seem driven to believe that they discharge the function of flood-emissaries.

Mr. Lowell does not hesitate to pronounce them of artificial formation, and, on that large assumption, the purpose of their connection with his "oases" becomes transparently clear. They bring to these Tadmors in the wilderness the water supply by which they are made to "blossom as the rose." The junction-spots, we are told, do not enlarge when the vernal freshet reaches them; they only darken through the sudden development of vegetation. These circular "districts, artificially fertilized by the canal system," are strewn broadcast over vast desert areas, the orange-ochreous sections of Mars, covering the greater part of its surface, but deep buried in[391] the millennial dust of disintegrated red sandstone strata.

"Here, then," Mr. Lowell remarks, "we have an end and reason for the existence of canals, and the most natural conceivable—namely, that the canals are constructed for the express purpose of fertilizing the oases. When we consider the amazing system of the canal lines, we are carried to this conclusion as forthright as is the water itself; what we see being not the canal itself, indeed, but the vegetation along its banks."

The proportion of water to land is much smaller on Mars than on the earth. Only two-sevenths of the disk are covered by the dusky areas, and of late the aqueous nature of some, if not all, of these has been seriously called in question. Professor Pickering was convinced by his observations, in 1892 and 1894, "that the permanent water area upon Mars, if it exist at all, is extremely limited in its dimensions." He estimated it at about half the size of the Mediterranean. Professor Schaeberle is similarly incredulous. If the dark markings are seas, he asks, how explain the irregular gradations of shade in them? How, above all, explain their apparent intersection by well-marked canals? Professor Barnard, observing with the Lick thirty-six inch in 1894, discerned on the Martian surface an astonishing wealth of detail, "so intricate, small, and abundant, that it baffled all attempts to properly delineate it." It was embarrassing to find these minute features belonging more characteristically to the "seas" than to the "continents." Under the best conditions, the[392] dark regions lost all trace of uniformity. Their appearance resembled that of a mountainous country, broken by cañon, rift, and ridge, seen from a great elevation. These effects were especially marked in the "ocean" area of the Hour-Glass Sea.

Evidently the relations of solid and liquid in that remote orb are abnormal; they can not be completely explained by terrestrial analogies. Yet a series of well-attested phenomena are intelligible only on the supposition that Mars is, in some real sense, a terraqueous globe. Where snows melt there must be water; and the origin of the Rhone from a great glacier is scarcely more evident to our senses than the dissolution of Martian ice-caps into pools and streams.

The testimony of the spectroscope is to the same effect. Dr. Huggins found, in 1867, the spectrum of Mars impressed with the distinct traces of aqueous absorption, and the fact, although called in question by Professor Campbell of Lick, in 1894, has been reaffirmed both at Tulse Hill and at Potsdam. That clouds form and mists rise in the thin Martian air, admits of doubt. During the latter half of October, 1894, an area much larger than Europe remained densely obscured. Whether or no actual rain was at that time falling over the Maraldi Sea and the adjacent continent it would be useless to conjecture. We only know that with the low barometric pressure at the surface of Mars, the boiling point of water must be proportionately depressed (Flammarion puts it at 115° Fahrenheit), which implies that it evaporates rapidly, and can be transported easily.

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If the Martian atmosphere be of the same proportionate mass as that of our earth, it can possess no more than one-seventh its superficial density. That is to say, it is more than twice as tenuous as the air at the summits of the Himalayas. The corresponding height of a terrestrial barometer would be four and a half inches. Owing, however, to the reduced strength of gravity on Mars, this slender envelope is exceedingly extensive. In the pure sky scarcely veiled by it, the sun, diminished to less than half his size at our horizons, probably exhibits his coronal streamers and prominences as a regular part of his noontide glory; atmospheric circulation proceeds so tranquilly as not to trouble the repose of a land “in which it seemeth always afternoon”; no cyclones traverse its surface, only mild trade-winds flow toward the equator, to supply for the volumes of air gently lifted by the power of the sun, to carry reinforcements of water-vapor north and south. Aerial movements are, in fact, by a very strong presumption, of the terrestrial type, but executed with greatly abated vigor.

Brilliant projections above the terminator of Mars were first distinctly perceived at the Lick Observatory in 1890. They have been reobserved at Nice, Arequipa, and Flagstaff (Mr. Lowell’s observatory), coming into view, as a rule, when circumstances concur to favor their visibility. They strictly resemble lunar peaks and craters, catching the first rays of the sun, while the ground about them is still immersed in darkness; and Professor Campbell connects them with “mountain chains lying across the[394] terminator of the planet,” and in some cases possibly snow-covered. He calculates their height at about ten thousand feet. Their presence was unlooked for, since a flat expanse is a condition sine quâ non for the minute intersection of land by water, which seems to prevail on Mars.

Although the sun is less than half as powerful on Mars as it is here, the Martian climate, to outward appearance, compares favorably with our own. Polar glaciation is less extensive and more evanescent, and little snow falls outside the arctic and antarctic regions. Yet the theoretical mean temperature is minus 4° C., or 61° of Fahrenheit below freezing. This means a tremendous ice-grip. The coldest spot on the earth’s surface is considerably warmer than this cruel average. Fortunately, it exists only on paper. Some compensatory store of warmth must then be possessed by Mars, and it can scarcely be provided by its attenuated air. Possibly, internal heat may still be effective, and we see exemplified in Mars the geological period when vines and magnolias flourished in Greenland, and date-palms ripened their fruit on the coast of Hampshire.

The climate of Mars, according to Schiaparelli, “must resemble that of a clear day upon a high mountain. By day a very strong solar radiation hardly at all mitigated by mist or vapor; by night a copious radiation from the soil toward celestial space, and hence a very marked refrigeration; consequently, a climate of extremes, and great changes of temperature from day to night, and from one season to another. And as on the earth, at altitudes of from[395] 17,000 to 20,000 feet, the vapor of the atmosphere is condensed only into the solid form, producing those whitish masses of suspended crystals which we call cirrus-clouds, so in the atmosphere of Mars it would be rarely possible to find collections of cloud capable of producing rain of any consequence. The variation of temperature from one season to another would be notably increased by their long duration, and thus we can understand the great freezing and melting of the snow, renewed in turn at the poles at each complete revolution of the planet round the sun.”

The German astronomer Mädler searched in 1830 for a Martian satellite, and although his telescope was of less than four inches aperture, he satisfied himself that none with a diameter of as much as twenty-three miles could be in existence. As it happened, he was right. The pair of moons detected by Professor Asaph Hall with the Washington twenty-six refractor, August 11 and 17, 1877, are unquestionably below that limit of size. Neither of them can well be more than ten miles across. Their names, “Deimos” and

“Phobos,” are taken from the Iliad, where Fear and Panic are introduced as attendants upon the God of War. Deimos revolves in 30 hours and 18 minutes at a distance of 14,600 miles from the centre of Mars. And since the planet rotates in 24 hours, 37 minutes, the diurnal motion of the sphere from east to west is so nearly neutralized by the orbital circulation of the satellite from west to east that nearly 132 hours elapse between its rising and its setting. During the interval, it changes four times from new to full, and vice versâ.

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Phobos is more effective in illumination, both because it is larger and because it is less distant. At the Martian equator, its brightness is equal to 1/60th that of our moon, but beyond 69° of latitude it is permanently shut out from view by the curvature of the globe. THE PLANETOIDS.—Camille Flammarion

On the first day of the last century (January 1, 1801), Piazzi, an astronomer devoted to the sky, was observing at Palermo the small stars of the constellation Taurus, and noting their exact positions, when he remarked one which he had never seen before. The following evening (January 2) he directed his telescope again toward the same region of the sky, and remarked that the star was no longer at the point where he had seen it the day before, and that it had retrograded by 4′. It continued to retrograde up to the 12th, stopped, and then moved in the direct way—that is to say, from west to east. What was this moving star? The idea that it might be a planet did not immediately occur to the mind of the observer, and he took it for a comet, as William Herschel had done in 1781, when he discovered Uranus.

However, the skilful Sicilian observer was a member of an association which had for its special object the search for an unknown planet between Mars and Jupiter. From the earliest times of modern astronomy Kepler had described the disproportion, the void which exists between the orbit of Mars and that[397] of Jupiter. If we omit, in fact, the orbit of the small planets or asteroids, we notice that the four planets, Mercury, Venus, the earth, and Mars, are in some measure crowded quite close to the sun, while Jupiter, Saturn, Uranus, and Neptune extend far into immensity. The law of Titius indicates a number, the number 28, as not being represented by any planet. It was in 1772 that this savant published this relation in a German translation which he had made of the Contemplation de la Nature of Charles Bonnet. Bode, Director of the Berlin Observatory, was so astonished at the coincidence that he announced this arithmetical relation as being a real law of nature, and spoke of it in such a way that it is generally known only by his name. He even organized an association of twenty-four astronomers to explore each hour of the Zodiac and search for the unknown. This systematic exploration had not yet produced any result when, by the merest chance, Piazzi saw his moving star, and at first believed it to be a comet. But on receipt of the news, Bode was convinced that this was the looked-for planet.

The new planet was found to be at the distance 2.77, and to revolve within a few days of the predicted period. Piazzi gave to the new body the name of Ceres, the protecting divinity of Sicily in the “good old times” of mythology.

The gap being thus filled up at the distance 28 by the discovery of Ceres, no one thought that other planets might exist there; and if Piazzi had supposed so, he might have at once discovered a dozen of the small bodies which revolve in this region.[398] An astronomer of Bremen, Olbers, observed this planet on the evening of March 28, 1802, when he perceived in the constellation of the Virgin a star of the seventh magnitude which was not marked on Bode’s chart, which he used. The following day he found it had changed its place, and recognized by this fact that it was a second planet. But it was much more difficult to give citizenship to it than to its elder sister, because, the gap being filled up, it was not required, and it was more inconvenient than agreeable. They looked upon it, then, as a comet until its motion proved that it revolved in the same region as Ceres at the distance 2.77, and in 1,685 days (the period of Ceres is 1,681 days). They gave it the name of Pallas.

The unexpected discoveries of Ceres and Pallas led astronomers to revise the catalogues of stars and celestial charts. Harding was of the number of the zealous revisers. He was soon rewarded for his trouble. On September 1, 1804, at ten o’clock in the evening, he saw in the constellation of Pisces a star of the eighth magnitude which was not noted in the Histoire Céleste of Lalande. On September 4, he found it had perceptibly changed its place: it was a new planet. It received the name of Juno. Its distance from the sun is expressed by the number 2.67, and its revolution is performed in 1,592 days.

After these three discoveries, Olbers, noticing that the orbits of these planets crossed each other in the constellation of the Virgin, advanced the hypothesis that they might be nothing else but fragments of a[399] large shattered planet. Mechanics show that, in this case, the fragments would again pass every year—that is to say, at each of their revolutions—through the spot where the catastrophe took place. Olbers then set himself to explore the constellation Virgo carefully, and found on March 29, 1807, a fourth small planet, to which he gave the name of Vesta. Its distance is but 2.36, and its revolution only 1.326 days. This is the brightest of

the small planets, and it is sometimes seen with the naked eye (when we know where it is), like a star of the sixth magnitude.

It seems surprising that after these brilliant beginnings thirty-eight years should then have passed without the discovery of a single planet, for it was only in 1845 that the fifth, Astræa, was discovered by Hencke (who should not be confused with the astronomer Encke), a simple amateur astronomer, postmaster at Berlin, who amused himself by constructing charts of the stars. The principal reason for this must be attributed to the want of good star-charts, for to find these little moving points the first thing necessary is to have a very precise chart of the region of the Zodiac which we observe, in order to see whether one of the stars observed is in motion. The earliest good Zodiacal charts are those which the Academy of Berlin commenced to publish in 1830, taking as a basis the zones of Bessel continued by Argelander. Those of the Paris Observatory, which are more perfect, were only begun in 1854.

These small planets are all telescopic, invisible to the naked eye, with the exception of Vesta, and sometimes Ceres, which good sight can occasionally succeed[400] in distinguishing; they are of the seventh, eighth, ninth, tenth, and eleventh magnitudes, and even still smaller, and it was for this reason also that so long an interval of time elapsed between the fourth and fifth discoveries. It is probable that all the small planets of any importance are now known, but that a great number—several hundreds, perhaps—still remain to be discovered of which the average brightness does not exceed that of stars of the twelfth magnitude, and of which the diameter is but a few miles. The diameter of the largest, Vesta, may be estimated at 400 kilometres (248 miles).

Hencke found successively the 5th and the 6th in 1845 and 1847; Hind, the English astronomer, the 7th and 8th in 1847; Graham, an English observer, the 9th in 1848; Gasparis, an Italian astronomer, the 10th and 11th in 1849 and 1850, and afterward seven others. Hind has further discovered eight others; Goldschmidt, a German painter (a naturalized Frenchman), discovered fourteen between 1852 and 1861.[27] They are now discovered by swarms; Paliser alone has found sixty-eight since 1874.

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The names given to these small bodies commenced with the mythological army of divinities of the earth and ancient heaven; but even before the list had been exhausted certain scientific, or even national or political, circumstances caused the preference to be given to more modern names. It was thus that the 11th, discovered at Naples, received the name of Parthenope; the 12th, discovered in England, that of Victoria; the 20th, that of Massilia; the 21st, that of Lutetia; the 25th, that of Phocæa, before even Urania had been restored to the skies; the 45th was named in honor of the Empress of the French; the 54th, in honor of the illustrious Alexander von Humboldt; etc. The 87th, 107th, 141st, 154th, and 169th have been named in honor of a young astronomer who has devoted his best years to the culture of astronomy.

A rather curious fact is that they have put Wisdom (Sapientia) in the sky only at the 275th, discovered in 1888; Bellona has been placed there since the 28th (1854).

Of all this number of planets, the nearest to the sun is No. 149, Medusa, of which the distance is 2.17—that is to say, about twice as far from the sun as the earth; and the most distant is No. 279, Thule, of which the distance is 4.26, about 4¼ times our distance.

A large number of these small bodies are remarkable[402] for their great eccentricity and for their high inclination to the ecliptic, an inclination so great that some of them leave the Zodiac; thus, Pallas (2) goes 34 degrees from the ecliptic; Euphrosyne (31) and Anna (265) and Istria (183), to 26 degrees. They are sometimes northern circumpolar stars, always above the horizon, sometimes southern stars, not arising above the horizon of Paris. All these orbits are so interlaced with each other that, if they were material hoops, we could by means of one or two taken by chance raise all the others.

Are they globes? Yes, doubtless, for the most part. But several among the smaller ones may be polyhedral, and may have proceeded from subsequent explosions; the variations of brightness which have been sometimes observed seem to imply surfaces irregularly broken.

Are they worlds? Why not? Is not a drop of water shown in the microscope peopled with a multitude of various beings? Does not a stone in a meadow hide a world of swarming insects? Is not the leaf of a plant a world for the species which inhabit and prey upon it? Doubtless among the multitude of small planets there are those which must remain desert and sterile because the conditions of life (of any kind) are not found united. But we can not doubt that on the majority the ever-active forces of nature have produced, as in our world, creations appropriate to these minute planets. Let us repeat, moreover, that for nature there is neither great nor little. And there is no necessity to flatter ourselves with a supreme disdain for these little[403] worlds, for in reality the inhabitants of Jupiter would have more right to despise us than we have to despise Vesta, Ceres, Pallas, or Juno: the disparity is greater between Jupiter and the earth than between the earth and these planets. FOOTNOTES:

[27] Goldschmidt passionately loved astronomy, and I have found among his papers, which his family left me, numerous observations and remarks which show how he loved the study of the sky. His greatest ambition had been, at first, to possess a small telescope, in order to make some observations, and the best day of his life was that on which he found one in the possession of a dealer in old stores. He hastened to direct it to the sky from his modest studio, situated in one of the most frequented streets of Paris (Rue de l'Ancienne-Comédie), above the Café Procope, formerly used as a rendezvous by the stars of literature. There, from his window, he discovered, in 1852, the 21st small planet, which received from Arago the name of Lutetia; then, in 1854, the 32d (Pomona); then, in 1855, the 36th (Atlanta); and afterward eleven others, all from his window. Having often removed in search of a pure atmosphere, he finally retired to Fontainebleau, where the forest offered him on all sides admirable subjects for painting; and here he died in 1866. JUPITER.—Agnes M. Clerke

Jupiter is by far the most important member of the solar family. The aggregate mass of all the other planets is only two-fifths of his, which 316 earths would be needed to counterbalance. His size is on a still more colossal scale than his weight, since in volume he exceeds our globe 1,380 times. His polar and equatorial diameters measure respectively 84,570 and 90,190 miles, giving a mean diameter of 88,250 miles, and a polar compression of 1/16th. The corresponding equatorial protuberance rises to 2,000 miles, so that the elliptical figure of the planet strikes an observer at the first glance. This at once indicates rapid axial movement; and Jupiter's rotation is accordingly performed in nine hours and fifty-five minutes, with an uncertainty of a couple of minutes.

The numbers just given imply that this great planet is of somewhat slight consistence, and its mean density is, in fact, a little less than that of the sun. The sun is heavier than an equal bulk of water in the proportion of 1.4 to 1, Jupiter in the proportion of 1.33 to 1. The earth is thus more than four times specifically heavier than the latter globe. Three Jupiters would keep in equipoise four equal globes[404] of water, while the earth would turn the scale against five and a half aqueous models of itself. This low density, an unfailing characteristic of all the giant planets, is charged with meaning. It at once gives us to understand that, in crossing the zone of asteroids, we enter upon a different planetary region from that left behind. The bodies revolving there are on an immensely larger scale of magnitude than those on the hither side; they are of solar, rather than terrestrial, density; they rotate much more rapidly, and are in consequence of a more elliptical shape; they display, and most likely possess, no solid surface; they are attended by retinues of satellites.

Jupiter circulates round the sun in 11.86 years, in an orbit deviating by less than one and a half degrees from the plane of the ecliptic, but of thrice the eccentricity of the ellipse traced out by the earth. With a mean distance from the sun of 483 millions of miles, it accordingly approaches within 462 at perihelion, and withdraws to 504 millions of miles at aphelion. Seasons it has none worth mentioning; nor could they be of much effect even if they were better marked.

Under propitious circumstances Jupiter comes within 369 million miles of the earth. These occur when he is in opposition nearly at the epoch of his perihelion passage. His maximum opposition distance, on the other hand, is 411 million miles. He is then at aphelion. Thus, at the most favorable opposition, he is 42 million miles nearer to us than at the least favorable. The effect on his brightness is evident to the eye. When his midnight culmination[405] takes place in October, he in fact sends us one and a half times more light than when the event comes round to April. We need only recall the unusual splendor of his appearance in September and October, 1892, when his lustre was double that of Sirius. His opposition period, as we may call it, is 399 days.

The intrinsic brilliancy of his surfaces is surprising, especially when we consider that it is somewhat deeply tinged with color.

The minimum diameter of the visible disk considerably exceeds the maximum of that of Mars. Even with a low power it thus makes a beautiful and interesting telescopic object. Its distinctive aspect is that of a belted planet, the belts varying greatly in number and arrangement. As many as thirty have, on occasions, been counted, delicately ruling the disk from pole to pole. They are always parallel to the equator, but are otherwise highly changeable, and can not be too closely studied as an index to the planet's physical constitution. Two in particular are remarkable. They are called the north and south equatorial belts, and inclose a lustrous equatorial zone. The poles are shaded by dusky hoods.

This general scheme of markings, however, when viewed with one of the great telescopes of the world, is so overlaid with minor particulars as sometimes to be scarcely recognizable. One can not see the wood for the trees. Lovely color-effects, too, come out under the best circumstances of definition and aerial transparency. The tropical belts may be summarily described as red; but they are of complex structure, and their subordinate features and formations[406] are marked out, under the sway of alternating and tumultuous activities, by strips and patches of vermilion, pink, purple, drab, and brown. The intermediate space is divided into two bands by a line, or narrow ribbon, pretty nearly coinciding with the equator, and rosy or vivid scarlet in hue. The polar caps are

sometimes of a delicate wine-color, sometimes pale gray.

Professor Keeler made an elaborate study of the planet with the Lick 36-inch in 1889, and executed a series of valuable drawings. With a power of 320, the disk, he tells us, “was a most beautiful object, covered with a wealth of detail which could not possibly be accurately represented in a drawing.” Most of the surface was then “mottled with flocculent and irregular cloud-masses. The edges of the equatorial zone were brilliantly white, and were formed of rounded, cloud-like masses, which, at certain places, extended into the red belt as long streamers. These formed the most remarkable and curious feature of the equatorial regions. They are the cause of the double or triple aspect which the red belts present in small telescopes.”

Near their starting-points the streamers were white and sharply defined, but became gradually diffused over the ruddy surface of the belts. When at all elongated, they invariably flowed backward against the rotational drift, and were inferred to be cloud-like masses expelled from the equatorial region, and progressively left behind by its advance. This hypothesis was confirmed by the motion of some bright points, or knots, on the streamers. “The portions[407] of the equatorial zone surrounding the roots of well-marked streamers were somewhat brighter,” Professor Keeler continues, “than at other places, and it is a curious circumstance that they were almost invariably suffused with a pale olive-green color, which seemed to be associated with great disturbance, and was rarely seen elsewhere.”

Now, if the material of the streamers had been simply a superficial overflow, it should have carried with it into higher latitudes an excess of linear rotational speed, and should hence have pushed its way onward as it proceeded north and south. But, instead, it fell behind; its velocity was less, not greater, than that of the belts with which it eventually became incorporated. What are we to gather from this fact? Evidently that the currents issuing north and south were of eruptive origin. Their motion, in miles per second, was slow, because they belonged to profound strata of the planet’s interior. Their backward drift measured the depth from which they had been flung upward.

The spots, red, white, and black, constantly visible on the Jovian surface, excite the highest curiosity. They are of all kinds and qualities, and their histories and adventures are as diverse as they are in themselves. Some are quite evanescent; others last for years. At times they come in undistinguished crowds, like flocks of sheep, then a solitary spot will acquire notoriety on its own account. White spots appear in both ways; black spots more often in communities; and it is remarkable that the former frequent distinctively, though not exclusively, the[408] Southern, the latter the Northern Hemisphere. Red spots, too, develop pretty freely; but the attention due to them has been mainly observed by one striking specimen.

The Great Red Spot has been present with us for at least nineteen years; and it is a moot point whether its beginnings were not watched by Cassini more than two centuries ago. Its modern conspicuousness, however, dates from 1878. Then of a full brick-red hue, and strongly marked contour, it measured 30,000 by nearly 7,000 miles, and might easily have inclosed three such bodies as the earth. It has since faded several times to the verge of extinction, and partially recovered; but there has never been a time when it ceased to dominate the planet’s surface-configuration. More than once it has been replaced by a bare elliptical outline, as if through an effusion of white matter into a mold previously filled with red matter; and just such a sketch was observed by Gledhill in 1870. The red spot is attached, on the polar side, to the southern equatorial belt. It might almost be described as jammed down upon it; for a huge gulf, bounded at one end by a jutting promontory, appears as if scooped out of the chocolate-colored material of the belt to make room for it. Absolute contact, nevertheless, seems impossible. The spot is surrounded by a shining aureola, which seemingly defends it against encroachments, and acts as a chevaux-de-frise to preserve its integrity. The formation thus constituted behaves like an irremovable obstacle in a strong current. The belt-stuff encounters its resistance, and rears itself up into a[409] promontory or “shoulder,” testifying to the solid presence of the spot, even though it be temporarily submerged. The great red spot, the white aureola, and the brownish shoulder are indissolubly connected.

The spot is then no mere cloudy condensation. Yet it has no real fixity. Its period of rotation is inconstant. In 1870-80, it was of 9 hours, 55 minutes, 34 seconds; in 1885-86, it was longer by 7 seconds. The object had retrograded at a rate corresponding to one complete circuit of Jupiter in six years, or of the earth in seven months. It is not then fast moored, but floats at the mercy of the currents and breezes predominant in the strange region it navigates. A quiescent condition is implied by the approximate constancy of its rotation-period during the last ten years. With the paling of its color, its “proper motion” slackens or ceases. This must mean that, at its maxima of agitation, it is the scene of uprushes from great depths, which, bringing with them a slower linear velocity, occasion the observed laggings. It is not self-luminous, and shows no symptom of being depressed below the general level of the Jovian surface.

Jupiter has no certain and single period of rotation. Nearly all the spots that from time to time come into view on its disk are in relative motion, and thus give only individual results. The great red spot has the slowest drift of all (with the rarest exceptions), while the black cohorts of the Northern Hemisphere outmarch all competitors. Mr. Stanley Williams, as the upshot of long study, has delimitated[410] nine atmospheric surfaces with definite periods. They are well marked, and evidently have some degree of permanence, yet the velocities severally belonging to them are distributed with extreme irregularity. Thus, two narrow, adjacent zones differ in movement by 400 miles an hour. This state of things must obviously be maintained by some constantly acting force, since friction, if unchecked, would very quickly abolish such enormous discrepancies. The rotational zones are unsymmetrically placed; there is no correspondence between those north and south of the Jovian equator; and, although the equatorial drift is quicker than that of either tropic, it is outdone in 20° to 24° north latitude.

Jupiter's equatorial rotation, as indicated by observations of spots, is accomplished in 9 hours 50 minutes; but Bélopolsky and Deslandres's spectrographic determinations gave rates of approach and recession falling somewhat short of the corresponding velocity. Drawings of Saturn Three Views of Saturn Showing Varying Aspects of the Ring taken at Different Intervals: 1, Feb. 2, 1862; 2, Nov. 3, 1858; 3, March 23, 1856

However this be, the rotation of the great planet, albeit ill-regulated (if the expression be permissible), is distinctly of the solar type. It is itself a "semi-sun," showing no trace of a solid surface, but a continual succession of cloud-like masses belched forth from within. Jupiter's low mean density, considered apart from every other circumstance, suffices to demonstrate the primitive nature of his state. In a sun-like body, the circulation is bodily and vertical. That the processes going on in Jupiter are of this kind is beyond question. Exchanges of hot and colder substances are effected, not by surface-flows, but by up[411] and down rushes. The parallelism of his belts to his equator makes this visible to the eye. An occasional oblique streak betokens a current in latitude, but it is exceptional, and might be called out of character.

Jupiter's true atmosphere encompasses the disturbed shell of vapors observed telescopically. Its general absorptive action upon light is betrayed by the darkening of the planet's limb—another point of resemblance to the sun; while its special, or selective, absorption can only be detected with the spectroscope.

The actinic power of Jupiter's light is very remarkable. It surpasses that of moonlight nine times, and that of Mars twenty-four times. Dr. Lohse further ascertained that the Southern Hemisphere is twice as chemically effective as the Northern. This superiority is doubtless connected with the greater physical agitation of the same region. A series of photographs of Jupiter, taken in 1891 with the great Lick refractor, were the first of any value for purposes of investigation.

Jupiter's satellites were the first trophies of telescopic observation. They are, indeed, bright enough for naked-eye perception, could they be removed from the disk which obscures them with its excessive splendor; and the first and third have actually been seen, in despite of the glare, by a few persons with phenomenally good eyesight. The mythological titles of the Galilean group—Io, Europa, Ganymede, and Calypso (proceeding from within outward)—have been superseded by prosaic numbers.

The Jovian family presents an animated and attractive[412] spectacle. The smallest of its original members (No. II) is almost exactly the size of our moon; the largest (No. III), with its diameter of 3,550 miles, considerably exceeds the modest proportions of Mercury. Satellite I revolves in 42½ hours at the same average distance from Jupiter's surface that our moon does from that of the earth. No. II has a period of 3 days 13 hours, and its distance from Jupiter's centre is 415,000 miles. Both these orbits are sensibly circular; and Nos. III and IV travel in ellipses of very small eccentricity, the one at a mean distance of 664,000, the other at 1,167,000 miles, in periods respectively of 7 days 4 hours, and 16 days 16½ hours. All four revolve strictly in the plane of Jupiter's equator.

They constitute a system bound together by peculiar dynamical relations, in consequence of which they can never be all either eclipsed or seen aligned at one side of their primary at the same time. They can all, however, be simultaneously hidden behind it, or in its shadow; although this moonless condition is looked out for as a telescopic rarity.

The transits of the satellites across the Jovian disk present many curious appearances, due to complicated and changeable effects of light and shade both upon the planetary background and upon the little circular objects self-compared with it. These, in the ordinary course, show bright while near the dusky limb, then vanish during the central passage, and re-emerge again bright at the opposite side. But instead of duly vanishing, they now and then darken even to the point of becoming indistinguishable from[413] their own shadows, by which they are preceded or followed. This difference of behavior can not be attributed wholly to varieties of lustre in the sections of the disk transited; otherwise it could be predicted. But this has never been attempted; "black transits" come

when least expected. The third and fourth satellites are those chiefly subject to these phases; the second has never been known to exhibit them; and they but slightly affect the first. Indeed, all the satellites, except, perhaps, No. II, are striped or spotted; and this leads to seeming deformations in their shape, as well as fluctuations in their brightness, the markings being evidently of atmospheric origin, and hence changeable. Their distinct and accurate perception has been made possible by the excellence of the Lick 36-inch refractor.

Jupiter's moons seem to resemble him in constitution. The first three possess the same high reflective power. No. II is as bright as the planet's brightest parts, so that its albedo can not fall short of 0.70. And even No. IV (formerly designated "Calypso" in reference to its frequent obscurations) exactly matches, during its darkest phases, the blue-gray polar hoods of its primary. On an average, too, the satellites seem to be of about the same mean density as Jupiter, No. I being considerably the lightest for its bulk; and their spectra, according to Vogel's observations in 1873, are composed of solar rays modified in precisely the same way as those reflected by the planet.

The discovery, September 9, 1892, of Jupiter's "fifth satellite" was one of the keenest astronomical[414] surprises on record. Professor Barnard seized the opportunity, lent by the specially favorable opposition of 1892, to rummage the system for novelties. Keeping the telescopic field dark by means of a metallic bar placed so as to occult the gorgeous planetary round, he sought, night after night, for what might appear. At length, on September 9, he caught the glimmer he wanted, and made sure, September 10, that it truly intimated the presence of a new satellite.

This small body revolves in a period of 11 hours, 57 minutes, 23 seconds at a mean distance of 112,160 miles from Jupiter's centre, or 67,000 from his bulged equatorial surface. Hence, it should by right be called "No. I" instead of "No. V." The major axis of the ellipse in which it circulates advances so rapidly, owing to the disturbance caused by Jupiter's spheroidal figure, as to complete a revolution in five months. The implied eccentricity of its orbit, as M. Tisserand has shown, very slightly exceeds that of the orbit of Venus, yet it has been made obvious by Barnard's observations of the differences between its east and west elongations. Its orbital velocity of 16½ miles a second far surpasses that of any other satellite in the solar system. Close vicinity to a mass so vast as Jupiter's demands counterbalancing swiftness. Its period of revolution being, however, longer by one hour than Jupiter's period of rotation, it so far conducts itself normally as to rise in the east and set in the west. On the other hand, since its progress over the sphere is measured by the difference between the two periods, it spends five Jovian days in journeying from one horizon to the other, running,[415] in the meantime, four times through all its phases. Yet it never appears full. Jupiter's voluminous shadow cuts off sunlight from it during nearly one-fifth of each circuit. SATURN.—Agnes M. Clerke

Nearly twice as far from the sun as Jupiter revolves a planet, the spacious orbit of which was, until 1781, supposed to mark the uttermost boundary of the Solar System. The mean radius of that orbit is 886 millions of miles; but in consequence of its eccentricity, the sun is displaced from its middle point to the extent of 50 million miles, and Saturn is accordingly 100 million miles nearer to him at perihelion than at aphelion. The immense round assigned to the "saturnine" planet is traversed in 29½ years, at the tardy pace of six miles a second. His seasons are thus twenty-nine times more protracted than ours, and are nominally more accentuated, since his axis of rotation deviates from the vertical by 27°. But solar heat, however distributed, plays an insignificant part in his internal economy. In the first place, its amount is only 1/91st its amount on the earth; in the second, Saturn, like Jupiter—even more than Jupiter—is thermally self-supporting. The bulk of his globe comparatively to its mass suffices in itself to make this certain. The mean diameter of Saturn is 71,000 miles, or nine times (very nearly) that of the earth; if of equal density, its mass should then be nine cubed, or 729 times the same unit. The actual proportion, however, is 95;[416] hence the planet has a mean density of only 95/729th, or between 1/7th and 1/8th the terrestrial, and being thus composed of matter as light as cork, would float in water. Professor G. H. Darwin has, moreover, demonstrated, from the movements of its largest satellite, that its density gains markedly with descent into the interior, so that its surface-materials must be lighter than any known solid or liquid.

When at its nearest to the earth, Saturn is as large as a sixpence held up at a distance of 210 yards. But instead of being round like a sixpence, it is strongly compressed—more compressed even than Jupiter. The spectra of the two planets are almost identical. Both are impressed with traces of aqueous absorption, and include the "red star line."

Saturn resembles to the eye a large, dull star; its rays are entirely devoid of the sparkling quality which distinguishes those of Jupiter. But it shows telescopically an analogous surface-structure. Its most conspicuous markings are tropical dark belts of a grayish or greenish hue; the equatorial region is light yellow, diversified by vague white spots; while the poles carry extensive pale blue canopies. The apparent tranquillity of the disk may be attributed in part to the vast distance from which it is viewed; yet not wholly.

From measures executed by Barnard in 1895, it appears that the equatorial diameter of Saturn is 76,470, its polar diameter 69,770 miles, giving a mean diameter of 74,240, and a compression of about 1/12th. Gravity, at its surface, is only 1/5th more powerful than on the earth.

[417]

Thus, Saturn not only belongs to the same celestial species as Jupiter, but is a closely related individual of that species. There is no probability that either is to any extent solid. Both exhibit the same type of markings; both betray internal tumults by eruptions of spots which, by their varying movements, supply a measure for the profundity of their origin; both possess identically constituted atmospheres, and are darkened marginally by atmospheric absorption.

Saturn is, however, distinguished by the possession of a unique set of appendages. Nothing like them is to be seen elsewhere in the heavens; and when well opened they form, with the globe they inclose, and the retinue of satellites in waiting outside, a strange and wonderful telescopic object. The rings, since they lie in the plane of Saturn's equator, are inclined 27° to the Saturnian orbit, and 28° to the ecliptic. The earth is, however, comparatively to Saturn, so near the sun, that their variations in aspect, as viewed from it, may in a rough way be considered the same as if seen from the sun. They correspond exactly with the Saturnian seasons. At the Saturnian equinoxes, the rings are illuminated edgewise, and disappear, totally or approximately; at the Saturnian solstices, sunlight strikes them nearly at the full angle of 27°, first from below, then from above. At these epochs, we perceive the appendage expanded into an ellipse about half as wide as it is long. Two concentric rings (generally called A and B) are then very plainly distinguishable, the inner being the brighter. The black fissure which separates them[418] is called "Cassini's division," because that eminent observer was, in 1675, the first to perceive it. A chasm known as "Encke's division," in the outer ring (A), is a thinning-out rather than an empty space; and temporary gaps frequently appear in A, while B is entirely exempt from them. There are then two definite and permanent bright rings, and no more; but with them is associated the dusky formation discovered by W. C. Bond, November 15, 1850, and described by Lassell as "something like a crape veil covering a part of the sky within the inner ring." It is semi-transparent, the limb of Saturn showing distinctly through it.

The exterior diameter of the ring-system is 172,800, while its breadth is 42,300 miles. The rings A and C are each 11,000 miles wide; while B measures 18,000, Cassini's division 2,270, and the clear interval between C and the planetary surface somewhat less than 6,000 miles. Each ring, C included, is brightest at its outer edge; but there is no gap between the shining and the dusky structures, B shading by insensible gradations up to C, yet maintaining distinctness from it. The earliest exact determinations of the former were made by Bradley in 1719, since when they have been affected by no appreciable change. The theoretically inevitable subversion of the system is progressing with extreme slowness.

The thickness of the rings is quite inconsiderable. They are flat sheets, without (so to speak) a third dimension. For this reason, they disappear utterly in most telescopes, when their plane passes through the[419] earth, as it does twice in each Saturnian year. Only under exceptional conditions, a narrow, knotted, often nebulous, streak survives as an index to their whereabouts. On October 26, 1891, Professor Barnard, armed with the Lick refractor, found it impossible to see them projected upon the sky, notwithstanding that their shadow lay heavily on the planet. It was not until three days later that "slender threads of light" came into view. The corresponding thickness of the formation was estimated at less than fifty miles. The phenomenon of ring disappearance will not recur until July 29, 1907.

The constitution of this marvelous structure is no longer doubtful. It represents what might be called the fixed form of a revolving multitude of diminutive bodies. This was demonstrated by Clerk Maxwell in the Adams Prize Essay of 1857. His conclusion proved irreversible. The pulverulent composition of Saturn's rings is one of the acquired truths of science. An incalculable number of tiny satellites revolving independently in distinct orbits, in the precise periods prescribed by their several distances from the planet, are aggregated into the unmatched appendages of Galileo's tergeminus planeta. The local differences in their brightness depend upon the distribution of the component satelloids. Where they are closely packed, as in the outer margins of rings A and B, sunlight is copiously reflected; where the interspaces are wide, the blackness of the sky is barely veiled by the scanty rays thrown back from the thinly scattered cosmic dust. The appearance of the crape ring as a dark stripe on the planet results—as[420] M. Seeliger has pointed out—not from the transits of the objects themselves, but from the flitting of their shadows in continual procession across the disk.

The albedo of these particles is so high as to render it improbable that they are of an earthy or rocky nature, such as the meteorites which penetrate our atmosphere. The rings they form are, on the whole, more lustrous than Saturn's globe; but this superiority is

held to be due to the absence of atmospheric absorption. Their spectrum is that of unmodified sunlight.

An eclipse of Japetus, the eighth Saturnian moon, by the globe and rings, November 1, 1889, was highly instructive as to the nature of the dusky appendage. The satellite was never lost sight of during its passage behind it; but became more and more deeply obscured as it traveled outward; then, at the moment of ingress into the shadow of ring B, suddenly disappeared. Certainty was thus acquired that the particles forming the crape ring are most sparsely strewn at its inner edge—which is, nevertheless, perfectly definite—and gradually reach a maximum of density at its outer edge. Yet, while there is not the smallest clear interval, a sharp line of demarcation separates it from the contiguous bright ring. Professor Barnard was the only observer of these curious appearances. The distribution of the ring-constituents, like that of the asteroids, was governed by the law of commensurable periods, Saturn's moons replacing Jupiter as the perturbing and regulating power.

[421]

The "satellite-theory" of Saturn's rings has received confirmation from apparently the least promising quarters. Professor Seeliger of Munich showed, from photometric experiments in 1888, that their constant lustre under angles of illumination ranging from 0° to 30° was proof positive of their composition out of discrete small bodies. And Professor Keeler of Alleghany, by a beautiful and refined application of the spectroscopic method, arrived at the same result in April, 1895. "Under the two different hypotheses," he remarked, "that the ring is a rigid body, and that it is a swarm of satellites, the relative motion of its parts would be essentially different." The former would necessarily involve increasing velocity outward, the latter, increase of velocity inward, just for the same reason that Mercury moves more swiftly than the earth, and the earth than Saturn; while the sections of a solid body, which could have but one period of rotation, should move faster, in miles per second, the further they were from the centre of attraction. The line of sight test is then theoretically available; but it was an arduous task to render it practically so. The difficulties were, however, one by one overcome; and a successful photograph of the spectra of Saturn and its rings gave the required information in unmistakable shape. From measurements of the inclinations of five dusky rays contained in it with reference to a standard horizontal line, rates of movement were derived of 12½ miles per second for the inner edge of ring B, and of 10 miles for the outer edge of ring A. The agreement with theory was,[422] as nearly as possible, exact; the components of the rings were experimentally demonstrated to be moving, each independently of every other, under the dominion of Kepler's laws.

For the globe of Saturn, Professor Keeler obtained, by the same exquisite method, a rotational period of 10 hours, 14 minutes, 24 seconds, in precise accordance with that indicated by the white spot of 1876, which thus seems to have had no proper motion, but to have floated on the ochreous equatorial surface as tranquilly as a water-lily upon a stagnant pool. The result, so far as it goes, hints that Saturn may be really, as well as apparently, less ebullient than Jupiter.

Seers into the future of the heavenly bodies consider that the rings of Saturn, like the gills of a tadpole, are symptomatic of an early stage of development; and will be disposed of before he arrives at maturity. They can not be regarded otherwise than as abnormal excrescences. No other planet retains matter circulating round it in such close relative vicinity. It was proved by Roche of Montpellier that no secondary body of importance can exist within less than 2.44 mean radii of its primary; inside of that limit it would be rent asunder by tidal strain. But the entire ring-system lies within the assigned boundary; hence, being where it is, it can only exist as it is—in flights of discrete particles. Will it, however, always remain where it is?

"Clerk Maxwell," wrote Mr. Cowper Ranyard, "used to describe the matter of the rings as a shower of brickbats, among which there would inevitably[423] be continual collisions. The theoretical results of such impacts would be a spreading of the ring both inward and outward. The outward spreading will in time carry the meteorites beyond Roche's limit, where, in all probability, they will, as Professor Darwin suggests, slowly aggregate, and a minute satellite will be formed. The inward spreading will in time carry the meteorites at the inner edge of the ring into the atmosphere of the planet, where they will become incandescent, and disappear as meteorites do in our atmosphere."

Yet it may be that collisions are infrequent in this conglomeration of "brickbats." There is the strongest presumption that they all circulate in the same direction, in orbits nearly circular, and scarcely deviating from the plane of the Saturnian equator. Those pursuing markedly eccentric tracks must long ago have been eliminated. Thus, encounters can only occur through gravitational disturbances by Saturn's moons, and they must be of a mild character, depending upon very small differences of velocity. The first sign of a "spreading outward" should be the formation of an exterior "crape ring," of which no faintest trace has yet been perceived.

Saturn's rings are entirely invisible from its polar regions, but occasion prolonged and complex eclipse-effects in its temperate and equatorial zones. They have been fully treated of from the geometrical point of view by Mr. Proctor in Saturn and its System.

Of this planet's eight satellites,[28] the largest, Titan[424] (No. VI), was discovered first (by Huygens in 1655), and the smallest, Hyperion (No. VII), last (by Lassell and Bond in 1848). The five others were detected by J. D. Cassini and William Herschel. Titan, alone of the entire group, equals our moon in size. It measures, according to Professor Barnard, 2,720 miles across. Its period of revolution is nearly sixteen days, its distance from Saturn's centre, 771,000 miles. The orbit of Japetus (No. VIII) is the largest, and its period the longest of any secondary body in the Solar System. It circulates in 79■ days at a distance of 2,225,000 miles, equal to 59½ of Saturn's equatorial radii. Hence its path is of about the same proportional dimensions as that of our moon. Japetus is remarkable for its variability in light. It is capable of tripling or quadrupling its minimum lustre. Sir William Herschel noticed that these maxima coincided with a position on the western side of the planet, and inferred rotation of the lunar kind. "From the changes in this body," he argued in 1792, "we may conclude that some part of its surface, and this by far the largest, reflects much less light than the rest; and that neither the darkest nor the brightest side is turned toward the planet, but partly one and partly the other, though probably less of the bright side."

This explanation, however, he admitted to be incomplete. There was, and is, outstanding variability, which seems to intimate the presence of an atmosphere[425] and the formation of clouds. But no positive knowledge has yet been gained regarding the physical state of Saturn's moons. We may, nevertheless, conjecture that, since tidal friction has destroyed the rotation (as regards Saturn) of the remotest member of the family, it has not spared those more exposed to its grinding-down action. All presumably rotate in the same time that they revolve.

The five inner satellites move in approximately circular orbits; the three outer in ellipses about twice as eccentric as the terrestrial path. All, Japetus only excepted, keep strictly to the plane of the rings. And since this makes an angle of 27° with the planet's orbit, eclipses are much less frequent here than in the Jovian system. They can only occur when Saturn is within a certain distance (different for each) from the node of the satellite-orbit. Even Mimas (No. I), although it wheels round the ring at an interval of only 34,000 miles, often slips outside the obliquely projected shadow-cone. Its distance from Saturn's centre is 118,000 miles, and it completes a circuit in 22½ hours. Perpetually wrapped in the glare of its magnificent primary, it is a very shy object, only to be caught sight of in its timid excursions by the very finest telescopes. Like all the Saturnian moons, except Titan, and, by a rare conjunction, Japetus, it is far too much contracted to be visible in transit across the disk.

The movements of these bodies have been carefully studied, and their mutual perturbations to some extent unraveled. They have proved exceedingly interesting to students of celestial mechanics. Titan[426] has, in this department, chiefly to be reckoned with. He exercises in the Saturnian system a similar overpowering influence to that wielded by Jupiter in the Solar System.
FOOTNOTES:

[28] A ninth satellite, Phœbe, was discovered in 1904. Its existence had been suspected for many years, and it was discovered at the Arequipa Observatory, Peru, on March 14, 1899, by means of photography. Since that date, it has been several times lost and rediscovered.—E. S. URANUS AND NEPTUNE.—William F. Denning

While Sir W. Herschel was a musician at Bath he formed the design of making a telescopic survey of the heavens. While engaged in this, he accidentally effected a discovery of great importance, for on the night of March 13, 1781, an object entered the field of his 6.3-inch reflector which ultimately proved to be a new major planet of our system.

The acute eye of Herschel, directly it alighted upon the strange body, recognized it as one of unusual character, for it had a perceptible disk, and could be neither fixed star nor nebula. He afterward found the object to be in motion, and its appearance being "hazy and ill-defined," with very high powers, he was led to regard it as a comet, and communicated his discovery to the Royal Society at its meeting on April 26, 1781.

The supposed comet soon came under the observation of others, including Maskelyne, the Astronomer Royal, and Messier, the "Comet Ferret," of Paris. The latter, in a letter to Herschel, said: "Nothing was more difficult than to catch it, and I can not conceive how you could have hit this star or comet several times, for it was absolutely necessary for me[427] to observe it for several days in succession before I could perceive that it was in motion."

As observations began to accumulate, it was seen that a parabolic orbit failed to accommodate them. Ultimately the secret was revealed. The only orbit to represent the motion of the new body was found to be an approximately circular one situated far outside the path of Saturn, and the inference became irresistible that the supposed "comet" must in reality be a new primary planet revolving on the outskirts of the Solar System. This conclusion was justified by facts of a convincing nature, and its announcement created no small excitement in the scientific world. Every telescope was directed to that part of the firmament which contained the

new orb, and its pale blue disk, wrapped in tiny proportions, was viewed again and again with all the delight that so great a novelty could inspire. From the earliest period of ancient history, no discovery of the same kind had been effected. The Chaldeans were acquainted with five major planets, in addition to the earth, and the number had remained constant until the vigilant eye of Herschel enlarged our knowledge, and Saturn was relieved as the sentinel planet going his rounds on the distant frontiers of our system.

When the elements of the new body had been computed, a search was instituted among the records of previous observers, and it was found that Herschel's planet had been seen on many occasions, but it had invariably been mistaken for a fixed star. Flamsteed observed it on six occasions between 1690 and 1715, while Le Monnier saw it on twelve nights in[428] the years 1750 to 1771, and it seems to have been pure carelessness on the part of the latter which prevented him from anticipating Herschel in one of the greatest discoveries of modern times.

The name Uranus was applied to the new planet, though the discoverer himself called it Georgium Sidus, and there were others who termed it Herschel in honor of the man through whose sagacity it had been revealed.

Uranus revolves around the sun in 30,687 days, which very slightly exceeds 84 terrestrial years. His mean distance from the sun is 1,782,000,000 miles, but the interval varies between 1,699 and 1,865 millions of miles. The apparent diameter of the planet undergoes little variation; the mean is 3″.6, but observers differ. His real diameter is approximately 31,000 miles, and the polar compression about 1/13, though this value is not that found by all authorities.

The planet near opposition shines like a star of the sixth magnitude, and is observable with the naked eye. He emits a bluish light. While engaged in meteoric observations, I have sometimes followed the planet with the naked eye during several months, and noted the changes in his position relatively to the stars near. It is clear from this that Uranus admitted of detection before the invention of the telescope.

A luminous ring, similar to that of Saturn, was at first supposed to surround Uranus, and Herschel suspected the existence of such a feature on several occasions; but it scarcely survived his later researches, and modern observations have finally disposed of it.

[429]

In May and June, 1883, Professor Young, having the advantage of the fine 23-inch refractor at the Princeton Observatory, observed two faint belts, one on each side of the equator, and much like the belts of Saturn. On March 18, 1884, Messrs. Thollon and Perrotin, with the 14-inch equatorial at Nice, remarked dark spots similar to those on Mars, toward the centre of the disk, and a white spot was seen on the limb. Two different tints were perceived, the color of the Northwest Hemisphere being dark and that of the Southeast a bluish-white color. In April observations were continued, and the white spot was seen "rather as a luminous band than a simple spot," but it was most conspicuous near the limb. The observers thought the appearances indicated a rotation-period of about ten hours. The brothers Henry at Paris, in 1884, invariably noticed two belts lying parallel to each other, and including between them the brighter equatorial zone of the planet. Their results apparently show that the angle between the plane of the Uranian equator and that of the satellite-orbits is about 41°.

M. Perrotin, with the great 30-inch equatorial at Nice, reobserved the belts in May and June, 1889. He wrote that dark parallel bands were noticed several times, and they were very similar to the belts of Jupiter. M. Perrotin notes that the bands of Uranus do not always present the same aspect. They vary in size and number in different parts of their circumference.

For many years it was supposed that Uranus possessed six satellites, all of which were discovered by[430] Sir W. Herschel, but later observations proved that four of these had no existence. They were small stars near the planet. But two of Herschel's satellites were fully corroborated, and two new ones were discovered by Lassell and Struve. The number of satellites attending Uranus is four, and it is probable that many others exist, though they are too minute to be distinguished in the most powerful instruments hitherto constructed. The following are the known satellites: 3d Ariel, discovered in 1847; 4th Umbriel, discovered in 1847; 1st Titania, discovered in 1787, and 2d Oberon, discovered in 1787.

Titania and Oberon are the two brightest satellites, but none of them can be seen except in large instruments. From observations with large modern instruments it appears highly probable that the four known satellites must be considerably larger than any others which may be revolving round the planet. A curious fact in connection with these satellites is that their motions are retrograde.

The leading incidents in the narrative of the discovery of Uranus and Neptune present a great dissimilarity—Uranus was discovered by accident, Neptune by design. Telescopic power revealed the former, while theory disclosed the latter. In one case optical

appliance afforded the direct means of success, while in the other the unerring precision of mathematical analysis attained it. The telescope played but a secondary part in the discovery of Neptune, for this instrument was employed simply to realize or confirm what theory had proven.

Certain irregularities in the motion of Uranus[431] could not be explained but on the assumption of an undetected planet situated outside the known boundaries of the system. Two able geometers applied themselves to study the problem of these irregularities, and to deduce from them the place of the disturbing body. This was effected independently by Messrs. Le Verrier and Adams; and Dr. Galle of Berlin, having received from Le Verrier the leading results of his computations, and the intimation that the longitude of the suspected planet was then 326°, found it with his telescope on the night of September 23, 1846, in longitude 326° 52′. The calculated place by Professor Adams was 329° 19′ for the same date.

The name given to the new planet was Neptune. When the elements were computed it was found that they presented rather large differences with those theoretically computed by Le Verrier and Adams. It was also found that the planet had been previously observed by Lalande on May 8 and 10, 1795, but its true character escaped detection. This astronomer had observed a star of the eighth magnitude on May 8; but on May 10, not finding the same star in the exact place noted on the former evening, he rejected the first observation as inaccurate and adopted the second, marking it doubtful. Lalande, like Le Monnier, the unsuspecting discoverer of Uranus, let a valuable discovery slip through his hands.

Neptune revolves round the sun in 60,126 days, which is equal to rather more than 164½ of our years. His mean distance from the sun is 2,792,000,000 miles, and his usual diameter 2″.7. He exceeds[432] Uranus in dimensions, his real diameter being 37,000 miles.

Our knowledge of this distant orb is extremely limited, owing to his apparently diminutive size and feebleness. No markings have ever been sighted on his miniature disk, and we can expect to learn nothing until one of the large telescopes is employed in the work. No doubt this planet exhibits the same belted appearance as that of Uranus, and there is every probability that he possesses numerous satellites.

Directly the new planet was discovered, Mr. Lassell turned his large reflector upon it and sought to learn something of its appearance, and possibly detect one or more of its satellites. On October 3 and 10, 1846, he was struck with the appearance of the disk, which was obviously not spherical. He subsequently confirmed this impression, and concluded that a ring, inclined about 70°, surrounded the planet. Professor Challis supported this view, but later observations in a purer sky led Mr. Lassell to abandon the idea. Thus the ring of Neptune, like the ring of Uranus, though apparently obvious at first, vanished in the light of more modern researches.

But if Mr. Lassell quite failed to demonstrate the existence of a ring, he nevertheless succeeded in discovering a satellite belonging to the planet. This was on October 10, 1846. The new satellite was found to have a period of 5 days, 21 hours, and 3 minutes, and to be situated about 220,000 miles distant from the planet.

END OF VOLUME ONE

TRANSCRIBER'S NOTE

Footnote [13] is referenced twice from page 102.

Obvious typographical errors and punctuation errors have been corrected after careful comparison with other occurrences within the text and consultation of external sources.

Some hyphens in words have been silently removed, some added, when a predominant preference was found in the original book.

Except for those changes noted below, all misspellings in the text, and inconsistent or archaic usage, have been retained.

Pg 3: 'Caliph Al-Mamum' replaced by 'Caliph Al-Mamun'. Pg 20: 'Ninteenth Century' replaced by 'Nineteenth Century'. Pg 21: 'Map of the' replaced by 'Chart of the'. Pg 21: 'Hourglass Sea' replaced by 'Nine Views of the Hour-Glass Sea'. Pg 74: 'cose che redire' replaced by 'cose che ridire'. Pg 74: 'Nè sa, nè' replaced by 'Né sa, né'. Pg 100: 'Hesoid' replaced by 'Hesiod'. Pg 122: 'familar to most' replaced by 'familiar to most'. Pg 150: 'formed of myraids' replaced by 'formed of myriads'. Pg 223: 'may be interred' replaced by 'may be inferred'. Pg 238: 'Will some motral' replaced by 'Will some mortal'. Pg 292: 'its orbitual motion' replaced by 'its orbital motion'. Pg 380: 'the Mare Humorom' replaced by 'the Mare Humorum'. Pg 390: 'present themelves' replaced by 'present

themselves’. Pg 391: ‘Mr. Lowell remarks,*’ replaced by ‘Mr. Lowell remarks,’; (the * anchor had no footnote and has been removed). Pg 396: ‘permamently shut’ replaced by ‘permanently shut’. Pg 418: ‘is a thining-out’ replaced by ‘is a thinning-out’.

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Handbook on dress and cloak cutting

Charles Hecklinger

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HANDBOOK ON DRESS AND CLOAK CUTTING,

BY CHAS. HECKLINGER.

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PREFACE.

The following pages contain the author's Improved System of Dress and Cloak Cutting, fully explained, with the intention of helping those students who, desirous to follow this branch of industry, are met on the very threshold by a difficulty—the choice of a suitable System.

The System given has been found to give the greatest security in its results, with the least trouble, it being easy to learn, readily used, and gives the greatest satisfaction to the large number of those using it. Everything in illustrating and explaining has been omitted which might tend to complicate or retard the student in acquiring it. Every point needed to make it clear has been carefully put down—in its illustrations, in the simple description, and in grouping the separate articles in their correct places—making it at once easy to comprehend and perfect as a whole.

[Illustration]

[Illustration]

PROPORTIONATE SYSTEM.

Most Systems of proportion, thus far issued, are projected on the breast-measure. It will be evident, on investigating the proportions of the human figure, that a System based only on one size of the body, and that its width, can never lead to the best results.

[Illustration]

When the height and width are equal it is immaterial which we use. But this is only the case on normal sizes, from 34 to 38 breast, as all deviations from these sizes are different in their proportions of heights to the widths.

The problem to be solved in using a proportionate system is to arrange the lengths so that they agree with a certain breast size and use it for the heights.

In practice we find that the average forms, measuring from 34 to 38 breast, require and can be cut by the full breast-measure, as the lengths agree, in the majority of cases, with this size; but in larger and smaller sizes this breast-measure will either be too small or too large, therefore, in drafting any other sizes than those indicated, we must use the quantities as given in the following Table, as set opposite the full breast-measure, in order that the pattern in its length may be of correct size, and neither too small or too large.

Table of Sizes.

=======+================+======= | SIZE TO DRAFT | BREAST.| ONE-HALF | WAIST. |BREAST-MEASURE.| -------+---------------+------- 30 | 15½ | 22 31 | 15■ | 22½ 32 | 16¼ | 23 33 | 16¾ | 23½ 34 | 17¼ | 24 35 | 17■ | 24½ 36 | 18 | 25 37 | 18½ | 25½ 38 | 19 | 26 39 | 19½ | 26½ 40 | 20 | 27 41 | 20¼ | 28 42 | 20¾ | 29 43 | 21■ | 30 44 | 21■ | 31½ 45 | 21 | 33 46 | 21■ | 34½ 47 | 22¼ | 36 48 | 22¾ | 37½ 49 | 23 | 38½ 50 | 23¼ | 39 -------+---------------+-------

In considering the human body it must be allowed that sufficient and marked characteristics exist between a young girl and the full-grown woman—the slender, and the large, fleshy form. All these tend to establish that the first elements of a good System for constructing garments is a good proportionate standard.

[Illustration]

In strict accordance with this we have given diagrams, illustrating the system by which the art of cutting is thoroughly attained; we also give the system as it should be used in drafting by measure.

Table of Sizes for Children.

====+========+========+========== AGE.| BREAST.| WAIST. | LENGTH OF | | | BACK TO | | | NATURAL | | | WAIST. ----+--------+--------+---------- 2 | 22 | 22 | 9 3 | 22¾ | 22¼ | 9½ 4 | 23½ | 22½ | 10 5 | 24¼ | 22¾ | 10½ 6 | 25 | 23 | 11 7 | 25¾ | 23¼ | 11½ 8 | 26½ | 23½ | 12 9 | 27¼ | 23¾ | 12½ 10 | 28 | 24 | 13 11 | 28¾ | 24¼ | 13½ 12 | 29½ | 24½ | 14 13 | 30¼ | 24¾ | 14½ 14 | 31 | 25 | 15 15 | 32 | 25 | 15½ ----+--------+--------+----------

[Illustration: Fig. 1.]

[Illustration: Fig. 2.]

THE MEASURES.

The measures required are few, and only such as give correct results (See Fig. 1).

Have a tape which fastens around the waist in such a manner that it will be level.

Measure from socket bone at top of back, point O, to waist I below the tape to B, for the highest part of hip, and to the full length of garment wanted.

Take next the width of back from E to D, being careful to see whether the dress worn has this width in the correct place. Should it be either too narrow or too wide modify your measure as seems right.

Take the measure around the arm-hole; then move the arm forward to allow you to put the tape directly under the arm to seam of sleeve at F, and measure down to bottom of tape at J.

Next, put the tape under the arm, close up, and measure the length of the sleeve down to the wrist.

Turn to Fig. 2, and measure, as shown, from back of neck, point O, past the front of arm, to bottom of tape at J. This measure must be taken easy, and should run straight down in front of arm.

Measure next from front of arm to centre of back. To take this measure, a little square, having a tape attached, is very handy to use.

Take the breast-measure over the fullest part of the bosom and shoulder blades, then the waist-measure, always taken close, and the hip-measure.

These are all the measures required for a dress-waist, a jacket, or a long garment. For a skirt we take the length on the side, from the hip down to the floor. For a circular take the width around the shoulders.

FIG. 3 AND 4. THE WAIST PATTERN.

Commence by drawing line O on the edge of a sheet of paper from point O to F, and one line C at right angles with it from O to N.

From O go down three-fourths of an inch for the actual top of back.

From O to C is one-quarter of the breast-measure, which for a 36 bust would be 9 inches, and from C over to 16 draw line D (see Fig. 4) at right angles with the back line.

Next, measure from ¾, or the top of back down to F, the length of back, from socket bone to the natural waist and from F draw a line over to the front at T.

From F go in 1½ inch, and draw a line for the centre of the back, from ¾ at top to 1½ at the bottom.

From O over on the top line, place 2 inches to the point marked ■. This will be about right for all medium sizes. For large sizes, over 40 breast, make it 2¼ inches to 2½ inches and for sizes under 30 breast-measure let it be 1½ to 1¾ inches. It will make no difference in the fit what this width may be, as it only affects the appearance of the shoulder-seam. A little practice, however, will enable any one to apply the right width.

In the middle, between O and E (see Fig. 4), fix point B, and in the centre, between B and E, locate point C, and draw lines B and G from both points.

Starting at E, measure over to S one-third of the breast, which is 6 inches for a 36; and add to it one inch, which fixes S; and from S to H place one-fourth, or 4½ inches. All fractions and divisions that we use in explanation are based on the breast-measure, and are found already divided on the square.

At S and H draw lines up, as shown. Where lines S-J and B-J cross, begin by drawing another to the top, at A.

Now, curve from ¾ to A, and from A to G, which last point is one-half inch above J. Commencing at G curve past J to R, going a trifle inside of straight line, then from R past X to V.

From R draw a straight line to 1½, and curve the back seam from R by going only a little inside of straight line at 19, thence to 2. Point 2 is 1½ inches from centre 1½. From 2 to 1 place 1 inch, then curve the side-body from 19 to 1.

Next, measure from the centre of the back at Z, on the line under the arm, to get the point D in front. This should be one-half of the breast-measure (18). Point D being placed, draw a line from there up and down to N and to U, at right angles with the line under the arm.

[Illustration: Fig. 3.]

To form the neck we take one-sixth of the breast and place it from N to P, and, using N as a pivot, sweep from P to 15. One-quarter inch inside of front line at 15 we start to draw the curved front line to the bottom, by going outside of D one-half inch and coming back to straight line again, near U.

One and a half inches below the waist-line, at U, draw a line from T over to 12.

From P to B draw a straight line; then take the length of the back shoulder, from A to G, and place the same from P towards 17, and where this reaches is point 17.

Having located 17, curve from it above the line of shoulder at 21, and drop one-fourth inch below it at 20; and, also, from 20 draw the arm-hole past 18 to X; but do not quite touch A, and drop below V one-fourth inch.

Point V is midway between S and H; from it draw a straight line to 4; curve a little on both sides of it; that is, starting from V, keep following the line for two inches, then gradually separate towards the waist-line, so that you will have two curves, which will be apart one-fourth inch near waist, but coming together again at 4.

About one-half inch more forward than the middle, between 19 and V, fix point X; and in the centre, between 1 and 4, locate 3; then draw a line from X to 3 and curve it.

In the middle, between H and D, mark point 12, and in the middle, between 12 and H, point 13.

Measure the distance from front, at U, to 1, and from 2 to 1½; on this draft it will be 16 inches. Now deduct from this the size of waist, 12 inches, and the remainder, 4 inches, must be taken out in darts. We put them in as follows: From U to 5 place a distance of 2 inches for all average medium sizes; from 5 to 6 is one dart of 2 inches, and between the darts, from 6 to 7, is three-fourths inch, then from 7 to 8 is another dart of 2 inches.

Take two-thirds of the distance under the arm and place it upwards from 7 towards 13 for the height of the back dart, and let the front one start one-half inch lower; then draw them, as shown, from 22 and 23 to 9, 10, 11 and 12.

Now, at one-fourth inch below 1, curve the lower line past 3, and a trifle above it, to 12, drop point 12 a little below the line; also drop 10 a little below it; from 9 to T remain on the line straight across.

The draft is now finished by proportion, and we can assure our readers that, with the use of the sizes on our Proportionate Table, it is applicable to all forms, the manner of drafting remaining the same in all cases.

All our figures, unless otherwise stated, are drafted without seams. We do this because it is far easier to add the amount necessary on different material than to draft it on the pattern.

THE WAIST, BY MEASURE.

The measures we shall use are the following: Breast, 36; waist, 24; length of natural waist, 15; height under arm, 7; front of arm, 10½; width of back, 6½; front length, 18½.

In drafting this we drop proportion altogether and use only the measures as stated above to get all points on the draft. All the lines and curves will come out in similar manner to the previous draft. Fig. 4 starts by drawing a line O-F and O-N; go down from O three-fourths of an inch, and in from O, to A, two inches, and curve from ¾ to A.

From ¾ down, measure the length of back 15 inches to F, and at F draw a line over to the front and go in 1½ inches and mark a point.

From ¾ to this last point draw a straight line for the centre of the back.

Up from F measure the height under arm 7 inches to E, and from E draw a line to the front.

From Z to D is one-half of the breast-measure, and draw the front line up and down. Also measure from Z to S, the actual width of the back, and from Z to H, the front of the arm, 10½ inches, or the blade measure which is taken from the front of the arm over the blade to the centre of the back. At S and H draw lines up.

In the middle between O and E mark point B, and in the middle between B and E point C, and draw the lines across as shown. (See Fig. 4.)

From where the lines cross at J, draw one across to top of back at A, and curve from A to G which point is one-half inch above J.

Beginning at G curve arm-hole past J, a trifle inside of line between J and R, and from thence to V. This last is midway between S and H.

Make the bottom of the back 1½ inches wide. This is only a medium, as it can be made 1 inch or 2 inches, which only places the seam either further back or more to the front. Then from R draw a straight line to 1½ and slightly curve a line drawn to 19 and to 2. Between 19 and 2 curve more towards centre of back. A few trials will enable you to make a nice shaped curve.

[Illustration: Fig. 4.]

From 2 on back to side body at 1 is 1 inch, and curve from 19 to 1.

From V, straight down, draw a line to 4 and curve a trifle on either side of it, also separate side-body from X to 3. Point X is midway between line R and V and the distance between 3 and 4 is about ½ inch more than X to V.

Take ■ of the breast, equal to 3 inches, and place it from point N to P and use point N as a pivot and sweep from P to 15.

At a point on waist-line directly under H, measure up past P, shoulder point, the front length, which is in our measure 18½, deducting the width of top of back, and wherever it reaches to is point P. This may, sometimes, when the person is erect, reach above the line; and again, on hollow or stooping shoulders, be below it. Wherever it reaches is the shoulder point, and when it goes above we sweep at a point above N even with shoulder for neck, and of course, should it be below the line, at a point below N, so that the neck will keep its shape to harmonize with the height of shoulder point.

[Illustration]

Wherever point P is located by measure, above or below, or on the line, start to draw the line to B, on back, for height of shoulder, and place the width of back shoulder from A to G on this line from P to get point 17. Then from 17 curve above it about one-quarter inch to P, and also draw the arm-hole, going inside of line H, but never over one-half inch, to V, as shown on the diagram. Drop a trifle from 17 to 20.

At the front, draw the line starting inside of straight line of 15 one-quarter of an inch, gradually curving out till at D we have one-half inch curve, and thence going in again to the line at waist, point U. From U go down 1¼ inch to T, and draw a line across to 12.

Measure the distance F to U, leaving out the opening between 1 and 2, which in this case will be 16 inches. Now, one-half of waist-measure, 12 inches, from 16 leaves 4 inches, which must be taken out in darts.

To produce the darts in the right place we proceed as follows: first locate a point in the middle between H and D which gives 12, and in the centre between H and 12, another which is marked 13.

From U to 5 place 2 inches, as we never wish to have the first dart any nearer to the front, then from 5 to 6 is one dart of 2 inches or one-half of the amount to be taken out. Between the darts leave three-fourths inch, and then place another dart of 2 inches from 7 to 8. In the centre of each dart mark a point and draw lines from these to 12 and 13.

One-third of the height under arm from 13 locates 23 while 22 is one-half inch lower, and starting from each of the last points curve the darts as shown.

It will be seen that they are drawn very pointed at top, and that below the waist-line they run straight down without any spring being given.

From 1 curve to 3 and 4; but between 3 and 4 it runs a trifle above waist-line, and then from 4 to 12 on lower line. Point 10 is a little lower than the line, while it rests on line, from 9 to T.

This finishes the draft by measure, and we have only to add that this, as well as the preceding, requires the adding of seams according to material used.

FIG. 5. LARGE SIZE WAIST.

In using this by measure, draft in the same way as explained in another article, the difference being only that the measure will be larger. We will explain this by the Proportionate Method: Breast, 44 inches; waist, 31½; drafting size, 21■, or equal to a breast-measure of 43¼ inches.

It should be understood that this last size of breast is used only for the height, while the original breast-measure must always be used for the width.

First draw line O-C, mark point O, and draw a line at right angles with O-C, to A; from O go down three-fourths inch to point 7, the top of back. From 7 to C is the length of the waist, 15½ or 16 inches.

[Illustration: Fig. 5.]

At the waist go in 1½ inch from C; draw a straight line from 7 to 1½ for the centre of the back.

From O go down to point B, one-quarter of the drafting size, which is, in this case, 10■ inches; this is one-quarter of 43■, as on large sizes the length is reduced in the shoulders to the drafting size. Now draw a line from B to H, and one from C to J.

Point D is in the centre between O and B; then from D draw a line over to K.

From B to G is one-third and 1 inch, equal to 8■ inches, and from G draw a line up.

From G to E is one-fourth, equal to 5¼ inches; here also draw a line up.

From N, on the back line, to H, place one-half of the full breast-measure, which is 22 inches; and at this point draw a line up and down, thus making the front line A-J.

From O to 6 is one-eighth of breast, 2■ inches. From 7 curve to 6, for the top of back, at neck; from K to 6 draw a line, and at 6 begin to curve the line for shoulder, raising it one-half inch above K to 8. Also commence to curve the arm-hole from 8, going inside

of line one-eighth inch at 16, and thence past 15 and 4 to E.

Midway between K and G is point 16. Start to make the seam for the back from 16, past 17 to 1; the last point is 1½ inch from 1½. When it is desired to produce a narrow shoulder, raise the seam above 8 one-half inch, and back from 8 fully 1 inch, and draw the arm-hole from 18 to 16.

To draw the first side-body, place 1 inch from 1 to 2, and curve the line from 16 to 17; thence separate and curve nicely to 2.

In the centre, between G and E, mark point 4, and draw a line straight down, which will be 5; and, in the middle, between 17 and 4, fix point 15. Also take the distance from 2 to 5, and fix a point in the centre, which will be 3, and then draw a line from 15 to 3; curve a little on each side of these two lines, as shown.

In producing the front, be very careful to follow the instructions as here given: From A to F is one-sixth of the breast-measure, 3½ inches; and the same amount from A to I; now, sweep from F to I, using A as pivot; from F to D draw a straight line, and place the same distance, as on the back shoulder from 6 to 8, on to F to 9, and then curve it a little above the line at 20; finish the arm-hole by curving it from 19 downwards past E. It will be seen that it runs over and in front of line E, and one-fourth inch below breast-line at 4.

For the front edge, commence one-fourth inch inside of straight line at I, and go gradually out to one-half inch at H, and in again until it touches line at J and 14.

Now to manage to fix the darts: Measure from 1½ to 1-2, to 3, and 3 to J; this will give 19½ inches. But as the measure is only 15¾, one-half of 31½, we take out the difference between these two widths in darts. This amounts to 2¾ inches, which we take out in two darts of 1■ inch each.

First find the centre between H and E, which fixes point R; and the centre, also, between R and E, which gives point P. This first dart commences 2¼ inches from J. Then put in one dart of 1■; inch. Between the darts, let the space be 1 inch, and then place the width of the other dart, which is also 1■ inch, and fix a centre in each dart.

From R draw a line through the centre of the first dart, and from P one through the centre of the second; then curve the lines of both darts like those on the diagram. The darts are started two-thirds of the distance up under the arm, but the front one is made one-half inch shorter.

From J go down 1½ inch and draw a line across to 10.

The bottom of the waist is straight from 14 to 13. At 12 begin one-fourth inch below and draw to the line at 11. From 10, also one-fourth inch below, draw a curved line to 5, raising to 3, and back to 2.

When the back has been narrowed on the shoulders it becomes necessary, also, to conform the front to it; as we have raised above 8 to 18 one-half inch, therefore, we must reduce the shoulder on the front the same amount we added, and it will bring it to 19. Then the waist is finished. Let it again be stated that seams must be added, except in the neck and arm-hole.

FIG. 6. LOW NECK DRESS WAIST.

It will be seen that the general arrangement of this draft is the same as all produced by this System.

The pointed basque-like shape at bottom is made to whatever length desired, only, it will be noticed, they are made short on the side just over the hips.

[Illustration: Fig. 6.]

In making these waists low in the neck, the first point to be considered is that they reach down lower on the shoulders, and, therefore, we have to draft them so as to meet this requirement.

From S, the original shaped draft, we go out to 10, on line D-10, 1 to 1½ inch, according to the lowness of opening; the same is added from Q to R, and the arm-hole drafted from these two last points.

Now, decide how low it should be open, and draw the curved lines from T to Q, and from B to 9. The strap on shoulder can be made 1 or 2 inches wide. If a short sleeve is wanted flatten the sleeve-head about the same amount as was added to the shoulder

over S to 10.

FIG. 7. BASQUE PATTERN.

This figure represents a short pointed basque as it can be produced by this System—whether by proportion or by measure. We have already fully explained the manner of producing all the upper portions of the draft in previous articles, and it is not necessary to go over it here again, it being the same as any other waist.

[Illustration: Fig. 7.]

From the waist down we place whatever length is wanted in the back to get point J or line B. From 1 and 1½ lines are drawn down, and whatever is put on from S to back line must be also added from line at 30 to 28.

[Illustration]

On a short basque the back line does not touch point J, it having less spring, and therefore the width of back, at S, is only a little more than at the waist, or about one-half inch on each side of the straight lines.

From J to 28 curve up, to taste. If wanted with a high curve at side, over the hips, it may reach above 28; and when desired straight around the bottom draw it along bottom line, or similar to a jacket, as shown on other Figures.

The side-body at bottom must start at S, level with 28, rising up towards R.

Q is even with R, and from it to O draw the line a little lower.

Point P is also level with O; thence, forward, it is drawn so that the front point is either level with the back or longer pointed, as shown on the Figure, where it is two inches lower.

The darts are placed the same as on a waist. But below the waist line F they curve, as shown. The best way to produce a good result is to draw straight lines down from 11, 12, 13 and 14, drawing them inside or outside of these lines, as shown. It will thus be seen that 23 comes nearly in the centre of the second dart, because more curve is here needed for the hips, while the space between the darts is drawn so that the distance between 24 and 25 is only a little more than at 12 to 13. In this way, when the darts are sewn up they will take the shape, or the seams will shape themselves like the centre-piece between the darts.

When dividing the side-body, from 18 to 19, directly under the arm draw a straight line down and let the spring on each side of this line be equal, as P and O. Also take out about one-fourth inch above the waist-line along the side-body seams, to curve them more to the shape.

From 15 to 20 a straight line is also drawn, and an equal amount is put each side of this line, over the hips, to R and O.

It will be noticed that point 18 is in the middle, between line E and the line K, or point S on Fig. 4; and point 15 is midway between 18 and line K; the width of the side-body, at the waist, is made wider; the line from 18 is always drawn straight down, then divide the distance from point 19 and 2, the centre of which is 20; and from 15 through 20 draw the other line.

FIG. 8. POLONAISE.

This is drafted in the same manner as the one given in Fig. 7. As, however, this is a long garment the amount of drapery must be increased; therefore below the hip line D we spring out till at bottom, point F, it amounts to one inch. At 4 there is one inch over line; at 6, on side-body, one inch; there draw a straight line from 4 down, through this inch, and curve the one-half inch over it. On the side, from 5 to 7, is 1½ inches, the same at bottom.

[Illustration: Fig. 8.]

Where 3 and X, of fore-part, are located lay the side-body on top of it, 1 resting on 3, and point 3, of side-body, resting on X, then finish the line from X to 14, by the way the side-body lays, and fix the length also by the side-body. Put in two darts, letting them run only 4 inches below the hip line.

FIGS. 9 AND 10. THE SLEEVE.

[Illustration: Fig. 9.]

Commence by drawing lines O-E and O-F. Use the arm-hole size to produce the sleeve, and go down from O to B one-fourth of this; A is in the middle between O and B. Draw lines across.

From O to F is one-half of arm-hole, and from there draw a line down to K.

From B to F draw a straight line and halve it, which will be point H; and from this last also draw a short line at right angles with the diagonal line from H to J.

Measure the length of line B-F and take one-third of it and place it from H to J.

Now, using J as pivot, sweep from line at top, point 4, around to the front and the back; from B curve line past 5 to this sweep. Where the sweep crosses line at G draw a line down to K.

Go down from B to C three-fourths of an inch, and from here measure the length of arm to E.

Mark a point midway between B and E, which gives D, and draw a line across.

In the middle, between the two parallel lines at back, mark a point _f_.

Now lay the square in such a position on the pattern that 5 inches will touch point E and the long arm will touch _f_, then draw along the bottom, from E to N, and to _f_.

[Illustration]

Begin to curve from C, past L to _f_, and curve to N.

Go in from D 1½ inch and draw the front-seam of the sleeve.

From X, where the curve strikes line B, begin to draw the under-sleeve parallel with upper part 6 to 1.

Measure from B around the sleeve-head to C, and apply number of inches obtained to X, and measure past 1 towards 3, the measure of arm-hole, and 2 inches more. If the upper-sleeve measures 11 inches place 11 on to X and measure 16 inches, adding 2 inches more to line at 3 for a 16-sleeve. Wherever point 3 is located begin to draw back arm-seam to bottom by running straight down, curving out to 2, or as much inside of line 7 as _f_ is outside of it.

FIG. 10.

Draw the line O-G and O-F. From O to C go down one-third, less one-half inch, and draw line over to K. In the middle, between C and O, draw also a line from B to H.

[Illustration: Fig. 10.]

From O to G is one-half of arm-hole size, and draw a line from G downwards.

From C begin to curve the sleeve-top past I to H, touching the top line at I. From L to E apply the length of sleeve. Make F 1¼ inches lower down than E.

From E to N is an average of 5 inches. Draw a line from H past K to M and N, curving it inside of K about one-half inch and curve the line only a trifle below the elbow. Go in from D 1½ inch, and draw the inside seam from C to E.

This finishes the upper-sleeve. For the under-sleeve draw from C, curving under straight line to L, thence to J. Point J is 1 inch inside of H. From J draw down to within one-half inch of M and to N.

The front-seam is the same as the upper-sleeve from C to E and N.

In drawing any sleeve use the measure of the arm-hole, and bear in mind that this manner of drafting has the seams already included.

FIG. 11. SKIRTS.

Cutting and making a dress skirt, of any style and kind, is sometimes considered of very little importance. By many dressmakers the work is entrusted to inexperienced hands and blocked out by a pattern which will not fit the form. Many fine costumes lack style

because the laws of cutting skirts for the different figures have not been observed.

The fashion for the present, and for some time past, requires the skirt to be fitted with as much care as any other part of the dress. All fullness must be so arranged as to fall into the back breadths of the train. The sloping of the bottom must be proportionate, so as to give a straight even effect across the front and sides and allow the train to suddenly spring out at the lower part of the back widths.

[Illustration: Fig. 11.]

The careful sloping of the gores at the sides causes the train to fall into a fan-like sweep. The necessity of fine slopes, and a difference of those in different costumes, as well as for different figures, will be readily appreciated when we observe the use for which the dress is intended.

In a walking dress, as it should be to be in harmony with style and the present demands of fashion, the skirts should adhere closely all around the front and sides, leaving whatever fullness there may be at the back. In order to gain this, darts are required between the breadths, which reduce the size needed over the hips down to the size at waist. As the hips proportionately increase at a given ratio at the sides it must be evident that, in order that the skirt may fall down fairly over the hips, these darts at side must be larger there, while towards the front they must be smaller.

The bottom should have a regular sweep. This sweep can be gained the easiest by laying the gores in a closing position on the table, drawing a straight line along the centre of the front and extending upwards about the same length as the skirt. At the centre of the back breadth another line is drawn far enough up to cross the first line. In this shape the two lines would represent a cone; at the point attach a string to a pin driven into the table, and extending this string to the lower length of the skirt sweep around the bottom—this will produce a correct effect in every case.

The front width is now cut wide enough so that only one additional width is needed at each side. As we have already said, much depends upon goring the sides as regards fitting the hips, but on stout ladies extra care must be taken that the front be also sufficient to cover the round form of the body. The defect liable to occur in this point has the same result as not sloping enough at the side for large hips, namely, the skirt will hitch-up on the waist-band.

Putting on a skirt to the band is of equal importance. A dart in the apron or front width gives sufficient fullness over the round of the body in front; so also do darts at side. All the rest of the fullness should be pleated or gathered into the few inches left of the band after the front and sides have been sewed to the band.

We should not advise any one to cut out a skirt, whether short or with train, with out a good pattern, unless they understand how to draft one and know the points of the different shapes in gores.

Such skirt patterns we are prepared to forward to any address, on application, but in order that students may acquire an idea of how to cut them, Fig. 11 will show the general form and shape of them.

Draw line A, and make it 45 inches long, and mark off all the distances on the line, as shown by the number of inches given at all these points; draw lines across at right angles to line A.

Draw a line from point 6 to 12 and curve it to within one-half inch of 6, and then curve slightly one-half inch below line at centre to 6½ on line A. This finishes top of front breadth; connect 12 and 45, which finishes the bottom.

Finish the top of side-breadth by drawing lines from 7 to 11, curving these lines like Figure; at the bottom, curve from 12 to 42.

Connect points 32 and 42, also 22 and 12, by straight lines, which finishes the back part; this will give a skirt 38 inches long and the prevailing width.

Lay the front part, line A, on the fold of the goods.

In sewing to the band the front and side-breadths are left plain while the back is pleated in three or four large pleats.

FIGS. 12, 13, 14. SACK JACKET.

It will be seen that every shape and style of garment must be drafted in the same manner as the principle employed in the construction of the waist-body or basque.

We first commence to draw the back line B and O to F (Fig. 12).

[Illustration: Fig. 12.]

[Illustration: Fig. 13.]

From O down, on the first line, place three-fourths of an inch, and from O over to F, one-eighth of the breast-measure, or simply 2 inches, on average size.

Starting at ¾, measure down to C, the length of natural waist, and to D, the full parts of the hips; also to E the length wanted.

From C up to B place the height under the arm. Now at every one of these points draw lines across, all at right angles with the first line.

Go in from C to N 1½ inch, and then draw a line from ¾, at top, to N, and from the last point to E, and curve the back-line, as shown from ¾, past R.

From N to M make the width of back, at waist, 2 inches or more, as desired.

Starting at R, place the width of back to G and draw a line up to S.

In the middle, between O and B, fix point A, and from there draw a line over to J.

From the point where lines A-J and G-S cross draw a line to F.

Raise above J one-half inch to S and curve the shoulder from F to S; then from S go inside of line at J and curve the arm-hole of the back to I. This last point is midway between J and G.

From I draw a line to N, then commence at I and draw line for the side-seam to 8, going inside of straight line a trifle and thence with a decided curve to M.

Draw a right-angle line with the waist-line F down to 3 from N, and to 4 from 2.

Now whatever the distance E is drawn from 3 must be placed from 4 to 5, and the back may be finished by drawing the line from 2 to 5.

In case it is desired to make a narrow back, point E may be nearer to 3; in such case point 5 would also be nearer to 4.

Cut the back out, and in order to draw the side-body lay it on the paper in such a manner that there will be room enough to cut it out without piecing.

THE SIDE-BODY.—FIG. 13.

Lines D-F and O are extended over. From 2 to 10 is 1 inch in every case.

Draw from I, along the back, to 8, and from thence begin to separate from the back and curve to 10 and down to 6, which is the point on the back where line O and the line from 2 downwards cross. From 6 down give this line a nice curve, not springing out too much nor making it too flat—a medium is what is desired.

From B to K is one-fourth of the breast-measure.

Curve from I to H and K.

About 1 inch inside of K draw a line down to L, which should make the side-body as wide from 8 to H as 10 to L.

At right angles with waist-line draw one down from 10 to 3, and another from L to 4.

Now whatever the distance is from 3 to 5 should be placed from 4 to 6, and then the seam from L is drawn past 11 to 6.

Make the length at bottom one-half inch longer at 5 to 6; also notice that the distance from 7 to 11 may be a little more than that from 9 to 6, as more ease over the hip, at side, is desirable.

THE FRONT.—FIG. 14.

All the lines are extended over on the paper, and the side-body and back are laid in the position as when they were drafted, and as shown.

First measure from B to V, one-half the breast-measure, and draw line A up and down.

From B to R is the measure to the front of the arm, where a line is drawn up. From P back, place one-sixth of the breast to N, here draw a line up and down, as shown.

[Illustration: Fig. 14.]

Measure up from star on side, marked Z, to line at N, the front length less the width of the top of back, and where this reaches on the line fix the height.

From this height draw a line to A, which gives the height of shoulder.

From P as pivot sweep from N to 21 for neck. Place the length of back shoulder from F to S on to N, on line N, and where it reaches will be point 22.

Drop one-half inch below line and curve from 22 to 23, which is one-fourth above the line, to N. Also curve arm-hole from 22 through R to H.

Draw the front line one-half inch inside at 21, curving outside one-half inch near V, coming back to line at U, and outside one-half inch at bottom to point 20.

From H, through L, draw line to 11.

Whatever the distance from 11 to 24 is place over from 11 to 13 and then curve from L, through 12, to 13. Sweep the bottom from 13 by a point 1 inch back of N and flatten this curve near 14.

Midway between R and V fix point 2, and midway between 2 and R point 1.

Measure the distance from the front at U to 10 and from 2 to C.

Deduct the half size of waist from this last and the remainder is taken out in darts.

From U to 12 is 2 inches.

From 12 to 9 is one-half of what is to be taken out in darts.

From 9 to 8 is always three-fourths of an inch.

From 8 to 7 is another dart.

Fix a point in the centre of the darts and draw a straight line from 1 and 2 to 6 and 5; and at right angles with waist-line draw lines from centre of dart down to the bottom. Now, one-third of the height under arm, down, fix point 3, and make 4 one-half inch more.

Draw the darts from 3 and 4 through the points, as shown, to 15 and 14.

FIG. 15. DOUBLE-BREASTED SACK JACKET.

[Illustration]

Draft by measure—breast, 36; waist, 24; and hip, 40. Length to waist 14½, and full length, 26.

By using these measures we will endeavor to show how to draft a jacket, each piece separately, thus doing away with the over-lapping of patterns as it occurs when it is drafted altogether, as in our previous articles on proportionate cutting. It is the same principle, but more practical, as a pattern can thus be cut whole in the skirt.

Commence by drawing the back construction line from O to L and O to P.

From O down is three-fourths inch to T.

From O to E is one-fourth of breast—9 inches.

From T measure down to the waist 14½ inches, and the full length to L, 26 inches, and from O over on top line to 5 two inches, and curve the top, T, to 5.

B is midway between O and E.

K is 6 inches below the waist; now draw all the lines across.

At F go in 1½ inch to back, and draw a curved line from the centre seam of the back, from T to 1½, and spring out three-fourths inch at 9, thence to L.

From E to 7 is one-third and one inch, equal to 7 inches. Draw a line up from 7 to 3, and one from 5 to 3.

Raise above 3 one-half inch to 4, then curve the shoulder-seam of the back; form also the curved line from 4 to 6.

Point 6 is midway between 3 and 7. Make the width of the back at waist 2 inches, and from 2 draw a straight line down to the bottom.

Now curve the side seam from 6 past 2 to 10 at bottom, which point is three-fourths of an inch outside of the straight line, also connect L and 10 by a line.

[Illustration: Fig. 15]

THE SIDE-BODY.

Cut out the back and lay it on the paper in such a manner that the breast-line will lay on the same line further towards the front, so that there will be sufficient room at the bottom to draft out the side-body whole. Now, first draw along the edge of the back from 6 to 2; go in at 2 one inch, and curve from the blade down to 13.

At 13 draw a straight line down, and curve out from 13 to 18; this last will be exactly underneath point 8 of the back, and from here to the bottom draw it with a slight curve to 20, which is the same length as point 10 of the back.

From 14 to 13 is 2 inches, and make the distance from 11 to 12 the same; now draw a straight line from 12 to 14, and down to the bottom.

Go out from 15 to 16 one inch, and curve seam from 14 to 19, which should not be over 1½ inch outside of straight line. Draw line from 20 to 19.

THE FRONT.

Lay the side-body on breast-line and back in position against side-body, so that the breast-line of each lays correct and straight, then measure from I on centre of the back to the centre of the front D, half-breast, or 18 inches; at this last point draw a line up and down for front line.

[Illustration]

Point 12 of the side-body will now be the same as point 21 of the front; draw down to 27 a line with a slight curve to shape in at waist; also draw a straight line down from 27 to 35 at bottom.

From P to C is one-sixth, or 3 inches, and the same to 23, now sweep the neck from P.

From C, which is one-half inch above the top line for erect or ordinary builds, on the line draw one to B on the back.

Now measure the length of shoulder on the back from 5 to 4, and place the same from C to 22, and curve a little above it, as shown in Fig. 15. From G on side-body forward to front of arm is one-fourth, or 4½ inches, where a line is drawn from H; then finish arm-hole from 22 to H and 21.

Finish the side-seam by going out at 31 1 inch to 33, and curve seam to 34; also locate the length by laying the side-body, point 12, on 21, and where 19 comes is 34.

From C, by 34, sweep the bottom of front and straighten this some in the centre.

At the centre of breast-line, beyond D, put one-half of breast, and curve the front line from 23 to waist at S, where it comes back to the straight line, and thence to the bottom at 30, where it is one-half inch outside of it. For a double-breasted jacket make the lap 2½ inches at breast, 2 at waist, and 2¼ at bottom. Whatever the size of the draft at waist, from points S to 1½ on back, exceeds the actual measure must be taken out in darts.

In this Figure we take out one dart only, starting in the centre, J, which is between H and D, and take out between points 25 and 26, the full amount which will be about 2½ or 3 inches, starting the dart at 24, two-thirds above 25, and finishing about 4 inches below the hip-line.

In case two darts are preferred they are put in as already shown in previous Figures.

FIG. 16. SACK JACKET.

This shows the manner of drafting a jacket with an extra piece under the arm and only one dart in the front. The correctness of the lines, and the simplicity of the process, will be of much benefit to our students. This method is the same as we have given in several different styles, and therefore it is drafted in a similar manner. It requires only one method to draft all kinds of garments, and our aim in giving the different shapes is to familiarize our readers with its application to a variety of shapes and styles, so that whatever garment they may be called to cut they will be able to do it.

[Illustration]

Let us take a size—36 breast, 24 waist, with a length of 30 inches, and a waist reaching down from neck 15½ inches.

In drafting, first draw the line O-F.

From O go down three-fourths inch for the top of the back.

From the top of the back to D is the length to the waist, 15½ inches; from the same point down to the bottom of the garment measure 30 inches to F.

At D go in to point 14 1½ inch. Then from the top of the back to 14 draw a straight line, and also draw one from 14 to F, curve slightly over the line below 14, past 20, to F. Make the width from 14 to 2 two inches, and run a line parallel with back-line from 2 to 29, and curve it a trifle, as shown on the Figure.

From O go down to C one-quarter of the breast, which is 9 inches, and draw a line across. Draw a line from O over to K at right angles with the back-line.

In the middle, between O and C, fix a point marked B and draw a line over to N. From C to G is one-third breast and 1 inch, equal to 7 inches, and draw a line at right angles with line C-G. From G to H is one-fourth breast, equal to 4½ inches, there draw a line at right angles with the one under arm.

From 1, centre of back, to J, at the front of the breast, place one-half of the breast-measure, equal to 18 inches, and at J draw a right angle line up and down like line K-J and S. From O to 13 is 2 inches.

From N to 13 draw a line, and then, commencing at 13, curve the shoulder, letting it rise above the last line one-half inch to 14.

Starting three-fourths inch inside of line G begin to curve the arm-hole past 12 to 17 and H. In the middle, between N and G, fix the point to start seams from for the back. Draw line from thence past 19 to 2 and 29—this makes the back with narrow shoulders.

To draw the first side-body place from 2 to 3 one inch, curve the line from 19 to 3, gradually beginning to separate below 19 without curving too much, care being taken to get a neat curve. Below 3 curve toward the back till at hip, 21, it will meet the back, and thence downwards, till at the bottom it will over-lap the back 1 inch to 30.

Make the width of side-body at the top any distance desired, say 3 inches, and make it the same at waist, or from 3 to 4, 3 inches. Then curve from 17 to 4.

Lay a long straight-edge, closing at 17, and three-fourths inch from point 4; while in this position mark a line along it from the hip-line downward, and connect it by a curve from 4 to 24.

Go in from 4 to 5 a distance of three-fourths inch, and curve from 17 to 5, but be careful to commence to separate side-body only 1½ inch below 17. Lay a straight-edge, as before, at 17, and three-fourths inch from 5, so that it will lay towards front, then from hip downwards draw a line to the bottom and finish by curving from 5 to meet this at hip, 23.

From 17 to 18 may be only 1½ or 2 inches, according to the size—2 inches will be sufficient for a 36 breast.

Draw a straight line to 6 and take out a slight curve to shape it to the form. Again, lay a straight-edge against 18, and three-fourths inch from 6, and mark along it from the hips downward; curve from 6 to hip.

Commencing at 18, curve the front to 7, taking out one-half inch, then lay a straight-edge against 18, and three-fourths inch from 7 mark along it below the hips and finish the curve from 7 to 25.

To produce the front, place from K to P one-sixth of breast, equal to 3 inches, also the same from K to 16. From P to B draw a line, then place the same distance as on the back shoulder from 13 to 24 on to P to produce point 15, or the length of front shoulder, curve it above this line, and at 15 drop it one-half inch below. At 15 curve the arm-hole to H, going outside of the line enough to give the arm-hole a good shape, but under no consideration go beyond point H—rather go inside.

Curve the front-line one-fourth inch inside of 16, and outside at J one-half inch, and coming back to R, where it should spring out to the bottom one-half inch at S.

Add beyond last curve 1 inch for the lap, on a single-breasted jacket, all the way down.

Measure from 14 to 2, 3 to 4, 5 to 6, and 7 to R, which will be about 15 inches; but as the waist must be 12 inches, or one-half of 24, we must take out the difference in a dart, which is 3 inches. Divide the space between H and J which gives point I, and from this draw a straight line down. Go down from I 2 inches to 17. On each side of the line at 9 place one-half of the dart, 1½ inch, then curve from 17 to 8, 27 and 35; also from the same point to 10, 28 and 36. At the bottom it should be three-fourths inch.

[Illustration: Fig. 16.]

The bottom of the first side-body must be one-half inch longer than the back; the second the same length as the first; and the front must start at the same length as the second, and curve forward 1 inch below line 33 to 37.

FIG. 17. SHORT JACKET.

This gives a short jacket, of a neat, peculiar shape. As regards the darts all points are the same as given in Fig. 18, except that instead of putting in two side-bodies we only cut a dart out under the arm, and one across the front, both being equal, of a size required to make the waist lay close. The dart in front is started from H and runs into the pocket.

[Illustration: Fig. 17.]

The back is made 4 inches wide at the waist and wide enough at the bottom to harmonize with it. Point F is the hip. Any sleeve cut to the size of arm-hole will go with this.

FIG. 18. JERSEY BLOUSE.

Draw line O-J and O-F. From O to D is one-fourth of breast. From O to 20 is three-fourths inch. From O to D take one-half the distance to get point B, and in the centre, between B and D, is point C. From 20 to E is length of back and to F the full length.

[Illustration: Fig. 18.]

Go in from E 1½ inch and draw the back-line from 20 to 1½ and to F. From O is 2 inches for top of back to 2. From D is one-third of breast and 1 inch to G. Draw a line up from G to 6. From 6 draw one to 2 and curve 1 inch above it at 1.

Curve arm-hole from 1 through 9 to 10. From G to H is one-fourth of breast—4½ inches on a 36 breast. Draw a line up. From back, near D, to K is one-half of breast. Draw line up and down. From J back to I is one-sixth of breast, and the same down to 3.

From I to 6 draw a line. Curve above line at 18 one-half inch for front shoulder, and curve the arm-hole from 18 to 17, and H to 10. Point 10 is about 1½ inch from G.

Make the width of back 5½ inches from 1½ and 9½ inches to point 10, and 10 inches at bottom. Then curve the side-seam at 10 to 5½ and U. From N, at front of the waist, go in 3 inches, to 16 4½ inches, and to 4 6 inches.

Draw a straight line up and down through 16, and form the dart, from 20, through 3 and 4, to 5 and 6.

Lay the back on the front to meet at 10, 5½ on V, 8 on U, to get the right curve for the side seam.

Measure the waist and make the distance at V to correspond with it. Using I as pivot sweep from 8 for the bottom of the front.

Add one-half inch button-stand, and 1 inch on the side the buttons are sewed on. Buttons should be 1 inch apart.

The Jersey is finished with standing collar.

This pattern is intended only for goods which are elastic—like stockinet or tweed.

The seams in the dart and at side should be stretched somewhat in pressing, thus allowing them to fit closer to the form.

FIG. 19. GIRL'S SACK.

[Illustration]

This is a sack for a young girl of size 31 breast, close-fitting. The figure illustrates a very jaunty and comfortable jacket.

For the Fall Season it should be made of heavy ribbed cloaking, of a dark shade of grey, and an extra neat finish is obtained by binding it with a braid of a darker shade, and buttons to match the braid.

It has eight buttons in front, is cut single-breasted, with a very small turn-over lapel, which allows it to be buttoned up close to the neck.

A side edge is imitated on the back by braid, and three buttons put on it.

The full-size pattern may be cut by following the Figure, as represented, using inches for every number marked out.

In order that this may be readily understood we will go over this manner of doing it again, so that our readers who desire to take them off may not make any mistakes.

First draw a line on the edge of paper, and draw out the back first, by fixing a point at the top.

O is the starting point. From O go down in inches as indicated by the points marked ¾, 2¾, 5¾, 13, 20 and 34.

Draw lines across from these points and apply the numbers on the Figure to these lines. When all these points are fixed connect the points by lines, which will form the outlines of the back.

For the side-body use the same process and you will have the full size. It can be made double-breasted by adding 1½ inch in front of the breast all the way down.

[Illustration: Fig. 19.]

FIG. 20. BRAIDED JACKET.

This Figure represents a fashionable style of close-fitting jackets for Spring wear. They are made single-breasted, having the buttons close together, and have the appearance of a Jersey. The same may be made double-breasted by the addition of 2 inches to the front. In trimming they may be plain, with nothing but small flat lasting, or a round crochet button. Braid in military style may be used, or a simple binding.

The Figure is drawn from a pattern of a 36 breast, 25 waist; the length may be regulated to taste. In drafting this pattern use inches for all the figures on the draft.

[Illustration: Fig. 20.]

FIG. 21. DOUBLE-BREASTED CUT-AWAY JACKET.

This gives an elegant and very stylish jacket. The front is double-breasted towards the top with a broad, sharp lap, while at the waist only one button is used.

In order to enlarge the draft to full size, which is a 36 inch breast-measure, use inches for all the figures on the draft.

The jacket itself is finished at the neck with a collar, which is put on to the cape. The front, at the neck, is held together by an agraffe ornament. This garment, as it should appear, may be seen by the illustration.

[Illustration: Fig. 21.]

FIG. 22. LADY'S JACKET.

These drafts illustrate a new style of lady's jacket, which will be acceptable to many for street wear. The style and general effect at once denote the character of the garment. The jacket is well adapted for outdoor wear. It is made with a moderate addition for double-breasted added on to the fore-part, and the button holes are worked in close together, as the buttons now used are so very small; therefore, on this jacket, they are placed only one inch apart.

The waist is medium length, and the skirt can be made to suit the height of the lady. A lap-over is made at the centre of the back skirt, finished off with small buttons put close together.

The pockets may be put in at the side like a coat pocket, or only a flap put on, leaving the top edge unfastened, which forms the opening. In the latter case it can be ornamented with buttons. Pockets, however, are only put in when it is cut longer than Figure.

The sleeves are narrow, finished by a row of buttons, and can be regulated in width by the measure of the arm. This is very essential, as ladies now-a-days like the sleeve as close as possible.

The darts are cut down to the bottom, which is more preferable to running them to a point, as a seam looks better which runs continuously to the bottom. Cutting the dart so that it reaches only to the hip, will, unless carefully made, rise up in a puff at its lower end. It must always be borne in mind that the spring must be allowed to rise at the side-seam. The sudden rise of a lady's hip, and the marked difference between the size of the waist and of the body but a few inches below, make it extremely difficult to obtain the necessary amount of freedom for the prominence of the figure at this part of the body.

The bottom edge of this jacket should be edged on the inside by a facing of silk, which is held on tight so that the edge may cling close to the dress-skirt.

The collar is cut like a coat-collar and the lapel rolls short. A narrow binding one-half inch wide is put on the edge on all goods with a close and firm texture, while on heavy, loose material, the stitching looks more appropriate.

[Illustration: Fig. 22.]

The button-holes run down to the bottom of the skirt. This form of jacket makes up well in fine diagonal or brocaded velvet.

For heavy winter wear, rough suiting will make very stylish garments.

The lower edge of this jacket may be drawn straight across instead of curving up over the hips as on the Figure, and then it is equally as well adapted to be worn with any dress, as in the shape we illustrate.

FIG. 23. SINGLE-BREASTED LONG SACK.

Figure 23 represents a long, close-fitting, single-breasted sack, consisting of back, side-body, front and sleeve. They are all drawn by measuring the lines, and placing the number of inches on each line as designated by the numbers shown on the Figure. Thus, for the back draw a straight line from O, then apply each measure as shown, and draw the lines across at right angles with the line O. When these figures are all located, finish by drawing the outlines.

Draw the straight line O down to the desired length for the side-body; at 28½ apply the figures on the lines—when these are all fixed curve the outlines.

For the front, draw the straight line down from O, and mark the number of inches for both length and width; when these are all fixed finish the outlines.

[Illustration: Fig. 23.]

The sleeve is drawn from O down to the required length, applying the number of inches for length as well as width, as shown; after these have all been found, and the line drawn at right angles with the line O, draw the outlines. After the upper part of the sleeve has been drawn cut it out; then locate the points for the under-sleeve, and lay the back of upper-sleeve against the points of the back part of the under-sleeve, and draw it like the back of upper-sleeve; fix the points in front, and lay the upper-sleeve on and draw for the front of sleeve, then finish for top, as shown.

FIG. 24. JACKET OR CLOAK—FROM A WAIST PATTERN.

The method which is explained below is one of the most handy, as well as the easiest, that can be used, and will invariably produce good results. It is evident, in the first place, that the original pattern must have the essential qualities of fit and good lines, otherwise it would be of little value as a base or guide to produce another garment. In order to get such a waist pattern one must be able to design it, or have it on hand; in the latter case we are prepared to furnish these patterns when ordered.

THE BACK:

In drafting a jacket pattern, first draw a line (like O-G) on the edge of your paper. Lay the back against the line at O and within 1½ inch of the line at the waist, then trace along the centre seam from O to 5. Now move it one-fourth inch away, this is for seam; then the same quantity is allowed above at neck from 1 to 2 and from 2 to 3.

Along the arm-hole, from 3 to 4, trace close to the pattern. Measure next the length wanted from O to 5 and 9 and draw a line over to 10. From 5 to 9 draw a straight line, and then curve outside of this, at point 8, about one-half inch, as shown on Figure.

Make the width of waist any size desired, say 3 inches, which establishes point 7, and from this point draw a line down to 10. This line should be no further away from the first line at 10 than at 7, or the distance from the line 9 to 10 should be the same as at waist, from 1½ to 7. Now, starting at 4, slightly curve to 7 and go one-half inch outside of straight line to 10.

THE SIDE-BODY.

In this case, as on the back, the first thing we do is to draw a straight line from O to 10. Now lay the side-body against it, at O, and swing it away from the line at the waist 1¼ inch. Trace along the pattern from O to 1¼. Then move the pattern one-fourth inch away from the last line, which would leave from 1 to 3 just one-fourth inch for the seam. From 5 to 6 go in one-half the distance allowed over and above the allowance on the back, as from 6 to 7. Now curve the side-body from 2 to 5, keeping as nearly as possible the same shape as the original. Then from 5 draw a line down parallel with the first line which runs from O to 10. Now apply the back from 2 to 9 and regulate the length, which is point 9; then from 5 curve one-half inch outside of straight line at 8 to 9. At 9, square across to 10, and also draw a straight line from 1¼ to 10, and begin to curve from 3, past 7, to 10. This curve should be more round near hip, or begin to curve closer to the waist. The curves on the back and on the side seam, from 5 to 8, may be gradual, as it thus has the appearance of being longer waisted than it actually is.

THE FRONT.

[Illustration: Fig. 24.]

First draw the straight line like O-B. Lay the fore-part of the pattern against this line, touching at the centre of the breast, B, and trace along it at the front from 1 to the bottom at 3. Next move the pattern back one-half inch to B. Trace along the arm-hole without any allowances, but on the top of shoulder add one-fourth inch, also a trifle at neck. On the side-seam, from 15 to 20, add one-fourth inch; then lay the finished side-body on top of the front, touching point 15, and at the waist at 20, and finish the balance from 20 to 22 by the side-body. Now from the top of the shoulder-point, by the bottom, point 22, sweep the bottom to the front at B. From 3 to B draw a straight line, and for a double-breasted jacket, as the Figure given, add on to the front, at B, 3 inches, at waist 2½ inches, at the bottom 3 inches, and shape it as shown. At the bottom, after it has been curved by a sweep, straighten it one-half inch above the sweep in the centre. Instead of two darts at the back only one is used, as shown, and this one can be increased one-half inch, and a cut is also taken out under the arm from 16 to 17.

It is evident that two darts can be put in as well as one, or when the same is intended for plush goods the darts can be left out altogether without altering the balance in any manner.

To produce a collar for this jacket draw a line from C, where it is intended to roll, to E, which is one-half inch from curved line of neck; then drop down from this line at 13 to 11 one inch and curve the break, as shown from 11 to E. From 11 to 12 is ¾ inch; curve this also to neckline at F, and thence along the neck to the front. From 11 to 13 make the part of collar which is to turn over 1½ to 2 inches wide, and shape to the front at G.

Sleeves for this jacket are cut similar to those already explained.

FIGS. 25 AND 26. WALKING COAT.

[Illustration: Fig. 25.]

By using a sack pattern, cut to the measure, a walking-coat can be cut in the most ready manner.

The back is the same as a sack-jacket. We only measure from the top down to the length of open skirt A. From here add the lap for pleats; single pleats require only 1¼ inch; box pleats, according to size, 2 to 4 inches.

The side-body is cut off at a length to correspond to 2 on back, plus one-half inch, and curved up some towards side seam.

The front is made as long as the side-body, and the bottom swept from the shoulder-point. When cut it will leave the skirt in pieces as 1, 2, 3 and 4.

Now take these pieces and lay them down, closing at hip, so that the opening will be no more at bottom than at top; they lay close together at 12, 13 and 14.

Now draw along the skirt at back from 4 to 15. From 4 draw towards 5, raise one-half inch above the pattern to 10, curving pattern at front.

Put in a dart at 7. From 11 to 16 trace along the front, and also along the bottom. Add the pleat behind.

The side-body in this Figure is laid in a closing position at side, point 2, to show that the seam must have a continuous curve from 1 and 2 to the front.

The distance from 1 and 2 to 3, and from there to the front, is noted, and the skirt from 4 to 5-7 and 11 should be just the same with 1 inch more added, which is pressed in before the skirt is seamed on to the fore-part. It will be noticed that in laying the pieces of the of the skirt together they close at 14, 12 and 13, but at the top and bottom they are separated, equal distances, the cut at 7 reduces one opening, and 1 inch fullness equalizes the amount the fullness is greater at 9 and forward. The addition for single and double-breasted is made by adding on in front of the fore-part and also on to the skirt: for a single-breasted 1 inch is enough, but for a double-breasted from 2 to 3 inches is required.

[Illustration: Fig. 26.]

FIG. 27. DOUBLE-BREASTED NEWMARKET JACKET.

[Illustration: Fig. 27.]

Commence this by drafting on the same principle as all drafts—by the Proportionate System—by drawing line from O to F. From O go down to 11 three-fourths of an inch, and to 10 2 inches; from 11 to 10 curve the top of the back, and measure from the top of the back, at 11, to C, the length of waist 15 inches, to D 18 inches and to F the full length, 32 inches; at C, O and F draw right angle lines across. From C to the back is 1½ inch; Draw a line from 11 to 1½, and one from 1½ to F; make the width of back from 1½ to 2 inches wide. From O to B is one-fourth of the breast-measure, 9 inches in a 36 inch breast, and A is midway between these two points; draw lines over from A and B. From B to G is one-third of breast and 1 inch, equal to 7 inches; from G to H is one-fourth of breast, or 4½ inches. From Y to J is one-half of breast, 18 inches; draw lines up from G, H and J, also down from J to N.

Where line A crosses line G, at M, draw another line from M to 10; raise one-half inch above M to V, and draw a curved line from 10 to V.

Commence to curve the arm-hole from V to M and H, dropping one-fourth inch below breast-line at 15.

In the centre, between M and G, begin to draw the back to 2 at waist, and from there, with a slight curve, to Z at the bottom, so that the distance from F to Z will be about equal to that from C to 2.

Go in from 2 to 3 one inch and shape the side-body from line under the arm to 3 and S, where it touches the back; make the side-body any width desired, say 2 inches to 14, the same from 3 to 4, curve the seam under the arm and spring it out below 4 to 21, to give it ease over the hips; also draw the curve for the piece under the arm from 14 to 4 and 20. From S curve up to 21, which latter point is 1½ inch above the line S-18. Point 20 is on the same level as 21, the line runs straight across to the front seam which runs down from 5. The piece under the arm is 1½ inch wide at top, from 14 to 15, and 2 inches from 4 to 5; this should be shaped somewhat like draft.

From L to I is one-sixth of the breast, 3 inches, and the same down from L to T. Curve the neck; from I to A draw a straight line, and place the length of shoulder from 10 to V on the front from I to U; shape the front of shoulder by dropping below line at U one-half inch, and raise slightly above it at 12.

Finish drawing the arm-hole from U to H, going out beyond the line H at 13 about one half inch.

Draw from T, at the front, outside of J one-half inch, thence to K at waist, going inside of front line one-fourth inch at K and N to point P at bottom.

In the middle, between J and H, locate a point for the dart, and in the centre, between this and H, fix another point for the back dart. From K to 1½, across the waist, measure the distance, taking out 1 inch between 2 and 3, which will be 16 inches; deduct the size of waist, 12 inches, from 16 inches and the remainder, 4 inches, is to be taken out in darts; therefore, put in two darts of 2 inches each. From K to 9 is 2 inches; from 9 to 8 is one dart; from 8 to 7, between the darts, is three-fourths inch; from 7 to 6 is another dart of 2 inches. About 2½ inches below the waist-line begin to draw the darts past 9, 8, 7 and 6, nearly straight down from waist-line. From 21 curve lower seam to 19, 18 and N; at N it is one-half inch below straight line.

Make the lapel straight on its inside edge, and 2 inches at waist, and 3 inches at centre of breast, in width, and shape like Figure.

To draw the skirt lay a straight-edge from 3 to S against the side-body, and draw a line to R, then curve it about one-half inch more over the hips. Regulate the length by the back. From S draw the upper edge of the skirt to within one-half inch of side-body at 21, thence to N; from N forward add the width of lapel and draw straight down; also put in two cuts on the hip, of one-half inch each, and the skirt will be right to fit the body. Should it, on measuring, be a little too wide, take the extra width off in front; whatever overlaps on the side-body will equalize the loss of the darts.

A flap can be put on over the hips. An ordinary coat-collar will suit this jacket.

FIG. 28. TRAVELING ULSTER.

[Illustration: Fig. 28.]

A Spring and Fall garment for traveling or outdoor wear is represented by this Figure and is a reduced copy of the pattern of a 38 size breast, and can be readily enlarged by simply using inches for the numbers marked upon it. The draft is a close-fitting traveling paletot, double-breasted, and buttons down to the bottom, and has a collar which turns over, as represented by Fig. 5. This collar should be well stretched with the hot iron, at the lower edge, before it is sewed on, in order that it may cling around the neck nicely. This way of making and sewing on a collar is far superior to the usual custom of dressmakers, and is always adopted by tailors in making jackets or other ladies' garments.

The back has at its centre, below the waist, a lap, which can be put in a box-pleat or lapped over like a coat, and at the side it has a simple pleat.

The front has a large dart cut in one piece—that is, like a sack coat, having the skirt attached to the body—but the side-body is sewed in as cut, in a separate piece. Over the hips pockets are put in covered with liberal flaps.

For use as a traveling garment it will be well to make it out of waterproof cloth, but it makes a handsome street paletot when made out of diagonal cloth or melton.

FIGS. 29 AND 30. NEWMARKET.

[Illustration: Fig. 29.]

This style of Newmarket has only one dart. Proceed to make a full size draft in accordance with the directions. First draw a straight line O, and mark off the number of inches down from O, as given on the Figure; at these points draw lines across, and on these lines mark the number of inches as given, in like manner proceed to draw each part of the garment.

[Illustration: Fig. 30.]

FIG. 31. RIDING-HABIT.

[Illustration: Fig. 31.]

The demand and orders for these garments have, so far, been considerable in the leading houses, and a few hints are always seasonable, not only to those who make them for the highest fashionables, but especially to those who are located in smaller towns and who are not often called upon to make this style of garment. There are now many ladies who have a horse at their disposal, and whose chief enjoyment is in equestrian exercise, and it is quite necessary, not only for the tailor but the dressmaker, to know how a riding-habit should be cut and made. At one time it was thought impossible for anyone but a tailor to make a stylish riding-habit, but now many ladies have them made by their dressmakers.

[Illustration]

The first thing necessary is a good measure of the form, by which a correct pattern must be cut, as a well-setting, comfortable riding-habit cannot be made without it.

The jacket has a few peculiarities:

There should be no seam down the middle of the back; the front, side-body and back are cut one inch below the natural waist.

The skirt and back form a pleat like the skirt-pleat of a coat.

The buttons should be small and round. The sleeves are tightly buttoned up at wrist.

The inside of jacket should be lined with silk, carefully wadded and stitched in close rows. It should have a belt inside, stitched to each seam at waist, which is to close it tight to the form.

The Figures we give show to advantage some of these peculiarities. The draft is a good model of such a habit, and is universally adopted, being both suitable and elegant. It “looks quite English” and very pretty. A plain standing collar of white linen should be worn with it and a gentleman’s cravat of black silk, or if the jacket is made with the lapels turning down a flat scarf is more appropriate.

[Illustration]

We add to this an article published in “Munster’s Gazette of Fashion” on riding-habits. This will enable our readers to be more fully posted, not only on what is worn here but what is in keeping with London styles:

“We have devoted one of the plates issued with the current number of our publication to the representation of the newest and most fashionable style of a lady’s riding-habit in wear. The lengthening of the waist, which we reported last year, has been maintained, although it has not been increased; and the jacket-skirt is about the same in length. It is fastened up to the throat by buttons and holes, and with a small stand-collar rounded off at the front. The jacket-skirt is cut in one piece instead of two, as heretofore, and at front runs off at an angle from the bottom of the front edge of the fore-part, and is lined with cloth, or interlined with some article of substance, to give it a firmness. The edges of the back skirts terminate in a point at the bottom. A small square tab, with two holes in it, is sewn across under the bottom of the back, and is fastened on to two buttons sewn on the top of the back part of train. The edges are usually trimmed with a narrow silk braid, sewn on flat, and the body and the sleeves lined with light colored silk. Ball buttons and fancy silk buttons are generally used. Five or six buttons are sewn on at the hind-arm; the two lower holes only are worked open.

Some ladies affect a certain tone of severity in their riding-habits, and eschewing all fictitious aids by way of adornment to the bodies have made them perfectly plain, with the edges turned in and stitched, and smoked pearl or vegetable ivory shank buttons.

Veils are no longer considered correct, no doubt because they may be considered too effeminate in character and out of place with the “billy-cock” hat.

The train, as now worn, is only cut a few inches longer than the walking length. It is turned up at the bottom, with a narrow hem only, and the V's taken out at the seams are covered with ribbon.

Colored habits are being worn in rich shades of brown, olive and green—not too light. Blue and black are also worn. The small diagonal elastic coating and Venetian cloth are preferred on account of their making up so satisfactorily. Dress meltons and tweeds are also worn, but the makes are not so appropriate.

One inevitable consequence of short and scanty trains is the necessity for every lady, taking equestrian exercise, to wear riding trousers. They are usually made of the same cloth as the habit, with a fly-front open to leg-seam, or with a long opening at each side-seam and a button and button-hole in the centre, and a narrow strap at bottom."

In order to produce Figure 31 use inches for all numbers on the draft. But in drafting it to measure use the same principle as laid down for waists, and lengthen the skirt as on Figure 7 and draw the skirt like that on last Figure.

FIG. 32. CIRCULAR.

Draw lines O-5 and O-J. From O to J is one-fourth of breast. From O to H is one-third of breast. Lay the pattern of the back against H and 1½ inch inside of line at the waist. Lay also the pattern of the front against the shoulder of the back near F and touching front-line at J. Draw along the top of the back from H to 1, and add to the pattern at 1, for seams, one-half inch. Draw from 1 to F and from 2, on the front shoulder, to F. From J, along the front of the body-pattern, draw a straight line to 4. Now from 1 and 2 draw a line and make a point in the centre at 3. Apply the length from H to 5 for full length of what the garment should be, and using point 3 as a pivot sweep from 5 to the front for the lower or bottom edge; then square the bottom at 5, and in front at 4, as shown in the Figure.

[Illustration: Fig. 32.]

If a seam is wanted draw a line through the centre from F and take out about 3 inches at bottom, starting from 6 to 7 and 6 to 8.

For a close back, curve from H along the back to 1½ and thence to 5 at bottom.

FIGS. 33 AND 34. RUSSIAN CIRCULAR.

In making a pattern of this garment we first draw a line on the edge of paper and make a point on the right end, as O. From O down place three-fourths of an inch. From O to I is one-half of breast measure, or 9 inches, for a 36 size. Between O and I is J. H and I are at right angles with first back-line. From I over on the line place one-third of breast, equal to 6 inches, and add 1 inch, making in all 7 inches, and draw a line up to 5. Next, from O on top line place 2 or 2½ inches and curve from ¾ to 2½.

[Illustration: Fig. 33.]

Measure down from ¾ to D, the length of waist, say 15 inches, and the whole length to R. Go in from straight line at D 1½ inch and curve the right back-seam from ¾ to 1½ and R.

Make the back, at waist, 4 inches wide and curve from 5 through waist at 11 to 12 at bottom. The run of this line should be nearly straight past V and curving at 11, and should also be wider at bottom, about 1 inch more than from D to 11. From 2½ draw a line raising it one-half inch at 5.

For the front (Figure 34) draw a straight line from O to J. From O down to a is one-eighth of breast, equal to 2¼ inches. From O to B is one-sixth of breast, or 3 inches. From O to K is one-fourth of breast, or 9 inches. Square lines across at all these points. From O to A, the neck, is one-sixth of breast.

Lay the back on to the point A and extreme shoulder resting on the line at C. Now draw along the back shoulder while it is in this position, and also curve from C to 12, which should only be 4 inches below C.

From K go out to H one-quarter of the breast, less 1 inch, equal to 8 inches. Having established this we can curve the shoulder easier, as seen by dotted lines. Measure from K over on the line one-half of breast, equal to 18 inches, and one-third of breast, or 6 inches, added.

Now lay the back-line against this last point in such a way that point 5 of the back will rest on line A-13, and so that it will be placed as seen in Figure 35. Then carefully measure to see if the distance from K-H and to the back-line will be exactly one-halt and one-third of breast, or 27 inches. Then curve from 12 to 13 to 14 down the back and reducing it at the bottom about 4 inches from the position as it would be when the back is laid as stated.

Now by the length of the back regulate that of the front, and then sweep by the point of shoulder A from 10 to J. This latter point, and part of this round, as produced by the sweep, should be shortened about 1 inch. Curve the neck from A to B, and add 1 inch all along the front for a turn-in hem.

From where the back lies against the wing, at O, draw the curve to 13 on the top of sleeve head.

The upper part of the sleeve-head should be gathered-in considerable, and at O a notch should be placed to facilitate the sewing in, for notch should be sewn on notch. (See Figure 35.)

[Illustration: Fig. 34.]

FIG. 35. CLOSED CIRCULAR.

After this has been drawn the same as the Russian circular, lay it against the front and cut without a seam from O down to the bottom. For this shape, after the shoulders are seamed up, gather in the round of sleeve from O forward. The same can be cut like the circular; also cut off in front from top, past V, to the bottom, in a straight line down from B. This makes a wrap with a back wing and a front. When cut in this manner an opening can be left for the hands to go through, as shown on the Figure, below E.

[Illustration: Fig. 35.]

A short cape, such as have been worn for some time in Europe, and are just making their appearance here, is cut like this, reaching, however, only to the waist. This same wrap can be cut from a dolman pattern by laying the sleeve of a dolman on to front so that the front notches come together and the two patterns close together some distance above, or till within 4 or 5 inches of the top of the shoulder, then draw along sleeve-top past the back of the sleeve.

If a line is drawn through the shoulder-point, next to the sleeve, at right angles with the front, and the back shoulder-point laid on this line and closing against the sleeve at blade, it will represent exactly this circular cape, and will be one of the easiest ways to make it. The Figure shows the outline of the dolman sleeve by the dotted line from E forward, as it appears when lying in position.

These several wraps can be made of silk, and fur-lined, or they may be of brocade, velvet, or seal, and are handsome in shape and outline when correctly cut. As they are so different from the old circular they will be much sought after, because of the newness of design and that the sleeve can be raised on the shoulder to harmonize with the increased prevalence of gathered and high style of sleeve-heads.

[Illustration]

[Illustration]

FIGS. 36, 37, 38, 39, 40. DOLMAN.

Draw a line O-H; from O, down, mark three-fourths of an inch. From O draw a short line over to 3, and make it 2½ inches. From O down to B is one-fourth of breast, equal to 9 inches on a 36 breast. Point F is in the centre, between O and B; from ¾ to D is the length of the waist, and to H the full length of garment. Draw lines across at F, B and D. Between F and B, directly in the centre, make a mark C, and draw a line across.

Go in at the waist 1■ inch from line at D; draw line from ¾ to 1½ for the centre of back, and curve below D to H. From 1½, at waist, measure in to 4 3½ inches to 4 inches.

On line C make the width of back one-third of breast and one inch and draw a line up.

On the top of shoulder draw a line from 3 to 14, and raise it one-half inch above 14; commencing there, exactly at the crossing of the lines, begin to curve past 16 and 4 to 1 at bottom. Having finished the back, first make a line across in the middle, between ¾ and F, from E over; next lay a sleeve pattern, of regular size, on 15 as when sewn in the arm-hole; holding it at 15, swing it down till the upper part of the sleeve-head rests about one-half inch below line E, at 13, and when in this position draw along the round of

the sleeve, which will give exactly the round as shown on the Figure from 15, past 13, to 2.

[Illustration: Fig. 36.]

Next, placing the width over from B on the back line, measure to 10, 24 inches, and curve the sleeve from 2 to 10, running below the line 2 inches. Point G is about 12 inches below the waist, and from this place 1 inch more than one-quarter of the hips to 8, and draw from 6, which is one-quarter of hip from D, a line through 8 to 9; then finish the curve at bottom, and shape the round of front of sleeve to any desired shape. The front is constructed by drawing a line from O down the front edge or centre of front.

[Illustration: Fig. 37.]

[Illustration: Fig. 38.]

From O over to shoulder point is one-sixth breast, the same down to 3; also go down one-eighth breast and draw a line across; curve the neck from ■ to 3, and apply the same width of shoulder as the back on the front, ■ to 10. From O down is one-half breast to E, there draw a line over to 8 and make last point, from E, one-fourth breast less 1 inch.

Measure the distance on the back, from B to H, and place it from E to P, then sweep the bottom of the front by the shoulder-point, which gives line P to K. Make the distance over from H to J one-quarter of the hips, and 1 to 1½, inch more; draw a line from K through J to L. Next measure the back from 6 to 9 and place the same from K up to L; curve arm-hole from 10 through 8 to L. Add 3 inches for a lap of double-breasted style; mark and space the buttons.

[Illustration]

The under-sleeve is cut like the upper part from 2 to 10 and 11, like the outside curve. The inside curve from 2 to 7 is short, just as much as is needed to sew in the front—to find how much this should be we make a notch opposite 14 and one at 2, which is about 10 inches from 14. This measure, less 1 inch, is marked from 10 to 16, and at that point make another notch. What is left from 16 to L must be placed from 2 to 7, and this curve should be like curve on front. Lastly, draw a line from 7 to the star, which finishes the whole garment.

In order to draft a dolman pattern which will fit well and hang with a good balance the same manner of drafting as that which produces a good shaped sack should be used, then the balance and hang of the garment will be equally as good as in a tight-fitting sack, and a dolman can then be cut as close as a sack, if so desired.

The manner of drafting the back, side-body and front, are, in fact, just like a sack, the main difference being in the shape of the sleeve. The sleeve, even in the upper part, must be like an ordinary coat-sleeve, while the lower part may be any of the various shapes in fashion.

In drafting make a line to start on from O to F (Figure 37); from O down is three-fourths inch, and from O over to top line is 2¼ inches to 1. From O to B is one-fourth of breast, 9 inches of a 36 size. Point D is in the middle, between O and B, and point 6 is in the middle, between O and D. From ¾, which is the top of the back, measure down to C 15 inches, and to F 40 inches, the full length. Point E is 6 inches, or one-third of breast, below the waist-line at C. At all these points draw lines across. From B to H is one-third and 1 inch, equal, on 36 breast, to 7 inches; draw a line up to J; in the middle, between I, the point where the two lines cross and H, mark point K. At the waist-line go in from straight line C to 3 one and one-half inches, then draw line down from ¾ to 3 and from 3 to F. Also draw a straight line at right angles with waist-line from 3 to 6 at bottom.

Make the width at waist, from 3 to 4, about 3 inches, and draw also a line down to 7. Now curve back-seam, as shown, and whatever amount there is from 6 to F place from 7 to 8, and curve from 4 past 5 to 8.

Draw a line from I to 1, raise above I to J three-fourths inch, and curve the shoulder. Starting from J up upright line, curve back seam to 4 and 8; also mark a dim line from J past I, K to G, just like in a sack back—the dotted line shows that. Point G is one-fourth of breast, or 9 inches, from B.

Notice that the curve on the back, from C to 3, is a trifle outside of the straight line, and that below 3 it runs a shade inside to give an appearance of a long waist, and below E it curves outside again to F.

[Illustration: Fig. 39.]

The inside seam from J past breast-line should be very nearly straight, and begin to curve only near the waist, and from 5 down it must have the same curve as outside line below point E to F.

Now have a sleeve cut for a 36 size and lay this on to K, as shown, so that the sleeve-head rests against the line from K to I; then in the centre, between I and K, find point 2 and stick a pin.

Now turn to Figure 38: In the middle, between line A and D, draw line E; keeping it pinned at 2, move the lower part of the sleeve towards the back till the top of the sleeve-head just touches line E at 10. While it lays thus draw along the top from 2 to 10 and 9, also down from 9, in front of sleeve pattern, to line B. This gives the outline of the sleeve, but we modify it by drawing a corrected line from 10, inside of point 9 of sleeve, down to 12.

[Illustration]

Figure 39 gives the balance of the sleeve. First draw a line in the centre, between lines B and C, which places line D.

Then take out the pin which was placed in the sleeve at point 2, and without moving the sleeve stick a pin at point U; this point is found two-thirds of the width of the sleeve forward. When this is done take hold of the sleeve at its lower point and move it upwards, till point T of sleeve rests on line D at N, and then curve from 16 to N. To produce this curve just right take the distance from line B at 18 to line D at 17, and place the same from 17 to 19, and draw a straight line from 19 to 18, then curve line from 16, resting on line at 20, thence to N. From N curve form of sleeve to 21 and 15, and to 13 for one style of sleeve, or from U to 21 and 14 for another style.

Go in from 4 to 5 three-quarters of an inch; curve from 10, past 2, touching the back, and along it past line B, and thence separate from the back to 5 and 14—this last line must touch at point 13 on the straight line which was drawn down from point 4 on Fig. 37 and is marked 5 on the same.

THE FRONT—FIG. 40.

Lay the back down on paper and extend all the lines across, line A, B, C, D and bottom line. Measure from Z to A on line B, one-half of breast, or 18 inches; from B to H is one-third of breast and 1 inch; H to P is one-fourth of breast, equal to 4½ inches. Draw a line up at P, and one up and down at A. Mark line A also. From K to L is one-sixth of breast, equal to 3 inches, and K to 7 is the same, 3 inches; curve neck.

Draw a line from L to D and place the width of the top of shoulder on the back from L to 8, and curve from 8 upwards above the line one-fourth inch; draw from 8 down in front of line P to 9. This will be three-fourths inch in front of line P. Let this curve of the arm-hole extend below line B, or nearly down to midway between lines B and C, and curve to 6. From 6 draw down to 5, which is three-fourths inch from 4 to 15 and 17; at the last point it should be about 1¼ inch over the straight line drawn down from 4 on the back.

From point G, which, as before stated, is one-fourth of the breast-measure, 9 inches from B, draw a straight line down. Curve from G to 12, 13 and 18; the last point is 2 inches from T; also curve from G to 12, 14 and 19. Point 19 is the same distance from T as 18.

Draw bottom line from 19 to 30 at front, where curve three-fourths inch below the line. Add in front over F line, for double-breasted 3 inches, and for single-breasted 1½ inches.

[Illustration: Fig. 40.]

Now we have only to show how the under-sleeve is produced. This is done by measuring first the sleeve-head from O, where point J of the back is sewn on, to 16, which point is in middle, between 9 and 18. This will measure 10½ inches; as we put in 1 inch of fullness in the sleeve-head it leaves us only 9½ inches, which is measured down the front from 8 to 10 and notched. Lay sleeve notch, marked 16, on to notch on the fore-part 10, hold it there with a pin, move it till line on sleeve, marked C, will lay parallel with any of the lines, as C or B on fore-part. Then mark on the fore-part along the sleeve, from notch at 10 to N of sleeve, and from N to 21; the sleeve will now be marked on the fore-part line 10 to O, P and A, and will be cut the same shape as the arm-hole from 10 to A, and can be traced off on another sheet of paper.

The principle as given in this article is suitable, and the only thing necessary, to produce any style of dolman. The change necessary for the short or long pointed sleeve, or for any shape of arm-wing, does not alter the principle. Pleated backs, or very much fullness in the top of the sleeve, must be met by putting enough extra goods in to meet the amount required for pleats or fullness.

When a regular pattern is cut addition is made where pleats are wanted. When more fullness is wanted in the sleeve the easiest and most correct plan is to cut the sleeve in two, from the highest part of the sleeve-head, and opened as far as required, about 1 or 2 inches, and a little more round put on the top.

The principle, as shown in this book, will produce for every style of garment a correct fit, and yet it may be urged upon all using it, that in order to produce new styles, or garments of such styles that contain pleats or ornaments laid on the cloth, the reader's own judgment must necessarily help to carry him through.

In conclusion, let me say—that any point or measuring that does not seem clear, by addressing me I will always be ready to enlighten to the best of my ability.

[Illustration]

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[Illustration:

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PLATE DLIII.

LOBELIA ASSURGENS.

Assurgent Lobelia.

CLASS V. ORDER I.

PENTANDRIA MONOGYNIA. Five Chives. One Pointal.

GENERIC CHARACTER.

CALYX quinquefidus, Corolla monopetala, irregularis. Antheræ cohærentes. Capsula infera, 2-seu 3-locularis.

EMPALEMENT five-cleft. Blossom of one petal, irregular. Anthers cohering. Seed-vessel below, with 2 or 3 partitions.

SPECIFIC CHARACTER.

LOBELIA foliis lanceolatis serratis, infernè denticulatis decurrentibus, racemis compositis terminalibus.

LOBELIA with leaves lance-shaped, serrate, toothed towards the base, and running down the stem; the racemes compound and terminal.

REFERENCE TO THE PLATE.

1. A blossom spread open. 2. The chives spread open. 3. The seed-bud and pointal.

* * * * *

This curious species of Lobelia is a native of high mountains in Jamaica, where Brown informs us it grows to the height of 5 or 6 feet. The plant is at present so scarce as not to be enumerated in the Catalogue of the Cambridge Garden; nor has any figure of it, to our knowledge, been before published. Specimens were communicated by A. B. Lambert, esq. from his stove at Boyton, where

he informs us that the plant is now about five feet high, with some of the lower leaves a foot and a half long; that it began to blossom in the middle of July, and continued to the end of November; four or five racemes flowering at the same time, and nodding in the manner of ostrich plumes; the blossoms gradually opening in succession towards the top, and the racemes continuing to lengthen until more than a foot long. The flowers have withered without producing any seed. The plant appears to be perennial.

[Illustration: [Plate 553]]

PLATE DLIV.

VOLKAMERIA ANGUSTIFOLIA.

Narrow-leaved Volkameria.

CLASS XIV. ORDER II.

DIDYNAMIA ANGIOSPERMIA. Two Chives longer. Seeds covered.

GENERIC CHARACTER.

CALYX quinquefidus: Corollæ laciniis secundis. Drupa 2-locularis. Semina 4, seu abortu tantum 2.

EMPALEMENT five-cleft. Blossom with the divisions pointing one way. Berry 2-celled. Seeds 4, or from abortion only 2.

SPECIFIC CHARACTER.

VOLKAMERIA fruticosa glaberrima, foliis oblongo-lanceolatis integerrimis, pedunculis trichotomis axillaribus et terminalibus.

VOLKAMERIA shrubby and very smooth, with oblong-lanced very entire leaves, and peduncles divided by threes, both axillary and terminal.

REFERENCE TO THE PLATE.

1. The empalement. 2. A blossom spread open, one tip detached and magnified. 3. Seed-bud and pointal, summit magnified. 4. The seed-bud magnified.

* * * * *

Volkameria angustifolia is a dwarf branchy shrub flowering in great profusion about the middle of August. The blossoms are white and remarkably sweet-scented. It was communicated by Mr. Donn, Curator of the Cambridge Botanic garden, and is to be enumerated in the new edition of his Catalogue now in the press. It requires to be kept in the bark-bed in the hot-house, and is supposed to be a native of the Isle of France. We believe no other figure of it has been given.

[Illustration: [Plate 554]]

PLATE DLV.

ZINGIBER CLIFFORDIÆ.

Cliffordian Zingiber.

CLASS I. ORDER I.

MONANDRIA MONOGYNIA. One Chive. One Pointal.

GENERIC CHARACTER.

CALYX monophyllus. Corolla 4-5-fida. Antheræ 2. Filamentum simplex ultra antheras productum.

EMPALEMENT of one leaf. Blossom either 4-or 5-cleft. Anthers two. Filament simple, extended beyond the anthers.

SPECIFIC CHARACTER.

ZINGIBER scapo simplicissimo, crasso, brevi, capitulo subovato, bracteis inferioribus lato-ovatis obtusis; corollâ 4-fidâ, laciniis tribus exterioribus oblongis marginibus involutis; alteris sub-cordatis duplo majoribus, mox convolutis.

GINGER with an unbranched, thick, short flower-stalk, the lower flower-scales broadly-oval and blunt: the blossom 4-cleft, the three outer divisions oblong with their margins turned inwards, the inner inversely nearly heart-shaped and doubly larger, soon folding together.

REFERENCE TO THE PLATE.

1. Sheath at the base of the calyx. 2. A detached flower. 3. Seed-bud, anthers, and pointal, summit magnified. 4. The plant in miniature.

* * * * *

This fine species of Ginger, we are informed, is a native of Guinea, and in the gardens has long been supposed to be the plant which produced the Grains of Paradise, Amomum Granum Paradisi of Linnæus; but it certainly by no means accords with the character of that plant, either as given in the Hortus Kewensis or by Linnæus himself. From the other species of Zingiber enumerated in the eighth volume of the Linnæan Society's Transactions it is easily distinguished. Having as yet only blossomed in England in the collection of Lady de Clifford at Paddington, in honour of that patroness and lover of botany we have given its specific designation. The culture is the same as for other plants of the family. Our drawing was taken in 1804.

[Illustration: [Plate 555]]

PLATE DLVI.

PANCRATIUM AMŒNUM.

Broad-leaved Pancratium.

CLASS VI. ORDER I.

HEXANDRIA MONOGYNIA. Six Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

PETALA 6. Nectarium 12-fidum. Stamina nectario imposita.

PETALS 6. Honey-cup 12-cleft. Stamens seated on the nectary.

SPECIFIC CHARACTER.

PANCRATIUM spathâ multiflorâ, fragrantissimâ: foliis longo-lanceolatis, corollæ laciniis tubum excedentibus: nectario 6-lobato, sinubus sub-denticulatis. _Willd. Sp._

PANCRATIUM with the sheath many-flowered, and very sweet-scented: the leaves long-lanced, the divisions of the blossom longer than its tube: and the nectary 6-lobed, mostly with little teeth between.

REFERENCE TO THE PLATE.

1. A flower spread open.

* * * * *

Several species of the genus Pancratium approach so very near to each other, that it is a difficult task to discriminate them with accuracy. We have little doubt that the _Pancratium foliis amplis ovatis_ of Ehret (Trew's Plantæ Selectæ, tab. 28.) belongs to our plant, notwithstanding the absence of the little teeth between the lobes of the nectary. Indeed, that character appears so variable in the synonyms commonly given to this species, that we are rather inclined to doubt of its constancy. Neither are the painters of those days always safely to be trusted in such minutiæ. Mr. Lambert, who favoured us with the specimen in March 1808, informs us that he received the bulbs from Lord Seaforth, on his return to England from the West Indies, from the _Pancratium caribæum_,

cultivated in the same collection. It is certainly distinct; the blossoms are extremely fragrant, and we are not yet certain whether the amœnum and fragrans of botanists may not be the same species.

[Illustration]

PLATE DLVII.

PERIPLOCA AFRICANA.

African Periploca.

CLASS V. ORDER II.

PENTANDRIA DIGYNIA. Five Chives. Two Pointals.

ESSENTIAL GENERIC CHARACTER.

CONTORTA. Nectarium ambiens genitalia, filamenta 5, exserentia.

CONTORTED. Honey-cup surrounding the stamens. Threads 5, standing out.

SPECIFIC CHARACTER.

PERIPLOCA foliis ovato-acutis, pilosis: floribus corymbosis: caule volubili, hirsuto. _Willd. Sp. Pl._

PERIPLOCA with ovate-pointed hairy leaves: flowers corymbose: stem twining and hairy.

REFERENCE TO THE PLATE.

1. The empalement. 2. The outer part of the blossom. 3. The tubular part of the same detached. 4. The same spread open. 5. One of the lobes of the nectary surrounding the parts of fructification. 6. Seed-buds, chives, and pointals, magnified.

* * * * *

The Periploca Africana is at present a rare plant to the gardens, although, according to Donn's Catalogue, it has been introduced to this country as long ago as the year 1726. There are several figures of it among the older botanists, but not one that does it any justice, as an ornamental green-house plant, which it undoubtedly is, and continues in bloom almost from June till January.

Our figure represents the entire plant, just as we received it from Messrs. Whitley and Brames.

[Illustration]

PLATE DLVIII.

FERULA PERSICA.

Persian Ferula.

CLASS V. ORDER II.

PENTANDRIA DIGYNIA. Five Chives. Two Pointals.

ESSENTIAL GENERIC CHARACTER.

FRUCTUS ovalis, compresso-planus, striis utrinque 3.

FRUIT oval, flatly compressed, with three stripes on both sides.

SPECIFIC CHARACTER.

FERULA foliis supra-decompositis: foliolis multifidis, decurrentibus: umbellâ primordiali sessili.

FERULA with leaves more than doubly compound: leaflets many-cleft and decurrent: the first umbel of flowers sessile.

REFERENCE TO THE PLATE.

1. A perfect flower. 2. A male or abortive flower. 3. The pointals.

* * * * *

Assa fœtida grows naturally near Gilan in Persia; and from seeds sent from thence to the Academy at St. Petersburgh plants were obtained, two of which were sent to Dr. Hope at Edinburgh, by Dr. Guthrie, to whom they had been presented by Professor Pallas, in whose herbarium we have seen specimens of it, but without fructification. One of these plants flowered and ripened seeds in the Botanic Garden at Edinburgh, and is described by Dr. Hope in the lxxvth vol. of the Philosophical Transactions, and a figure annexed, the only one hitherto published of the species; the Assa fœtida of Kæmpfer being undoubtedly a different plant. Our specimens were obligingly communicated by Dr. Williams from the Botanic Garden at Oxford; which, with that of Edinburgh above mentioned, the Cambridge Garden, the Physic Gardens at Chelsea, and Mr. Dickson's private collection at Croydon, are the only gardens in Britain, as we are informed, that yet possess the plant. The gum exudes from the roots, which are tuberous and perennial, on the slightest incision being made; and every part of the plant, even to the extremities of the leaves, smells strongly of it. It is hardy enough to bear our climate, and even ripen its seeds in mild seasons. It is not improbable that at a future time we may be furnished with this valuable article of the Materia Medica, of English growth. The long list of its virtues mentioned by Dr. Woodville we need not here enumerate; its reputation as a cordial for low spirits alone, in these days, entitles it to notice.

[Illustration]

PLATE DLIX.

CAMELLIA JAPONICA, _semi-duplex_.

Semidouble-flowered Camellia.

CLASS XVI. ORDER VI.

MONADELPHIA POLYANDRIA. Threads united. Many Chives.

ESSENTIAL GENERIC CHARACTER.

CALYX imbricatus, polyphyllus: interioribus majoribus.

EMPALEMENT tiled, many-leaved: the inner ones the largest.

SPECIFIC CHARACTER.

CAMELLIA floribus semi-duplicibus, staminibus divergentibus in petalos.

CAMELLIA with semi-double flowers, the stamens growing into petals.

REFERENCE TO THE PLATE.

1. The empalement. 2. The stamens growing into petals. 3. Seed-bud and pointals. 4. A transverse section of the seed-bud.

* * * * *

This Camellia with semi-double flowers was communicated to us by Mr. Davey, nurseryman and florist in the King's Road, Chelsea; who informs us it was a cutting from a plant brought by a gentleman from the coast of China, and regarded as distinct in its flowers from all those in cultivation with us. It certainly has a very different appearance; and as every variety in this short but splendid genus is particularly admired and sought after, this one, which possesses parts of its botanic character entire, will doubtless be considered by the amateurs of plants in general as a variety equally interesting.

[Illustration]

PLATE DLX.

VEREA ACUTIFLORA.

Pointed-flowered Verea.

CLASS VIII. ORDER IV.

OCTANDRIA TETRAGYNIA. Eight Chives. Four Pointals.

ESSENTIAL GENERIC CHARACTER.

CALYX 4-phyllus. Corolla hypocrateriformis, 4-fida: tubo ventricoso, Nectaria 4, ad basin germinum. Capsulæ 4, superæ, 1-loculares, polyspermæ.

EMPALEMENT 4-leaved. Blossom funnel-shaped, 4-sided: tube bellied. Nectaries 4, at the base of the seed-buds. Capsules 4, above, one-celled, many-seeded.

SPECIFIC CHARACTER.

VEREA foliis lato-lanceolatis, oppositis, crenatis, crassis: floribus paniculatis, terminalibus: corollis albentibus: laciniis oris acutissimis.

VEREA with leaves broadly lance-shaped, opposite, scolloped, and thick. Flowers paniculated and terminal. Blossom whitish: segments of the border very pointed.

REFERENCE TO THE PLATE.

1. The empalement. 2. A blossom spread open. 3. Seed-buds and pointals. 4. The same magnified.

* * * * *

This new species of Verea flowered (we believe, for the first time in this country) in the collection of the Hon. C. Greville at Paddington, whence our drawing was taken. The foliage is compact, and rather handsome. The flowers are by no means specious; but, as it blossoms in the depth of winter, its rivals are but few. This considered, with the addition of its novelty, renders it a valuable acquisition to the hot-stove.

[Illustration]

PLATE DLXI.

XERANTHEMUM FRAGRANS.

Fragrant Xeranthemum.

CLASS XIX. ORDER II.

SYNGENESIA POLYGAMIA SUPERFLUA. Tips united Superfluous.

ESSENTIAL GENERIC CHARACTER.

RECEPTACULUM paleaceum aut nudum. Pappus setaceus. Calyx imbricatus, radiatus: radio colorato.

RECEPTACLE chaffy, or naked. Feather bristly, Empalement tiled, rayed: the ray coloured.

SPECIFIC CHARACTER.

XERANTHEMUM foliis undulatis, lanatis, apice reflexis: floribus parvis, odoratis, terminalibus: radiis calycis exterioribus rubris: radio interiore albo.

Habitat ad Caput Bonæ Spei.

XERANTHEMUM with waved woolly leaves reflexed at the point: flowers small, sweet-scented and terminal: the outer rays of the empalement red, the inner one white.

Native of the Cape of Good Hope.

REFERENCE TO THE PLATE.

1. A scale from the outer ray of the empalement. 2. A scale from the inner ray. 3. A flower of the disk.

* * * * *

This little Xeranthemum is a native of the Cape, perfectly new, and very sweet-scented. As fragrance is very unusual in this fine tribe of plants, we have on that account considered it as a good specific title. It was introduced to the Clapham gardens about the year 1803; and as we have not seen it since that period, we are inclined to think it is not at present in this country. In the herbarium of A. B. Lambert, esq. we found a fine native specimen of an unnamed species very much resembling our plant, but with a profusion of flowers--a habit which ours would in all probability have assumed as soon as it had been familiarized to the change of climate.

[Illustration]

PLATE DLXII.

CYNANCHUM BICOLOR.

Two-coloured Cynanchum.

CLASS V. ORDER II.

PENTANDRIA DIGYNIA. Five Chives. Two Pointals.

ESSENTIAL GENERIC CHARACTER.

CONTORTA. Nectarium cylindricum, quinque-dentatum.

CONTORTED. Honey-cup cylindrical, five-toothed.

SPECIFIC CHARACTER.

CYNANCHUM foliis cordatis, acutis, pilosis: floribus in umbellis proliferis: corollis bicoloribus: petalis ad basin hirsutis: caule volubili.

CYNANCHUM with heart-shaped, pointed, hairy leaves: flowers grow in proliferous umbels: blossoms two-coloured: petals hirsute at the base: stem twining.

REFERENCE TO THE PLATE.

1. The empalement. 2. A blossom spread open. 3. The parts of fructification magnified. 4. The seed-bud, shaft, summit, and chives. 5. The same magnified.

* * * * *

This Cynanchum is, we believe, a perfectly new species, and continues to flower during the summer and autumnal months, running to a great length. In that, as well as in other particulars, it bears a considerable resemblance to the Cynanchum extensum of Jacquin’s Icones, but is far superior to that species from its petals being enlivened with a rich purple spot, a slight tinge of which is even visible on the smallest buds. There is an abundant succession of bloom, and the flowers appear to expand with freedom. Our drawing was made last August from a fine plant in the hot-stove of the Countess de Vandes.

[Illustration]

PLATE DLXIII.

MIMOSA ELEGANS.

Elegant Mimosa.

CLASS XXIII. ORDER I.

POLYGAMIA MONŒCIA. Various Dispositions upon one Plant.

ESSENTIAL GENERIC CHARACTER.

HERMAPH. Calyx 5-dentatus. Corolla 5-fida. Stamina 5, sive plura. Pistillum 1, legumen.

MASCUL. Calyx 5-dentatus. Corolla 5-fida. Stamina 5-10, sive plura.

HERMAPH. Empalement 5-toothed. Blossom 5-cleft. Chives 5 or more. Pointal 1, a pod.

MALE. Empalement 5-toothed. Blossom 5-cleft. Chives 5-10, or more.

SPECIFIC CHARACTER.

MIMOSA frutescens, inermis: ramis verrucosis foliis bipinnatis, pennis propriis 8-ad 9-jugis, partialibus 20-ad 24-jugis, cum impari ad imum minore; spicis axillaribus oblongis divaricatis.

MIMOSA shrubby, unarmed: with warty branches: leaves doubly winged, the first of 8 or 9 pairs, the second of 20 to 24 with a small odd leaflet at the bottom: spikes of flowers axillary, oblong, and divaricate.

REFERENCE TO THE PLATE.

1. A flower. 2. The same spread open. 3. The same shown from the inner side, one tip magnified. 4. The seed-bud and pointal, summit magnified.

* * * * *

Mimosa elegans is one of the handsomest of the family that yet been introduced from New Holland, and very rare, being at this time in no other private collection in this country, but that of A. B. Lambert, esq. from whom we received our specimens; and in whose conservatory it is now in full flower, his plant being about ten feet high and very much branched, with profusion of flowers. It is hardly possible to express the extreme delicacy of the blossoms. The stamens are united (monadelphous) towards the base, and are above two hundred in a single flower. What an apparatus for the impregnation of a single stigma!

From what we have already seen of the beautiful and interesting plants of this country, cultivators will do well to give them as much both of pot and branch room as their houses will afford; as well for the health of the plant as to advantage the size of its fine foliage, of which the circumscribed scale of our work would only allow us to represent one half.

[Illustration]

PLATE DLXIV.

IXIA CURTA.

Short Ixia.

CLASS III. ORDER I.

TRIANDRIA MONOGYNIA. Three Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA 6-petala, patens, æqualis. Stigmata tria erectiuscula, patula.

BLOSSOM six petals, spreading and equal. Summits three, nearly upright, and spreading.

SPECIFIC CHARACTER.

IXIA foliis falcatis: floribus alternis, tri-coloribus: caule humili.

Habitat ad Caput Bonæ Spei.

IXIA with scimitar-shaped leaves: flowers alternate, and three-coloured. Stem low.

Native of the Cape of Good Hope.

REFERENCE TO THE PLATE.

1. The two sheaths of the empalement. 2. A blossom spread open. 3. Seed-bud and pointal, summit magnified.

* * * * *

This new species of Ixia was delineated from a plant in the collection of J. Vere, esq. the summer before last, and although low in stature is certainly high in beauty, and surpassed by very few of loftier growth. It flowers about the middle of April, and requires the same treatment as most other Cape species.

[Illustration]

PLATE DLXV.

RUTA LINIFOLIA.

Flax-leaved Ruta.

CLASS X. ORDER I.

DECANDRIA MONOGYNIA. Ten Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

CALYX 5-partitus. Petala concava. Receptaculum punctis melliferis decem cinctum. Capsula lobata.

EMPALEMENT 5-parted. Petals concave. Receptacle beset with ten honey-bearing points. Capsule lobed.

SPECIFIC CHARACTER.

RUTA foliis simplicibus, lanceolatis, glabris: filamentis ciliatis: caule simplici, herbaceo.

Habitat in Hispania.

Ruta linifolia. _Willd. Sp. Pl._

RUE with simple leaves, lance-shaped and smooth: threads ciliated. Stem simple and herbaceous.

Native of Spain.

REFERENCE TO THE PLATE.

1. A petal. 2. Empalement, chives, and pointal. 3. A chive. 4. The empalement, seed-bud, and pointal.

* * * * *

The Ruta linifolia is a new plant to the gardens, and we believe is not at present in any other collection but that of Cambridge, where it was raised from seed by Mr. Donn. It is a handsome little herbaceous shrub, and requires the protection of the green-house to preserve it in this climate. Flowers in September and October.

[Illustration]

PLATE DLXVI.

CALLICOMA SERRATIFOLIA.

Sawed-leaved Callicoma.

CLASS XI. ORDER II.

DODECANDRIA DIGYNIA. Stamens 11 to 19. Styles 2.

GENERIC CHARACTER.

FLORES in capitulis subrotundis, pedunculatis; involucro sub 4-phyllo. Calyx 4-5-phyllus, foliolis lanceolatis. Corolla O. Stamina 11-19, calyce triplo longiora, e receptaculo. Styli 2, filiformes: stigmate simplici: germen superum, monoloculare, polyspermum.

FLOWERS in little round heads, upon footstalks; with an involucre of about 4 leaves. Calyx of 4 or 5 leaves, the leaflets lanced. Blossom none. Stamens from 11 to 19, thrice as long as the calyx, growing from the receptacle. Styles 2, thread-shaped. Stigma simple. Germen above, 1-celled, and many-seeded.

REFERENCE TO THE PLATE.

1. A flower. 2. The same spread open, one tip magnified. 3. The seed-bud and pointals. 4. The same magnified.

* * * * *

Callicoma serratifolia is a native of New South Wales, and has now for several years in some choice collections adorned the green-house and conservatory in early spring with its fine heads of flowers; but to whom we are indebted for its first introduction we are uncertain. Some botanists have considered it as a congener of Forster's _Codia_, to which it has certainly a considerable affinity; but as we cannot exactly see the propriety of coupling an apetalous flower having so many stamens with one that is penta-petalous and octandrous, and of which we have no description of the germen or fruit; and there being great probability that more plants of this family may be discovered in the vast tracts of New Holland yet unexplored, we have rather chose to describe it as distinct, than to excuse ourselves by leaving it to be separated at some future period and create more changes of names, a circumstance always to be deprecated and avoided as much as possible by Naturalists. Callicoma is a middle-sized shrub with the leaves finely cottony and whitish on the under side, and has considerable beauty even when out of blossom. It is propagated by layers.

[Illustration]

PLATE DLXVII.

CERATONIA SILIQUA.

Pod-bearing Ceratonia.

CLASS XXIII. ORDER II.

POLYGAMIA DIŒCIA. Many Nuptials on separate Plants.

GENERIC CHARACTER.

HERMAPH. Calyx 5-partitus. Corolla 0. Stamina 5-8. Stylus filiformis. Stigma capitatum. Legumen coriaceum, pulpâ plenum, polyspermum.

HERMAPH. Empalement 5-parted. Blossom none. Chives 5 to 8. Shaft thread-shaped. Summit headed. Pod leathery, full of pulp, and many-seeded.

REFERENCE TO THE PLATE.

1. A flower shown from the outside. 2. A dry pod a little opened, one seed detached.

* * * * *

Instead of a new plant, we here submit to our readers one that according to the Kew Catalogue has been an inhabitant of our gardens 239 years: but neither Mr. Alton nor Mr. Miller had ever seen it blossom, nor during all this long period have we any account of its flowering in this country. Its male flowers however appeared in the Cambridge Botanic Garden the beginning of last February, and from a specimen communicated by Mr. Donn to A. B. Lambert, esq. the present drawing was taken. Mr. Donn's plant was between 4 and 5 feet high, moderately branched, and had the same treatment as his other green-house shrubs. We are uncertain whether the hermaphrodite or female plant be yet in this country; but as the propagation is principally from seed, we think it is very probable. The stamens in our specimen vary in number, being commonly 5, sometimes 6, and more rarely 8. The fruit is added from a dried legume in the Lambertian collection, which was sent from Spain by the late Abbé Cavanilles, who in his _Icones Plantarum_, _vol._ 2. _p._ 8. and _tab._ 113. (in addition to what was formerly known of the Ceratonia) informs us, that it grows spontaneously on little hills and dry fields in Valencia, and is yet more impatient of cold and moisture than the olive, vast numbers being sometimes killed there by the frost in severe winters. It is in this province also, that the principal cultivation of this useful plant in Spain is situated. The propagation is from seeds, and the diœcious plants are always selected in preference to the hermaphrodites, being better bearers. Some of the more skilful cultivators engraft a male bough upon their female plants for their impregnation, and by this means have no sterile plants in their collections. They flower twice a year, first in February, and again more plentifully in August and September; which is also the time of the fruit's ripening, and the trees are seen at the same time adorned with blossoms, and laden with ripe fruit. Eighty pounds of legumes are sometimes collected from a single tree. They are known to be mature by their putting on a chesnut colour, and are then beaten from the trees by canes of the _Arundo Donax_ from 16 to 20 feet long, with part of their crooked roots left, which serve as hooks. Rain is said to be beneficial to the ripe fruits, and even to improve them after they are laid in heaps on the ground. They are finally dried and stored up in barns for use. The cultivators enumerate three varieties, which they call _Melars_, _Llandars_, and _Costelluts_. The last they distinguish by having larger leaves and of a deeper green, with legumes often a foot long, but with little solidity or sweetness; the second has shorter legumes, but more solid and very sweet; the leaves also are shorter. The first are called Melars (_quasi Melleas_) from _Mel_ honey, of which the fruit contains small drops, and sometimes in such abundance that it distils upon the ground, and is fed upon by the bees. The fruits are the principal food of the cattle in the province of Valencia, and also form part of the sustenance of the poor people. The leaves are used in the preparation of leather. Monsieur Olivier also informs us in his _Travels in the Ottoman Empire_, that the Carob-tree grows all over the Island of Crete, and delights most in stony grounds and the clefts of rocks; that the fruits are conveyed thence to Constantinople, to Syria and Egypt, and serve for food to the poor and to children. They are also an ingredient in the sherbets of which the Mussulmans make daily use.

[Illustration]

PLATE DLXVIII.

LIPARIA SPHÆRICA.

Round-headed Liparia.

CLASS XVII. ORDER IV.

DIADELPHIA DECANDRIA. Two Brotherhoods. Ten Chives.

ESSENTIAL GENERIC CHARACTER.

CALYX quinquefidus, lacinia infima elongata. Corollæ alæ inferius bilobæ. Filamenta alternatim breviora. Legumen polyspermum.

CALYX 5-cleft, the lower segment very long. Wings of the blossom two-lobed on the lower side. Chives alternately shorter. Pod many-seeded.

SPECIFIC CHARACTER.

LIPARIA floribus capitatis; foliis lanceolatis, nervosis, glabris. _Willd. Sp. Pl. vol._ iii.

LIPARIA with flowers in heads; the leaves lance-shaped, nerved, and smooth.

REFERENCE TO THE PLATE.

1. A bract. 2. The empalement. 3. A flower spread open. 4. The chives. 5. The same spread open. 6. Seed-bud and pointal. 7. A back view of the head of flowers.

* * * * *

Africa has long been celebrated as the land of wonders and novelties, and its vegetable as well as animal productions well entitle it to that character. The beauty and astonishing variety of ever-varying Geraniums, delicate Ixias, elegant Ericas, superb Amaryllises, and magnificent Proteas, received from the Cape of Good Hope alone within these few years, and many of them totally unknown before, have given to our gardens that splendour and perpetual novelty which justly make them the admiration of the world. What still more enhances the pleasure is, that the mine is yet unexhausted, as our present charming subject, not before enumerated in any of our catalogues of cultivated plants will testify. Mr. Milne, gardener at Fonthill, well known for his zeal and skill in the cultivation of rare plants, obligingly communicated the specimens. Having forwarded the first a little too early, being struck with the singular beauty, and not knowing the habits of the plant, a fortnight after he forwarded a third specimen fully expanded, from which the figure is taken. Mr. Milne informs us, that he raised the Liparia from Cape seeds some years ago, and has kept it in the conservatory, where it is now in blossom. The plant is branchy, and between four and five feet in height. He thinks he possesses two more new species of the genus raised at the same time, which have not yet blossomed with him.

[Illustration]

PLATE DLXIX.

CEANOTHUS LANIGER.

Woolly Ceanothus.

CLASS V. ORDER I.

PENTANDRIA MONOGYNIA. Five Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

PETALA 5, saccata. Bacca sicca, 3-locularis, 3-sperma.

PETALS 5, bagged. Berry dry, three-celled, three-seeded.

SPECIFIC CHARACTER.

CEANOTHUS foliis oblongo-lanceolatis, integerrimis, subtus lanuginosis; ramulis, pedunculis, petiolis, calycibusque hirsutis.

CEANOTHUS with the leaves oblong-lanced, entire, and woolly beneath; the branches, footstalks, flowerstalks, and calyxes hairy.

REFERENCE TO THE PLATE.

1. A flower. 2. A segment of the calyx, with a petal and stamen attached. 3. Seed-bud and pointal.

* * * * *

To New Holland we export criminals for our convenience and safety, and from thence import furs for our covering and flowers for our amusement. So far the balance of trade is in our favour. But by whose hands, or at what time, our present subject was first brought over, we have not been able to learn. The specimen was communicated by A. B. Lambert, esq. in the beginning of April from his collection at Boyton, and we have also seen the plant very finely in flower at Mr. Whitley’s nursery, Brompton. Its woolly leaves and branches, contrasted with the Mimosas and other hard-leaved plants from the same country, make an agreeable variety, and the early blossoms are very ornamental. The plants we have seen are moderate-sized branchy shrubs, are kept in the green-house like other New Holland plants, and require no particular treatment. We have seen more species from the same country in herbariums, and some are now alive in this country, although they have not yet blossomed.

[Illustration]

PLATE DLXX.

JUSTICIA NITIDA.

Shining-leaved Justicia.

CLASS II. ORDER I.

DIANDRIA MONOGYNIA. Two Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

CALYX simplex seu duplex. Corolla 1-petala, irregularis. Capsula ungue elastico dissiliens: dissepimentum contrarium; adnatum.

EMPALEMENT simple or double. Blossom one-petalled, irregular. Capsule splitting with an elastic claw: partition contrary to the valve; affixed.

SPECIFIC CHARACTER

JUSTICIA fruticosa: foliis ellipticis, acuminatis: racemis spicæformibus, verticillatis: bracteis minutis: pedicellis calycibusque glabris.

Swartz. _Flora Indiæ occidentalis._

Habitat in insulis Jamaicæ, S. Christophori, Martiniquæ, S. Crucis, et Guadalupæ.

JUSTICIA with a shrubby stem: leaves elliptic and pointed: raceme in the form of a spike, whorled: floral leaves small: footstalks and calyx smooth.

Native of Jamaica, St. Christopher, Martinique, St. Croix, and Guadaloupe.

REFERENCE TO THE PLATE.

1. A flower spread open. 2. Seed-bud and pointal, 3. The capsule. 4. The same split open.

* * * * *

Of this species of Justicia the only figure extant that we know of is a very indifferent representation of it in Sloane’s Jamaica, evidently from a dried specimen. The fine glossy character of the foliage has furnished it with a specific title. The flowers are abundant in succession, but, like most of this genus, of a deciduous or short-lived character. It was introduced to the British gardens, according to Donn’s Catalogue, in 1793, Our drawing was made from a plant brought from the West Indies by Lord Seaforth, which flowered in August 1808 in the hot-stove of A. B. Lambert, esq.

[Illustration]

PLATE DLXXI.

SIDA PATENS.

Spreading Sida.

CLASS XVI. ORDER VIII.

MONADELPHIA POLYANDRIA. Threads united. Many Chives.

ESSENTIAL GENERIC CHARACTER.

CALYX simplex. Stylus multipartitus. Capsulæ plures, mono-seu tri-spermæ.

CALYX simple. Pointal many-parted. Seed-vessels many, one-or three-seeded.

SPECIFIC CHARACTER.

SIDA foliis cordatis, dentatis, longè acuminatis, leviter pubescentibus; pedunculis solitariis petiolis longioribus; corollis patentibus; stylis quinquepartitis; capsulis quinque, birostratis.

SIDA with heart-shaped, toothed, long-pointed, and slightly woolly leaves; solitary flower-stalks longer than the footstalks; spreading corollas, five-parted styles, and five two-beaked capsules.

REFERENCE TO THE PLATE.

1. The empalement. 2. The chives spread open, one tip magnified. 3. Seed-bud and pointal.

* * * * *

Another African novelty introduced by Viscount Valentia in 1806 from Abyssinia; and from specimens obligingly communicated by him from his gardens at Arly the drawing is taken. From the seeds already introduced by his Lordship from that yet unexplored, and hitherto almost inaccessible country, and from the connexions he is now endeavouring to establish there, Mr. Salt, who travelled in his Lordship's suite, being now dispatched on an embassy to the King of that country at Gondar, we may soon hope to have a few more specimens of its vegetable productions; at present as imperfectly known as the sources of the Nile, which have eluded the researches of philosophers above two thousand years.

Sida patens, in the natural arrangement of the genus, should be placed next to _Sida reflexa_ of Cavanilles and Willdenow.

[Illustration]

PLATE DLXXII.

PROTEA SALIGNA.

Willow-leaved Protea.

CLASS IV. ORDER I.

TETRANDRIA MONOGYNIA. Four Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA 4-fida, seu 4-petala. Antheræ lineares, petalis infra apices insertæ. Calyx proprius, nullus. Semina solitaria.

BLOSSOM four-cleft, or of four petals. Tips linear, inserted into the petals below the points. Cup proper, none. Seeds solitary.

SPECIFIC CHARACTER.

PROTEA foliis obliquis, lanceolatis, pubescentibus: capitulis oblongis, involucratis, terminalibus.

Feminei flores ramos terminant cum cono ovato magnitudine pisi, involucro bicolori circumdato.

Habitat ad Caput Bonæ Spei.

PROTEA with oblique, lance-shaped, hairy leaves: heads of flowers oblong, involucrated, and terminal.

Female flowers terminate the branches with an ovate cone about the size of a pea, surrounded by a two-coloured involucrum.

Native of the Cape of Good Hope.

REFERENCE TO THE PLATE.

1. A flower, one tip magnified. 2. Seed-bud and pointal, summit magnified. 3. Section of a head of flowers from the female plant. 4. Seed-bud and pointal, magnified.

* * * * *

Protea saligna, in the Species Plantarum of Linnæus, is considered as only a variety of P. conifera, but is certainly specifically distinct in its foliage, however resembling in other particulars. Finding, soon after we had made our drawing, a female plant in fine

bloom, we have annexed a branch of it on the same plate, to elucidate as much as possible the apparent confusion that at present seems to pervade this section of the Genus Protea. The P. saligna of Thunberg, enumerated by Willdenow, we have no doubt, describes the female specimen we have represented, the cone being there mentioned as about the size of a pea, and which exactly accords with our figure. The drawings were made from plants introduced to this country from the Cape of Good Hope, in the year 1806, by G. Hibbert, esq.

[Illustration]

PLATE DLXXIII.

MAGNOLIA AURICULATA.

Ear-leaved Magnolia.

CLASS XIII. ORDER VII.

POLYANDRIA POLYGYNIA. Many Chives. Many Pointals.

ESSENTIAL GENERIC CHARACTER.

CALYX 3-phyllus. Petala 6-12. Capsulæ 2-valves, imbricatæ. Semina baccata, pendula.

CUP 3-leaved. Petals 6-12. Capsules 2-valved, tiled. Seeds berried, pendulous.

SPECIFIC CHARACTER.

MAGNOLIA foliis obovato-lanceolatis, basi attenuatis, auritis, glabris, subtus glaucis.

Habitat in America boreali.

MAGNOLIA with obovate lance-shaped leaves, attenuated towards the base, eared, smooth, and glaucous beneath.

Native of North America.

REFERENCE TO THE PLATE.

1. A chive. 2. Seed-bud and pointals.

* * * * *

Amongst the finest hardy exotics that ornament the gardens, the Magnolias are eminently conspicuous. A fine species of that description our figure represents, drawn from a plant seven feet high in the nursery-ground of Messrs. Whitley and Brames, who inform me that it was sent to them from Maryland in North America, by Mr. Bartram, about the year 1793. It does not seed with us, as very few of the genus do; and when any of them appear to have ripened their seed perfectly, we understand they have very rarely if ever vegetated. This species is perfectly hardy, but is with difficulty raised by layers; which accounts for its being (after a period of sixteen years since its first introduction to this country) not so generally known as it deserves to be. It flowers in the month of May.

[Illustration]

PLATE DLXXIV.

PULTENÆA OBCORDATA.

Inversely Heart-leaved Pultenæa.

CLASS X. ORDER I.

DECANDRIA MONOGYNIA. Ten Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

CALYX quinque-dentatus, utrinque appendiculatus. Corolla papilionacea, alis vexillo brevioribus. Legumen uniloculare, dispermum.

CUP five-toothed, with an appendage on each side. Blossom butterfly-shaped, with the wings shorter than the standard. Pod of one cell, with two seeds.

See Pultenæa Daphnoides, Pl. XCVIII. Vol. II.

SPECIFIC CHARACTER.

PULTENÆA foliis obcordatis, mucronatis, nitidis.

PULTENÆA with inversely heart-shaped leaves, mucronated, and shining.

REFERENCE TO THE PLATE.

1. The empalement. 2. The vexillum. 3. One of the wings. 4. The two petals of the keel. 5. The chives and pointal, one tip magnified. 6. Seed-bud and pointal.

* * * * *

This nondescript species of Pultenæa is a native of New Holland, and was discovered on Van Diemen's Land by Mr. Littlejohn, one of the residents on Governor Collins's settlement. It possesses lively yellow flowers, and singularly obcordate leaves, and is a handsome addition to the genus Pultenæa, of which it is a genuine member, having the two little appendages on the cup, the principal (although trivial) leading feature that characterizes the genus. Our drawing was made from a specimen communicated by A. B. Lambert, esq. with whom it has flowered for the first time in this country.

[Illustration]

PLATE DLXXV.

MARTYNIA DIANDRA.

Diandrous Martynia.

CLASS XIV. ORDER II.

DIDYNAMIA ANGIOSPERMIA. Two Chives longer. Seeds covered.

ESSENTIAL GENERIC CHARACTER.

CALYX 5-fidus. Corolla ringens. Capsula lignosa, corticata, rostro hamata, 4-locularis, 4-valvis.

CALYX five-cleft. Corolla gaping. Capsule woody, covered, with a hooked beak; 4 divisions, and 4 openings.

SPECIFIC CHARACTER.

MARTYNIA caule ramoso, foliis oppositis, cordatis, dentatis, floribus diandris. _Willd. Sp. Pl._

MARTYNIA with the stem branching, leaves opposite, heart-shaped, and toothed, and flowers diandrous.

REFERENCE TO THE PLATE.

1. The empalement. 2. The chives. 3. Seed-bud and pointal. 4. The capsule.

* * * * *

We are glad to have an opportunity of giving a figure of a plant so very ornamental, and so rarely met with in our collections. Martynia diandra is a native of Mexico about Vera Cruz, and requires to be kept in the hothouse, or glass frame with artificial heat, and has much the same delicate texture as the Martynia proboscidea. Of the figures that have before been published of it, that of

Jacquin in his Hortus Schœnbrunnensis, vol. iii. plate 289, is by far the best. A specimen was communicated by A. B. Lambert, esq., in November 1808, and another in May last from a plant which had outlived the winter, and from which the present figure is taken. All the species of Martynia are considered as annuals.

[Illustration]

PLATE DLXXVI.

LITHOSPERMUM TINCTORIUM.

Dyers' Bugloss.

CLASS V. ORDER I.

PENTANDRIA MONOGYNIA. Five Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA infundibuliformis, fauce perforata, nuda. Calyx 5-partitus.

BLOSSOM funnel-shaped, with the mouth open and naked. Cup 5-cleft.

SPECIFIC CHARACTER.

LITHOSPERMUM villosum caulibus procumbentibus. _Sp. Pl. editio prima._

LITHOSPERMUM hairy. Stem procumbent.

REFERENCE TO THE PLATE.

1. The empalement. 2. A blossom spread open. 3. Seed-bud and pointal.

* * * * *

This rare plant, enumerated in the Hortus Kewensis upon the authority of Sutherland's Catalogue of the Plants in the Physic Garden at Edinburgh, published in 1683, has been long a desideratum in our collections. It grows naturally in dry sandy places about Montpelier, and also in the southern provinces of the Russian empire, from whence we have seen fine specimens collected by Professor Pallas in Mr. Lambert's Herbarium, which now contains the whole collection made at the expense of the Russian Government, during the space of 30 years, by that great naturalist and his assistants. The plant is well calculated for ornamenting rock-works, or light sandy and gravelly borders. The roots are an article of trade, and used to give a red colour to oils, wax, and spirits of wine. Linnæus, after having very properly arranged this plant as a Lithospermum in the first edition of his Species Plantarum, afterwards removed it to the genus Anchusa, which alteration has since been adopted by every editor of his works. The character, however, is decidedly that of a Lithospermum; and the alteration would be difficult to account for, were it not for a memorandum of the late M. L'Heritier (published in the Flore Française), stating that he had seen another plant under that name in the Linnæan herbarium. It therefore appears that Linnæus, after having described the true plant, from his not possessing a specimen of it had afterwards mistaken some species of Anchusa for it. The plant, however, was retained in its proper genus by Gerard in his Flora Gallico-Provincialis, and he has since been followed by Decandolle in the Flore Française. We are aware of Professor Vahl and Willdenow's having given to another Lithospermum the name of tinctorium; but if the genus Arnebia of Forskahl is given up, the characteristic specific of tetrastigma applied to it by Lamarck may be restored. We have never seen any figure of the plant but that of Plenck, Aubriet's in Alyon's Cours de Botanique, and the wooden cut of John Bauhin; the plant figured under the name of Anchusa tinctoria in Woodville's Medical Botany being the Anchusa officinalis. Specimens were communicated by A. B. Lambert, esq., and there is also a fine spreading plant of it now in blossom (May 27th) in the natural ground, in Mr. Harrison's nursery at Brompton.

[Illustration]

PLATE DLXXVII.

PROTEA VIRGATA.

Twiggy Protea.

CLASS IV. ORDER I.

TETRANDRIA MONOGYNIA. Four Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA 4-fida, seu 4-petala. Antheræ lineares, petalis infra apices insertæ. Calyx proprius, nullus. Semina solitaria.

BLOSSOM four-cleft, or of four petals. Tips linear, inserted into the petals below the points. Cup proper, none. Seeds solitary.

SPECIFIC CHARACTER.

PROTEA foliis linearibus acutis, supra concavis, subtus convexis: floribus confertis, procumbentibus.

Habitat ad Caput Bonæ Spei.

PROTEA with linear pointed leaves, concave above, and convex beneath. Flowers crowded, and lying on the ground.

Native of the Cape of Good Hope.

REFERENCE TO THE PLATE.

1. A flower complete, summit magnified.

* * * * *

The application of specific titles to this wide-spreading family of plants is now become an arduous task; and considering how many of the best are already occupied, an exclusive reference cannot be expected. This species of Protea is altogether new, but bears a powerful resemblance in the flowers to the P. humiflora: but the distinct character of its foliage gives to the tout ensemble a perfect air of novelty; nor is there any figure or description of it extant, that we know of.

Our drawing was made from a fine plant at the nursery of Mr. Knight in the King’s Road, Chelsea.

[Illustration]

PLATE DLXXVIII.

ÆGIPHILA DIFFUSA. Fig. 1.

Spreading Ægiphila.

CLASS IV. ORDER I.

TETRANDRIA MONOGYNIA. Four Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

CALYX 4-dentatus. Corolla 4-fida. Stylus semibifidus. Bacca bilocularis, loculis dispermis.

CUP four-toothed. Blossom four-cleft. Shaft cleft half-way down. Berry two-celled, cells two-seeded.

SPECIFIC CHARACTER.

ÆGIPHILA foliis ovato-lanceolatis, longè acuminatis, utrinque glabris; paniculis diffusis axillaribus et terminalibus; staminibus tubo vix excedentibus, stylo longissimo.

ÆGIPHILA with oval-lanced, long pointed leaves, smooth on both sides; panicles spreading, axillary, and terminal; stamens scarcely longer than the tube, and shaft very long.

ÆGIPHILA OBOVATA. Fig. 2.

Inversely Oval-leaved Ægiphila

SPECIFIC CHARACTER.

ÆGIPHILA foliis obovatis acuminatis, utrinque glabris; paniculis axillaribus et terminalibus; pedicellis calycibusque minutè pubescentibus.

ÆGIPHILA with leaves inversely oval, pointed and smooth; panicles axillary and terminal; flower-stalks and calyxes minutely pubescent.

REFERENCE TO THE PLATE.

1. The empalement. 2. A blossom spread open. 3. Seed-bud and pointal, as it appears in the opening buds. 4. The same when fully expanded.

* * * * *

This very natural genus was established by Jacquin from the Bois Cabril of the Creoles in Martinico, a shrub, the young shoots of which are greedily sought for and eaten by their cattle, particularly goats, whence the name (in English) Goatwood; and which Jacquin, following the botanical canon, elegantly turned into Ægiphila. With this species the celebrated Swartz has conjoined the Knoxia of Browne's Jamaica and Manabea lævis of Aublet's Guiana, and added two more species, Æ. fœtida and Æ. trifida, discovered by himself; and Willdenow has yet further augmented it with the Manabea villosa and arborescens of Aublet, and the Nuxia of Lamarck: the last, however, we consider as a very doubtful species. That fine collection of plants from the West Indies, introduced in 1807 by lord Seaforth, and by him presented to A. B. Lambert, esq. and which we have already so often quoted, has brought to our knowledge two more species, which we have denominated diffusa and obovata, from what appeared to us to be their most prominent features. Both shrubs are natives of the West Indies, and were sent to us in flower in August 1808. They are propagated by cuttings, and have not yet ripened seeds in England, but produce flowers annually in abundance during the months of July and August.

[Illustration]

PLATE DLXXIX.

CRATÆGUS AZAROLUS.

The Azarole.

CLASS II. ORDER XII.

ICOSANDRIA DIGYNIA. Twenty Chives. Two Pointals.

ESSENTIAL GENERIC CHARACTER.

CALYX quinquefidus. Petala quinque. Bacca infera, 1-5-sperma.

CUP five-cleft. Blossom five petals. Berry below, with from 1 to 5 seeds.

SPECIFIC CHARACTER.

CRATÆGUS foliis obtusis, subtrifidis, dentatis, pubescentibus.

CRATÆGUS with blunt, pubescent, toothed leaves generally 3-cleft.

REFERENCE TO THE PLATE.

1. A flower spread open. 2. The same shown from the outer side.

* * * * *

The Azarole grows naturally in Italy, in the South of France, in Carniola, and on the banks of the Tanais in the Russian empire where it was found by Gerber in 1741. It grows to be a tree of rather small size, and is much cultivated in Italy, in the South of France, and in Sicily, for the sake of the fruit, which is as large as a cherry, of a fine red colour with sometimes a tinge of yellow, and is said to have a very agreeable flavour. At present the Azarole is very scarce in this country, and we have never seen it in blossom but at Burchall's nursery at Fulham, in May 1808, when our drawing was made. This year the plant has produced no blossoms. To those who are desirous of cultivating the Azarole, and adding another variety to their deserts, we would recommend planting it in well sheltered situations; or perhaps training against a wall, as practised for peaches and other delicate fruits, would be still better. Considerable trees of the Azarole formerly existed in His Majesty's Gardens at Kew, and in those of the Duke or Northumberland at Sion House; and we have lately seen the remains of one in Mr. Swainson's collection at Twickenham; but we are not aware that any exist at present in England. That of Plenck excepted, in His Medical Plants, Pl. 390, we believe no other coloured figure of it has before been published.

[Illustration]

PLATE DLXXX.

MESEMBRYANTHEMUM ACINACIFORME.

Scimitar-leaved Mesembryanthemum.

CLASS XII. ORDER IV.

ICOSANDRIA PENTAGYNIA. Twenty Chives. Five Pointals.

ESSENTIAL GENERIC CHARACTER.

PETALA valde numerosa, linearia, basi cohærentia.

PETALS very numerous, linear, cohering at the base.

SPECIFIC CHARACTER.

MESEMBRYANTHEMUM foliis acinaciformibus: floribus amplissimis, lætè purpureis.

Dillenii Hortus Elthamensis, tab. CCXI.

FIG-MARYGOLD with scimitar-shaped leaves: flowers very large, and of a bright purple colour.

REFERENCE TO THE PLATE.

1. The empalement, seed-bud, and pointals.

* * * * *

Throughout this extensive tribe of plants, this is the most splendid species of Mesembryanthemum we are at present acquainted with; and although an old plant in the gardens, it is quite a rarity to meet with it in flower. Our specimen is from the collection of Mr. Trimmer, of Kew Bridge, whose method of forcing it into bloom may be worth the attention of cultivators. It is by training it up against the glass, and watering it very sparingly; indeed, so little water is requisite for many of the succulent plants, that we have seen them thrive very well without any, except what they absorb from the humidity of the atmosphere in the descending dews.

[Illustration]

PLATE DLXXXI.

SALIX VIOLACEA.

Violet-coloured Willow.

CLASS XXII. ORDER II.

DIŒCIA DIANDRIA. Chives and Pointals on different Plants. Two Chives.

ESSENTIAL GENERIC CHARACTER.

* _Masculi flores._

AMENTUM cylindraceum. Calyx squamosus. Corolla 0. Glandulæ baseos nectariferæ.

* _Feminei flores._

AMENTUM cylindraceum. Calyx squamosus. Corolla 0. Stylus 2-fidus. Capsula 1-locularis, 2-valvis. Semina papposa.

* _Male flowers._

CATKIN cylindrical. Empalement squamous. Blossom none. Glands at the base, bearing honey.

* _Female Flowers._

CATKIN cylindrical. Empalement squamous. Blossom none. Shaft 2-cleft. Capsule 1-locular, 2-valved. Seeds downy.

SPECIFIC CHARACTER.

SALIX foliis lanceolatis, acuminatis, serrulatis, glabris, subtus glaucis: ramis pulvere violaceo tectis.

WILLOW with lance-shaped leaves finely sawed, smooth, and glaucous beneath: branches covered over with a violet-coloured powder.

REFERENCE TO THE PLATE.

1. A male flower. 2. A bit of the lower part of the stem with some of the powder rubbed off.

* * * * *

This fine species of willow is remarkable, first, for the gigantic size of its shoots, rising to the height of ten and sometimes twelve feet in one season; secondly, for their superior tenacity, being yet more tough than the common Osier; and thirdly, for the singular blue powder (considerably resembling that found upon the Orleans plum) with which they are always covered; and which, when any part of it has been accidentally rubbed off, is very quickly regenerated. It is said to be a native of Russia or Siberia, and to have been introduced by Mr. John Bell of Sion Gate about the year 1798. Whether it may or may not be the same species as Salix acutifolia of Willdenow, which he published without having seen the fructification, we leave to those who have seen his specimen to determine.

Our specimens are from the collection of A. B. Lambert, esq. who informs us that it produces in April male flowers annually at Boyton, and besides its great utility is a very ornamental plant.

[Illustration]

PLATE DLXXXII.

PROTEA MELLIFERA ALBIFLORA.

White-flowered Honey-bearing Protea.

CLASS IV. ORDER I.

TETRANDRIA MONOGYNIA. Four Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA 4-fida, seu 4-petala. Antheræ lineares, petalis infra apices insertæ. Calyx proprius, nullus. Semina solitaria.

BLOSSOM four-cleft, or of four petals. Tips linear, inserted into the petals below the points. Cup proper, none. Seeds solitary.

SPECIFIC CHARACTER.

PROTEA foliis lanceolatis ellipticis: capituloque terminali, magno, albo.

Habitat ad Caput Bonæ Spei.

PROTEA with elliptic lance-shaped leaves: head of flowers terminal, large, and white.

Native of the Cape of Good Hope.

REFERENCE TO THE PLATE.

1. Seed-bud, chives, and pointal.

* * * * *

Whether we consider this Protea as a species, or only a variety, it well deserves a representation. The only plant we have ever seen of it, and from whence our figure was taken, was in the collection of the Duke of Northumberland at Sion House, in the year 1807. Its unequivocal claim to the specific title of mellifera we unawares experienced, as, in bending the plant a little forward to view the interior of its flowers, (the plant being near seven feet high,) it literally poured out a stream of nectareous juice, the cup being filled with honey as high as the imbrications could possibly contain it.

[Illustration]

PLATE DLXXXIII.

LONICERA JAPONICA.

Japanese Woodbine.

CLASS V. ORDER I.

PENTANDRIA MONOGYNIA. Five Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA 1-petala, irregularis. Bacca polysperma, bilocularis, infera.

BLOSSOM of one petal, irregular. Berry many-seeded, 2-celled, below.

SPECIFIC CHARACTER.

LONICERA foliis perennantibus petiolatis villosis: caule volubili.

Lonicera japonica. _Willd. Sp. Pl._

LONICERA with ever-green downy leaves upon footstalks, and a twining stem.

REFERENCE TO THE PLATE.

1. A flower spread open. 2. The seed-bud and pointal.

* * * * *

This far-fetched and yet rare species of “the luscious woodbine” is the Kin-gin-qua, or Gold and Silver Flower, of the Japanese, as we learn from Kæmpfer and Thunberg. The same name is also affixed to a Chinese drawing of the plant, a copy of which we have seen in the collection of A. B. Lambert, esq. From the same drawing we learn that the flowers come sometimes more in heads, and much more numerous than in our specimen; which may probably be accounted for from the plants being kept here in the green-house. Being an ever-green, like the Minorca and American twining honey-suckles, the species is the more desirable. It was introduced, we are informed, from China about the year 1805, and our drawing was taken in July 1809, in the garden of the Count de Vandes at Bayswater.

[Illustration]

PLATE DLXXXIV.

PHLOMIS SAMIA.

Samian Phlomis.

CLASS XIV. ORDER I.

DIDYNAMIA ANGIOSPERMIA. Two Chives longer. Seeds covered.

ESSENTIAL GENERIC CHARACTER.

CALYX angulatus. Corollæ labium superius incumbens, compressum, villosum.

CUP angled: upper lip of the corolla incumbent, compressed and downy.

SPECIFIC CHARACTER.

PHLOMIS caule hirsuto, foliis cordatis, crenatis, subtus tomentosis, bracteis tripartitis subulatis mucronatis calycem æquantibus. _Willd. Sp. Pl. 3. p. 120._

PHLOMIS with a hairy stalk: leaves heart-shaped, scolloped, and cottony underneath: bracts 3-parted, awl-shaped, as long as the cup.

REFERENCE TO THE PLATE.

1. The empalement. 2. A flower spread open. 3. Seed-bud and pointal.

* * * * *

This curious species appears to have been introduced by Mr. Miller; but, not being enumerated in the Hortus Kewensis, nor the Catalogue of the Cambridge Botanic Garden, must have been since lost. Indeed Mr. Miller informs us, that the severe winter of 1740 destroyed all the plants of it then in England. A. B. Lambert, esq. who communicated the specimens in July last from his garden at Boyton, informs us that Dr. Williams, regius professor of botany at Oxford, favoured him with the plant; and his predecessor Dr. Sibthorpe, who made two journeys into Greece to enrich us with the natural history of that interesting country, was probably the re-introducer. The name Samia is derived from the island of Samos; but Monsieur Desfontaines informs us (in his Flora Atlantica) that the original Samian plant of Tournefort and the Phlomis Samia of Linnæus (which he found wild about Mount Atlas) are different species. Both may possibly be natives of Samos: the posthumous Flora Græca of Dr. Sibthorpe, now publishing by his friend Dr. Smith, will, we trust, decide it. There is no prior figure of the plant.

[Illustration]

PLATE DLXXXV.

SOPHORA JAPONICA.

Japanese Sophora.

CLASS X. ORDER I.

DECANDRIA MONOGYNIA. Ten Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

CALYX 5-dentatus, supernè gibbus. Corolla papilionacea: alis longitudine vexilli. Lomentum moniliforme.

CUP five-toothed, swelling above. Blossom butterfly-shaped, with wings the length of the keel. Pod necklace-shaped.

SPECIFIC CHARACTER.

SOPHORA foliis pinnatis: foliolis pluribus ovatis glabris: caule arboreo. _Willd. Sp. Pl._

SOPHORA with winged leaves: the leaflets numerous, ovate, and smooth: stem arborescent.

REFERENCE TO THE PLATE.

1. The empalement. 2. The vexillum. 3. One of the alæ. 4. The carina. 5. The chives. 6. The seed-bud and pointal.

* * * * *

Sophora japonica is the largest species of that genus at present known. The specimen exhibited is from a tree more than 40 feet high, in the collection of John Ord, esq. at Purser's Cross, Fulham, which was planted by himself about fifty years ago. Our attachment to even the inanimate companions of our youth, and the pleasure we derive from them, are thus beautifully expressed by one of our English poets (Cowley, we believe):

"A wood coëval with himself he sees; And loves his old cotemporary trees."

Mr. Ord obtained his plants of Mr. Gordon, nurseryman at Mile End, who introduced the species from China in the year 1753. The first time of its flowering in this country, we learn, was in his Grace the Duke of Northumberland's collection at Sion, in August 1797. The only figure we have seen is in Jacquin's Hortus Schœnbrunnensis, vol. iii. Burmann, in his Flora Indica, and after him Linnæus, describe the flowers as white. In Mr. Ord's garden they are of a faint yellow, as in the figure of Jacquin; and in the specimens which we have seen from Sion House, faint yellow tinged with purple. Excellent in the study of flowers is the maxim of Virgil,

".... Nimiùm ne crede colori."

[Illustration]

PLATE DLXXXVI.

LILIUM SPECIOSUM.

Showy Lily.

CLASS VI. ORDER I.

HEXANDRIA MONOGYNIA. Six Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA 6-petala, campanulata: nectarium linea longitudinalis: capsulæ valvulis pilo cancellato connexis.

BLOSSOM 6-leaved, bell-shaped. Nectary a longitudinal line. Valves of the seed-pod connected with a lattice-work of hairs.

SPECIFIC CHARACTER.

LILIUM foliis sparsis, ovato-oblongis: floribus cernuis mox revolutis: caule ramoso.

Lilium speciosum. _Willd. Sp. Pl._

LILY with scattered oval-oblong leaves: the flowers nodding, soon rolled back, and the stem branching.

REFERENCE TO THE PLATE.

1. Seed-bud and pointal.

* * * * *

We can but seldom have the pleasure of recording so valuable an acquisition to our collections as this truly magnificent species, introduced from China by the Right Hon. Sir Joseph Banks about the year 1807, and a figure of it also published by him in 1791, being plate 47 of the Icones Selectæ, from drawings made in Japan by Kæmpfer, and now deposited in the British Museum. The

woolliness and bulbs on the stem in our specimen, and the want of constriction at the base of the leaves, (if any such ever exists in nature,) differ considerably from the figure above quoted; but the strong general resemblance, and a consideration of the many variations to which other species of this genus are subject, induce us to regard it as a variety from the same common stock. The stem rises to between three and four feet in height, and sometimes even higher; and produces from three to nine or more flowers, according to its strength and situation. The bulb which it produces from the base of every leaf forms a future plant, and thus to unrivalled beauty adds abundance. Its time of flowering enhances its value, being in August, when all other lilies have deserted the parterre. Mr. Williams, nurseryman at Turnham Green, favoured us with the specimen.

[Illustration]

PLATE DLXXXVII.

CORCHORUS? JAPONICUS _flore pleno_.

Japanese Corchorus with double flowers.

CLASS XIII. ORDER I.

POLYANDRIA MONOGYNIA. Many Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA 5-petala. Calyx 5-phyllus, deciduus. Capsula plurivalvis, loculamentosa.

BLOSSOM of 5 petals. Cup 5-leaved, falling off, Fruit with many valves, subdivided.

SPECIFIC CHARACTER.

CORCHORUS capsulis rotundis glabris, foliis duplicato-serratis.--_Flora Japonica, p. 227._

CORCHORUS with round smooth capsules, and the leaves doubly sawed.

REFERENCE TO THE PLATE.

1. The pointals.

* * * * *

This elegant shrub is amply described in the Flora Japonica of Professor Thunberg, who found it growing naturally about Nagasaki, Miaco, and various parts of the Japanese empire; where it is also commonly cultivated for ornament. The double variety here figured he particularly specifies as naturally adorning the country about Miaco. In Houttuyn’s Pflanrensystem, vol. vii. plate 54, there is also an engraving of it. The single-flowered has not yet been introduced to this country. The time of blossoming is in early spring: but it does not appear to confine itself to that season, as we have been favoured with fresh specimens at various seasons from April to October; and we may therefore safely predict its being long a favourite with cultivators. The flexile twigs starred with blossoms look at a little distance like garlands, and extend when supported to a great length. All the flowers that we have seen are from 5-to 8-gynous; which, with the singular form of the capsule, makes us consider it as a very doubtful species of Corchorus. The Japanese name is Jamma Buki.

Our figure is taken from specimens communicated by Mr. Milne of Fonthill, who informs us that his plant now growing in the conservatory is ten feet high. We first observed it in bloom early last spring at Messrs. Colville’s, and in several other collections during the summer, but smaller both in flowers and leaves.

[Illustration]

PLATE DLXXXVIII.

SIDA HASTATA.

Halberd-leaved Sida.

CLASS XVI. ORDER VIII.

MONADELPHIA POLYANDRIA. One Brotherhood. Many Chives.

ESSENTIAL GENERIC CHARACTER.

CALYX simplex, angulatus. Stylus multi-partitus. Capsulæ plures, 1-seu 3-spermæ.

CUP simple-angled. Shafts many-parted. Seedpods many, one-to three-seeded.

SPECIFIC CHARACTER.

SIDA foliis inferioribus cordatis angulatis, superioribus elongato-hastatis; pedunculis axillaribus, unifloris, longissimis.

Sida hastata, _Willd. Sp. Pl._

SIDA with the lower leaves somewhat heart-shaped and angled, the upper ones long-halberd-shaped; flower-stalks very long, one-flowered, and axillary.

REFERENCE TO THE PLATE.

1. The chives spread open. 2. The pointals.

* * * * *

This species was first properly distinguished and described by the Spanish botanist Cavanilles in his Dissertatio de Sida, where he has also given a figure of it; and upon this with the Sida cristata and Dilleniana his genus Anoda was founded. Other botanists, however, have not agreed to this division, and both Professor Martyn in his Dictionary and Willdenow still consider them as Sidas of which they now enumerate 99 species; and the new species brought from Abyssinia by Lord Valentia, and published in our 117th number, completes the century. Most of the species have been destined by nature to blossom beneath a milder sky than ours; the Sida hastata was found by the French botanist Dombey growing naturally in Peru and Lima in moist places; and A. B. Lambert, esq., who favoured us with the specimen last September, received the seeds from the East Indies, The two other varieties of this enumerated by Cavanilles and Willdenow we have not seen. The plant is annual, and has yet been kept in the stove.

[Illustration]

PLATE DLXXXIX.

GLADIOLUS ANGUSTUS, _minor_.

Small Narrow-leaved Cornflag.

CLASS III. ORDER I.

TRIANDRIA MONOGYNIA. Three Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

COROLLA sexpartita, ringens. Stamina adscendentia.

BLOSSOM six divisions, gaping. Chives ascending.

SPECIFIC CHARACTER.

GLADIOLUS foliis linearibus, longis, costatis; corollis flavescentibus; petalis tribus inferioribus rubro notatis.

Gladiolus angustus. _Jacquin. Icones, tab. 252, vol. ii._

CORNFLAG with linear leaves long and ribbed: blossom yellowish; the three lower petals marked with red.

REFERENCE TO THE PLATE.

1. The outer sheath of the empalement. 2. The inner sheath. 3. A blossom spread open. 4. Seed-bud and pointal. 5. Flower of a larger variety.

* * * * *

Our figure represents a plant from the nursery of Mr. Williams, and which we at first were inclined to regard as a distinct species from the Gladiolus angustus of Jacquin: but meeting soon after with a plant in the collection of Messrs. Whitley and Brames, of larger dimensions, (a flower of which we have represented,) its intermediate character appears, upon comparison, to connect a regular chain of variation, the smallest link of which is (at present) the one now figured.

Both plants are of easy culture, requiring no other treatment than what is common to bulbs of this class.

[Illustration]

PLATE DXC.

MESPILUS ODORATISSIMA.

Sweet-scented Mespilus.

CLASS XII. ORDER V.

ICOSANDRIA PENTAGYNIA. Twenty Chives. Five Pointals.

ESSENTIAL GENERIC CHARACTER.

CALYX 5-fidus. Petala 5. Bacca infera, 5-sperma.

CALYX 5-cleft. Petals 5. Berry below, 5-seeded.

SPECIFIC CHARACTER.

MESPILUS foliis utrinque pubescentibus, pinnatifidis; laciniis incisis.

MESPILUS with leaves downy on both sides, and wing-cleft; with the segments slit.

REFERENCE TO THE PLATE.

1. The empalement and pointals. 2. A branch of ripe fruit.

* * * * *

For this undescribed species of Mespilus we are indebted to the Right Hon. the Marquis of Bath, who first observed it to be distinct from the Mespilus tanacetifolia, with which it has commonly been confounded, and pointed out the specific differences to Mr. Lambert in 1807. The accuracy of his Lordship's observations we have often verified this summer in the different collections about London, and find the two species quite distinct in fruit, foliage, and bracteæ. Mespilus odoratissima forms handsome dwarf trees, from 6 to 12 feet high in the specimens we have seen. The blossoms appear in June, and are remarkably fragrant, but considerably smaller than in M. tanacetifolia; but this is abundantly compensated by the livelier colour and greater profusion of the fruit with which the boughs are loaded in autumn. The tree called by Professor Pallas Cratægus orientalis, (see the English translation of his Travels in the Crimea, vol. ii. p. 174 and 181,) and which he found cultivated for its fruit in the south-western parts of the Crimea, where it also grows wild on the mountains, is this species, as we have ascertained from his Herbarium; and the little red Medlar found in Anatolia by Tournefort, (see his Travels, vol. ii. p. 322 of the English translation,) noticed by Dr. Smith in his Exotic Botany, is probably the same thing. We were favoured with the specimens both of this and M. tanacetifolia (our next plate) by the Right Hon. the Marchioness of Bath, from Longleat.

[Illustration]

PLATE DXCI.

MESPILUS TANACETIFOLIA.

Tansy-leaved Medlar.

CLASS XII. ORDER V.

ICOSANDRIA PENTAGYNIA. Twenty Chives. Five Pointals.

ESSENTIAL GENERIC CHARACTER.

CALYX 5-fidus. Petala 5. Bacca infera, 5-sperma.

CALYX 5-cleft. Petals 5. Berry below, 5-seeded.

SPECIFIC CHARACTER.

MESPILUS floribus bracteatis; foliis pinnatifidis; laciniis argutè serratis, pubescentibus.

MESPILUS with bracts to the flowers; the leaves wing-cleft, with the divisions sawed and downy.

REFERENCE TO THE PLATE.

1. The empalement and pointals. 2. A branch with ripe fruit.

* * * * *

Neither is this species enumerated in the works of Linnæus. The great French botanist Tournefort, who discovered it on the mountains of Anatolia in 1701, thus describes it: “These mountains produce a fine sort of Azarolíer or Medlar-tree; there are some as big as oaks. Their trunk is covered with a cleft grayish bark; the branches are bushy, and spreading out on the sides; the leaves are in bunches two inches and a half long, fifteen lines broad, shining, a little hairy on both sides, commonly divided into three parts even to the rib, and these parts indented very neatly on the edges, pretty much like the leaves of tansy; the part at the end of the leaf is again divided into three parts. The fruit grow two or three together at the end of the young shoots, and resemble small apples of an inch diameter with five roundings like the ribs of a melon, a little hairy, pale green inclining to a yellow, with a navel raised of five leaves. We sometimes find one or two of these leaves growing out of the flesh of the fruit, or its stalk. The fruit though agreeable is not so pleasant as our Medlar, but I believe it would be excellent if it were cultivated. The Armenians not only eat as much of this as they can, but likewise fill their bags. The short period the tree has been introduced (not above 20 years, as we are informed) will not allow any in England, as yet, to have reached the size above mentioned; and we much doubt whether it may be thought worthy of cultivation here for the fruit: but the beauty of the tree and agreeable fragrance of the blossoms sufficiently recommend it to a place in the pleasure-garden. This and the last described species with the artificial characters of the genus Mespilus have all the natural habits of Cratægus, and show how ill even our most admired systems are calculated to trace and mark these fine gradations, which, while they yet distinguish, closely connect all nature. Too often the hue and cry of “Heretics! Innovators!” thundered out by the schools against all who will not implicitly follow their dogmas, drive the calm and unprejudiced students of nature out of the field. Yet he that discovers one new truth is surely a benefactor to society; but he that defends and inculcates error is a tyrant in the kingdom of Nature.

[Illustration]

PLATE DXCII.

MIMOSA GRANDIFLORA.

Great-flowered Mimosa.

CLASS XXIII. ORDER I.

POLYGAMIA MONOECIA. Flowers Male, Female, and Hermaphrodite, on the same Plant.

ESSENTIAL GENERIC CHARACTER.

HERMAPHRODITI. Calyx 5-dentatus. Corolla 5-fida vel 5-petala. Stamina 4-200. Pistillum 1. Legumen bivalve.

MASCULI. Calyx 5-dentatus. Corolla 5-fida sen 5-petala. Stamina 4-200.

HERMAPHRODITES. Cup 5-toothed. Blossom 5-cleft or 5-petalled. Chives 4 to 200. Shaft 1. Pod two-valved.

MALE FLOWERS. Cup 5-toothed. Blossom 5-cleft, or of 5 petals. Chives 4 to 200.

SPECIFIC CHARACTER.

MIMOSA inermis, foliis bipinnatis, multijugis, ciliatis; racemo composito terminali.

Acacia grandiflora. _Willd. Sp. Pl. 4. p. 1074._

MIMOSA unarmed, with doubly-winged leaves in many pairs and ciliated, and flowers in a compound terminating bunch.

REFERENCE TO THE PLATE.

1. The empalement. 2. The chives spread open. 3. The pointal.

* * * * *

This species, conspicuous by its tall woody stems, large purple blossoms, and delicate foliage, was brought to the Royal Gardens at Kew from India by Mrs. Norman, about the year 1769. It is a plant of quick growth, and blossoms freely, but has never produced any pods in this country. The only figure of it we have seen is that by Reinagle in Dr. Thornton's Illustration of the System of Linnæus. A plate however was finished for L'Heritier, who first described it; but his death prevented its publication. The stamens (as in many other Mimosas) are united near the base. The blossoms open in succession from the bottom of the bunch upwards, and continue great part of the summer. The leaves are deciduous. The specimen was communicated from Boyton by A. B. Lambert, esq. in August.

[Illustration]

PLATE DXCIII.

CROTALARIA TETRAGONA.

Four-sided Crotalaria.

CLASS XVII. ORDER IV.

DIADELPHIA DECANDRIA. Two Brotherhoods. Ten Stamens.

ESSENTIAL GENERIC CHARACTER.

LEGUMEN pedicellatum, turgidum. Stamina omnia connexa.

POD on a stalk, swollen. Stamens all connected.

SPECIFIC CHARACTER.

CROTALARIA caule tetragono, strigoso; petiolis brevibus, foliis oblongo-lanceolatis, acuminatis; stipulis caulem amplexantibus.

CROTALARIA with the stem 4-sided, with flat pressed hairs: short footstalks: leaves oblong-lanced, and pointed: stipules embracing the stem.

REFERENCE TO THE PLATE.

1. The keel. 2. The chives and pointal. 3. Seed-bud and pointal.

* * * * *

This new and very ornamental species is remarkable for having the under lip of the calyx often undivided, and every part of the plant up to the blossom covered with shining close-pressed hairs: nor are they entirely wanting on the blossom; on the lower part of the keel they are very conspicuous, hanging downwards like a little beard. A groove with a fringe on each side runs also along the upper side of the style towards the summit. Two thread-shaped silky stipules rise at the base of every leaf-stalk, and, being reflected backwards, closely embrace the stem. A solitary stipule also rises at the base of each flower-stalk, and two where it unites with the calyx: but these, from their singular situation, must perhaps be considered as bracteæ.

We were favoured with the specimens in November from Lord Valentia's gardens at Arley, along with the Plectranthus barbata. His Lordship received the seeds last year from Dr. Roxburgh in India, by the name of Crotalaria tetragona. The plant appears to be shrubby. No account of the species has before been published. Its place in the genus is near to the Crotalaria juncea figured in our sixth volume.

[Illustration]

PLATE DXCIV.

PLECTRANTHUS BARBATUS.

Bearded Plectranthus.

CLASS XIV. ORDER I.

DIDYNAMIA GYMNOSPERMIA. Four unequal Stamens. Naked Seeds.

ESSENTIAL GENERIC CHARACTER.

CALYX laciniâ summâ majore. Corolla resupinata, ringens; tubo sursùm gibbo vel calcarato.

CUP with the upper division largest. Blossom lying on its back, gaping; tube with a spur above or swelled out.

SPECIFIC CHARACTER.

PLECTRANTHUS racemis bracteatis, bracteis deciduis; foliis ovatis, crenatis, pubescentibus, rugosis, per petioles decurrentibus: corollæ labio superiore emarginato brevissimo; inferiore subovato, concavo, hirsuto.

PLECTRANTHUS with bracts to the bunches, bracts falling off: the leaves oval, scolloped, downy and wrinkled, running down the footstalks; the upper lip of the blossom short, and slightly notched; the lower nearly ovate, compressed and hairy.

REFERENCE TO THE PLATE.

1. The empalement. 2. A blossom with the segments cut off to expose the chives. 3. The seed-bud and pointal, summit magnified.

* * * * *

The stem of Plectranthus is four-sided with blunt corners, and woolly. The leaves are fleshy, minutely dotted on both sides, and border their footstalks down to the stem. The flower-stalks, the lower part of the cups, and under lip of the blossom, are set with stiff clear bristles. The tube of the blossom is without a spur, and swelled on the upper side. Every part of the plant has a powerful fragrance. The specimens were communicated in November by Mr. Giddings, gardener to Lord Valentia at Arley; with a letter stating, that he raised the plants from Abyssinian seeds sent home by his Lordship about four years ago, and that they grow at Arley to about two feet in height, and thrive with the common treatment of stove plants.

The first species known of this genus, Plectranthus punctatus, the Ocymum punctatum of Linnæus, was also brought from Abyssinia by the celebrated Bruce.

[Illustration]

PLATE DXCV.

PANAX FRUTICOSUM.

Shrubby Panax.

CLASS XXIII. ORDER II.

POLYGAMIA DIŒCIA. Flowers Male, Female, and Hermaphrodite on different Plants.

ESSENTIAL GENERIC CHARACTER.

HERMAPHRODITUS. Umbella. Calyx 5-dentatus, superus. Corolla 5-petala. Stamina 5. Styli 2 vel 3, sæpe cohærentes. Bacca 2-vel 3-sperma, infera.

HERMAPHRODITE. An umbel. Cup 5-toothed, above. Blossom 5-petalled. Stamens 5. Shafts 2 or 3, sometimes cohering. Berry 2-or 3-seeded, below.

The male or female flowers we have never seen.

SPECIFIC CHARACTER.

PANAX foliis supradecompositis, dentato-ciliatis; caule fruticoso. _Willd. Sp. Pl._

PANAX with leaves more than doubly compound, ciliated with little teeth; the stem shrubby.

REFERENCE TO THE PLATE.

1. Empalement, chives, and pointals. 2. The pointals. 3. The plant in miniature.

* * * * *

On examining the flowers of this curious and rare species of Panax, we were a little startled to find how widely they differed from the character of the genus; being trigynous, and the berry three-seeded. Professor Jacquin has also observed the same variation in the flowers of P. aculeatum (see his Icones, tab. 634); and fifty years ago Trew observed and delineated the same number of styles in Panax trifolium, one of the original species upon which the genus was established. Nor had this escaped the scrutinizing eye of that profound observer of nature Bernard Jussieu. From these authorities, therefore, in consonance with our own observations, we have enlarged the character of the genus to include the species. Panax fruticosum, as we learn from Rumphius's Herbarium Amboinense, vol. iv. p. 78 and 79, rises to between five and six feet in height, with a stem as thick as a man's arm, and grows naturally in the Island of Ternate, where it is also much cultivated by the natives for food, medicine, and œconomy; being planted to separate the areas of their gardens and mark the boundaries of their fields. The boiled leaves are eaten as greens, and a decoction both of the leaves and root is used successfully in nephritic diseases, for which they also sometimes prescribe the roots to be eaten raw. The fame of the plant as a powerful diuretic is also great in Amboyna; where, as well as in Ternate, it is commonly planted both for ornament and use. Labillardiere, the French botanist, who accompanied the expedition that sailed in quest of the unfortunate Lapeyrouse, informs us (in his account of the voyage) that when at Amboyna he found this plant encircling the tomb of the venerable Rumphius, its first described.

Nature he loved; with her he spent his hours: The grateful goddess wreathes his tomb with flowers!

The famous _Gin-seng_, to which the Chinese attribute such extraordinary virtues, and which, as Osbeck informs us, was commonly sold in their shops in 1751 (see his Travels, English edit. p. 222) for from 30 to 40 times its weight in silver, and which one of their Emperors, 40 years before that, sent 10,000 Tartars in quest of at once, is said by that author to be a species of Panax; but the plant is yet unknown in Europe. Panax fruticosum, we are informed, was introduced to this country about the year 1800, and requires to be kept in the hot-house. The specimen was communicated from Boyton by A. B. Lambert, esq.

[Illustration]

PLATE DXCVI.

LAURUS CINNAMOMUM.

Cinnamon Tree.

CLASS IX. ORDER I. OR CLASS XXII. ORDER VII.

ENNEANDRIA MONOGYNIA, or _DIŒCIA POLYANDRIA_. Nine Stamens. One Style, or Male and Female Flowers on different Plants. Stamens more than Seven.

ESSENTIAL GENERIC CHARACTER.

CALYX nullus. Corolla 6-partita, glandulis tribus germen cingentibus. Filamenta interiora glandulifera. Drupa 1-sperma.

CUP none. Blossom 6-parted. Glands three, surrounding the germen. Inner filaments bearing glands. Berry dry, one-seeded.

SPECIFIC CHARACTER.

LAURUS foliis trinerviis ovato-oblongis, nervis versus apicem evanescentibus. _Willdenow, Sp. Pl. vol. 2. p. 477._

LEAVES three nerved, oval-oblong, nerves vanishing towards the point of the leaf.

REFERENCE TO THE PLATE.

1. A flower spread open, shown from the outer side. 2. The same shown from the inner side. 3. The pointal.

* * * * *

For the first tolerable figure of the Cinnamon tree we are indebted to Dr. Hermann, Professor of Botany at Leyden who had also the honour of introducing it to Europe, having brought living plants with him, on his return from Ceylon, which vegetated in the Leyden Academy's garden, and in the gardens of Mynheers Benting and Beverning between two and three years, until a severe winter destroyed them. See his Catalogue of the Plants in the Leyden Garden (Horti Academici Lugduno-Batavi Catalogus), page 130, plates 665 and 666. This fact is the more curious, as Linnæus, describing the Cinnamon from dried specimens in his noble patron Clifford's collection, fifty years after, speaks of it as a plant forbidden to our shores; which Europe had never seen alive, and could hardly hope to see, or to retain even if it could be procured.

The Cinnamon was first cultivated in England by Mr. Miller in the Apothecaries' garden at Chelsea about the year 1768; who probably received it from Holland, the Spice plantations at that time being entirely in the hands of the Dutch. No figure of it has before been published in this country, nor any account of its flowering. It grows naturally in the Island of Ceylon, from whence the vast quantity annually imported into Europe is supplied. The following method of procuring and preparing the bark is abridged from Thunberg's Travels. Proper trees being selected, that is, those that are neither too young nor too old, the branches of three years growth are cut off with a pruning-knife, and their green outer bark scraped off with a crooked knife. The remaining bark is then ripped up lengthwise and peeled off and the smaller pieces being drawn into the larger, they are laid in the sun to dry. After being sufficiently dried, they are tied up in bundles of about 30 pounds weight each, and brought to the Company's storehouses, where inspectors appointed for that purpose examine every bundle by tasting of it; and on its being approved of, it is tied in bundles of about 85 pounds weight each, which are then sewed into double woollen sacks, over which black pepper is strewed to attract any remaining moisture, and in this state shipped for Europe. From the dust and fragments remaining in the warehouses the extremely valuable and rare oil of Cinnamon is distilled. An oil is also distilled from the leaves, another from the fruit, and a fourth from the bark of the root.

Cinnamon is also found wild in the woods of Martinico, according to Professor Jacquin; but the Ceylon Cinnamon is always considered the best.

We are informed by our friend Mr. Anderson, that a Cinnamon tree in the garden of the Bishop of Winchester at Farnham Castle (perhaps the finest in England) has for many years blossomed and ripened its fruit annually, and that great numbers of young trees have been raised from the fruit, which have far surpassed for healthiness and hardiness the plants commonly obtained from layers, or those imported; and which leads us to hope that the Cinnamon trees may soon become more common and less difficult of cultivation: and his lordship's great success with it will, we hope, serve to stimulate others. We have also seen a drawing in Mr. Lambert's collection, taken in the Bishop of Durham's garden at Mongewell, where it flowered, as we are informed by his lordship, in February 1796.

The Cinnamon tree requires to be kept in the bark-bed in the stove, and is propagated by cuttings and layers.

Our drawing was made in the month of February at J. Knight’s nursery, King’s Road, from a fine plant upwards of three feet high.

[Illustration]

PLATE DCXVII.

TROPÆOLUM PEREGRINUM.

The Little Bird Plant.

CLASS VIII. ORDER I.

OCTANDRIA MONOGYNIA. Eight Stamens. One Style.

ESSENTIAL GENERIC CHARACTER.

CALYX monophyllus, calcaratus, quinquefidus. Petala duo ad quinque. Stigma trifidum, seu stigmata tria. Drupæ tres, siccæ, et monospermæ.

CUP of one leaf with a spur five-cleft. Petals two to five. Summits three, or summit three-cleft. Berries three, dry, and one-seeded.

SPECIFIC CHARACTER.

TROPÆOLUM petalis serrato-incisis, duobus maximis, tribus minimis. _Jacq. Hort. Schœnb. 1. p. 51. tab. 98._

TROPÆOLUM with the petals tooth-gashed, two much larger than the rest; three very small.

REFERENCE TO THE PLATE.

1. Chives and pointal. 2. Seed-bud and pointal, summit magnified.

* * * * *

The Tropæolum peregrinum grows naturally in Peru, and was gathered wild by the French naturalist Feuillée near the town of Lima. The native name, according to that author, is Malla; the Spaniards call it Paxarito, which signifies a little bird; from the resemblance the expanded blossoms have to little humming-birds flying. Attaching itself by the long footstalks of the leaves to the branches, the plant often ascends to the very summits of trees in its native soil; and Professor Jacquin, director of the Emperor of Germany’s gardens at Schœnbrunn, informs us (in the work above quoted) that it grew there in the open ground to twenty-six feet in length, with a stem of a finger’s thickness, and a great many branches, but produced no flowers until transplanted into the green-house. A. B. Lambert, esq. who communicated the specimen from his gardens at Boyton last November, informs us that he cultivated it in a three-light melon-frame, which it completely filled, branching in all directions, and producing almost innumerable blossoms. The seeds but rarely ripen in this country, and are generally imported from Spain or Portugal. The plant, however, may be propagated by cuttings. Besides the five species of Tropæolum enumerated in the edition of the Species Plantarum by Willdenow, and the new species in our last volume (T. pennatum), three more species are described and figured in the Flora Peruviana of Ruiz and Pavon; some of which, and others of the many beautiful flowers of that country, the great intercourse now carried on with South America gives us to hope that we may soon see. One of the species in the Flora Peruviana having only two petals, has obliged us to make a little alteration in the generic character.

[Illustration]

PLATE DXCVIII.

BÆCKIA VIRGATA.

Twiggy Bæckia.

CLASS VIII. ORDER I.

OCTANDRIA MONOGYNIA. Eight Chives. One Pointal.

ESSENTIAL GENERIC CHARACTER.

CALYX 5-dentatus. Corolla 5-petala. Capsula 3-seu 4-locularis, polysperma, calyce tecta.

CUP 5-toothed. Blossom of 5 petals. Fruit 3-or 4-celled, many-seeded, covered by the cup.

SPECIFIC CHARACTER.

BÆCKIA foliis lineari-lanceolatis pellucido-punctatis, pedunculis axillaribus umbelliferis.

Leptospermum virgatum. _Forster._

BÆCKIA with linear-lanced leaves with transparent dots; the flowerstalks axillary, and bearing umbels.

REFERENCE TO THE PLATE.

1. A petal. 2. The chives and pointal. 3. The same shown from the under side.

* * * * *

In the Island of New Caledonia, celebrated by Captain Cook (above all others) for the courteous, friendly, and honest disposition of the men, and the inflexible virtue of the females, (see his Second Voyage, vol. ii. p. 105 to 127.) and whence every day brought them something new in natural history, this plant with many others was discovered by the two Forsters, who accompanied him as naturalists, and is published in their Genera of Plants gathered in the Islands of the South Seas as a species of Leptospermum. Dr. Smith, however, justly observes, that neither the number of stamens, the fruit, nor the opposite leaves, agree at all with that genus, but most naturally with the Linnean genus Bæckia, of which several species have lately been found in New Holland. The stamens vary from eight to ten; the germen three-celled, with about sixteen seeds in each; but how many of these ripen we have had no opportunity of observing. The leaves are not absolutely without nerves, as described by Forster; we find them faintly three-nerved in his own specimen, but they are more conspicuously so after they become dry, particularly on the under side. In the specimens with which we have been favoured by Mr. Milne from Fonthill, the leaves are a little smaller than those upon the original specimen, which may be occasioned by this plant's being yet so young, being raised only three years ago in the collection of the Marquis of Bath. The time of flowering is October. The Leptospermum virgatum of Willdenow we cannot quote, his descriptions being from two plants of very different genera jumbled together into one species.

* * * * *

In the 277th Number of The Botanical Magazine the writer, endeavouring to destroy the authority of the figure of Yucca gloriosa in The Botanist's Repository, vol. vii., and establish that of his own as the first, says that our figure cannot belong to that plant, in which "the trunk reaches only from six inches to two feet (Miller says in his Dictionary, from two feet and a half to three feet!) in height, and where the leaves are quite entire; but to Y. aloifolia, whose trunk reaches from 6 to 10 feet in height, and the leaves have a finely crenulate edging." Our drawing was taken at Lord Boston's from a plant only ten feet high, the stem little more than three, and the leaves not in the least crenated! The panicle in our figure is also said to be much closer than in that, with its branches likewise more lax and drooping. With all these contradictory qualities, however, it very much resembles Barreliere's figure of the same, which the writer himself has quoted, and in which the curvature of the buds, which he holds to be so extraordinary, is also conspicuous. No less curious is his objection to the tinge of purple on the flowers. Could it be possible that he had not seen either the plant that he way describing or the drawing of it? (See the figure in The Botanical Magazine.) But we leave the Yuccas to speak for themselves. The filamentosa he has also complimented with five feet of a stem (Botanical Magazine, No. 900), and quoted Micham's authority for it, although that author expressly says that it is stemless!

[Illustration]

PLATE DXCIX.

CHAMÆROPS HUMILIS.

Dwarf Fan-Palm.

CLASS XXIII. ORDER II.

POLYGAMIA DIŒCIA. Stamens and Pointals on different Plants, with some perfect Flowers occasionally.

GENERIC CHARACTER.

MASC. Calyx 3-partitus. Corolla 3-petala. Stamina 6.

HERMAPH. Calyx, corolla et stamina ut in masculis. Styli 3. Drupæ 3, monospermæ.

MALES. Cup 3-parted. Blossom 3-petalled. Stamens 6.

HERMAPHRODITES. Cup, blossom and stamens as in the males. Styles 3. Berries 3, dry, one-seeded.

SPECIFIC CHARACTER.

CHAMÆROPS frondibus palmatis, stipitibus spinosis, spathâ simplici. _Willd. Sp. Pl. 4. p. 1154._

CHAMÆROPS with palmate boughs, prickly footstalks, and simple sheaths.

REFERENCE TO THE PLATE.

1. Empalement and blossom. 2. The same shown from the outer side. 3. The chives.

* * * * *

The Dwarf Fan-Palm is the only species indigenous to Europe, where it grows naturally in Italy on the coast of Etruria, in the Island of Sicily, and in Spain in the province of Valencia, where we are informed by Cavanilles, in his Icones Plantarum, (vol. ii. p. 12.) it is most commonly found stemless, and in that tract called Desierto de las Palmas, or the Desert of Palms, with stems rarely exceeding two feet in height. In the district of Xabea, however, on the coast of the Mediterranean, he found many with stems fourteen feet high, and one as high as thirty feet. The same author informs us that the lower part of the stem, which enters the earth, and the heads of young blossoms before they burst from the sheath, are eaten by the Spaniards, to whom also the leaves are of the greatest utility, furnishing them with mats, ropes, brooms, and baskets, in the manufacture of which boys are principally employed, and women during the evenings in winter. Many of our fair countrywomen, we fear, spend their evenings less usefully. Professor Pontedera, in his Anthologia, published at Padua in 1720, has given three good plates of the Chamærops and its fructification, taken from a plant, the stem of which was twelve feet high, growing in the public garden there. From this author we learn that the young shoots or suckers from the bottom of the plant (called there cefaglioni) are eaten by the Italians. The Chamærops also grows spontaneously upon uncultivated hills on the coast of Barbary, where the lower part of the young stems and the roots are also eaten by the Moors; and the leaves, after being macerated in water, made into mats, ropes, baskets, &c., as in Spain. (See Desfontaines' Flora Atlantica, vol. iii. p. 473.) Willdenow takes notice of two varieties of the Chamærops, one of which is nearly stemless, and the other twenty feet in height; and the former of which is probably that cultivated in England, as we have never met with any of a large size, although the plant has been in our gardens since the year 1731; while that in the Jardin des Plantes at Paris, (nearly twenty feet high,) mentioned by Chevalier Lamarck in the Encyclopédie Méthodique, seems to be the second variety. Our drawing was taken early in March, in Malcolm's Nursery at Kensington, from a male plant about two feet in height with three fine bunches of male blossoms.

[Illustration]

PLATE DC.

GÆRTNERA RACEMOSA.

Racemed Gærtnera.

CLASS X. ORDER I.

DECANDRIA MONO-DI-TRIGYNIA. Ten Chives. One to Three Pointals.

GENERIC CHARACTER.

CALYX 5-partitus. Petala 5 lacero-ciliata, inæqualia. Stamina decem, unicum reliquis longius. Stylus incurvus. Stigma simplex. Germen triloculare, 3-spermum. Samara inæqualiter quadrialata, monosperma.

CUP five-parted. Petals five, cut-fringed, unequal. Stamens ten, one longer than the rest. Style incurved. Summit simple. Seed-bud of three cells with three seeds. Fruit with four unequal wings, one-seeded.

REFERENCE TO THE PLATE.

1. The empalement. 2. The same shown from the outer side. 3. The chives and pointals. 4. The seed-bud and pointals. 5. The capsule.

* * * * *

This curious and interesting plant, originally considered as a species of Banisteria by Linnæus, was very properly separated and named in honour of the celebrated Gærtner by Schreber in his Genera Plantarum; and Cavanilles nearly about the same time published it in his Ninth Dissertation, under the name of Molina, in honour of the author of the Natural History of Chili. Gærtnera however has the right of priority, and has been continued by Dr. Roxburgh in his Plants of the Coast of Coromandel, where he has given a figure and description of the plant, (vol. i. p. 19. tab. 18.) and by Willdenow in his edition of the Species Plantarum.

On examining the fructification, we have found the plant more closely allied to Banisteria than has hitherto been suspected, the styles being commonly two with a rudiment of a third, and the germen three-locular with a young seed in each cell; but the inequality of the petals and stamens, the solitary gland on the calyx, and the abortion of the lateral seeds, furnish abundant distinctions.

From the Coromandel plants above quoted we learn that it is a large climbing shrub, growing naturally on the Circar mountains in India, and is commonly cultivated all over that coast on account of the beauty and fragrance of its flowers, which open there during the rainy season. According to Linnæus it is also a native of the Island of Ceylon. No other species of the genus has yet been described. The plant is certainly a great acquisition to our collections, and was introduced from India by the late Lady Amelia Hume about the year 1805. Our specimen was communicated from the collection at Wormley Bury the end of last March.

[Illustration]

PLATE DCI.

CROTALARIA PULCHRA.

Fair Crotalaria.

CLASS XVII. ORDER IV.

DIADELPHIA DECANDRIA. Two Brotherhoods. Ten Stamens.

GENERIC CHARACTER.

LEGUMEN pedicellatum, turgidum. Filamenta connata cum figurâ dorsali.

POD on a footstalk, swollen. Filaments united into a tube, which is cleft at the back.

SPECIFIC CHARACTER.

CROTALARIA caule hirsuto; foliis simplicibus, elliptico-obovatis, integerrimis, sericeis, nitentibus; leguminibus calyce tectis bracteisque strigoso-sericeis.

CROTALARIA with a hairy stem; simple, elliptical, inversely oval, entire, silky, shining leaves: the pods, the calyx which covers them, and the bracts, all shining with silky hairs.

REFERENCE TO THE PLATE.

1. The empalement. 2. The standard. 3. One of the wings. 4. The keel. 5. Chives and pointal. 6. The seed-bud and pointal.

* * * * *

The choice collection of the late Lady Amelia Hume, at Wormley-bury, Herts, which before furnished us with the magnificent and unrivalled Pæonia papaveracea, has again produced us this new species of Crotalaria, seeds of which were received by her ladyship, about the year 1807, from the East Indies, under the name of C. pulcherrima, which we have abridged to pulchra, as we can hardly presume to say which species is most beautiful before we have seen the whole genus, which, from the large catalogue of Indian species by Dr. Roxburgh in his unpublished Indian Flora, a copy of which we have seen in the collection of A. B. Lambert, esq. (besides the forty-four species already published by Willdenow) we think is not soon likely to happen.

Crotalaria pulchra is as yet in very few collections in this country, nor have we heard of its blossoming in any other collection. The foreign specimens which we have seen with the Catalogue above mentioned in the same collection have very large spreading bunches of flowers, and there can be no doubt but the plants in this country, when a little stronger, will blossom with equal profusion. The plant is a native of the Mysore country in the East Indies. We received the specimen in the middle of March last.

[Illustration]

PLATE DCII.

GLYCINE COMPTONIANA.

Comptonian Glycine.

CLASS XVII. ORDER IV.

DIADELPHIA DECANDRIA. Two Brotherhoods. Ten Chives.

GENERIC CHARACTER.

CALYX bilabiatus. Corollæ carina apice vexillum reflectens.

CUP two-lipped. Keel of the blossom turning back the standard at the end.

SPECIFIC CHARACTER.

GLYCINE volubilis, foliis ternatis elongato-ovatis utrinque glabris, petiolis partialibus supra pubescentibus, racemis axillaribus multi-floris.

GLYCINE twining; the leaves by threes of a long egg-shape, smooth on both sides; the partial footstalks hairy above; the bunches lateral and many-flowered.

REFERENCE TO THE PLATE.

1. The empalement. 2. The standard. 3. One of the wings. 4. The keel. 5. Chives and pointal. 6. The seed-bud and pointal.

* * * * *

This elegant species is a native of New Holland, and belongs to that division of the genus with many-seeded pods without any partitions. We find in the germen the rudiments of eight kidneyshaped seeds, but the ripe fruit we have not seen. Having found no antecedent description or figure of the plant, we have named it in honour of Lady Northampton, in whose collection at Castle Ashby it flowered last April. But by whom it was introduced we are uncertain.

[Illustration]

PLATE DCIII.

COMMERSONIA DASYPHYLLA.

Hairy-leaved Commersonia.

CLASS V. ORDER V.

PENTANDRIA PENTAGYNIA. Five Chives. Five Pointals.

GENERIC CHARACTER.

CALYX monophyllus 5-partitus. Petala 5 linearia basi sublobata, apice inflexa. Nectarium 5-partitum. Filamenta ad basin petalorum, brevissima. Germen subglobosum. Styli erecti. Stigmata capitata. Capsula dura, setosa, 5-locularis, 5-valvis, loculis 2-4-spermis.

EMPALEMENT of one leaf 5-parted. Petals 5, linear, commonly lobed at the base, turned in at the point. Nectary 5-parted. Threads at the base of the petals, very short. Seed-bud nearly round. Styles erect with their summits headed. Capsule hard, bristly, with 5 cells and 5 valves, the cells from 2-to 4-seeded.

SPECIFIC CHARACTER.

COMMERSONIA foliis elongato-cordatis inæqualiter serratis supra subtusque hirsutis.

COMMERSONIA with long heart-shaped unequally toothed leaves hairy on both sides.

REFERENCE TO THE PLATE.

1. Empalement, chives and pointals, magnified.

* * * * *

Commersonia dasyphylla is a low branching shrub, a native of New Holland or Van Diemen's Land, and is remarkable for a powerful odour of cucumbers which it emits when in blossom, and even retains for some time after it is dried. Being a plant which blossoms freely in early spring, and of very easy culture, it well deserves a place in the green-house or conservatory. Only one species of Commersonia has before flowered in England, the C. echinata of our last volume (Plate 519), but which has since been discovered to be a different species from the original C. echinata of Forster; which error we take the present opportunity of correcting, and beg of our readers to erase the name echinata in our 519th plate and description, and substitute platyphylla, with the following specific description:

COMMERSONIA platyphylla, foliis elongato-cordatis dentatis, supra stellato-hispidulis, subtus hirsutis, mollibus.

BROAD-LEAVED Commersonia with toothed leaves of a long heart-shape, a little rough with star-like bristles on the upper side; hairy and soft below.

Another nondescript Commersonia from Van Diemen's Land is now in our gardens, but has not yet blossomed; and we have seen dried specimens of a fifth species brought from New Holland by the late Governor King, in the collection of A. B. Lambert, esq.

We were favoured with the specimen of C. dasyphylla by Mr. Milne, from Fonthill, last April. The plant is at present in very few collections, and has not, we believe, yet blossomed anywhere else in England.

[Illustration]

PLATE DCIV.

MALPIGHIA POLYSTACHIA.

Branching Malpighia.

CLASS X. ORDER I. TO III.

DECANDRIA MONO-DI-TRIGYNIA. Ten Chives. One to Three Pointals.

GENERIC CHARACTER.

CALYX 5-phyllus basi extus poris binis melliferis. Petala 5 subrotunda, unguiculata. Filamenta basi cohærentia. Drupa 1-locularis tripyrena, nucibus monospermis.

CUP 5-leaved with two honey-bearing pores on the outside at the base. Petals five, nearly round with claws. Threads cohering at the base. Berry fleshy of one cell with three large bony seeds.

SPECIFIC CHARACTER.

MALPIGHIA foliis lanceolato-ovatis integerrimis glabris nitidis, subtus prope basin biglandulosis; racemis axillaribus et terminalibus; pedicellis uniglandulosis; floribus monogynis; stigmate capitato.

MALPIGHIA with lance-ovate, entire smooth shining leaves, with two glands on their underside near the base; bunches both from the sides and tops of the branches; flowerstalks with one gland; style one; stigma headed.

REFERENCE TO THE PLATE.

1. The empalement. 3. The chives spread open. 3. Seed-bud and pointals.

* * * * *

This splendid Malpighia is one of that fine collection of West Indian and American plants (we have before mentioned) made by Lord Seaforth when Governor of Barbadoes, and brought home with him on his return to England. From the catalogue of the collection we learn that the plant is a native of Trinidad, and his Lordship informs us that it was sent to him from that island by Mr. Thompson.

The species ought to be arranged between the M. nitida of Linnæus and M. glandulosa of Cavanilles, from both of which the glands on the leaf and solitary gland on the pedicel easily distinguish it. In the last circumstance, however, it agrees with the M. glandulosa of Jacquin, (see his Icones, tab. 469.) but is totally different both in the flowers and foliage. A. B. Lambert, esq., from whose stove at Boyton we were favoured with the specimen, informs us that it is a shrub of very free growth, throwing out long slender twigs on all sides, and requiring the frequent use of the knife to keep it in due bounds. The bunches of flowers first appeared in November, but did not open until the beginning of April. The leaf-stalks are thinly covered with silky bristles, some of which also appear towards the base of the younger leaves.

[Illustration]

PLATE DCV.

PELIOSANTHES TETA.

Bengal Peliosanthes, or Teta.

CLASS VI. ORDER I.

HEXANDRIA MONOGYNIA. Six Chives. One Pointal.

GENERIC CHARACTER.

CALYX nullus. Corolla 6-partita, subrotata, laciniis lato-ovatis obtusis. Nectarium corollâ triplò breviore incumbente, ore angustato integro. Stamina sub ore nectarii affixa. Filamenta subnulla. Stylus crassus, brevis, obtusè trigonus, trisulcatus. Stigma sulculus tripartitus in apice styli. Germen inferum, 3-loculare loculis dispermis. Semina (immatura) obovata, erecta, fundo loculamenti affixa. Fructus bacca? subovata, carnosa.

CUP none. Blossom 6-parted, nearly wheel-shaped, the divisions broadly egg-shaped, blunt. Nectary three times shorter than the blossom, leaning inwards, the mouth narrowed and entire. Stamens affixed under the lip of the nectary. Filaments scarcely any. Pointal fleshy, short, bluntly three-sided, with three furrows. Stigma a little three-branched channel on the top of the pointal. Germ below, of three cells which are two-seeded. Seeds (while young) inversely egg-shaped, erect, and affixed to the bottom of the cells. Fruit a berry? nearly oval, fleshy.

REFERENCE TO THE PLATE.

1. A segment of the flower magnified. 2. Seed-bud and pointal magnified, with the seeds exposed. 3. Seed-bud cut transversely, magnified.

* * * * *

This very curious plant, so distinct from every genus hitherto described, was introduced from the East Indies, at the same time with the Gærtnera figured in our last number, by the late Lady Amelia Hume. The roots are fibrous and perennial, as are also the leaves, which rise from the root upon footstalks embracing one another at the base, and are of a long lance-shape with strong longitudinal nerves, which are transversely interwoven with little branching veins. The flower-stalks are round, rising to from one to two feet in height, with membranaceous bracts scattered at regular distances, and were four in number in the specimen which we have figured. The blossoms grow in a kind of raceme formed of little bunches or tufts of two to four flowers each: the footstalks are of unequal lengths with a joint near the top, and are attended by incurved bracts at the base, the lowermost bract at each tuft being always the largest. The germ is nearly top-shaped, but a little hexangular upwards. Three of the divisions of the blossom are just perceptibly broader than the other three, and both the corolla and nectary are closely pierced with transparent dots hardly visible to the naked eye, but very distinct when magnified.

We have seen a very good coloured drawing of the plant taken in India in the collection of J. Fleming, esq. which represents the fruit (which has not yet ripened in England) as a bluntly oval, fleshy berry, with the seeds in pairs as in the germ. Both this drawing and the plant received from India by Lady Amelia Hume were marked _Teta viridiflora_; Teta being perhaps (if we may hazard a conjecture) the name applied to the plant by the native Indians. However this may be, as it appears to be known in India by that name, we have retained it for the specific designation; applying to the genus, in conformity to the Linnæan canons, (from πελιος, lividus, and ανθς, flos,) the name of Peliosanthes. Our drawing represents the original plant imported from India, with which we were favoured by Sir Abraham Hume, bart. last April, through the kindness of A. B. Lambert, esq. who has also informed us, from Dr. Roxburgh's MSS. in his possession, that the plant is found growing naturally about Chittagong in the East Indies. We have just seen two other species of the genus in the curious collection of T. Evans, esq. at Stepney, imported by him last Autumn from Prince of Wales's Island, of which they are natives. One of them has the leaves nearly of a blue colour; and Mr. Evans's collector informs us, that he found five or six species growing naturally in the island above mentioned, although he had not the good fortune to bring them alive to England.

Linnæus was of opinion, that there were not above ten thousand plants in the world; but above five-and-twenty thousand have already been described, and ten thousand probably yet remain to be added to the number!

[Illustration]

PLATE DCVI.

ZIERIA SMITHII.

Smithian Zieria.

CLASS IV. ORDER I.

TETRANDRIA MONOGYNIA. Four Chives. One Pointal.

GENERIC CHARACTER.

CALYX quadripartitus. Petala quatuor. Stamina glabra, glandulis insidentia. Stylus simplex. Stigma subquadrilobum. Capsulæ quatuor coalitæ. Semina arillata.

CUP four-parted. Petals four. Chives smooth, sitting on glands. Pointal simple. Summit generally four-lobed. Fruit of four cohering capsules. Seeds covered with an arillus.

REFERENCE TO THE PLATE.

1. Empalement magnified. 2. Chives and pointal. 3. A chive magnified. 4. The same shown from the outer side. 5. Empalement, seed-bud, and pointal magnified.

* * * * *

The Zieria Smithii is a dwarf warty shrub with opposite branches, and leaves which are composed of three lanceolate leaflets, rough with transparent dots, which probably secrete an oil, as the bruised leaves are very fragrant. A few small scattered hairs are just visible on their upper surface. The panicles of flowers rise from the axils of the leaves, which they often excel in length, and branch in the same opposite manner as the stem, with linear bracts at the divisions. The cups are very short, finely haired and dotted as the leaves. The petals are broad-lanced, pointed, and slightly tinged with purple on the outside. The genus was established by Dr. Smith in the fourth volume of the Linnean Society's Transactions, and named in memory of his friend Mr. Zier, whom he calls "an indefatigable botanist, but whose labours generally gained celebrity under another name than his own." Were celebrity only to be gained by real merit, many of the high-sounding names that now swell the trump of fame would, we fear, have far less pretensions than Zier. The Zieria Smithii was communicated last April by A. B. Lambert, esq. from his collection, and we have seen dried specimens of four other species preserved in his Herbarium, all (like the present) natives of New Holland, and agreeing in their shrubby nature, opposite branches, ternate leaves, and axillary bunches of flowers. None of the species have before been published.

[Illustration]

PLATE DCVII.

CLERODENDRUM TOMENTOSUM.

Downy Clerodendrum.

CLASS XII. ORDER II.

DIDYNAMIA ANGIOSPERMIA. Two Chives longer. Seeds covered.

GENERIC CHARACTER.

CALYX campanulatus, quinquefidus. Corolla tubo elongato, limbo quinquepartito, æquali. Stamina exserta. Germen quadriloculare, loculis monospermis. Drupa tetrapyrena.

CUP bell-shaped, five-cleft. Tube of the blossom elongated, with the limb equally five-parted. Stamens longer than the tube. Seed-bud four-celled, the cells one-seeded. Fruit a dry berry including four nuts.

SPECIFIC CHARACTER.

CLERODENDRUM tomentosum, foliis ellipticis acutis integris calycibusque tomentosis; corymbis congestis.--_Brown. Prodromus Floræ Novæ Hollandiæ et Insulæ Van Diemen, vol. 1. p. 510._

DOWNY Clerodendrum with elliptic acute entire leaves downy as well as the cups; corymbs crowded.

REFERENCE TO THE PLATE.

1. Empalement. 2. A blossom spread open. 3. Seed-bud and pointal. 4. A ripe fruit.

* * * * *

The Clerodendrum tomentosum is found naturally growing about Port Jackson and some other parts of the eastern and northern coasts of New Holland, according to Mr. Brown's Prodromus of the Flora of that country, just published. This long expected and interesting work contains descriptions of about two thousand plants, (of which, scarcely a third part have before been published) in the first volume, and the second is now in the press.

Although the Clerodendrum tomentosum has been in England above ten years, no figure of it has before been given in this country. All the plants which we have seen of it form erect shrubs from four to six feet in height. The time of blossoming is March and April. We have been favoured with specimens in blossom from the botanic garden of the Company of Apothecaries at Chelsea, and with the ripe fruit from Sir Abraham Hume's collection at Wormley-bury, but are uncertain who first introduced it.

[Illustration]

PLATE DCVIII.

CITRUS NOBILIS.

Mandarin Orange.

CLASS XVIII. ORDER III.

POLYADELPHIA ICOSANDRIA. Many Sets of Chives. Threads from the Calyx or Receptacle.

GENERIC CHARACTER.

CALYX 5-dendatus. Corolla 5-petala. Stamina 20 in cylindrum passim connata. Stylus 1. Bacca 9-12-locularis, pulpâ vesiculari.

CUP five-toothed. Petals five. Stamens about twenty, generally united at the base. Shaft 1. Fruit 9-to 12-celled, the pulp variously divided.

SPECIFIC CHARACTER.

CITRUS petiolis sublinearibus, fructu latescente depresso.

CITRUS with nearly linear leafstalks; the fruit broad depressed.

CITRUS nobilis, inermis, ramis adscendentibus: petiolis strictis, fructu tuberculoso subcompresso.--_Lour. Flor. Cochinchin. 2. p. 569?_

REFERENCE TO THE PLATE.

1. The empalement. 2. Chives and pointal. 3. The chives spread open, a tip magnified. 4. Seed-bud and pointal. 5. A horizontal section of the fruit.

* * * * *

The drawing of this remarkable Orange, which has so long been a desideratum in this country, was taken at Wormley-bury in the beginning of last May. The plant is a native of China, and Mr. Barrow informs us, that he found the fruit very common when on his travels in that country, and in much higher estimation than the common Orange by the Chinese, who call it Mandarin Orange (answering nearly to the English epithet of noble) by way of pre-eminence. The same gentleman also informs us, that he found some fine trees of it in the gardens at the Cape of Good Hope; it is therefore the more singular that it has been so long in reaching this country. From Loureiro’s description of his Citrus nobilis, there can be little doubt of its being intended for the Mandarin Orange; which, he informs us, grows to a moderately sized tree, and particularly notices the superior excellence and the depression of the fruit, whose common size is about five inches across. The plant at Sir Abraham Hume’s is as yet only about five feet in height, and was imported from Canton in 1805.

It is easily distinguished from the common Orange, both by its curious form and internal structure, the pulp adhering so loosely to the rind as to be separable from it by the slightest effort, and leaving in many places a considerable opening between them.

[Illustration]

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ERRATA.

Plate 586 for Lilium speciosum, read Lilium tigrinum, a perfectly new species, distinct from the references given in the description.

587 In reference to the plate, instead of pointals, read empalement and pointals.

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The wonders of the world

John Loraine Abbott

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Transcriber’s Note:

This version of the text cannot represent certain typographical effects. Italics are delimited with the ‘_’ character as _italic_.

Footnotes have been moved to follow the paragraphs in which they are referenced.

There are numerous illustrations, which are represented here by their captions and which have been moved slightly to fall in between paragraphs or sections.

Minor errors, attributable to the printer, have been corrected. Please see the transcriber’s note at the end of this text for details regarding the handling of any textual issues encountered during its preparation.

[Illustration:

WONDERS of the WORLD.]

THE

WONDERS OF THE WORLD:

A

COMPLETE MUSEUM, DESCRIPTIVE AND PICTORIAL,

OF THE

WONDERFUL PHENOMENA AND RESULTS

OF

NATURE, SCIENCE AND ART.

BY

JOHN LORAINE ABBOTT.

ILLUSTRATED FROM ORIGINAL DESIGNS BY BILLINGS AND OTHERS.

=Hartford:= PUBLISHED BY CASE, TIFFANY AND COMPANY. 1856.

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PREFACE.

The _ancients_ boasted of their SEVEN WONDERS OF THE WORLD. These were the Pyramids of Egypt, the Colossus of Rhodes, the Aqueducts of Rome, the Labyrinth on the banks of the Nile, the Pharos of Alexandria, the Walls of Babylon, and the temple of Diana at Ephesus. But the WONDERS known to those of the _present_ day, may be counted by hundreds: wonders of Nature, wonders of Science, wonders of Art, and Miscellaneous wonders; each department full, to overflowing, of themes of the richest instruction and deepest interest.

To present some of the most striking of these wonders, in a manner that shall be acceptable to the man of science and profound research, and at the same time full of interest to the general reader, and the family at the fireside, has been the aim of the editor of the following pages. The exaggerated and marvelous stories which the mischievous fancy of travelers has too often imposed on the credulity of the weak, as well as the foolish fables founded in bigotry and superstition, which were too often received as truths in the dark ages, have been carefully avoided, and, where the narrative permitted, exposed; and nothing has been brought forward that has not been confirmed by the concurrent testimony of enlightened travelers, and men of science, and extended observation. On the subjects in which Nature, in her various departments, displays her most wondrous magnificence and beauty; or in those in which Science and Art have sought out their most wondrous inventions, and wrought out the most wondrous results, the best authorities have been carefully consulted. And the endeavor has been, so to assemble and arrange the multiplied objects of wonder and delight, as to confer a lasting benefit on the rising generation, and on families, and at the same time to present a work that shall commend itself to those whose lives have been wholly devoted to researches among the sublime wonders of nature, science and art. Believing that the standard of general reading is constantly rising higher, and that the sphere of intellectual tastes and pursuits is constantly growing wider, the writer has endeavored to prepare a volume that shall have more than the interest of fiction, and, at the same time, the ripe and rich instruction of the book of travels, or the work of science or descriptive art. The table of contents makes manifest how extensive the range of the topics presented; while the list of engravings may show how profusely and richly the enterprise of the publishers has illustrated a work, which it is hoped may meet with universal acceptance.

J. L. A.

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THE

=Wonders of the World.=

MOUNTAINS.

“And lo! the mountains print the distant sky, And o’er their airy tops faint clouds are driven, So softly blending that the cheated eye, Forgets or which is earth, or which is heaven!”—FAY.

“Mountains and all hills—let them praise the name of the Lord, for his name alone is excellent; his glory is above the earth and heaven.”—DAVID.

Among the _wonders_, or uncommon phenomena of the world, may be classed stupendous _mountains_. For though compared with the entire diameter of the earth, the highest elevations on its surface are no more than the inequalities on the skin of the orange to the orange itself, yet to our eyes they often appear immensely lofty and sublime. Descriptions of such vast and striking objects often fail to excite corresponding ideas; so that however accurate or poetical may be the accounts of this class of the prodigies of nature, no just notions of their vastness can be conveyed, by any written or graphical representation. The magnitude of an object must be seen to be duly conceived; and the mountain-wonders of the world will best be understood and felt by those who have visited Wales, Scotland, Switzerland, or the mountainous regions of America or Asia.

THE ANDES.

Some of the loftiest and most extensive mountains in the world, are the Andes, in South America. These stupendous hills, called by the Spaniards the =Cordilleras=, (from the word _cord_ or _chain_,) =i. e.=, the chains of the Andes, stretch north and south near the western coast, from the isthmus of Darien, through the whole of the continent of South America, to the straits of Magellan. In the north, there are three chains of separate ridges; but in advancing from Popayan toward the south, the three chains unite into a

single group, which is continued far beyond the equator. In Equador, near Quito, the more elevated summits of this group are ranged in two rows, (as seen in the cut below,) which form a double crest to the Cordilleras. The extent of the Andes mountains is not less than four thousand three hundred miles, from one end to the other.

[Illustration: THE CORDILLERAS, OR ANDES, NEAR QUITO.]

“Rocks rich in gems, and mountains big with mines, That on the high equator ridgy rise, Whence many a bursting stream auriferous plays.”—THOMSON.

In this country, the operations of nature appear to have been carried on on a larger scale, and with a bolder hand, than elsewhere; and in consequence, the whole is distinguished by a peculiar magnificence. Even the plain of Quito, which may be considered as the base of the Andes, is more elevated above the sea than the summits of many European mountains. In different places the Andes rise more than one-third higher than the famous peak of Teneriffe, the highest land in the ancient hemisphere. Their cloud-enveloped summits, though exposed to the rays of the sun in the torrid zone, are covered with eternal snows, and below them the storm is seen to burst, and the exploring traveler hears the thunder roll, and sees the lightnings dart beneath his feet. Throughout the whole of the range of these extensive mountains, as far as they have been explored, there is a certain boundary, above which the snow never melts; which boundary, in the torrid zone, has been ascertained to be fourteen thousand, six hundred feet, or nearly three miles above the level of the sea.

The ascent to the plain of Quito, on which stands Chimborazo, Cotopaxi, Pichincha, &c., is thus described by Don Juan de Ulloa:

“The ruggedness of the road from Taraguaga, leading up the mountain, is not easily described. The declivity is so great, in some parts, that the mules can scarcely keep their footing; and, in others, the acclivity is equally difficult. The trouble of sending people before to mend the road, the pain arising from the many falls and bruises, and the being constantly wet to the skin, might be supported; but these inconveniences are augmented by the sight of such frightful precipices and deep abysses, as excite in the mind constant terror. The road, in some places, is so steep, and yet so narrow, that the mules are obliged to slide down without making any use whatever of their feet. On one side of the rider, in this situation, rises an eminence of many hundred yards; and, on the other, is an abyss of equal depth; so that, if he should give the least check to his mule, and destroy the equilibrium, both must inevitably perish.

“Having traveled nine days in this manner, slowly winding along the sides of the mountains, we began to find the whole country covered with a hoar-frost; and a hut, in which we reposed, had ice in it. At length, after a perilous journey of fifteen days, we arrived upon a plain, at the extremity of which stands the city of Quito, the capital of one of the most charming regions in the world. Here, in the center of the torrid zone, the heat is not only very tolerable, but, in some places, the cold is even painful. Here the inhabitants enjoy the temperature and advantages of perpetual spring; the fields being constantly covered with verdure, and enameled with flowers of the most lively colors. But although this beautiful region is more elevated than any other country in the world, and it employs so many days of painful journey in the ascent, it is itself overlooked by tremendous mountains, their sides being covered with snow, while their summits are flaming with volcanoes. These mountains seem piled one upon the other, and to rise, with great boldness, to an astonishing hight. However, at a determined point above the surface of the sea, the congelation is found at the same hight in all the mountains. Those parts which are not subject to a continual frost, have here and there growing upon them a species of rush, resembling the broom, but much softer and more flexible. Toward the extremity of the part where the rush grows, and the cold begins to increase, is found a vegetable with a round bulbous head. Higher still, the earth is bare of vegetation, and seems covered with eternal snow. The most remarkable of the Andes are the mountains of Chimborazo, Cotopaxi, and Pichincha.”

CHIMBORAZO.

This is the most lofty and majestic peak of the Andes, and has a circular summit. It is twenty-two thousand feet, or more than four miles high. On the shores of the ocean, after the long rains of winter, Chimborazo appears like a cloud in the horizon. It detaches itself from the neighboring summits, and raises its lofty head over the whole chain of the Andes. Travelers who have approached the summits of Mont Blanc and Mont Rose, are alone capable of feeling the effect of such vast, majestic, and solemn scenery.

The bulk of Chimborazo is so enormous, that the part which the eye embraces at once, near the limit of the snows, is twenty-two thousand, nine hundred and sixty-eight feet, or four miles and a third in breadth. The extreme rarity of the strata of air across which the summits of the Andes are seen, contributes greatly to the splendor of the snow and the magical effect of its reflection. Under the tropics, at a hight of sixteen thousand, four hundred feet, or upward of three miles, the azure vault of the heavens appears of an

indigo tint; while, in so pure and transparent an atmosphere, the outlines of the mountains seem to detach themselves from the sky, and produce an effect at once sublime, awful, and profoundly impressive.

With the exception of the loftiest of the Himalaya, in Asia, Chimborazo is the highest known mountain in the world. Humboldt, Bonpland, and Montufar, were persevering enough to approach within one thousand, six hundred feet of the summit of this mighty king of mountains. Being aided in their ascent by a train of volcanic rocks, destitute of snow, they thus attained the amazing hight of nearly four miles above the level of the sea; and the former of these naturalists is persuaded that they might have reached the highest summit, had it not been for the intervention of a great crevice, or gap, which they were unable to cross. They were, therefore, obliged to descend, after experiencing great inconveniences and many unpleasant sensations. For three or four days, even after their return into the plain, they were not free from sickness, and an uncomfortable feeling, owing, as they suppose, to the vast proportion of oxygen in the atmosphere above. Long before they reached the above surprising hight, they had been abandoned by their guides, the Indians, who had taken alarm and were fearful of their lives. So great was the fall of snow on their return, that they could scarcely recognize each other, and they all suffered dreadfully from the intenseness of the cold.

A great number of Spaniards formerly perished in crossing the vast and dangerous deserts which lie on the declivity of Chimborazo; being now, however, better acquainted with them, such misfortunes seldom occur, especially as very few take this route, unless there be a prospect of calm and serene weather.

COTOPAXI.

This mountain is the loftiest of those volcanoes of the Andes which, at recent epochs, have undergone eruptions. Notwithstanding it lies near the equator, its summits are covered with perpetual snows. The absolute hight of Cotopaxi is eighteen thousand, eight hundred and seventy-six feet, or three miles and a half; consequently it is two thousand, six hundred and twenty-two feet, or half a mile, higher than Vesuvius would be, were that mountain placed on the top of the peak of Teneriffe! Cotopaxi is the most mischievous of the volcanoes in the vicinity of Quito, and its explosions are the most frequent and disastrous. The masses of scoriæ, and the pieces of rock, thrown out of this volcano, cover a surface of several square leagues, and would form, were they heaped together, a prodigious mountain. In 1738, the flames of Cotopaxi rose three thousand feet, or upward of half a mile, above the brink of the crater. In 1744, the roarings of this volcano were heard at the distance of six hundred miles. On the fourth of April, 1768, the quantity of ashes ejected at the mouth of Cotopaxi was so great, that it was dark till three in the afternoon. The explosion which took place in 1803, was preceded by the sudden melting of the snows which covered the mountain. For twenty years before no smoke or vapor, that could be perceived, had issued from the crater; but in a single night the subterraneous fires became so active, that at sunrise the external walls of the cone, heated to a very considerable temperature, appeared naked, and of the dark color which is peculiar to vitrified scoriæ. “At the port of Guyaquil,” observes Humboldt, “fifty-two leagues distant in a straight line from the crater, we heard, day and night, the noise of this volcano, like continued discharges of a battery; and we distinguished these tremendous sounds even on the Pacific ocean.”

The form of Cotopaxi is the most beautiful and regular of the colossal summits of the high Andes. It is a perfect cone, which, covered with a perpetual layer of snow, shines with dazzling splendor at the setting of the sun, and detaches itself in the most picturesque manner from the azure vault above. This covering of snow conceals from the eye of the observer even the smallest inequalities of the soil; no point of rock, no stony mass, penetrating this coat of ice, or breaking the regularity of the figure of the cone.

PICHINCHA.

Though celebrated for its great hight, Pichincha is three thousand, eight hundred and forty-nine feet, or three-fourths of a mile, lower than the perpendicular elevation of Cotopaxi. It was formerly a volcano; but the mouth or crater on one of its sides is now covered with sand or calcined matter, so that at present neither smoke nor ashes issue from it.

When it was ascended by Don George Juan and Don Antonio de Ulloa, for the purpose of their astronomical observations, they found the cold on the top of this mountain extremely intense, the wind very violent, and the fog, or, in other words, the cloud, so thick, that objects at the distance of six or eight paces were scarcely discernible. On the air becoming clear, by the clouds descending nearer the earth, in such a manner as to surround the mountain on all sides to a vast distance, these clouds afforded a lively representation of the sea, in which the top of the mountain seemed to stand, like an island in the center.

“With aspect mild, and elevated eye, Behold him seated on a mount serene, Above the fogs of sense, and passion’s storm: All the black cares and tumults of this life, Like harmless thunders, breaking at his feet.”—YOUNG.

When the clouds descended, the astronomers heard the dreadful noise of tempests, which discharged themselves from them on the adjacent country. They saw the lightning issue from the clouds, and heard the thunder roll far beneath them. While the lower parts were thus involved in tempests of thunder and rain, they enjoyed a delightful serenity; the wind abated, the sky cleared, and the enlivening rays of the sun moderated the severity of the cold. But when the clouds rose, their density rendered respiration difficult: snow and hail fell continually, and the winds returned with such violence, that it was impossible to overcome the fear of being blown down the precipices, or of being buried by the accumulation of ice and snow, or by the enormous fragments of rocks which rolled around them. Every crevice in their hut was stopped, and though the hut was small, was crowded with inhabitants, and several lamps were constantly burning, the cold was so great, that each individual was obliged to have a chafing-dish of coals, and several men were employed every morning in removing the snow which had fallen during the night. Their feet were swollen, and they became so tender and sensible, that walking was attended with extreme pain; their hands also were covered with chilblains, and their lips were so swollen and chapped, that every motion in speaking brought blood.

MOUNT ETNA.

“Now under sulphurous Cuma’s sea-bound coast, And vast Sicilia, lies the shaggy breast Of snowy Etna, nurse of endless frost, The pillared prop of heaven, forever pressed: Forth from whose sulph’rous caverns issuing rise Pure liquid fountains of tempestuous fire, Which vail in ruddy mists the noonday skies, While wrapt in smoke the eddying flames aspire, Or gleaming through the night with hideous roar, Far o’er the redd’ning main huge rocky fragments pour.

“But he, Vulcanian monster, to the clouds The fiercest, hottest inundations throws, While, with the burthen of incumbent woods, And Etna’s gloomy cliffs o’erwhelmed he glows. There on his flinty bed outstretch’d he lies, Whose pointed rock his tossing carcass wounds; There with dismay he strikes beholding eyes, Or frights the distant ear with horrid sounds.”—WEST.

Mount Etna, one of the most majestic of all the volcanoes, which the ancients considered as one of the highest mountains in the world, and on the summit of which they believed that Deucalion and Pyrrha sought refuge, to save themselves from the universal deluge, is situated on the plain of Catania, in Sicily.

Its elevation above the level of the sea has been estimated at ten thousand, nine hundred and sixty-three feet, or upward of two miles. On clear days it is distinctly seen from Valetta, the capital of Malta, a distance of one hundred and fifty miles. It is incomparably the largest burning mountain in Europe. From its sides other mountains arise, which, in different ages, have been ejected in single masses from its enormous crater. The most extensive lavas of Vesuvius do not exceed seven miles in length, while those of Etna extend to fifteen, twenty, and some even to thirty miles. The crater of Etna is seldom less than a mile in circuit, and sometimes is two or three miles; but the circumference of the Vesuvian crater is never more than half a mile, even when widely distended, in its most destructive conflagrations. And, lastly, the earthquakes occasioned by these adjacent volcanoes, their eruptions, their showers of ignited stones, and the destruction and desolation which they create, are severally proportionate to their respective dimensions.

[Illustration: CRATER OF MOUNT ETNA.]

A journey up Etna is considered as an enterprise of importance, as well from the difficulty of the route, as from the distance, it being thirty miles from Catania to the summit of the mountain. Its gigantic bulk, its sublime elevation, and the extensive, varied, and grand prospects which are presented from its summit, have, however, induced the curious in every age to ascend and examine it; and not a few have transmitted, through the press, the observations which they have made during their arduous journey. From its vast base it rises like a pyramid to the perpendicular hight of two miles, by an acclivity nearly equal on all sides, forming with the horizon an angle of about fifteen degrees, which becomes greater on approaching the crater; but the inclination of the steepest part of the cone nowhere exceeds an angle of forty-five degrees. This prodigious volcano may be compared to a forge, which, in proportion to the violence of the fire, to the nature of the fossil matters on which it acts, and of the gases which urge and set it in motion, produces, destroys, and reproduces, a variety of forms; and of this, as of all active volcanoes, we may say in the language of Young,

“The dread volcano ministers to good; Its smothered flames might undermine the world Loud Etnas fulminate in love to man.”

The top of Etna being above the common region of vapors, the heavens, at this elevation, appear with an unusual splendor. Brydone and his company observed, as they ascended in the night, that the number of the stars seemed to be infinitely increased, and the light of each was brighter than usual. The whiteness of the milky way was like a pure flame which spread across the heavens; and, with the naked eye, they could observe clusters of stars which were invisible from below. They likewise noticed several of those meteors called falling stars, which appeared as much elevated here as when viewed from the plain beneath.

This single mountain contains an epitome of the different climates throughout the world, presenting at once all the seasons of the year, and all the varieties of produce. It is accordingly divided into three distinct zones or regions, which may be distinguished as the torrid, temperate, and frigid, but which are known by the names of the cultivated region, the woody or temperate region, and the frigid or desert region. The former of these extends through twelve miles of the ascent toward the summit, and is almost incredibly abundant in pastures and fruit-trees of every description. It is covered with towns, villages and monasteries; and the number of inhabitants spread over its surface is estimated at one hundred and twenty thousand. In ascending to the woody or temperate region, the scene changes; it is a new climate, a new creation. Below, the heat is suffocating; but here, the air is mild and fresh. The turf is covered with aromatic plants; and the gulfs, which formerly ejected torrents of fire, are changed into woody valleys. Nothing can be more picturesque than this; the inequality of the soil displaying every moment some variety of scene: here, the ash and flowering thorns form domes of verdure; and there, the chestnut-trees grow to an enormous size. The one called =castagno de cento cavilli=, according to Brydone and Glover, has a circumference of two hundred and four feet. Many of the oaks also are of a prodigious size. Mr. Swinburne measured one which had a circumference of twenty-eight feet. The last, or desert region, commences more than a mile above the level of the sea. The lower part is covered with snow in winter only; but on the upper half of this sterile district the snows continually lie.

[Illustration: THE “CASTAGNO DE CENTO CAVILLI,” OR GREAT CHESTNUT TREE OF MOUNT ETNA.]

The cone of Etna is, in a right line, about a mile in ascent. The crater is about a mile and a half in circumference; and from the inner part of this, a column of smoke constantly rises; while the liquid fiery matter may be seen rolling, rising and falling within. As to the vastness and beauty of the prospect from the summit of Etna, all writers agree that it is probably unsurpassed. M. Houel was there at sunrise, when the horizon was perfectly clear, and the coast of Calabria, as seen in the distance, appeared to the eye misty, and undistinguishable from the sea. The sky above was specked with the light floating clouds that are so often seen in that delightful climate before the rising of the sun; and in the calm silence all nature seemed waiting the coming of the orb of day. And very soon the promise thus given began to be fulfilled. In a short time a fiery radiance appeared in the east. The fleecy clouds were tinged with purple; the atmosphere became strongly illuminated, and, reflecting the rays of the sun, seemed to be filled with a bright refulgence of flame. Although the heavens were thus enlightened, the sea still retained its dark azure, and the fields and forests did not yet reflect the rays of the sun. The gradual rising of this luminary, however, soon diffused light over the hills which lie below the peak of Etna. This last stood like an island in the midst of the ocean, with luminous points multiplying every moment around, and spreading over a wider extent with the greatest rapidity. It was, he said, as if the world had been observed suddenly to spring from the night of non-existence.

“Ere the rising sun Shone o’er the deep, or ’mid the vault of night The moon her silver lamp suspended; ere The vales with springs were watered, or with groves Of oak or pine the ancient hills were crowned; Then the Great Spirit, whom his works adore, Within his own deep essence viewed the forms, The forms eternal of created things: The radiant sun; the moon’s nocturnal lamp; The mountains and the streams: the ample stores Of earth, of heaven, of nature. From the first, On that full scene his love divine he fixed, His admiration. Till, in time complete, What he admired and loved, his vital power Unfolded into being. Hence the breath Of life, informing each organic frame; Hence the green earth, and wild resounding waves; Hence light and shade, alternate; warmth and cold; And bright autumnal skies, and vernal showers, And all the fair variety of things.”—AKENSIDE.

The most sublime object, however, which the summit of Etna presents, is the immense mass of its own colossal body. Its upper region exhibits rough and craggy cliffs, rising perpendicularly, fearful to the view, and surrounded by an assemblage of fugitive clouds, to increase the wild variety of the scene. Amid the multitude of woods in the middle or temperate region, are numerous mountains, which, in any other situation, would appear of a gigantic size, but which, compared to Etna, are mere mole-hills. Lastly, the eye contemplates with admiration the lower region, the most extensive of the three, adorned with elegant villas and castles, verdant hills and flowery fields, and terminated by the extensive coast, where to the south stands the beautiful city of Catania, to which the waves of the neighboring sea serve as a mirror.

Etna has been celebrated as a volcano from the remotest antiquity. Eruptions are recorded by Diodorus Siculus, as having happened five hundred years before the Trojan war, or sixteen hundred and ninety-three years before the Christian era.

“Etna roars with dreadful ruins nigh, Now hurls a bursting cloud of cinders high, Involved in smoky whirlwinds to the sky; With loud displosion to the starry frame, Shoots fiery globes, and furious floods of flame: Now from her bellowing caverns burst away Vast piles of melted rocks in open day. Her shattered entrails wide the mountain throws, And deep as hell her flaming center glows.”—WARTON.

In 1669, the torrent of burning lava inundated a space fourteen miles in length, and four in breadth, burying beneath it part of Catania, till at length it precipitated itself into the sea. For several months before the lava broke out, the old mouth, or great crater of the summit, was observed to send forth much smoke and flame, and the top had fallen in, so that the mountain was much lowered.

Eighteen days before, the sky was very thick and dark, with thunder, lightning, frequent concussions of the earth, and dreadful subterraneous bellowings. On the eleventh of March, about sunset, an immense gulf opened in the mountain, into which when stones were thrown, they could not be heard to strike the bottom. Ignited rocks, fifteen feet in length, were hurled to the distance of a mile; while others of a smaller size were carried three miles. During the night, the red-hot lava burst out of a vineyard twenty miles below the great crater, and ascended into the air to a considerable hight. In its course, it destroyed five thousand habitations, and filled up a lake several fathoms deep. It shortly after reached Catania, rose over the walls, whence it ran for a considerable length into the sea, forming a safe and beautiful harbor, which was, however, soon filled up by a similar torrent of inflamed matter. This is the stream, the hideous deformity of which, devoid of vegetation, still disfigures the south and western borders of Catania, and on which part of the noble modern city is built.

The showers of scoriæ and sand which, after a lapse of two days, followed this eruption, formed a mountain called Monte Rosso, having a base of about two miles, and a perpendicular hight of seven hundred and fifty feet. On the twenty-fifth, the whole mountain, even to the most elevated peak, was agitated by a tremendous earthquake. The highest crater of Etna, which was one of the loftiest parts of the mountain, then sunk into the volcanic gulf, and in the place which it had occupied, there now appeared nothing but a wide gulf, more than a mile in extent, from which issued enormous quantities of smoke, ashes and stones.

In 1809, twelve new craters opened about half-way down the mountain, and threw out rivers of burning lava, by which several estates were covered to the depth of thirty or forty feet; and during three or four successive nights, a very large river of red-hot lava was distinctly seen, in its whole extent, running down from the mountain.

In 1811, several mouths opened on the eastern side of the mountain: being nearly in the same line, and at equal distances, they presented to the view a striking spectacle; torrents of burning matter, discharged with the greatest force from the interior of the volcano, illuminated the horizon to a great extent. An immense quantity of matter, which was driven to considerable distances, was discharged from these apertures, the largest of which continued for several months to emit torrents of fire. Even at the time when it had the appearance of being choked, there suddenly issued from it clouds of ashes, which descended, in the form of rain, on the city of Catania and its environs, as well as on the fields situated at a very considerable distance. A roaring, resembling that of a sea in the midst of a tempest, was heard to proceed from the interior of the mountain; and this sound, accompanied from time to time by dreadful explosions, resembling thunder, reëchoed through the valleys, and spread terror on every side.

MOUNT VESUVIUS.

“The fluid lake that works below, Bitumen, sulphur, salt, and iron scum, Heaves up its boiling tide. The lab’ring mount Is torn with agonizing throes. At once, Forth from its sides disparted, blazing pours A mighty river; burning in prone waves, That glimmer through the night, to yonder plain. Divided there, a hundred torrent streams, Each plowing up its bed, roll dreadful on, Resistless. Villages, and woods, and rocks, Fall flat before their sweep. The region round, Where myrtle-walks and groves of golden fruit Rose fair; where harvest wav’d in all its pride; And where the vineyard spread its purple store, Maturing into nectar; now despoiled Of herb, leaf, fruit and flower, from end to end Lies buried under fire, a glowing sea!”—MALLET.

This celebrated volcano, which has for so many ages attracted the attention of mankind, and the desolating eruptions of which have been so often and so fatally experienced, is distant, in an eastern direction, about seven miles from Naples. It rises, insulated, upon a vast and well cultivated plain, presenting two summits on the same base, in which particular it resembles Mount Parnassus. One of these, La Somma, is generally agreed to have been the Vesuvius of Strabo and the ancients; the other, having the greatest elevation, is the mouth of the volcano, which almost constantly emits smoke. Its hight above the level of the sea, is thirty-nine

hundred feet, and it may be ascended by three different routes, which are all very steep and difficult, from the conical form of the mountain, and the loose ashes which slip from under the feet: still, from the base to the summit, the distance is not more than three Italian miles. The circumference of the platform on the top, is five thousand and twenty-four feet, or nearly a mile. Thence may be seen Portici, Capræa, Ischia, Pausilippo, and the whole coast of the gulf of Naples, bordered with orange-trees: the prospect is that of Paradise seen from the infernal regions.

[Illustration: MOUNT VESUVIUS.]

On approaching the mountain, its aspect does not convey any impression of terror, nor is it gloomy, being cultivated for more than two-thirds of its hight, and having its brown top alone barren. There all verdure ceases; yet, when it appears covered with clouds, which sometimes encompass its middle only, this circumstance rather adds to than detracts from the magnificence of the spectacle. Upon the lavas which the volcano long ago ejected, and which, like great furrows, extend into the plain and to the sea, are built houses, villages and towns. Gardens, vineyards and cultivated fields surround them; but a sentiment of sorrow, blended with apprehensions about the future, arises on the recollection that, beneath a soil so fruitful and so smiling, lie edifices, gardens and whole towns swallowed up. Portici rests upon Herculaneum; its environs upon Resina; and at a little distance is Pompeii, in the streets of which, after more than seventeen centuries of non-existence, the astonished traveler now walks. After a long interval of repose, in the first year of the reign of Titus, (the seventy-ninth of the Christian era,) the volcano suddenly broke out, ejecting thick clouds of ashes and pumice-stones, beneath which Herculaneum, Stabia and Pompeii were completely buried. This eruption was fatal to the elder Pliny, the historian, who fell a victim to his humanity and love of science. Even at this day, in speaking of Vesuvius, the remembrance of his untimely death excites a melancholy regret. All the coast to the east of the gulf of Naples was, on the above occasion, ravaged and destroyed, presenting nothing but a long succession of ejected matters from Herculaneum to Stabia. The destruction did not extend to the western part, but stopped at Naples, which suffered comparatively little.

Thirty-eight eruptions of Vesuvius are recorded in history up to the year 1806. That of 1779, has been described by Sir William Hamilton, as among the most remarkable, from its extraordinary and terrific appearance. During the whole of July, the mountain was in a state of considerable fermentation, subterraneous explosions and rumbling noises being heard, and quantities of smoke thrown up with great violence, sometimes with red-hot stones, scoriæ, and ashes. On the fifth of August, the volcano was greatly agitated, a white sulphurous smoke, apparently four times the hight and size of the volcano itself, issuing from the crater, at the same time that vast quantities of stones, &c., were thrown up to the supposed hight of two thousand feet. The liquid lava, having cleared the rim of the crater, flowed down the sides of the mountain to the distance of four miles. The air was darkened by showers of reddish ashes, blended with long filaments of a vitrified matter resembling glass.

On the seventh, at midnight, a fountain of fire shot up from the crater to an incredible hight, casting so bright a light, that the smallest objects were clearly distinguishable at any place within six miles of the volcano. On the following evening, after a tremendous explosion, which broke the windows of the houses at Portici, another fountain of liquid fire rose to the surprising hight of ten thousand feet, (nearly two miles,) while puffs of the blackest smoke accompanied the red-hot lava, interrupting its splendid brightness here and there by patches of the darkest hue. The lava was partly directed by the wind toward Ottaiano, on which so thick a shower of ashes, blended with vast pieces of scoriæ, fell, that had it been of longer continuance, that town would have shared the fate of Pompeii. It took fire in several places; and had there been much wind, the inhabitants would have been burned in their houses, it being impossible for them to stir out. To add to the horror of the scene, incessant volcanic lightning darted through the black cloud that surrounded them, while the sulphureous smell and heat would scarcely allow them to draw their breath. In this dreadful state they remained nearly half an hour. The remaining part of the lava, still red-hot and liquid, fell on the top of Vesuvius, and covered its whole cone, together with that of La Somma, and the valley between them, thus forming one complete body of fire, which could not be less than two miles and a half in breadth, and casting a heat to the distance of at least six miles around.

The eruption of 1794 is accurately described by the above writer; but has not an equal degree of interest with the one cited above. We subjoin a few particulars, among which is a circumstance well deserving notice, as it leads to an estimate of the degree of heat in volcanoes. Sir William says that although the town of Torre del Greco was instantly surrounded with red-hot lava, the inhabitants saved themselves by coming out of the tops of their houses on the following day. It is evident, observes Mr. Kirwan, that if this lava had been hot enough to melt even the most fusible stones, these persons must have been suffocated.

This eruption happened on the fifteenth of June, at ten o’clock at night, and was announced by a shock of an earthquake, which was distinctly felt at Naples. At the same moment a fountain of bright fire, attended with a very black smoke and a loud report, was seen to issue, and rise to a considerable hight, from about the middle of the cone of Vesuvius. It was hastily succeeded by other

fountains, fifteen of which were counted, all in a direct line, tending for the space of about a mile and a half downward, toward the towns of Resina and Torre del Greco. This fiery scene, this great operation of nature, was accompanied by the loudest thunder, the incessant reports of which, like those of a numerous heavy artillery, were attended by a continued hollow murmur, similar to that of the roaring of the ocean during a violent storm. Another blowing noise resembled that of the ascent of a large flight of rockets. The houses at Naples were for several hours in a constant tremor, the doors and windows shaking and rattling incessantly, and the bells ringing. At this awful moment the sky, from a bright full moon and starlight, became obscured; the moon seemed eclipsed, and was soon lost in obscurity. The murmur of the prayers and lamentations of a numerous population, forming various processions, and parading the streets, added to the horrors of the scene.

On the following day a new mouth was opened on the opposite side of the mountain, facing the town of Ottaiano: from this aperture a considerable stream of lava issued, and ran with great velocity through a wood, which it burnt; but it stopped, after having run about three miles in a few hours, before it reached the vineyards and cultivated lands. The lava which had flowed from several new mouths on the south side of the mountain, reached the sea into which it ran, after having overwhelmed, burnt and destroyed the greater part of Torre del Greco, through the center of which it took its course. This town contained about eighteen thousand inhabitants, all of whom escaped, with the exception of about fifteen, who through age or infirmity, were overwhelmed in their houses by the lava. Its rapid progress was such, that their goods and effects were entirely abandoned.

It was ascertained some time after, that a considerable part of the crater had fallen in, so as to have given a great extension to the mouth of Vesuvius, which was conjectured to be nearly two miles in circumference. This sinking of the crater was chiefly on the west side, opposite Naples, and, in all probability, occurred early in the morning of the eighteenth, when a violent shock of an earthquake was felt at Resina, and other places situated at the foot of the volcano. The clouds of smoke which issued from the now widely extended mouth of Vesuvius, were of such a density as to appear to force their passage with the utmost difficulty. One cloud heaped itself on another, and, succeeding each other incessantly, they formed in a few hours such a gigantic and elevated column, of the darkest hue, over the mountain, as seemed to threaten Naples with immediate destruction, it having at one time been bent over the city, and appearing to be much too massive and ponderous to remain long suspended in the air.

From the above time, till 1804, Vesuvius remained in a state of almost constant tranquillity. Symptoms of a fresh eruption had manifested themselves for several months, when at length on the night of the eleventh of August, a deep roaring was heard at the hermitage of Salvador, and the places adjacent to the mountain, accompanied by shocks of an earthquake, which were sensibly felt at Resina. On the following morning, at noon, a thick black smoke rose from the mouth of the crater, which, dilating prodigiously, covered the whole volcano. In the evening, loud explosions were heard; and at Naples a column of fire was seen to rise from the aperture, carrying up stones in a state of complete ignition, which fell again into the crater. The noise by which these igneous explosions were accompanied, resembled the roaring of the most dreadful tempest and the whistling of the most furious winds; while the celerity with which the substances were ejected was such, that the first emission had not terminated when it was succeeded by a second. Small monticules were at this time formed of a fluid matter, resembling a vitreous paste of a red color, which flowed from the mouth of the crater; and these became more considerable in proportion as the matter accumulated.

In this state the eruption continued for several days, the fire being equally intense, with frequent and dreadful noises. On the twenty-eighth, amid these fearful symptoms, another aperture, ejecting fire and stones, situated behind the crater, was seen from Naples. The burning mass of lava which escaped from the crater on the following day, was distinguished from Torre del Greco, having the appearance of a vitreous fluid, and advancing toward the base of the mountain between the south and south-west. It reached the base on the thirtieth, having flowed from the aperture, in less than twenty-four hours, a distance of three thousand and fifty-three feet, while its mean breadth appeared to be about three hundred and fifty, but at the base, eight hundred and sixty feet. In its course it divided into four branches, and finally reached a spot called the Guide’s Retreat. Its entire progress to this point was more than a mile, so that, taking a mean proportion, this lava flowed at the rate of eighty-six feet an hour.

At the time of this eruption, Kotzebue was at Naples. Vesuvius lay opposite to his window, and when it was dark he could clearly perceive in what manner the masses of fire rolled down the mountain. As long as any glimmering of light remained, that part of the mountain was to be seen on the declivity of which the lava formed a straight but oblique line. As soon, however, as it was perfectly dark, and the mountain itself had vanished from the eye, it seemed as if a comet with a long tail stood in the sky. The spectacle was awful and grand!

Kotzebue ascended the mountain on the morning succeeding the opening of a new gulf, and approached the crater as nearly as prudence would allow. From its center ascended the sulphurous yellow cone which the eruption of this year had formed: on the

other side, a thick smoke perpetually arose from the abyss opened during the preceding night. The side of the crater opposite to him, which rose considerably higher than that on which he stood, afforded a singular aspect; for it was covered with little pillars of smoke, which burst forth from it, and had some resemblance to extinguished lights. The air over the crater was actually embodied, and was clearly to be seen in a tremulous motion. Below, the volcano boiled and roared dreadfully, like the most violent hurricane; but occasionally a sudden deadly stillness ensued for some moments, after which the roaring renewed with double vehemence, and the smoke burst forth in thicker and blacker clouds. It was, he observes, as if the spirit of the mountain had suddenly tried to stop the gulf, while the flames indignantly refused to endure the confinement.

It is remarkable, that the great eruption of 1805, happened on the twelfth of August, within a day of that of the preceding year. Subterraneous noises had been previously heard, and a general apprehension of some violent commotion prevailing, the inhabitants of Torre del Greco and Annunciada had left their homes, through the apprehension of a shower of fire and ashes, similar to that which buried Pompeii. The stream of lava took the same course with that of 1794, described above, one of the arms following the direction of the great road, and rolling toward the sea. The stream soon divided again, and spreading itself with an increased celerity, swept away many houses and the finest plantations. The other branch, at first, took the direction of Portici, which was threatened; but turning, and joining the preceding one, formed a sort of islet of boiling lava in the middle, both ending in the sea, and composing a promontory of volcanic matters. In the space of twenty minutes the whole extent of ground which the lava occupied was on fire, offering a terrible yet singular spectacle, as the burning trees presented the aspect of white flames, in contrast with those of the volcanic matters, which were red. The lava swept along with it enormous masses of whatever occurred in its course, and, on its reaching the sea, nothing was to be seen or heard for a great extent of shore, beside the boiling and hissing arising from the conflict of the water and fire.

It remains now to introduce a slight notice of the eruption of 1806, which, without any sensible indication, took place on the evening of the thirty-first of May, when a bright flame rose from the mountain to the hight of about six hundred feet, sinking and rising alternately, and affording so clear a light, that a letter might have been read at the distance of a league around the mountain. On the following morning, without any earthquake preceding, as had been customary, the volcano began to eject inflamed substances from three new mouths, pretty near to each other, and about six hundred and fifty feet from the summit. The lava took the direction of Torre del Greco and Annunciada, approaching Portici, on the road leading from Naples to Pompeii. Throughout the whole of the second of June, a noise was heard, resembling that of two armies engaged, when the discharges of artillery and musketry are very brisk. The current of lava now resembled a wall of glass in a state of fusion, sparks and flashes issuing from it from time to time, with a powerful detonation. Vines, trees, houses—whatever objects, in short, it encountered on its way, were instantly overthrown or destroyed. In one part, where it met with the resistance of a wall, it formed a cascade of fire. In a few days Portici, Resina, and Torre del Greco, were covered with ashes thrown out by the volcano; and on the ninth, the two former places were deluged with a thick black rain, consisting of a species of mud filled with sulphurous particles. On the first of July, the ancient crater had wholly disappeared, being filled with ashes and lava, and a new one was formed in the eastern part of the mountain, about six hundred feet in depth, and having about the same width at the opening. Several persons, on the above day, descended about half-way down this new mouth, and remained half an hour very near the flames, admiring the spectacle presented by the liquid lava, which bubbled up at the bottom of the crater, like the fused matter in a glass-house. This eruption continued until September, made great ravages, and was considered as one of the most terrible that had occurred in the memory of the inhabitants.

MOUNT HECLA.

[See cut, page 29.]

“Still pressing on beneath Tornea’s lake, And Hecla flaming through a waste of snow, And farthest Greenland, to the pole itself, Where, falling gradual, life at length goes out, The Muse expands her solitary flight; And hov’ring o’er the wide stupendous scene, Beholds new scenes beneath another sky. Throned in his palace of cerulean ice, Here Winter holds his unrejoicing court, And through his airy hall the loud misrule Of driving tempest is forever heard; Here the grim tyrant meditates his wrath; Here arms his winds with all-subduing frost, Molds his fierce hail, and treasures up his snows.”

On proceeding along the southern coast of Iceland, and at an inconsiderable distance from Skalholt, Mount Hecla, with its three summits, presents itself to the view. Its hight is five thousand feet, or nearly a mile above the level of the sea. It is not a promontory, but lies about four miles inland. It is neither so elevated nor so picturesque as several of the surrounding Icelandic mountains; but has been more noticed than many other volcanoes of an equal extent, partly through the frequency of its eruptions, and partly from its situation, which exposes it to the view of many ships sailing to Greenland and North America. The surrounding territory has been

so devastated by these eruptions, that it has been deserted.

“Vast regions dreary, bleak and bare! There on an icy mountain’s hight, Seen only by the moon’s pale light Stern Winter rears his giant form, His robe a mist, his life a storm: His frown the shiv’ring nations fly, And, hid for half the year, in smoky caverns lie.”

[Illustration: MOUNT HECLA AND THE GEYSERS.]

The natives assert that it is impossible to ascend the mountain, on account of the great number of dangerous bogs, which, according to them, are constantly emitting sulphurous flames and exhaling smoke; while the more elevated summit in the center is covered with boiling springs and large craters, which continually propel fire and smoke. To the south and west the environs present the most desolating results of frequent eruptions, the finest part of the territory being covered by torrents of melted stone, sand, ashes, and other volcanic matter; notwithstanding which, between the sinuosities of the lava in different parts, some portion of meadows, walls and broken hedges may be observed. The devastation is still greater on the north and east sides, which present dreadful traces of the ruin of the country and its habitations. Neither plants nor grass are to be met with to the extent of two leagues round the mountain, in consequence of the soil being covered with stones and lava; and in some parts, where the subterraneous fire has broken out a second time, or where the matter which was not entirely consumed has again become ignited, the fire has contributed to form small red and black hillocks and eminences, from scoriæ, pumice-stones and ashes. The nearer the mountain the larger are these hillocks, and there are some of them, the summits of which form a circular hollow, whence the subterraneous fire ejects the matter. On approaching Hecla the ground becomes almost impassable, particularly near the higher branches of lava thrown from the volcano. Round the latter is a mountain of lava, consisting of large fused stones, from forty to seventy feet high, and in the form of a rampart or wall. These stones are detached, and chiefly covered with moss; while between them are very deep holes, so that the ascent on the western side requires great circumspection. The rocks are completely reduced to pumice, dispersed in thin horizontal layers, and fractured in every direction, from which some idea may be formed of the intensity of the fire that has acted on them.

“There Winter, armed with terrors here unknown, Sits absolute on his unshaken throne; Piles up his stores amidst the frozen waste, And bids the mountains he has built stand fast; Beckons the legions of his storms away From happier scenes to make the land a prey; Proclaims the soil a conquest he has won, And scorns to share it with the distant sun.”

Sir Joseph Banks, Dr. Solander, Dr. James Lind, of Edinburgh, and Dr. Van Troil, a Swede, were the earliest adventurous travelers who ascended to the summit of Mount Hecla. This was in 1772; and the attempt was facilitated by a preceding eruption in 1766, which had greatly diminished the steepness and difficulty of the ascent. On their first landing, they found a tract of land sixty or seventy miles in extent, entirely ruined by lava, which appeared to have been in a state of complete liquefaction. To accomplish their undertaking, they had to travel from three hundred to three hundred and sixty miles over uninterrupted tracts of lava. In ascending, they were obliged to quit their horses at the first opening from which the fire had burst: a spot, which they describe as presenting lofty glazed walls and high glazed cliffs, differing from anything they had ever seen before. At another opening above, they fancied they discerned the effects of boiling water; and not far from thence, the mountain, with the exception of some bare spots, was covered with snow. The difference of aspect they soon perceived to be occasioned by the hot vapor ascending from the mountain. The higher they proceeded, the larger these spots became; and, about two hundred yards below the summit, a hole about a yard and a half in diameter, was observed, whence issued so hot a stream, that they could not measure the degree of heat with a thermometer. The cold now began to be very intense. Fahrenheit’s thermometer, which at the foot of the mountain was at fifty-four degrees, fell to twenty-four degrees; while the wind became so violent, that they were sometimes obliged to lie down, from a dread of being blown into the most dreadful precipices. On the summit itself they experienced, at one and the same time, a high degree of heat and cold; for, in the air, Fahrenheit’s thermometer constantly stood at twenty-four degrees, but when placed on the ground, it rose to one hundred and fifty-three degrees.

Messrs. Olafsen and Povelsen, two naturalists, whose travels in Iceland were undertaken by order of his Danish majesty, after a fatiguing journey up several small slopes, which occurred at intervals, and seven of which they had to pass, at length reached the summit of Mount Hecla at midnight. It was as light as at noonday, so that they had a view of an immense extent, but could perceive nothing but ice; neither fissures, streams of water, boiling springs, smoke, nor fire, were apparent. They surveyed the glaciers in the eastern part, and in the distance saw the high and square mountain of Hærdabreid, an ancient volcano, which appeared like a large castle.

Sir G. S. Mackenzie, in his travels in Iceland, ascended Mount Hecla; and from his account we extract the following interesting particulars. In proceeding to the southern extremity of the mountain, he descended, by a dangerous path, into a valley, having a small lake in one corner, and the opposite extremity bounded by a perpendicular face of rock, resembling, in its broken and rugged appearance, a stream of lava. While advancing, the sun suddenly broke through the clouds, and the brilliant reflection of his beams, from different parts of this supposed lava, as if from a surface of glass, delighted our traveler by the instantaneous conviction that he had now attained one of the principal objects connected with the plan of his expedition to Iceland. He hastened to the spot, and all his wishes were fully accomplished in the examination of an object which greatly exceeded the expectations he had formed. On ascending one of the abrupt pinnacles, which rose out of this extraordinary mass of rock, he beheld a region, the desolation of which can scarcely be paralleled. Fantastic groups of hills, craters, and lava, leading the eye to distant snow-crowned “jockuls,” (inferior mountains,) the mist rising from a waterfall; lakes, embosomed among bleak mountains; an awful profound silence; lowering clouds; marks all around of the furious action of the most destructive of elements; all combined to impress the soul with sensations of dread and wonder. The longer he and his companions contemplated this scene, the more unable they were to turn their eyes from it; and a considerable time elapsed before they could bring themselves to attend to the business which had tempted them to enter so frightful a district of the country.

Having proceeded a considerable distance along the edge of a stream of lava, a narrow part of which they crossed, they gained the foot of the south end of Mount Hecla. While, in ascending, they had to pass over rugged lava, they experienced no great difficulty in advancing; but when they reached the steepest part of the mountain, which was covered with loose slags, they sometimes lost at one step by the yielding of these, a space which had been gained by several.

Having passed a number of fissures, by leaping across some, and stepping along masses of slags which lay over others, they at length reached the summit of the first peak. The clouds now became so thick, that they began to despair of being able to proceed any further: it was, indeed, dangerous even to move; for the peak consists of a very narrow ridge of slags, not more than two feet broad, having a precipice on each side, several hundred feet in depth. One of these precipices forms the side of a vast hollow, which seems to have been one of the craters. At length the sky cleared a little, and enabled them to discover a ridge below, which seemed to connect the peak they had ascended with the middle or principal one. They lost no time in availing themselves of this opportunity, and, by balancing themselves like rope-dancers, succeeded in passing along a ridge of slags, so narrow that there was scarcely room for their feet. After a short, but very steep ascent, they gained the highest part of this celebrated mountain.

Its earliest eruption is said to have happened in 1004, since which time upward of twenty have occurred. That of 1693 was the most dreadful, and occasioned terrible devastations, the ashes having been thrown over the island in every direction, to the distance of more than one hundred miles. In 1728, a fire broke out among the surrounding lava; and also in that to the west of the volcano, in 1754, which lasted for three days. There has not been any eruption of lava since 1766; but for some years after, flames issued from the volcano.

THE GEYSERS.

[See cut on page 29.]

“Nor stops the restless fluid, mounting still, Though oft amid th’ irriguous vale of springs; But to the mountain courted by the sand, That leads it darkling on in faithful maze, Far from the parent main, it boils again! Fresh into day; and all the glittering hill Is bright with spouting rills. The crystal treasures of the liquid world, Through the stirred sands a bubbling passage burst; And welling out, around the middle steep, Or from the bottoms of the bosomed hills, In pure effusion flow.”—THOMSON.

These celebrated fountains, or hot spouting water springs, being nearly connected with the operations of subterraneous fire, so visible in every part of Iceland, may be properly introduced after the description of Mount Hecla, given above.

They are seldom very near the volcanoes, but are dispersed over the whole country, and are even to be found on the summits of several of the ice mountains. The largest and most remarkable of these is situated in a large field, about sixteen miles to the north of Skalholt. At a great distance from it, on one side, are high mountains covered with ice, and on the other Hecla is seen rising above the clouds, while opposite to it is a ridge of rocks, at the foot of which water from time to time rushes forth. At the distance of a mile and a half, a loud roaring noise is heard, like that of a torrent precipitated from stupendous rocks, each ejection being accompanied by violent subterraneous detonations. The depth of the opening from which the water rushes, has not been ascertained; but some seconds elapse before a stone thrown in reaches the surface. The Danish traveler, Olafsen, asserts, that the water rises as high as sixty fathoms: while Van Troil estimates the highest jet at not more than sixty feet: the latter allows, however,

that the jets may be more elevated, particularly in bad weather. The greatness of the explosive power is evinced by its not only preventing stones thrown in from sinking, but even forcing them up to a very great hight, together with the water, and splitting the pebbles into a thousand pieces. The heat was found by Van Troil to be two hundred and twelve degrees of Fahrenheit, the boiling point. The edges of the pipe or basin are covered by a coarse stalactitic rind, and the water has been found to have a petrifying quality. The opening is perfectly circular, in diameter nineteen feet, and forms above, on the surface of the ground, a basin fifty-nine feet in diameter, the edge of which is nine feet above the orifice or hole.

In speaking of the Geysers, or hot spouting springs, Horrebow observes, that if you fill a bottle at one of them, the water it contains will boil three or four times, at the same time with the water in the well. The inhabitants boil their meat in it, by putting the meat in a vessel of cold water, which they place in the hot spring.

Sir G. S. Mackenzie, whose travels in Iceland we have already cited, visited the Geysers at a season favorable to his observations, the latter end of July. He found the cultivation of the surrounding territory much higher than might have been inferred from the idea generally entertained of the barren and unproductive state of Iceland. All the flat ground in that quarter of the island was swampy, but not so much so as to impede the progress of the party, who, having passed several hot springs to the eastward of Skalholt, and others rising among the low hills they had left to the right, in proceeding to the great Geyser, came to a farm-house, situated on a rising ground in the midst of the bogs. Here the people were busily employed in making hay, a scene which afforded a pleasing change from the dreary solitude they had quitted. The whole of this extensive district, which abounds in grass, would, if drained, our traveler observes, prove a very rich pasture country. Farther on they came to several cottages at the foot of the mountain, round which they turned, and came in sight of the hill having the Geysers at one of its sides. This hill, in hight not more than three hundred feet, is separated from the mountain, toward the west, by a narrow slip of flat boggy ground, connected with that which extends over the whole valley. Having crossed this bog, and a small river which ran through it, the party came to a farm-house at the east end of the hill, and arrived at a spot where the most wonderful and awful effects of subterraneous heat are exhibited.

On the east side of the hill there are several banks of clay, from some of which steam rises in different places; and in others there are cavities, in which water boils briskly. In a few of these cavities, the water being mixed with clay, is thick and varies in color; but is chiefly red and gray. Below these banks there is a gentle and uniform slope, composed of matter which, at some distant period, has been deposited by springs which no longer exist. The strata or beds thus formed, seemed to have been broken by shocks of earthquakes, particularly near the great Geyser. Within a space not exceeding a quarter of a mile, numerous orifices are seen in the old incrustations, from which boiling water and steam issue, with different degrees of force. At the northern extremity is situated the great Geyser, sufficiently distinguishable from the others by every circumstance connected with it. On approaching this spot, it appeared that a mount had been formed of irregular, rough-looking depositions, upon the ancient regular strata, the origin of which had been similar. The slope of the latter has caused the mount to spread more on the east side; and the recent depositions of the water may be traced till they coincide with them. The perpendicular hight of the mount is about seven feet, measured from the highest part of the surface of the old depositions. From these the matter composing the mount may be readily distinguished, on the west side, where a disruption has taken place. On the top of this mount is a basin, which was found to extend fifty-six feet in one direction, and forty-six in another.

At a quarter before three o’clock in the afternoon, when the party reached the spot, they found the basin full of hot water, a little of which was running over. Having satisfied their curiosity at that time, they proceeded to examine some other places, whence they saw water ascending. Above the great Geyser, at a short distance, they came to a large irregular opening, the beauties of which, the writer observes, it is hardly possible to describe. The water with which it was filled was as clear as crystal, and perfectly still, although nearly at the boiling point. Through it they saw white incrustations, forming a variety of figures and cavities, to a great depth, and carrying the eye into a vast and dark abyss, over which the crust supporting them formed a dome of an inconsiderable thickness; a circumstance which though not of itself agreeable, contributed much to the effects of this awful scene.

Having pitched their tent at the distance of about one hundred yards from the Geyser, and so arranged matters that a regular watch might be kept during the night, Sir G. S. Mackenzie took his station at eleven o’clock, and his companions lay down to sleep. About ten minutes before twelve he heard subterraneous discharges, and waked his friends. The water in the basin was greatly agitated, and flowed over, but there was not any jet. The same occurred at half past two. At five minutes past four on Saturday morning, an alarm was given by one of the company. As our traveler lay next the door of the tent, he instantly drew aside the canvas, when at the distance of little more than fifty yards, a most extraordinary and magnificent appearance presented itself. From a place they had not before noticed, they saw water thrown up, and steam issuing with a tremendous noise. There was little water; but the force with which the steam escaped, produced a white column of spray and vapor, at least sixty feet high. They enjoyed this astonishing and

beautiful sight until seven o'clock, when it gradually disappeared.

The remaining part of the morning was occupied in examining the environs of the Geysers; and at every step they received some new gratification. Following the channel which had been formed by the water escaping from the great basin during the eruptions, they found several beautiful and delicate petrifactions. The leaves of birch and willow were seen converted into white stone, and in the most perfect state of preservation, every minute fiber being entire. Grass and rushes were in the same state, and also masses of peat. Several of these rare and elegant specimens were brought safely to Great Britain. On the outside of the mount of the Geyser, the depositions, owing to the splashing of the water, are rough and have been justly compared to the heads of cauliflowers. They are of a yellowish brown color, and are arranged around the mount, somewhat like a circular flight of steps. The inside of the basin is comparatively smooth: and the matter forming it is more compact and dense than the exterior crust; when polished it is not devoid of beauty, being of a gray color, mottled with black and white spots and streaks. The white incrustation formed by the water of the beautiful cavity before described, had taken a very curious form at the water's edge, very much resembling the capital of a Gothic column.

THE SULPHUR MOUNTAIN.

This mountain of Iceland, distant about three miles from the village of Krisuvik, presents a phenomenon very different from the one which has just been described, _viz._, that of a CALDRON OF BOILING MUD. We extract the following particulars of this singular curiosity from the relation given by Sir G. S. Mackenzie in his travels in Iceland.

At the foot of the mountain is a small bank, composed chiefly of white clay and sulphur, from every part of which steam issues. Having ascended this bank, a ridge presents itself, immediately beneath which is a deep hollow, whence a profusion of vapor arises, with a confused noise of boiling and splashing, accompanied by steam escaping from narrow crevices in the rock. This hollow, as well as the whole side of the mountain opposite, being covered with sulphur and clay, it was very hazardous to walk over a soft and steaming surface of such a description. The vapor concealing the party from each other occasioned much uneasiness; and there was some hazard of the crust of sulphur breaking, or of the clay sinking beneath their feet. They were thus several times in danger of being scalded, as indeed, happened to one of the party, Mr. Bright, who accidentally plunged one of his legs into the hot clay. When the thermometer was immersed in it, to the depth of a few inches, it generally rose to within a few degrees of the boiling point. By stepping cautiously, and avoiding every little hole from which steam issued, they soon ascertained how far they might venture. Their good fortune, however, Sir George observes, ought not to tempt any person to examine this wonderful place, without being provided with two boards, with which every part of the banks may be traversed in perfect safety. At the bottom of the hollow, above described, they found the caldron of mud, which boiled with the utmost vehemence. They approached within a few yards of it, the wind favoring them in viewing every part of this singular scene. The mud was in constant agitation, and often thrown up to the hight of six or eight feet. Near this spot was an irregular space filled with water, boiling briskly. At the foot of the hill, in a hollow formed by a bank of clay and sulphur, steam rushed with great force and noise from among the loose fragments of rock.

In ascending the mountain, our travelers met with a spring of cold water, which was little to be expected in such a place. At a greater elevation, they came to a ridge, composed entirely of sulphur and clay, joining two summits of the mountain. The smooth crust of sulphur was beautifully crystallized; and beneath it was a quantity of loose granular sulphur, which appeared to be collecting and crystallizing, as it was sublimed along with the steam. On removing the sulphurous crust, steam issued, and annoyed the party so much, that they could not examine this place to any depth.

Beneath the ridge, on the farther side of this great bed of sulphur, an abundance of vapor escaped with a loud noise. Having crossed to the side of the mountain opposite, they walked to what is called the principal spring. This was a task of much apparent danger, as the side of the mountain to the extent of about half a mile, was covered with loose clay, into which the feet of our travelers sunk at every step. In many places there was a thin crust, beneath which the clay was wet, and extremely hot. Good fortune attended them; and without any serious inconvenience, they reached the object they had in view. A dense column of steam, mixed with a small portion of water, forced its way impetuously through a crevice in a rock, at the head of a narrow valley, or break in the mountain. The violence with which it rushed out was so great, that the noise, thus occasioned, might often be heard at the distance of several miles. During the night while the party lay in their tent at Krisuvik, they more than once listened to it with mingled awe and astonishment. Behind the column of vapor was a dark-colored rock, which added to the sublimity of the effect.

"It is quite beyond my power," observes Sir George Mackenzie, "to offer such a description of this extraordinary place, as would convey adequate ideas of its wonders, or of its terrors. The sensations of a person, even of firm nerves, standing on a support

which feebly sustains him, over an abyss where, literally, fire and brimstone are in dreadful and incessant action; having before his eyes tremendous proofs of what is going on beneath him; enveloped in thick vapors; his ears stunned with thundering noises—must be experienced before they can be understood."

MONT BLANC.

[See cut, page 38.]

"When mid the lifeless summits proud Of Alpine cliffs, where to the gelid sky Snows piled on snows in wint'ry torpor lie, The rays divine of vernal Phœbus play; Th' awakened heaps, in streamlets from on high, Roused into action, lively leap away, Glad warbling through the vales, in their new being gay."—THOMSON.

[Illustration: MONT BLANC AND THE GLACIERS.]

This mountain, in Switzerland, so named on account of its white aspect, belongs to the great central chain of the Alps. It is truly gigantic, and is the most elevated mountain in Europe, rising no less than fifteen thousand, eight hundred and seventy-two feet, somewhat more than three miles, above the level of the sea, and fourteen thousand, six hundred and twenty-four feet above the lake of Geneva, in its vicinity. It is encompassed by those wonderful collections of snow and ice, called glaciers, two of the principal of which, are called Mont Dolent and Triolet. The highest part of Mont Blanc, named the Dromedary, is in the shape of a compressed hemisphere. From that point it sinks gradually, and presents a kind of concave surface of snow, in the midst of which is a small pyramid of ice. It then rises into a second hemisphere, which is named the Middle Dome; and thence descends into another concave surface, terminating in a point, which among other names bestowed on it by the Savoyards, is styled "Dome de Goute," and may be regarded as the inferior dome.

The first successful attempt to reach the summit of Mont Blanc was made in August, 1786, by Doctor Paccard, a physician of Chamouny. He was led to make the attempt by a guide, named Balma, who, in searching for crystals, had discovered the only practicable route by which so arduous an undertaking could be accomplished. The ascent occupied fifteen hours, and the descent five, under circumstances of the greatest difficulty; the sight of the doctor, and that of his guide, Balma, being so affected by the snow and wind, as to render them almost blind, at the same time that the face of each was excoriated, and the lips exceedingly swelled.

On the first of August of the following year, 1787, the celebrated and indefatigable naturalist, M. de Saussure, set out on his successful expedition, accompanied by a servant and eighteen guides, who carried a tent and mattresses, together with the necessary accommodations and various instruments of experimental philosophy. The first night they passed under the tent, on the summit of the mountain of La Cote, four thousand, nine hundred and eight-six feet above the Priory, a large village in the vale of Chamouny, the journey thither being exempt from trouble or danger, as the ascent is always over turf, or on the solid rock; though above this place it is wholly over ice or snows.

Early next morning they traversed the glacier of La Cote, to gain the foot of a small chain of rocks, inclosed in the snows of Mont Blanc. The glacier is both difficult and dangerous, being intersected by wide, deep, irregular chasms, which frequently can be passed only by three bridges of snow, which are suspended over the abyss. After reaching the ridge of rocks, the track winds along a hollow, or valley, filled with snow, which extends north and south to the foot of the highest summit, and is divided at intervals by enormous crevices. These show the snow to be disposed in horizontal beds, each of which answers to a year, and notwithstanding the width of the fissures, the depth can in no part be measured. At four in the afternoon, the party reached the second of the three great platforms of snow they had to traverse, and here they encamped, at the hight of nine thousand, three hundred and twelve feet above the Priory, or twelve thousand, seven hundred and sixty-eight feet (nearly two miles and a half) above the level of the sea.

From the center of this platform, inclosed between the farthest summit of Mont Blanc on the south, its high steps, or terraces, on the east, and the Dome de Goute on the west, nothing but snow appears. It is quite pure, of a dazzling whiteness, and on the high summits presents a singular contrast with the sky, which in these elevated regions is almost black. Here no living being is to be seen; no appearance of vegetation: it is the abode of cold and silence. "When," observes M. de Saussure, "I represent to myself Dr. Paccard and James Balma first arriving, on the decline of day, in these deserts, without shelter, without assistance, and even without the certainty that men could live in the places which they proposed to reach, and still pursuing their career with unshaken intrepidity, it seems impossible to admire too much their strength of mind and their courage."

The company departed, at seven the next morning, to traverse the third and last platform, the slope of which is extremely steep, being in some places thirty-nine degrees. It terminates in precipices on all sides; and the surface of the snow was so hard, that those who went foremost were obliged to cut places for the feet with hatchets. The last slope of all presents no danger; but the air possesses so high a degree of rarity, that the strength is speedily exhausted, and on approaching the summit it was found necessary to stop at every fifteen or sixteen paces to take breath. At eleven they reached the top of the mountain, where they continued four hours and a half, during which time M. de Saussure enjoyed, with rapture and astonishment, a view the most extensive as well as the most rugged and sublime in nature, and made those observations which have rendered this expedition important to philosophy.

A light vapor, suspended in the lower regions of the air, concealed from the sight the lowest and most remote objects, such as the plains of France and Lombardy; but the whole surrounding assemblage of high summits appeared with the greatest distinctness.

M. de Saussure descended with his party, and the next morning reached Chamouny, without the smallest accident. As they had taken the precaution to wear vails of crape, their faces were not excoriated, nor their sight debilitated. The cold was not found to be so extremely piercing as it was described by Dr. Paccard. By experiments made with the hygrometer, on the summit of the mountain, the air was found to contain a sixth portion only of the humidity of that of Geneva; and to this dryness of the air, M. de Saussure imputes the burning thirst which he and his companions experienced. The balls of the electrometer diverged three lines only, and the electricity was positive. At times the air seems filled with electricity. A recent traveler (1854) says, that, in the night, his guide having come out from the cabin of the Grand Mulets, saw the ridges of the mountain apparently all on fire. He immediately communicated what he had observed to his companions, who all rushed to assure themselves of the fact, and then they saw that through the electricity generated by the tempest, all the rocks of the Grand Mulets were illuminated. They found the same phenomenon on their own persons. When they raised their arms, their fingers became phosphorescent. M. de Saussure found it required half an hour to make water boil, while at Geneva fifteen or sixteen minutes sufficed, and twelve or thirteen at the seaside. None of his party discovered the smallest difference in the taste or smell of bread, wine, meat, fruits or liquors, as some travelers have pretended is the case at great hights; but sounds were of course much weakened, from the want of objects of reflection. Of all the organs, that of respiration was most affected, the pulse of one of the guides beating ninety-eight times in a minute, that of the servant one hundred and twelve, and that of M. de Saussure one hundred and one; while at Chamouny, the pulsations respectively were forty-nine, sixty, and seventy-two. A few days afterward, Mr. Beaufoy, an English gentleman, succeeded in a similar attempt, although it was attended with greater difficulty, arising from enlargements in the chasms in the ice.

A late traveler, wandering amid the same sublime scenery that has been described, says:

“Mont Blanc is clearly visible from Geneva, perhaps once in the week, or about sixty times in the year. When he is visible, a walk to the junction of the Arve and the Rhone, either by the way of the plains on the Genevan side, or by the hights on the side toward the south of France, affords a wonderful combination of sublimity and beauty on the earth and in the heavens. Those snowy mountain ranges, so white, so pure, so dazzling in the clear azure depths, do really look as if they belonged to another world; as if, like the faces of supernatural intelligences, they were looking sadly and steadfastly on our world, to speak to us of theirs. Some of these mountain peaks of snow you can see only through the perspective of other mountains, nearer to you, and covered with verdure, which makes the snowy pyramids appear so distant, so sharply defined, so high up, so glorious; it is indeed like the voice of great truths stirring the soul. As your eye follows the range, they lie in such glittering masses against the horizon, in such grand repose; they shoot into the sky in bright weather in such infinite clearness, so pure, so flashing; that they seem never to lose the charm of a sudden and startling revelation to the mind. Are they not sublime images of the great truths of God’s own word, that sometimes indeed are vailed with clouds, but in fair weather do carry us, as in a chariot of fire and with horses of fire, into eternity, into the presence of God? The atmosphere of our hearts is so misty and stormy, that we do not see them more than sixty times a year in their glory: if every Sabbath-day we get a view of them without clouds, we do well; but _when_ we see them as they are, then we feel their power, then we are rapt by them from earth, away, away, away, into the depths of heaven!

“In some circumstances, when we are climbing the mountains, even the mists that hang around them do add to the glory of the view; as in the rising sun, when they are so penetrated with brightness, that they softly rise over the crags as a robe of misty light, or seem like the motion of sweet Nature breathing into the atmosphere from her morning altars the incense of praise. And in the setting sun how often do they hang around the precipices, glowing with the golden and crimson hues of the west, and preventing us from clearly defining the forms of the mountains, only to make them more lovely to our view. So it is sometimes with the very clouds around God’s word, and the lights and shades upon it. There is an inscrutability of truth which sometimes increases its power, while we wait with solemn reverence for the hour when it shall be fully revealed to us; and our faith, like the setting sun, may clothe

celestial mysteries with a soft and rosy-colored light, which makes them more suitable to our present existence, than if we saw them in the clear and cloudless atmosphere of a spiritual noon.

“You have a fine point for viewing Mont Blanc, without going out of the city, from the ramparts on the west side of Rousseau’s island. Here a brazen indicator is erected, with the names of the different mountain summits and ridges, so that by taking sight across the index, you can distinguish them at once. You will not mistake Mont Blanc, if you see him; but until you get accustomed to the panorama, you may easily mistake one of his court for the king, when the monarch himself is not visible.

“A still better point of view you will have at Coppet, ascending toward the Jura. In proportion as you rise from the borders of the lake, every part of the landscape becomes more beautiful, though what you wish to gain is the most commanding view of the mountains, every other object being secondary. In a bright day, nothing can be more clearly and distinctly defined than Mont Blanc, with his attendant mighty ranges, cut in dazzling snowy brightness against the clear blue sky. The sight of those glorious glittering fields and mountains of ice and snow, produces immediately a longing to be there among them. They make an impression upon the soul, of something supernatural, almost divine. Although the whole scene lying before you is so beautiful, (the lake, the verdant banks, the trees, and the lower ranges of verdure-covered mountains, constituting in themselves alone one of the loveliest pictures in the world,) yet the snowy ranges of Mont Blanc are the grand feature. Those glittering distant peaks are the only thing in the scene that takes a powerful hold upon the soul; but they do quite possess it, and tyrannize over it, with an ecstatic thralldom. One is never wearied with gazing and wondering at the glory. I will lift up mine eyes unto the hills, from whence cometh my help!

“Another admirable point, much farther from the lake and the city than the preceding, and at a greater elevation, is what is called the promenade of the point Sacconex. A fine engraving of this view is printed on letter-paper for correspondence; but there is not sufficient distinctness given to the outlines of Mont Blanc and the other summits of the glittering snowy range, that seems to float in the heavens like the far-off alabaster walls of Paradise. No language, nor any engraving, can convey the ravishing magnificence and splendor, the exciting sublimity and beauty of the scene. But there are days in which the air around the mountains seems itself of such a hazy whiteness, that the snow melts into the atmosphere as it were, and dies away in the heavens like the indistinct outline of a bright but partially remembered dream. There are other days in which the fleecy clouds, like vails of light over the faces of angels, do so rest upon and mingle with the snowy summits, that you can hardly tell where one begins and the other ends. Sometimes you look upon the clouds thinking they are mountains, and then again Mont Blanc himself will be revealed in such far-off, unmoving, glittering grandeur, in such wonderful distinctness, that there is no mistaking the changeful imitations of his glory for the reality. Sometimes the clouds and the mountains together are mingled in such a multitudinous and interminable array of radiances, that it seems like the white-robed armies of heaven with their floating banners, marching and countermarching in front of the domes and jeweled battlements of the celestial city. When the fog scenery (of which I shall give you a description) takes place upon the earth, and at the same time there are such revelations of the snowy summits in the heavens, and such goings on of glory among them, and you get upon the mountain to see them, it is impossible to describe the effect, as of a vast enchantment, upon the mind.

“The view of Geneva, the lake, and the Jura mountains from Coligny is much admired; and at sunset, perhaps the world can not offer a more lovely scene. It was here that Byron took up his abode; a choice which I have wondered at, for you can not see Mont Blanc from this point, and therefore the situation is inferior to many others. Ascending the hill farther to the east, when you come to Col. Tronchin’s beautiful residence, you have perhaps the finest of all the views of Mont Blanc, in or around Geneva. Go upon the top of Col. Tronchin’s tower about half an hour before sunset, and the scene is not unworthy of comparison even with the glory of the sunrise as witnessed from the summit of the Righi. It is surprising to see how long Mont Blanc retains the light of day, and how long the snow burns in the setting sun, after his orb has sunk from your own view entirely behind the green range of the Jura. Then after a succession of tints from the crimson to the cold gray, it being manifest that the sun has left the mountain to a companionship with the stars alone, you also are ready to depart, the glory of the scene being over, when suddenly and unaccountably the snowy summits redden again, as if the sun were returning upon them, the countenance of Mont Blanc is filled with rosy light, and the cold gray gives place for a few moments to a deep warm radiant pink, (as if you saw a sudden smile playing over the features of a sleeping angel,) which at length again dies in the twilight. This phenomenon is extremely beautiful, but I know not how to account for it; nor was any one of our party wiser than I; nevertheless, our ignorance of causes need never diminish, but often increases the pleasure of beautiful sights.”

“I have said I would give you a description of the ‘fog-scenery.’ In the autumn, when the fogs prevail, it is often a thick drizzling mist in Geneva, and nothing visible, while on the mountain tops the air is pure, and the sun shining. On such a day as this, when the children of the mist tell you that on the mountains it is fair weather, you must start early for the range nearest Geneva, on the way to

Chamouny, the range of the Grand Saléve, the base of which is about four miles distant, prepared to spend the day upon the mountains, and you will witness one of the most singular and beautiful scenes to be enjoyed in Switzerland.

“The day I set out was so misty, that I took an umbrella, for the fog gathered and fell like rain, and I more than doubted whether I should see the sun at all. In the midst of this mist I climbed the rocky zigzag half hewn out of the face of the mountain, and half natural, and passing the village that is perched among the high rocks, which might be a refuge for the conies, began toiling up the last ascent of the mountain, seeing nothing, feeling nothing, but the thick mist, the vail of which had closed below and behind me over village, path and precipice, and still continued heavy and dark above me, so that I thought I never should get out of it. Suddenly my head rose above the level of the fog into the clear air, and the heavens were shining, and Mont Blanc, with the whole illimitable range of snowy mountain tops around him, was throwing back the sun! An ocean of mist, as smooth as a chalcedony, as soft and white as the down of the eider-duck’s breast, lay over the whole lower world; and as I rose above it, and ascended the mountain to its overhanging verge, it seemed an infinite abyss of vapor, where only the mountain tops were visible, on the Jura range like verdant wooded islands, on the Mont Blanc range as glittering surges and pyramids of ice and snow. No language can describe the extraordinary sublimity and beauty of the view. A level sea of white mist in every direction, as far as the eye could extend, with a continent of mighty icebergs on the one side floating in it, and on the other a forest promontory, with a slight undulating swell in the bosom of the sea, like the long, smooth undulations of the ocean in a calm.

“Standing on the overhanging crags, I could hear the chime of bells, the hum of busy labor, and the lowing of cattle, buried in the mist, and faintly coming up to you from the fields and villages. Now and then a bird darted up out of the mist into the clear sun and air, and sailed in playful circles, and then dived and disappeared again below the surface. By and by the wind began to agitate the cloudy sea, and more and more of the mountains became visible. Sometimes you have a bright sunset athwart this sea of cloud, which then rolls in waves burnished and tipped with fire. When you go down into the mist again, and leave behind you the beautiful sky, a clear, bracing atmosphere, the bright sun and the snow-shining mountains, it is like passing from heaven to earth, from the brightness and serenity of the one, to the darkness and cares of the other. The whole scene is a leaf in nature’s book, which but few turn over; but how rich it is in beauty and glory, and in food for meditation, none can tell but those who have witnessed it. This is a scene in Cloud-land, which hath its mysteries of beauty, that defy the skill of the painter and engraver.

“The poet Wordsworth has given two very vivid descriptions of these mist phenomena, under different aspects from that in which I witnessed them. The first is contained in his descriptive sketches of a pedestrian tour among the Alps.

“‘’Tis morn: with gold the verdant mountain glows, More high, the snowy peaks with hues of rose. Far stretched beneath the many-tinted hills A mighty waste of mist the valley fills, A solemn sea! whose vales and mountains round Stand motionless, to awful silence bound. A gulf of gloomy blue, that opens wide And bottomless, divides the midway tide. Like leaning masts of stranded ships appear The pines, that near the coast their summits rear. Of cabins, woods and lawns a pleasant shore Bounds calm and clear the chaos still and hoar. Loud through that midway gulf ascending, sound, Unnumbered streams with hollow roar profound. Mount through the nearer mist the chant of birds, And talking voices, and the low of herds, The bark of dogs, the drowsy tinkling bell, And wild-wood mountain lutes of saddest swell.’

“But this extract is not to be compared for power to the following from the same poem, describing an Alpine sunset after a day of mist and storm upon the mountains.

“‘’Tis storm, and hid in mist from hour to hour, All day the floods a deepening murmur pour. The sky is vailed, and every cheerful sight, Dark is the region as with coming night, But what a sudden burst of overpowering light Triumphant on the bosom of the storm Glances the fire-clad eagle’s wheeling form. Eastward, in long perspective glittering, shine The wood-crowned cliffs, that o’er the lake recline. Wide o’er the Alps a hundred streams unfold, At once to pillars turned, that flame with gold. Behind his sail the peasant tries to shun The west, that burns like one dilated sun, Where in a mighty crucible expire The mountains, glowing hot, like coals of fire!’

“There was a time during the middle ages, when Chamouny was inhabited by monks. The reigning lord of the country made a present of the whole valley to a convent of Benedictine friars, in the eleventh century. Two English travelers, Messrs. Pococke and Windham, drew attention to its wonderful scenery in 1741, and now it is a grand highway of summer travel, visited annually by three or four thousand people. A visit to Mont Blanc has become a pilgrimage of fashion. Fashion does some good things in her day; and it is a great thing to have the steps of men directed into this grand temple of nature, who would otherwise be dawdling the summer perhaps at immoral watering-places. A man can hardly pass through the vale of Chamouny, before the awful face of Mont Blanc,

and not feel that he is an immortal being. The great mountain looks with an eye, and speaks with a voice, that does something to wake the soul out of its slumbers.

“The sublime hymn by Coleridge, in the vale before sunrise, is the concentrated expression of all the inspiring and heaven-directing influences of the scenery. The poem is as remarkably distinguished above the whole range of poetry in our language, for its sublimity, as the mountain itself among all the great ranges of the Alps. I am determined to quote it in full, for that and the tour of Mont Blanc ought to go together; and I will present along with it the German original of the poem in twenty lines, nearly as translated by Coleridge’s admiring and affectionate relative. I am not aware that Coleridge himself ever visited the vale of Chamouny; and if not, then that wonderful hymn to Mont Blanc was the work of imagination solely, building on the basis of the original lines in German. This was a grand and noble foundation, it is true; but the hymn by Coleridge was a perfect transfiguration of the piece, an inspiration of it with a higher soul, and an investiture of it with garments that shine like the sun. It was the greatest work of the poet’s great and powerful imagination, combined with the deep worshiping sense of spiritual things in his soul.

“On visiting the scene, one is apt to feel as if he could not have written it in the vale itself: the details of the picture would have been somewhat different; and, confined by the reality, one may doubt if even Coleridge’s genius could have gained that lofty ideal point of observation and conception, from which he drew the vast and glorious imagery that rose before him. Not because the poem is more glorious than the reality, for that is impossible; but because, in painting _from_ the reality, the force and sublimity of his general conceptions would have been weakened by the attempt at faithfulness in the detail, and nothing like the impression of the aerial grandeur of the scene, its despotic unity in the imagination, notwithstanding its variety, would have been conveyed to the mind.

“Yet there are parts of it which at sunrise or sunset either, the poet might have written from the very windows of his bedroom, if he had been there in the dawn and evenings of days of such extraordinary brilliancy and glory, as marked and filled the atmosphere, during our sojourn in that blessed region. A glorious region it is, much nearer heaven than our common world, and carrying a sensitive, rightly constituted mind far up in spirit toward the gates of heaven, toward God, whose glory is the light of heaven, and of whose power and majesty the mountains, ice-fields and glaciers, whether beneath the sun, moon, or stars, are a dim, though grand and glittering, symbol. ‘Fire and hail, snow and vapor, stormy wind, fulfilling His word, mountains and all hills, fruitful trees and all cedars, praise the Lord. He looketh on the earth and it trembleth; He toucheth the hills, and they smoke.’

“The following is the original German hymn, in what the translator denominates a very bald English translation, to be compared as a curiosity with its glorification in Coleridge. It occupies but five stanzas of four lines, and is entitled, ‘Chamouny at Sunrise. To Klopstock.’ I have here put it into the metrical form of the original.

“Out of the deep shade of the silent fir-grove, Trembling I survey thee, mountain-head of eternity, Dazzling (blinding) summit, from whose vast hight My dimly perceiving spirit floats into the Everlasting.

“Who sank the pillar deep in the lap of earth Which, for past centuries, fast props thy mass up? Who uptowered, high in the vault of ether, Mighty and bold, thy beaming countenance?

“Who poured you from on high, out of eternal Winter’s realm, O jagged streams, downward with thunder-noise? And who bade aloud, with the Almighty Voice, ‘Here shall rest the stiffening billows?’

“Who marks out there the path for the Morning Star? Who wreathes with blossoms the skirt of eternal Frost? To whom, wild Arveiron, in terrible harmonies, Rolls up the sound of thy tumult of billows?

“Jehovah! Jehovah! crashes in the bursting ice! Avalanche-thunders roll it in the cleft downward: Jehovah! it rustles in the bright tree-tops; It whispers murmuring in the purling silver-brooks.

“This is very grand. Who but a mighty poet, one seeing with ‘the vision and the faculty divine’—what, but a transfusing, all-conquering imagination—would have dared the attempt to compose another poem on the same subject, or to carry this to a greater hight of sublimity, by melting it down anew, so to speak, and pouring it out into a vaster, more glorious mold? The more one thinks of it, the more he will see, in the poem so produced, a proof most remarkable, of the spontaneous, deep-seated, easily exerted, and almost exhaustless power and originality of Coleridge’s genius. Now let us peruse, ‘with mute thanks and secret ecstacy,’ his own solemn and stupendous lines.

HYMN BEFORE SUNRISE, IN THE VALE OF CHAMOUNY.

[Besides the rivers Arve and Arveiron, which have their sources in the foot of Mont Blanc, five conspicuous torrents rush down its sides; and, within a few paces of the glaciers, the Gentiana Major grows in immense numbers, with its ‘flowers of loveliest blue.’]

“Hast thou a charm to stay the Morning Star In his steep course? so long he seems to pause On thy bald, awful head, O Sovran Blanc? The Arve and Arveiron at thy base Rave ceaselessly; but thou, most awful form! Risest from forth thy silent sea of pines, How silently! Around thee and above, Deep is the air, and dark, substantial, black; An ebon mass: methinks thou piercest it As with a wedge! But when I look again, It is thine own calm home, thy crystal shrine, Thy habitation from Eternity!

“O dread and silent Mount! I gazed upon thee, Till thou, still present to the bodily sense, Didst vanish from my thought: entranced in prayer I worshiped the Invisible alone.

“Yet, like some sweet, beguiling melody, So sweet, we know not we are listening to it, Thou, the meanwhile, wast blending with my thought, Yea, with my life, and life’s own secret joy, Till the dilating Soul, enrapt, transfused, Into the mighty vision passing,—there, As in her natural form, swelled vast to heaven!

“Awake my Soul! not only passive praise Thou owest! not alone these swelling tears, Mute thanks and secret ecstacy! Awake, Voice of sweet song! Awake, my heart, awake! Green vales and icy cliffs, all join my hymn.

“Thou first and chief, sole sovran of the vale Oh, struggling with the darkness all night long, And all night visited by troops of stars, Or when they climb the sky, or when they sink! Companion of the morning star at dawn, Thyself earth’s rosy star, and of the dawn Coherald: wake, oh wake, and utter praise! Who sank thy sunless pillars deep in earth? Who filled thy countenance with rosy light? Who made thee parent of perpetual streams?

“And you, ye five wild torrents, fiercely glad! Who called you forth from night and utter death, From dark and icy caverns called you forth, Down those precipitous, black, jagged rocks, Forever shattered, and the same forever? Who gave you your invulnerable life, Your strength, your speed, your fury and your joy, Unceasing thunder and eternal foam? And who commanded (and the silence came,) Here let the billows stiffen and have rest?

“Ye ice-falls! ye that from the mountain’s brow, Adown enormous ravines slope amain— Torrents, methinks, that heard a mighty voice, And stopped at once, amidst their maddest plunge! Motionless torrents! silent cataracts! Who made you glorious as the gates of heaven Beneath the keen full moon? Who bade the sun Clothe you with rainbows? Who, with living flowers Of loveliest blue, spread garlands at your feet? GOD! let the torrents, like a shout of nations, Answer! and let the ice-plains echo, GOD! GOD! sing, ye meadow-streams, with gladsome voice! Ye pine-groves, with your soft and soul-like sounds! And they, too, have a voice, yon piles of snow, And in their perilous fall shall thunder, GOD!

“Ye living flowers, that skirt the eternal frost! Ye wild goats sporting round the eagle’s nest! Ye eagles, playmates of the mountain-storm! Ye lightnings, the dread arrows of the clouds! Ye signs and wonders of the elements! Utter forth GOD! and fill the hills with praise!

“Thou, too, hoar Mount, with thy sky-pointing peaks, Oft from whose feet, the avalanche, unheard, Shoots downward, glittering through the pure serene Into the depths of clouds, that vail thy breast; Thou too again, stupendous mountain! thou, That as I raise my head, awhile bowed low In adoration, upward from thy base Slow traveling with dim eyes suffused with tears, Solemnly seemest, like a vapory cloud, To rise before me,—Rise, oh ever rise! Rise, like a cloud of incense, from the earth! Thou kingly spirit throned among the hills, Thou dread embassador from Earth to Heaven, Great Hierarch! tell thou the silent sky, And tell the stars, and tell yon rising sun, Earth, with her thousand voices, praises God!

“Thanks to thee, thou noble poet, for giving this glorious voice to Alpine nature, for so befitting and not unworthy an interpretation of Nature’s own voice, in words of our own mother-tongue. Thanks to God for his grace vouchsafed to thee, so that now thou praisest Him amidst the infinite host of flaming seraphs, before the mount supreme of glory, where all the empyrean rings with angelic hallelujahs! The creation of such a mind as Coleridge’s, is only outdone by its redemption through the blood of the Lamb. Oh, who can tell the rapture of a soul, that could give a voice for nations to such a mighty burst of praise to God in this world, when its powers, uplifted in eternity, and dilated with absorbing, unmingled, unutterable love, shall pour themselves forth in the anthem of redemption, Worthy is the Lamb that was slain!”

THE GLACIERS, OR ICE MASSES.

The three great glaciers, or ice-mountains, which descend from the flanks of Mont Blanc, add their ice to that of the Miage, and present a majestic spectacle, amid the astonishing succession of icy summits, of deep valleys, and of wide chasms, which have become channels for the innumerable torrents and cataracts with which these mountains abound. The view which the glacier of Talafre affords from its center, looking toward the north, is as extraordinary as beautiful. It rises gradually to the base of a semicircular girdle, formed of peaks of granite of a great hight, and terminating in sharp summits, extremely varied in their forms; while the intervals between these peaks are filled up by ice, which falls into this mass, and this mass of ice is crowned by masses of snow, rising in festoons between the black and vertical tables of granite, the steepness of which does not allow them to remain. A ridge of shattered wrecks divides this glacier lengthwise, and forms its most elevated part, being eight thousand, five hundred and thirty-eight feet, or upward of a mile and a half above the level of the sea. This prospect has nothing in common with what is seen in other parts of the world. The immense masses of ice, surrounded and surmounted by pyramidal rocks, still more enormous in magnitude; the contrast between the whiteness of the snow and the obscure colors of the stones, moistened by the water which trickles down their sides; the purity of the air; the dazzling light of the sun, which gives to these objects extraordinary brilliancy; the majestic and awful silence which reigns in these vast solitudes, a silence which is only interrupted at intervals by the noise of some great mass of granite, or of ice, tumbling from the top of the mountain; and the nakedness of these elevated rocks themselves, on which neither animals, shrubs, nor verdure are to be seen, combined with the recollection of the fertile country and rich vegetation which the adjacent valleys at so small a distance present; all tend to produce a mixed impression of admiration and terror, which tempts the spectator to believe, that he has been suddenly transported into a world forgotten by the great Author of nature. One of these glaciers, that of Triolet, is covered with the wrecks of another ice-mountain, which fell some years ago, and buried many huts, flocks, and shepherds beneath its ruins.

THE MER DE GLACE.

These glaciers have their foundation in the wonderful =Mer de Glace=, or =Sea of Ice=; shooting up from it their sharp peaks into the frozen air. “To get the best view of it as a whole,” says a modern Alpine tourist, “you cross the meadows in the vale of Chamouny, step over the furious Arve, and climb the mountain precipices to the hight of two thousand feet, by a rough, craggy path, sometimes winding amidst a wood of firs, and sometimes wandering over green grasses. At Montanvert you find yourself on the extremity of a plateau, so situated, that on one side you may look down into the dread frozen sea, and on the other, by a few steps, into the lovely green vale of Chamouny! What astonishing variety and contrast in the spectacle! Far beneath, a smiling and verdant valley, watered by the Arve, with hamlets, fields and gardens, the abode of life, sweet children and flowers; far above, savage and inaccessible crags of ice and granite, and a cataract of stiffened billows, stretching away beyond sight—the throne of death and winter.

“From the bosom of the tumbling sea of ice, huge granite needles shoot into the sky, objects of singular sublimity, one of them rising to the great hight of thirteen thousand feet, seven thousand above the point where you are standing. This is more than double the hight of Mount Washington in our country, and this amazing pinnacle of rock looks like the spire of an interminable colossal cathedral, with other pinnacles around it. No snow can cling to the summits of these jagged spires; the lightning does not splinter them; the tempests rave round them; and at their base, those eternal drifting ranges of snow are formed, that sweep down into the frozen sea, and feed the perpetual, immeasurable masses of the glacier. Meanwhile, the laughing verdure, sprinkled with flowers, plays upon the edges of the enormous masses of ice, so near, that you may almost touch the ice with one hand, and with the other pluck the violet. So, oftentimes, the ice and the verdure are mingled in our earthly pilgrimage; so, sometimes, in one and the same family, you may see the exquisite refinements and the coarse repugnancies of human nature. So, in the same house of God, on the same bench, may sit an angel and a murderer; a villain, like a glacier, and a man with a heart like a sweet running brook in the sunshine.

“The impetuous arrested cataract seems as if it were plowing the rocky gorge with its turbulent surges. Indeed, the ridges of rocky fragments along the edges of the glacier, called _moraines_, do look precisely as if a colossal iron plow had torn them from the mountain, and laid them along in one continuous furrow on the frozen verge. It is a scene of stupendous sublimity. These mighty granite peaks, hewn and pinnacled into Gothic towers, and these rugged mountain-walls and buttresses—what a cathedral! with this cloudless sky, by starlight, for its fretted roof; the chanting wail of the tempest, and the rushing of the avalanche for its organ. How grand the thundering sound of the vast masses of ice tumbling from the roof of the Arve-cavern at the foot of the glacier! Does it not seem, as it sullenly and heavily echoes, and rolls up from so immense a distance below, even more sublime than the thunder of the avalanche above us? We could tell better if we could have a genuine upper avalanche to compare with it. But what a stupendous scene! ‘I begin now,’ said my companion, ‘to understand the origin of the Gothic architecture.’ This was a very natural

feeling; but, after all, it could not have been such a scene, that gave birth to the great idea of that ‘frozen poetry’ of the middle ages. Far more likely it was the sounding aisles of the dim woods, with their checkered green light, and festooned, pointing arches.

“The colossal furrows of rocks and gravel along the edges of the ice at the shores of the sea, are produced by the action of the frost and the avalanches, with the march of the glacier against the sides of the mountains. Nothing can be more singular than these ridges of mountain =debris=, apparently plowed up and worked off by the moving of the whole bed of ice down the valley. Near the shore, the sea is turbid with these rocks and gravel; but as you go out into the channel, the ice becomes clearer and more glittering, the crevices and fissures deeper and more dangerous, and all the phenomena more astonishing. Deep, blue, pellucid founts of ice-cold water lie in the opening gulfs; and sometimes, putting your ear to the yawning fissures, you may hear the rippling of the rills below, that from the bosom of the glacier are hurrying down to constitute the Arve, bursting furiously forth from the great ice-cavern in the valley.

“This Mer de Glace is an easy and excellent residence for the scientific study of the glaciers, a subject of very great interest, formerly filled with mysteries, which the bold and persevering investigations and theories of some modern naturalists have quite cleared up. The strange movements of the glaciers, their apparent willful rejection of extraneous bodies and substances to the surface and the margin, their increase and decrease, long remained invested with something of the supernatural: they seemed to have a soul and a life of their own. They look motionless and silent, yet they are always moving and sounding on, and they have great voices that give prophetic warning of the weather to the shepherds of the Alps. Scientific men have set up huts upon the sea, and landmarks on the mountains opposite, to test the progress of the icy masses, and in this way it was found that a cabin constructed by Professor Hugi on the glacier of the Aar, had traveled, between the years 1827 and 1840, a distance of forty-six hundred feet. It is supposed that the Mer de Glace moves down between four and five hundred feet annually.

“It is impossible to form a grander image of the rigidity and barrenness, the coldness and death of winter, than when you stand among the billows of one of these frozen seas; and yet it is here that Nature locks up in her careful bosom the treasures of the Alpine valleys, the sources of rich summer verdure and vegetable life. They are hoarded up in winter, to be poured forth beneath the sun, and with the sun in summer. Some of the largest rivers in Europe take their rise from the glaciers, and give to the Swiss valleys their most abundant supply of water, in the season when ordinary streams are dried up. This is a most interesting provision in the economy of nature, for if the glaciers did not exist, those verdant valleys into which the summer sun pours with such fervor, would be parched with drought. So the mountains are parents of perpetual streams, and the glaciers are reservoirs of plenty.

“The derivation of the German name for glacier, =gletscher=, is suggested as coming not from their icy material, but their perpetual motion, from =glitschen=, to glide; more probably, however, from the idea of gliding upon their surface. These glaciers come down from the air, down out of heaven, a perpetual frozen motion, ever changing and gliding, from the first fall of snow in the atmosphere, through the state of consolidated grinding blocks of ice, and then into musical streams that water the valleys. First it is a powdery, feathery snow, then granulated like hail, and denominated _firn_, forming vast beds and sheets around the highest mountain summits, then frozen into masses, by which time it has traveled down to within seven thousand feet above the level of the sea, where commences the great ice-ocean that fills the uninhabitable Alpine valleys, unceasingly freezing, melting and moving down. It has been estimated by Saussure and others, that these seas of ice, at their greatest thickness, are six or eight hundred feet deep. They are traversed by deep fissures, and as they approach the great precipices, over which they plunge like a cataract into the vales, they are split in all directions, and heaved up into waves, reefs, peaks, pinnacles and minarets. Underneath they are traversed by as many galleries and caverns, through which run the rills and torrents constantly gathering from the melting masses above. These innumerable streams, gathering in one as they approach the termination of the glacier, rush out from beneath it, under a great vault of ice, and thus are born into the breathing world, full-grown roaring rivers, from night, frost and chaos.

“A peasant has been known to have fallen into an ice-gulf in one of these seas, near one of the flowing sub-glacial torrents, and following the course of the stream to the foot of the glacier, he came out alive! The German naturalist, Hugi, set out to explore the recesses of one of the glaciers through the bed of a former torrent, and wandered on in its ice-caverns the distance of a mile. ‘The ice was everywhere eaten away into dome-shaped hollows, varying from two to twelve feet in hight, so that the whole mass of the glacier rested at intervals on pillars, or feet of ice, irregular in size and shape, which had been left standing. As soon as any of these props gave way, a portion of the glacier would of course fall in and move on. A dim twilight, scantily transmitted through the mass of ice above, prevailed in these caverns of ice, not sufficient to allow one to read, except close to the fissures, which directly admitted the daylight. The intense blue of the mass of the ice contrasted remarkably with the pure white of the icy stalactites, or pendents descending from the roof. The water streamed down upon him from all sides, so that, after wandering about for two hours, at times bending and creeping, to get along under the low vault, he returned to the open air, quite drenched and half-frozen.’

“This sea of ice, which embosoms in its farthest recesses a little living flower-garden, whither the humble-bees from Chamouny resort for honey, is also bordered by steep lonely beds of the fragrant rhododendron, or rose of the Alps. This hardy and beautiful flower grows from a bush larger than our sweet-fern, with foliage like the leaves of the ivory-plum. It continues blooming late in the season, and sometimes covers vast declivities on the mountains at a great hight, where one would hardly suppose it possible for a handful of earth to cling to the rocky surface. There, amid the snows and ice of a thousand winters, it pours forth its perfume on the air, though there be none to inhale the fragrance, or praise the sweetness, save only ‘the little busy bees,’ that seem dizzy with delight, as they throw themselves into the bosom of these beds of roses.

“Higher still on the opposite side of this great ice-sea, there are mountain-slopes of grass at the base of stupendous rocky pinnacles, whither the shepherds of the Alps drive their herds from Chamouny, for three months’ pasturage. They have no way of getting them there but across the dangerous glacier; and it is said that the passage is a sort of annual celebration, when men, women and children go up to Montanvert, to witness and assist the difficult transportation. When the herds have crossed, one peasant stays with them for the whole three months of their summer excursion, living upon bread and cheese, with one cow among the herd to supply him with milk. When he is not sleeping, he knits stockings, and ruminates as contentedly as the browsing cattle, his only care being to increase his store.”

VIEW FROM THE BUET.

Before we take our leave of Mont Blanc and of the Alps, the peculiarly brilliant view from the summit of the Buet ought to be noticed. Never, says M. Bourrit, did prospect appear so vast. Toward the west, the Rhone is seen, winding for the space of thirty-six leagues through the rich plains of the Valais; the parts of the river which the mountains cover with their shade seeming like threads of silver, and those which the sun illumines like threads of gold. Beyond the river and its rich plains, the view extends to the highest mountains of Switzerland, St. Gothard, and the Grisons, all covered with ice; while on the east, the hights sink suddenly, from some of the loftiest elevations on the globe, to level plains washed by the sea. Geneva seems like a spot at one end of the lake, and the lake itself like a sinuous band, dividing the fields which it waters. Beyond it are discovered the vast plains of Franche Comte and Burgundy, the mountains of which diminish by almost imperceptible gradations. Here the eye has neither power nor extent of sight to embrace the whole of the objects presented to its view. Amid the fearful aspect of the precipices which descend on every side, what a contrast between the country decorated with all that is smiling and gay, and the sublime spectacle of the Alps, their gloomy and aspiring summits, and, above all, the prodigious hight of Mont Blanc, that enormous colossus of snow and ice, which parts the clouds, and pierces to the very heavens! Below this mountain, which bids defiance to time, and whose eternal ice disregards the dissolving power of the sun, a band of pyramidical rocks appear, the intervals between them being so many valleys of ice, the immensity of which appalls the imagination. Their deep chasms may be distinguished, and the noise of the frequent avalanches (falls of immense masses of snow) presents to the mind the gloomy ideas of horror, devastation and ruin. Farther on, other summits of ice prolong this majestic picture. Among these are the high mountains of the St. Bernard, and those which border on the Boromean islands.

Perhaps there is not in the old world a theater more instructive, or more adapted for reflection, than the summit of this mountain. Where, beside, can be seen such variety and contrast of forms; such results of the efforts of time; such effects of all the climates, and of all the seasons? At one glance may be embraced frosts equally intense with those of Lapland, and the rich and delightful frontiers of Italy; eternal ice, and waving harvests; all the chilling horrors of winter, and the luxuriant vegetation of summer; eighty leagues of fertile plains, covered with towns, with vineyards, with fields and herds, and adjoining to these, a depth of twenty thousand feet of everlasting ice.

MONTSERRAT.

“Here, ’midst the changeful scenery, ever new, Fancy a thousand wond’rous forms descries, More wildly great than ever pencil drew; Rocks, torrents, gulfs, and shapes of giant size, And glittering cliffs on cliffs, and fiery ramparts rise.”—BEATTIE.

This Spanish mountain, which has been so long celebrated on account of the singularity of its shape, but chiefly for its convent and its numerous hermitages, is nine leagues north-west of Barcelona, in the province of Catalonia. It is in hight only three thousand, three hundred feet above the level of the sea, but it commands an enchanting prospect of the fine plain of Barcelona, extending to the sea, as well as of the islands of Majorca and Minorca, distant one hundred and fifty miles.

Toward Barcelona this mountain presents a bold and rugged front; but on the west, toward Vacarisas, it is almost perpendicular, notwithstanding which, a carriage-road winds round to the convent, which is placed in a sheltered recess among the rocks, at about

half the hight of the mountain. The Llobregat roars at the bottom; and the rock presents perpendicular walls from the edge of the water: but above the convent, the mountain divides into two crowns or cones, which form the most prominent features; while smaller pinnacles, blanched and bare, and split into pillars, pipes, and other singular shapes, give a most picturesque effect. Here are seen fourteen or fifteen hermitages, which are scattered over different points of the mountain, some of them on the very pinnacles of the cones, to which they seem to grow, while others are placed in cavities hewn out of the loftiest pyramids. The highest accessible part of the mountain is above the hermitage of St. Maddelena, the descent from which is between two cones, by a flight of steps, called Jacob's ladder, leading into a valley which runs along the summit of the mountain. The cones are here in the most grotesque shapes, the southern one being named the Organ, from its resemblance to a number of pipes.

At the extremity of this valley, which is a perfect shrubbery, and on an eminence, stands the hermitage of St. Jerome, the highest and most remote of all; and near it is the loftiest station of the whole mountain, on which is a little chapel dedicated to the Virgin. From this elevated pinnacle the prospect is vast and splendid.

Although the elements have wreaked all their fury on these shattered peaks, yet Nature has not been sparing in her gifts; the spaces between the rocks being filled up with close woods, while numerous evergreens, and other plants, serve to adorn the various chasms, rendering them valuable depositories of the vegetable kingdom. Few, indeed, are the evergreens of Europe which may not be found here; and when the mountain was visited by Mr. Swinburne, the apothecary of the convent had a list of four hundred and thirty-seven species of plants, and forty of trees, which shoot up spontaneously, and grace this hoary and venerable pile. There being two springs only on the mountain, there is a scarcity of water, which is chiefly collected in cisterns; an inconvenience, however, which is in a great measure counterbalanced by the absence of wolves, bears, and other wild beasts.

Captain Carlton, an Englishman, who visited Montserrat some years ago, ascended to the loftiest hermitage, that of St. Jerome, by the means of spiral steps hewn out in the rock on account of the steep acclivity. This, he observes, could not, in his time, be well accomplished by a stranger, without following the footsteps of an old ass, who carried from the convent a daily supply of food to the hermits. This animal having his two panniers stored with the provisions divided into portions, climbed without a guide, and having stopped at each of the cells, where the hermit took the portion allotted to him, returned back to the convent. He found that one of these hermits, to beguile the wearisomeness of his solitude, had contrived so effectually to tame the birds which frequented the groves surrounding his hermitage, that he could draw them together with a whistle, when they perched on his head, breast, and shoulders, taking the food from his mouth.

The convent is situated on the eastern side of the mountain, which seems to have been split by vast torrents of water, or by some violent convulsion of nature: in this way a platform has been formed in the cleft, sufficiently ample for the purpose of its construction. It is one of the forty-five religious houses of the Spanish congregation of the order of St. Benedict. The monks are bound to supply food and lodging for three days to all pilgrims who come up to pay their homage to the Virgin; besides which, they entertain the hermits on Sundays. The latter, who make a vow never to quit the mountain, take their stations by seniority, the junior hermit being placed at the greatest distance from the convent, and descending progressively as the vacancies happen. They are not altogether idle, taking pains to rival each other in making basket-work and other fanciful productions, which they display with great affability to their visitors. They assemble every morning to hear mass and perform divine service, in the parish church of St. Cecilia, which lies considerably above the convent; and twice a week they confess and communicate. They wear their beards long, and are clad in brown.

The church of St. Cecilia is a gloomy edifice, the gilding of which is much sullied by the smoke of eighty-five silver lamps, of various forms and sizes, suspended round the cornice of the sanctuary. For the supply of these with oil, funds have been bequeathed by devotees. The choir is decorated with wood carvings, curiously wrought, representing the most prominent passages in the life of Christ.

THE PEAK OF TENERIFFE.

[See cut below.]

[Illustration: THE PEAK OF TENERIFFE.]

The island of Teneriffe has received its present name from the inhabitants of the adjacent island Palma, in whose language =tener= signifies snow, and _iffe_, a hill. In extent, wealth, and fertility it exceeds all the other Canary islands. It continues to rise on all sides from the sea, until it terminates in the celebrated peak represented in the cut, which is, however, situated rather in the southern part

than in the center of the island. The ascent on the north side is more gradual than at the other parts, there being a space along the shore about three leagues in breadth, bounded on the sides by high mountains, or rather cliffs; but more inland it rises like a hanging garden all the way, without any considerable interruption of hills or valleys. The form of this island is triangular, extending itself into three capes, the nearest of which is about eighty leagues from the coast of Africa. In the middle it is divided by a ridge of mountains, which have been compared to the roof of a church, the peak forming the spire or steeple in the center.

The elevation of the peak of Teneriffe, according to the most accurate measurement, made by Cordier, is twelve thousand, one hundred and sixty-six feet, or nearly two miles and one-third above the level of the sea. In the ascent, the first eminence is called Monte Verde, or the green mountain, from the high fern with which it is covered, and presents a level plain of considerable extent. Beyond this is the mountain of pines, which are said to have formerly grown there in great abundance; but its steep sides are now craggy and barren, and its whole appearance very different from that of the eminence described above. After passing this summit, the traveler reaches a plain, on which the natives have bestowed the name of Mouton de Trigo, and upon which the peak in reality stands. It is a mountainous platform, rising more than seven thousand feet, or nearly a mile and a half, above the level of the sea; and here the currents of lava, hitherto concealed by the vegetation, begin to appear in all their aridity and confusion, a few lowly shrubs and creeping plants alone diversifying the surface of a desert, the most arid and rugged that can be imagined.

A small sandy platform of pumice-stones, bordered by two enormous currents of vitreous lava, and blocks of the same nature, ranged in a semicircle, forms what is called the station of the English, on account of the peak having been so often visited by British travelers. This platform is ninety-seven hundred and eighty-six feet, or upward of a mile and three-quarters above the level of the sea; and beyond it the acclivity is very steep, great masses of scoriæ, extremely rough and sharp, covering the currents of lava. Toward the summit, nothing but pumice-stone is to be seen. In fact the peak can only be ascended on the east and south-east sides. As it is impossible to get round the crater, the traveler's progress is arrested at the spot at which he reaches it. Here the two orders of volcanic substances are to be seen, the modern lavas being thrown up amid the ruins of ejections much more ancient, the immense masses of which constitute the platform on which the peak is placed. The shattered sides present a series of thick beds, almost all plunging toward the sea, composed alternately of ashes, volcanic sand, pumice-stones, lavas, either compact or porous, and scoriæ.

An incalculable number of currents, comparatively recent, which have descended from the peak, or have issued from its flanks, form irregular furrows, which run along the more ancient masses, and lose themselves in the sea to the west and north. Among these currents more than eighty craters are scattered, and augment with their ruins the confusion which prevails throughout.

The crater can alone be reached by descending down three chasms. Its sides are absolutely precipitous within, and are most elevated toward the north. Its form is elliptical; its circumference about twelve hundred feet; and its depth according to Cordier, one hundred and ten feet. Humboldt, however, estimates it at not more than from forty to sixty feet. The sides are, agreeably to the former of these observers, formed of an earth of snowy whiteness, resulting from the decomposition of the blackest and hardest vitreous porphyritic lava. All the rest is solid, and the lowest part occupied by blocks, which have fallen down from the sides. These solid parts are covered with shining crystals of sulphur, of a rhomboidal and octahedral figure, some of which are nearly an inch high, and are, perhaps, the finest specimens of native volcanic sulphur yet known. Vapors issue in abundance from among these blocks, and from an infinity of fissures which preserve a very intense heat. These vapors consist solely of sulphur and water, perfectly insipid. Beside the incrustations of sulphur, opal, in thin plates, is formed with great celerity. Humboldt regards the peak of Teneriffe as an enormous basaltic mountain, resting upon a dense secondary calcareous stone.

Various travelers have asserted, that the cold is intensely keen on the summit of the peak; that respiration is difficult; and that, particularly, spirituous liquors lose all their strength; which latter circumstance they ascribe to the spirit being more or less exposed to the sulphureous fumes exhaled from the crater. Cordier, and several other accurate observers, declare, however, that neither the smell nor the strength of liquids appeared, at this elevation, to be in the least degree impaired; and that volatile alkali, ether, and spirit of wine, possessed their usual pungency. They add, that the cold is very supportable; and that neither the aqueous sulphureous vapors, nor the rarity of the air, render breathing difficult.

We extract the following interesting particulars from Humboldt's account of his visit to Teneriffe.

"Toward three in the morning, by the sombrous light of a few fir torches, we began our expedition for the summit of the Piton. We scaled the volcano on the north-east, where the declivities are extremely steep; and came, after two hours' toil, to a small plain, which on account of its isolated situation, bears the name of Alta Vista. It is the station also of the Neveros, those natives whose

occupation it is to collect ice and snow, which they sell in the neighboring towns. Their mules, better practiced in climbing mountains than those hired by travelers, reach Alta Vista, and the Neveros are obliged to transport the snow to this place on their backs. Above this point the Malpays begins; a term by which is designated here, as well as in Mexico, Peru, and every other country subject to volcanoes, a ground destitute of vegetable mold, and covered with fragments of lavas.

“We observed, during the twilight, a phenomenon which is not unusual on high mountains, but which the position of the volcano we were scaling rendered very striking. A layer of white and fleecy clouds concealed from us the sight of the ocean, and the lower region of the island. This layer did not appear above sixteen hundred yards high; the clouds were so uniformly spread, and kept so perfect a level, that they wore the appearance of a vast plain covered with snow. The colossal pyramid of the peak, the volcanic summits of Lanzerota, of Fortaventura, and the isle of Palma, were like rocks amidst this vast sea of vapors, and their black tints were in fine contrast with the whiteness of the clouds.”

By an astronomical observation, made at the above elevation at sunrise, it was ascertained that the true horizon, that is, a part of the sea, was distant one hundred and thirty miles. Our traveler proceeds thus:

“We had yet to scale the steepest part of the mountain, the Piton, which forms the summit. The slope of this small cone, covered with volcanic ashes, and fragments of pumice-stone, is so steep, that it would have been almost impossible to reach the top, had we not ascended by an old current of lava, the wrecks of which have resisted the ravages of time. These wrecks form a wall of scorious rocks, which stretches itself into the midst of the loose ashes. We ascended the Piton by grasping these half-decomposed scoriæ, the sharp edges of which remained often in our hands. We employed nearly half an hour to scale a hill, the perpendicular hight of which does not exceed five hundred feet.

“When we gained the summit of the Piton, we were surprised to find scarcely room enough to seat ourselves conveniently. The west wind blew with such violence that we could scarcely stand. It was eight in the morning, and we were frozen with cold, though the thermometer kept a little above the freezing point.

“The wall, which surrounds the crater like a parapet, is so high, that it would be impossible to reach the Caldera, if on the eastern side there was not a breach, which seems to have been the effect of a flowing of very old lava. We descended through this breach toward the bottom of the tunnel, the figure of which is elliptical. The greatest breadth of the mouth appeared to us to be three hundred feet, the smallest two hundred feet.

“We descended to the bottom of the crater on a train of broken lava, from the eastern breach of the inclosure. The heat was perceptible only in a few crevices, which gave vent to aqueous vapors, with a peculiar buzzing noise. Some of these funnels or Crevices are on the outside of the inclosure, on the external brink of the parapet that surrounds the crater. We plunged the thermometer into them, and saw it rise rapidly to sixty-eight and seventy-five degrees.

“We prolonged in vain our stay on the summit of the peak, to wait the moment when we might enjoy the view of the whole of the archipelago of the Fortunate islands. We discovered Palma, Gomera, and the Great Canary, at our feet. The mountains of Lanzerota, free from vapors at sunrise, were soon enveloped in thick clouds. On a supposition only of an ordinary refraction, the eye takes in, in calm weather, from the summit of the volcano, a surface of the globe of fifty-seven hundred square leagues, equal to a fourth of the surface of Spain.

“Notwithstanding the heat we felt in our feet on the edge of the crater, the cone of ashes remains covered with snow during several months in the winter. It is probable, that under the cap of snow considerable hollows are found, like those we find under the glaciers of Switzerland, the temperature of which is constantly less elevated than that of the soil on which they repose. The cold and violent wind which blew from the time of sunrise, engaged us to seek shelter at the foot of the Piton. Our hands and faces were frozen, while our boots were burnt by the soil on which we walked. We descended in the space of a few minutes the sugar-loaf, which we had scaled with so much toil; and this rapidity was in part involuntary, for we often rolled down on the ashes. It was with regret that we quitted this solitary place, this domain where Nature towers in all her majesty.”

To the above we subjoin the following extract from the account published in the first volume of the Transactions of the Geological Society, by the Hon. Mr. Bennet.

At the distance of thirty-four leagues from the island, Mr. Bennet had a very distinct view of the peak, rising like a cone from the bed of the ocean. The rocks and strata of Teneriffe, he observes, are wholly volcanic, the long chain of mountains, which may be termed the central chain, traversing the island from the foot of the second region of the peak, and sloping down on the eastern,

western and northern sides, to the sea. Toward the south, or more properly the south-south-west, the mountains are nearly perpendicular, and though broken into ridges, and occasionally separated by deep ravines, that are cut transversely as well as longitudinally, there are none of those plains, nor that gradual declination of strata, which the south-eastern and north-western sides of the island exhibit.

Mr. Bennet ascended the peak in the month of September, 1810. We give the abridged details of this expedition in his own words.

“The road to the city of Orotava, is a gradual and easy slope for three or four miles, through a highly cultivated country. Leaving the town, after a steep ascent of about an hour, through a deep ravine, we quitted the cultivated part, and entered into forests of chestnuts, the trees of which are of a large size. The form of this forest is oblong; the soil is deep, and formed of decomposed lava, small ash and pumice. I examined several channels in the strata, or ravines worn by the rains, and there was no appearance of any other rock. Leaving this forest, the track passes over a series of green hills, which we traversed in about two hours, and at last halted to water our mules at a spot where there is a small spring of bad and brackish water issuing from a lava rock. The ravine is of considerable depth. The range of green hills extends a mile or two further, the soil shallowing by degrees, until at length the trees and shrubs gradually dwindling in size, the Spanish broom alone covers the ground. Leaving behind us this range of green hills, the track, still ascending, leads for several hours across a steep and difficult mass of lava-rock, broken here and there into strange and fantastic forms, worn into deep ravines, and scantly covered in places by a thin layer of yellow pumice. As we proceeded on our road, the hills on our left gradually rose in hight, till the summits were lost in those of the central chain; while, on our right, we were rapidly gaining an elevation above the lower range of the peak. We met with several small conical hills, or mouths of extinct volcanoes, the decomposed lava on the edges of the craters having a strong red ochreous tint. At length, an immense undulated plain spreads itself like a fan, on all sides, nearly as far as the eye can reach. This plain is bounded on the west-south-west and south-south-west, by the regions of the peak; and on the east and north-east, by a range of steep perpendicular precipices and mountains, many leagues in circumference, called by the Spaniards =Las Faldas=. On this plain, or desert, for we had long left all show of vegetation, except a few stunted plants of Spanish broom, a sensible change was felt in the atmosphere; the wind was keen and sharp, and the climate like that of England in the months of autumn. All here was sad, silent and solitary. We saw at a distance the fertile plains on the coast, lying as it were under our feet, and affording a cheerful contrast to the scenes of desolation with which we were surrounded. We were already seven or eight thousand feet above the level of the sea, and had reached the bottom of the second region of the peak.

“Having reached the end of the plain, we found ourselves at the bottom of a steep hill, at the foot of which is a mass or current of lava. After a laborious, not to say hazardous ascent of about an hour, the pumice and ash gave way, and the mules sinking knee-deep at every step, we arrived at about five in the afternoon at the other extremity of the stream of lava, which, descending from the summit of the second region of the peak, divides at the foot of the cone into two branches, the one running to the north-east, and the other to the north-west. It was here we were to pass the night; so, lighting a fire made of dry branches of the Spanish broom, and stretching a part of a sail over a portion of the rock, we ate our dinner and laid ourselves down to sleep. I, however, passed the best part of the night by the fire, the weather being piercingly cold. As I stood by the fire, the view all around me was wild and terrific; the moon rose about ten at night, and, though in her third quarter, gave sufficient light to show the waste and wilderness by which we were surrounded. The peak and the upper regions which we had yet to ascend, towered awfully above our heads, while below, the mountains that had appeared of such a hight in the morning, and had cost us a day’s labor to climb, lay stretched as plains at our feet. From the uncommon rarity of the atmosphere, the whole vault of heaven appeared studded with innumerable stars, while the valleys of Orotava were hidden from our view by a thin vail of light fleecy clouds, that floated far beneath the elevated spot we had chosen for our resting-place; the solemn stillness of the night was only interrupted by the crackling of the fire round which we stood, and by the whistling of the wind, which coming in hollow gusts from the mountain, resembled the roar of distant cannon.

“Between two and three in the morning, we resumed, on foot, our ascent of the mountain, the lower part of which we had climbed on horseback the preceding evening; the ascent, however, became much more rapid and difficult, our feet sinking deep in the ashes at every step. From the uncommon sharpness of the acclivity, we were obliged to stop often to take breath: after several halts, we at last reached the head of the pumice hill. After resting some short time here, we began to climb the stream of lava, stepping from mass to mass. The ascent is steep, painful and hazardous; in some places the stream of lava is heaped up in dykes or embankments; and we were obliged to clamber over them as one ascends a steep wall.

“We halted several times during the ascent, and at last reached a spot called La Cueva, one of the numerous caves that are found on the sides of the mountain; this is the largest of them, and is filled with snow and the most delicious water, which was just at the

point of congelation. The descent into it is difficult, it being thirty or forty feet deep. One of our party let himself down by a rope: he could not see the extent of the cave, but the guides declared it to be three hundred feet in length, and to contain thirty or forty feet of water in depth. The roof and sides are composed of a fine stalactitic lava, similar to that found on Vesuvius, and it is of the same nature as that which flowed on the surface. We rested here about half an hour, during which we had an opportunity of observing the rising of the sun, and that singular and rapid change of night into day, which is the consequence of an almost entire absence of twilight. As we ascended the north-east side of the mountain, this view was strikingly beautiful: at first there appeared a bright streak of red on the horizon, which gradually spread itself, lighting up the heavens by degrees, and growing brighter and brighter, till at last the sun burst forth from the bed of the ocean, gilding as it rose the mountains of Teneriffe, and those of the Great Canary; in a short time the whole country to the eastward lay spread out as a map. The Great Canary was easily to be distinguished; and its rugged and mountainous character, similar to that of the other islands, became visible to the naked eye. The cold at this time was intense, the wind keen and strong, and the thermometer sunk to thirty-two degrees. After a short though rapid ascent, we reached the summit of the second stage of the mountain, passing over a small plain of white pumice, on which were spread masses of lava, and at length arrived at the foot of the cone. This division of the mountain forms what is generally termed the peak of Teneriffe: it represents the present crater of Vesuvius, with this difference, however, that while the surface of that mountain is composed of a black cinder or ash, the superfices of this appear to be a deposit of pumice of a white color, of scoriæ and lava, with here and there considerable masses that were probably thrown out when the volcano was in action. Numerous small cavities on the side of the mountain emitted vapor, with considerable heat. Here begins the only fatiguing part of the ascent; the steepness of the cone is excessive; at each step our feet sunk into the ash, and large masses of pumice and lava rolled down from above; we were all bruised, and our feet and legs were cut, but not materially hurt: at last we surmounted all difficulties, and seated ourselves on the highest ridge of the mountain. This uppermost region does not appear to contain in superficies more than an acre and a half, and is itself a small crater, the walls of which are the different points on which we sat, and are plainly visible from below. Within, the lava is in the most rapid state of decomposition. The surface is hot to the feet, and the guides said it was dangerous to remain long in one spot: as it was, some of us sunk to our knees in the hot deposit of sulphur. Upon striking the ground with the feet, the sound is hollow, similar to what is produced by the same impulsion on the craters of Vesuvius and Solfaterra. I estimate the depth of the crater to be, from the highest ridge to the bottom, about two hundred feet, forming an easy and gradual descent.

“The view from the summit is stupendous: we could plainly discover the whole form of the island, and we made out distinctly three or four of the islands, which, collectively, are called the Canaries; we could not, however, see Lancerotte or Fuerteventura, though we were told that other travelers had distinguished them all.

“From this spot, the central chain of mountains that run from south-west to north-east, is easily to be distinguished. These, with the succession of fertile and woody valleys, commencing from San Ursula, and ending at Las Horcas, with the long line of precipitous lava rocks that lay on the right of our ascent, and which traverse that part of the island running from east to west, from their point of departure at the Canales, to where they end in an abrupt headland on the coast, with their forests, and villages, and vineyards, the port with the shipping in the roads, the town of Orotava, with its spires glittering as the morning sun burst upon them, afford a cheerful contrast to the streams of lava, the mounds of ash and pumice, and the sulphurated rock on which we had taken our seat. The sensation of extreme hight was in fact one of the most extraordinary I ever felt; and though I did not find the pain in my chest arising from the rarity of the atmosphere, by any means so acute as on the mountains of Switzerland, yet there was a keenness in the air, independent of the cold, that created no small uneasiness in the lungs. The respiration became short and quick, and repeated halts were found necessary. The idea also of extreme hight was to me more determinate and precise than on the mountains of Switzerland; and though the immediate objects of vision were not so numerous, yet as the ascent is more rapid, the declivity sharper, and there is here no mountain like Mont Blanc towering above you, the twelve thousand feet above the level of the sea appeared considerably more than a similar elevation above the lake of Geneva. We remained at the summit about three-quarters of an hour, our ascent having cost us the labor of four hours, as we left La Estancia at ten minutes before three, and reached the top of the peak before seven. Our thermometer, which was graduated to the scale of Fahrenheit, was, during our ascent, as follows: at Orotava, at eight in the morning, seventy-four degrees; at six in the evening, at La Estancia, fifty degrees; at one, in the following morning, forty-two degrees; at La Cueva, at half past four, thirty-two degrees; at the bottom of the cone, thirty-six degrees; at the top of the peak, one hour and a half after sunrise, thirty-three degrees. The descent down the cone is difficult, from its extreme rapidity, and from the fall of large stones, which loosen themselves from the beds of pumice. Having at last scrambled to the bottom, we pursued our march down the other course of the lava, that is to say, down its westerly side, having ascended its eastern. The ravines and rents in this stream of lava are deep and formidable; the descent into them is always painful and troublesome, often dangerous: in some places we let ourselves down from rock to rock. I can form no opinion why there should

be these strange irregularities in the surface of this lava; in places it resembles what sailors term the trough of the sea, and I can compare it to nothing but as if the sea in a storm, had by some force become on a sudden stationary, the waves retaining their swell. As we again approached La Cueva, we came to a singular steep valley, the depth of which, from its two sides, can not be less than one hundred to one hundred and fifty feet, the lava lying in broken ridges one upon the other, similar to the masses of granite rock that time and decay have tumbled down from the top of the Alps; and, except from the scoriæ, or what Milton calls 'the fiery surge,' they in no degree bear the marks of having rolled as a stream of liquid matter.

"We descended the pumice hill with great rapidity, almost at a run, and arrived at La Estancia in little more than two hours. We then mounted our mules, and following the track by which we had ascended the preceding day, we reached, about four o'clock, the country-house from which we had started."

The first eruption of which there is any distinct account, occurred on the twenty-fourth of December, 1704, when twenty-nine shocks of an earthquake were distinctly felt. On the thirty-first a great light was observed on Manja, toward the White mountains. Here the earth opened, and two volcanoes were formed, which threw up such heaps of stones as to raise two considerable mountains: the combustible matter, which still continued to be thrown up, kindled above fifty fires in the vicinity. The whole country for three leagues round was in flames, which were increased by another volcano opening by at least thirty different vents within the circumference of half a mile. On the second of February following, another volcano broke out in the town of Guimar, swallowing up a large church.

A subsequent eruption in 1706 filled up the port of Guarachico. The lava, in its descent, ran five leagues in six hours; and on this lava, houses are now built where ships formerly rode at anchor. Neither of these eruptions was from the crater on the summit of the peak, for that has not ejected lava for centuries, and it now issues from the flanks only. The last eruption was on the ninth of June, 1798, and was very terrible. Three new mouths opened at the hight of eighty-one hundred and thirty feet, or upward of a mile and a half above the level of the sea, upon the inclined slope of the base of the peak toward the south-west. Above this, at the hight of ten thousand, two hundred and forty feet, or nearly two miles, M. Cordier found a vast crater nearly four miles and a half in circumference, which lie ascertained to be very ancient. Its sides are extremely steep, and it still presents the most frightful picture of the violence of subterraneous fire. The peak rises from the sides of this monstrous aperture. To the south-west is the mountain of Cahora, which is said to have become a volcano in 1797. The other mountains of Teneriffe, which tradition reports to have been formerly volcanoes, are Monte Roxo, or the red mountain; several mountains, called the Malpasses, lying to the eastward; and one (Rejada) in a southern direction. Throughout the whole of the distance between Monte Roxo and the bay of Adexe, according to Mr. Glass, the shore is about twenty-five hundred feet, or nearly half a mile in hight, and perpendicular as a wall. The southern coast has a much superior elevation, the chain of mountains by which it is bounded being, agreeably to St. Vincent, eighty-three hundred and twenty feet, or more than a mile and a half, above the level of the sea.

THE SOUFFRIERE MOUNTAIN.

This volcanic mountain, the dreadful eruption of which we are about to describe, is the most elevated and most northerly of the lofty chain running through the West India island of St. Vincent. From the extraordinary frequency and violence of the earthquakes, which in 1811, are calculated to have exceeded two hundred, some great movement or eruption was looked for. In the interim the mountain indicated much disquietude; but the apprehension was not so immediate as to restrain curiosity, or to prevent repeated visits to the crater, which had latterly been more numerous than ever. Even on the twenty-sixth of April, 1812, the day preceding the eruption, several gentlemen ascended and remained there for some time. Nothing unusual was then remarked, nor any external difference observed, except rather a stronger emission of smoke from the interstices of the conical hill, at the bottom of the crater. To those who have not visited this romantic and wonderful spot, a slight description of it, as it lately stood, is previously necessary.

"About two thousand feet from the level of the sea, on the south side of the mountain, and at rather more than two-thirds of its hight, opens a circular chasm, somewhat exceeding half a mile in diameter, and between four hundred and five hundred feet in depth. Exactly in the center of this capacious bowl, rose a conical hill about two hundred and sixty or three hundred feet in hight, and about two hundred in diameter, richly covered and variegated with shrubs, brushwood and vines, above half-way up, and the remainder covered over with virgin sulphur to the top. From the fissures of the cone and interstices of the rocks, a thin white smoke was constantly emitted, occasionally tinged with a slight bluish flame. The precipitous sides of this magnificent amphitheater were fringed with various evergreens and aromatic shrubs, flowers, and many alpine plants. On the north and south sides of the base of the cone were two pieces of water, one perfectly pure and tasteless, the other strongly impregnated with sulphur and alum. This lonely and beautiful spot was rendered more enchanting by the singularly melodious notes of a bird, an inhabitant of these upper

solitudes, and altogether unknown to the other parts of the island, hence principally called or supposed to be invisible, though it certainly has been seen, and is a species of blackbird.

“A century had now elapsed since the last convulsion of the mountain, or since any other elements had disturbed the serenity of this wilderness, besides those which are common to the tropical tempest. It apparently slumbered in primeval solitude and tranquillity, and from the luxuriant vegetation and growth of the forest, which covered its side from the base nearly to the summit, seemed to discountenance the fact, and falsify the records of the ancient volcano. Such was the majestic, peaceful Souffriere, on April the twenty-seventh; but our imaginary safety was soon to be confounded by the sudden danger of devastation. Just as the plantation bell rang at noon on that day, an abrupt and dreadful crash from the mountain, with a severe concussion of the earth, and tremulous noise in the air, alarmed all around it. The resurrection of this fiery furnace was proclaimed in a moment by a vast column of thick, black, ropy smoke, like that of an immense glass-house, bursting forth at once, and mounting to the sky; showering down sand, gritty calcined particles of earth and ashes mixed, on all below. This, driven before the wind toward Wallibou and Morne Ronde, darkened the air like a cataract of rain, and covered the ridges, woods and cane-pieces with light gray-colored ashes, resembling snow when slightly covered by dust. As the eruption increased, this continual shower expanded, destroying every appearance of vegetation. At night a very considerable degree of ignition was observed on the lips of the crater; but it is not asserted that there was as yet any visible ascension of flame. The same awful scene presented itself on the following day; the fall of ashes and calcined pebbles still increasing, and the compact, pitchy column from the crater rising perpendicularly to an immense hight, with a noise at intervals like the muttering of distant thunder.

“On Wednesday, the twenty-ninth, all these menacing symptoms of horror and combustion still gathered more thick and terrific for miles around the dismal and half-obscured mountain. The prodigious column shot up with quicker motion, dilating as it rose like a balloon. The sun appeared in total eclipse, and shed a meridian of twilight over us, that aggravated the wintry gloom of the scene, now completely powdered over with falling particles. It was evident that the crisis was yet to come, that the burning fluid was struggling for a vent, and laboring to throw off the superincumbent strata and obstructions, which suppressed its torrent. At night, it was manifest that it had greatly disengaged itself from its burden, by the appearance of fire flashing above the mouth of the crater.

“On the memorable thirtieth of April, the reflection of the rising sun on this majestic body of curling vapor was sublime beyond imagination: any comparison of the Glaciers, or of the Andes, can but feebly convey an idea of the fleecy whiteness and brilliancy of this awful column of intermingled and wreathed smoke and clouds. It afterward assumed a more sulphureous cast, like what are called thunder-clouds, and in the course of the day had a ferruginous and sanguine appearance, with a much livelier action in the ascent, and a more extensive dilatation, as if almost freed from every obstruction. In the afternoon, the noise was incessant, and resembled the approach of thunder still nearer and nearer, with a vibration that affected the feelings and hearing: as yet there was no convulsive motion, or sensible earthquake. The Charaibs settled at Morne Ronde, at the foot of the Souffriere, abandoned their houses, with their live stock, and everything they possessed, and fled precipitately toward town. The negroes became confused, forsook their work, looked up to the mountain, and, as it shook, trembled, with the dread of what they could neither understand or describe: the birds fell to the ground, overpowered with showers of ashes, unable to keep themselves on the wing; the cattle were starving for want of food, as not a blade of grass or a leaf was now to be found; the sea was much discolored, but not uncommonly agitated; and it is remarkable, that throughout the whole of this violent disturbance of the earth, it continued quite passive, and did not at any time sympathize with the agitation of the land. About four o’clock in the afternoon, the noise became more alarming, and just before sunset the clouds reflected a bright copper color, suffused with fire. Scarcely had the day closed, when the flames burst at length pyramidically from the crater, through the mass of smoke; the rolling of the thunder became more awful and deafening; electric flashes quickly succeeded, attended with loud claps; and now, indeed, the tumult began. Those only who have witnessed such a sight, can form any idea of the magnificence and variety of the lightning and electric flashes; some forked and zigzag, playing across the perpendicular column from the crater; others shooting upward from the mouth like rockets of the most dazzling luster; others like shells, with their trailing fuses, flying in different parabolas, with the most vivid scintillations, from the dark sanguine column, which now seemed inflexible, and immovable by the wind. Shortly after seven in the afternoon, the mighty caldron was seen to simmer, and the ebullition of lava to break out on the north-west side. This, immediately after boiling over the orifice, and flowing a short way, was opposed by the acclivity of a higher point of land, over which it was impelled by the immense tide of liquefied fire which drove it on, forming the figure V in grand illumination. Sometimes, when the ebullition slackened, or was insufficient to urge it over the obstructing hill, it recoiled like a refluent billow, from the rock, and then again rushed forward, impelled by fresh supplies, and, surmounting every obstacle, carried rocks and woods together, in its course down the slope of the mountain, until it precipitated itself down some vast ravine, concealed from our sight by the intervening ridges of Morne Ronde. Vast globular bodies of fire were seen projected from the fiery furnace, and, bursting, fell back into it, or over it upon the

surrounding bushes, which were instantly set in flames. About four hours from the time of the lava's boiling over the crater, it reached the sea, as we could observe from the reflection of the fire and electric flashes attending it. About half past one, the following morning, another stream of lava was seen descending to the eastward toward Rabacca. The thundering noise of the mountain, and the vibration of sound that had been so formidable hitherto, now mingled in the sudden monotonous roar of the rolling lava, became so terrible, that dismay was almost turned into despair. At this time the first earthquake was felt; this was followed by showers of cinders, which fell with the hissing noise of hail, during two hours.

"At three o'clock, a rolling on the roofs of the houses indicated a fall of stones, which soon thickened, and at length descended in a rain of intermingled fire, which threatened at once the fate of Pompeii or Herculaneum. The crackling coruscations from the crater at this period exceeded all that had yet passed. The eyes were struck with a momentary blindness, and the ears stunned with a confusion of sounds. People sought shelter in the cellars, under rocks, or anywhere, for every place was nearly the same; and the miserable negroes, flying from their huts, were knocked down, or wounded, and many killed in the open air. Several houses were set on fire. The estates situated in the immediate vicinity, seemed doomed to destruction. Had the stones which fell been heavy in proportion to their size, not a living creature could have escaped death: these, having undergone a thorough fusion, were divested of their natural gravity, and fell almost as light as pumice, though in some places as large as a man's head. This dreadful rain of stones and fire lasted upward of an hour, and was again succeeded by cinders from three till six o'clock in the morning. Earthquake followed earthquake, almost momentarily; or rather the whole of this part of the island was in a state of continued oscillation; not agitated by shocks vertical or horizontal; but undulated like water shaken in a bowl.

"The break of day, if such it could be called, was truly terrific. Utter darkness prevailed till eight o'clock, and the birth of May dawned like the day of judgment: a chaotic gloom enveloped the mountain, and an impenetrable haze hung over the sea, with black sluggish clouds of a sulphureous cast. The whole island was covered with cinders, scoriæ, and broken masses of volcanic matter. It was not until the afternoon, that the muttering noise of the mountain sunk gradually into a solemn yet suspicious silence. Such are the particulars of this sublime and tremendous scene, from its commencement to its catastrophe."

PETER BOTTE'S MOUNTAIN.

[See cut, page 74.]

The singular peak represented in the cut, is in the island of Mauritius, which lies in the Indian ocean, east of Madagascar. The island is about one hundred and forty miles in circuit, and produces rice, sugar, cloves, indigo, and various tropical fruits. It was first settled by the Dutch; but the French gained possession of it in 1715. In 1810, the English took it, and it is still held by them. The island seems to have been thrown up from the sea by volcanic eruptions, as it everywhere bears marks of convulsions by inward fires. In its central parts are wild craggy mountains, the summits of which are always covered with snow. And among these is the peak represented in the cut, which is eighteen hundred feet in hight, and surrounded by dismal ravines. It is called Peter Botte's mountain, from a legend that a man of that name once ascended to the top. The general belief, however, is, that it was never ascended till the year 1832, when the top of it was reached by a party under Capt. Lloyd, an English engineer. The exploit was one of the most hazardous, and the account of it is almost painful to the reader, from the evident peril of the adventurers.

[Illustration: PETER BOTTE'S MOUNTAIN.]

KILAUEA.

While on the subject of wonderful volcanoes, we must not omit to notice one that has been called the "Niagara of volcanoes," and the "king of volcanoes," =viz.=, Kilauea, the great volcano of the Sandwich islands, which is on the island of Hawaii, about thirty miles from Hilo bay. One of the missionaries, from whom we have the account, started to visit it on horseback; but the way being rough and the animal unshod, he severely felt the inconvenience of the lava, became discouraged, and moved so slowly, that he was given up, and the missionary and his associate proceeded on foot.

"Toward evening," he continues, "we reached Olaa, an inland settlement; and the next day, before noon, had arrived at an elevation of some four thousand feet, at a distance of twenty miles from Hilo bay.

"Approaching the great crater of Kilauea, we had a fine view of the magnificent dome of Mauna Loa, stretching on some twenty miles beyond it, and rising above it to the lofty hight of ten thousand feet. Evidences of existing volcanic agency multiplied around us; steam, gas and smoke, issued from the sulphur banks on the north-east and south-east sides of the crater, and here and there, from deep and extended fissures connected with the fiery subterranean agency; and as we passed circumspectly along the

apparently depressed plain that surrounds the crater, we observed an immense volume of smoke and vapor ascending from the midst of it. At the same time, and from the same source, various unusual sounds, not easily described or explained, fell with increasing intensity on the ear. Then the angry abyss, the fabled habitation and throne of _Pele_, the great idol goddess whom the Hawaiians formerly worshiped, opened before us.

“Coming near to the rim, I fell upon my hands and knees, awe-struck, and crept cautiously to the rocky brink; for with all my natural and acquired courage, I was unwilling at once to walk up to the giddy verge, and look down upon the noisy, fiery gulf beneath my feet. Shortly, however, I was able to stand very near, and gaze upon this wonder of the world, which I wish I could set before my readers, in all its mystery, magnitude and grandeur. It is not a lofty cone, or mountain-top pointing to the heavens, but a vast chasm in the earth, five or six times the depth of Niagara falls, and seven or eight miles in circumference. It is situated on the flank of a vast mountain, which has been gradually piled up by a similar agency during the course of ages. Such is the immense extent and depth of Kilauea, that it would take in, entire, the city of Philadelphia or New York, and make their loftiest spires, viewed from the rim, appear small and low. But neither cities nor meadows, nor water nor vegetation, can be found in this chief of the deep places of the earth, but a lake of lava, some black and indurated, some fiery and flowing, some cooling as a floating bridge over the fathomless molten abyss, seven times hotter than Nebuchadnezzar’s hottest furnace, and some bursting up through this temporary incrustation, rending it here and there, and forming mounds and cones upon it. The immense mass, laboring to escape, pressed against the great crater’s sides, which consist not of a frail ‘Chinese wall,’ built by human hands to resist human strength, but an irregularly elliptical wall of basaltic rocks, extending a thousand feet above the surface of the lava lake, and to unknown depths below. Six hundred feet below, the verge stretches around horizontally, a vast amphitheater gallery of black indurated lava, once fluid but now solid, and on which an army of a hundred thousand men might stand to view the sublime spectacle beneath, around, and above them.

“While through the eye, the impressions of grandeur, strong at first, increased till the daylight was gone, the impressions received through the ear, were peculiar, and by no means inconsiderable. The fiercely whizzing sound of gas and steam, rushing with varying force through obstructed apertures in blowing cones, or cooling crusts of lava, and the laboring, wheezing, struggling, as of a living mountain, breathing fire and smoke and sulphurous gas from his lurid nostrils, tossing up molten rocks or detached portions of fluid lava, and breaking up vast indurated masses with varied detonations, all impressively bade us stand in awe. When we reached the verge, or whenever we came from a little distance to look over, these strange sounds increased, as if some intelligent power, with threatening tones and gestures, indignant at our obtrusiveness, were forbidding us to approach. The effect of all this on aboriginal visitors, before the true God was made known to them, may have been to induce or confirm the superstition, that a deity or family of deities dwelt there, and recognized the movements of men, and in various ways expressed anger against them. If my native fellow-travelers had not been cured of their superstition, or had not known me to be opposed to all idolatry, and particularly to the worship of Pele, the goddess whom they once supposed dwelt there, they might naturally have mistaken my almost involuntary prostration, as an act of religious homage to this discarded Hawaiian deity. But the missionaries had set at naught the _tabus_ of this deity, and Kapiolani had openly invaded the same, and descending into this crater had, in a fearless and Christian manner, there acknowledged Jehovah as the only true God, and proclaimed to her countrymen that this was but one of the fires which he has kindled and controls. So that the natives now with me were ready devoutly to acknowledge all this.

“When seven years before our visit, Messrs. Ellis, Thurston, Bishop and Goodrich, accompanied by Mr. Harwood, visited this yawning gulf, they said of it: ‘The bottom was filled with lava, and the south-west and northern parts of it were one vast flood of liquid fire, in a state of terrific ebullition, rolling to and fro its fiery surge and flaming billows. Fifty-one craters of various forms and sizes, rose, like so many conical islands from the surface of the burning lake. Twenty-two constantly emitted columns of gray smoke and pyramids of brilliant flame, and many of them at the same time vomited from their ignited mouths, streams of fluid lava, which rolled in blazing torrents down their black, indented sides, into the boiling mass of fire below.’ The surface of this body of lava is subject to unceasing changes from year to year; for ‘deep calleth unto deep’ continually, and the fiery billows of this troubled ocean never rest.

“As night came on we took our station on the north side of the very brink, where we supposed we should be able most securely and satisfactorily to watch the action of this awful laboratory during the absence of the light of the sun. Though the spot where we spread our blanket for a lodgment had been considered as the safest in the neighborhood, there was room for the feeling of insecurity which some who had preceded us have thus described. ‘The detachment of one small stone beneath, or a slight agitation of the earth, would have precipitated us, amid the horrid crash of falling rocks, into the burning lake.’ Had I thought the danger so imminent, I should have deemed it prudent to take a position somewhat further off. The mass which supported us had doubtless

been shaken a thousand times, and was liable every hour to be shaken again; but being in the short curvature of the crater, like the key-stone of an arch, it could not easily be thrown from its position by any agitation that would naturally occur while this great safety-valve is kept open, or the numerous fissures round it, reaching to the very bowels of the mountain, convey harmlessly from unknown depths, gases and volumes of steam, generated where water comes in contact with intense volcanic heat. Our position was about four thousand feet above the level of the sea, and one thousand above the surface of the lake below us.

“The great extent of the surface of this lava lake; the numerous places in it where the fiery element was displaying itself; the conical mouths here and there discharging glowing lava overflowing and spreading its waves around, or belched out in detached and molten masses that were shot forth with detonations, perhaps by the force of gases struggling through from below the surface, while the vast column of vapor and smoke ascended up toward heaven, and the coruscations of the emitted brilliant lava, illuminating the clouds that passed over the terrific gulf, all presented by night a splendid and sublime panorama of volcanic action, probably nowhere surpassed, if ever equaled, and which to be imagined must be seen. Had Vulcan employed ten thousand giant Cyclops, each with a steam-engine of a thousand horse-power, blowing anthracite coal for smelting mountain minerals, or heaving up and hammering to pieces the everlasting rocks and hills, their united efforts would but begin to compare with the work of Pele here.

“There was enough of mystery connected with the wonderful experiments going on before our eyes, to give ample employment to fancy and philosophy, and materially to enhance the sublimity of the fearful scene. For it might be asked, how can such an immense mass of rocks and earth be kept incessantly in a state of fusion without fuel or combustion? Or by what process could such solid masses be fused at all, in accordance with any mode of generating heat with which we are acquainted? If there be combustion in the crater adequate to the melting of such vast masses of substances so hard, rocky and earthy, why is there an accumulation and increase of the general mass, so that millions of cubic fathoms are, from time to time, added to the solid contents of the mountain? But if the bowels of the mountain are supposed to be melted by intense heat in some way generated, could they be heaved up by the expansion of steam or gas, while an orifice equal to three or four square miles, like that of Kilauea, or the terminal crater on the same mountain, is kept open; for steam and gas might be supposed to pass through the fluid masses and escape, instead of raising them from a depth, just as steam issues from the bottom of a boiling caldron, without materially elevating the surface of its contents.

“But if with one class of geologists, we suppose the interior of the earth to be in a molten and fluid state, as perhaps originally created, and that Kilauea and other volcanoes are but the openings and safety-valves of that subterranean, fiery, central ocean of red or white-hot matter, then we have here no faint illustration of the bold imagery used by the sacred writers, and of their phraseology, which to some seems hyperbolical and even paradoxical, as when they speak of the ‘bottomless pit,’ the ‘fire that is not quenched,’ ‘the lake that burneth with fire and brimstone,’ ‘the smoke of their torment which ascendeth up forever and ever.’ If such a vast mass of fiery fluid constitutes the main portion of the interior of the earth, it is literally ‘bottomless;’ and the opened surface, like that of Kilauea, may be strictly called a ‘lake of fire;’ and as sulphur and particles of the sulphuret of iron are present, it may well be called ‘a lake that burns with fire and brimstone.’

“After gazing at the wonderful and wonderfully sublime scene for some twenty hours, taking but a little time for repose, we found the sense of fear subsiding, and curiosity prompting to a closer intercourse with Pele, and a more familiar acquaintance with her doings and habits. Many who try the experiment, though at first appalled, are ready after a few hours, to wend their way down the steep sides of the crater. Thus we descended into the immense pit from the north-east side, where it was practicable, first to the black ledge or amphitheater gallery, and thence to the surface of the lava lake. This we found extremely irregular, presenting cones, mounds, plains, vast bridges of lava recently cooled, pits and caverns, and portions of considerable extent in a movable and agitated state. We walked over lava which, by some process, had been fractured into immensely large slabs, as though it had been contracted by cooling, or been heaved up irregularly by the semi-fluid mass below. In the fissures of this fractured lava, the slabs or blocks two feet below the surface, were red-hot. A walking-stick thrust down would be set on fire and flame instantly.

“Passing over many masses of such lava, we ventured toward the more central part of the lake, and came near to a recent mound which had probably been raised on the cooling surface, after our arrival the day before. From the top of it flowed melted lava, which spread itself in waves to a considerable distance, one side or the other, all around. The masses thrown out in succession moved sluggishly, and as they flowed down the inclined plane, a crust was formed over them, which darkened and hardened, and became stationary, while the stream still moved on below it. The front of the mass, red-hot, passed along down, widening and expanding itself, and forcing its way through a net-work, as it were, of irregular filaments of iron, which the cooling process freely supplied. This motion of a flowing mass, whether smaller or larger, seen from the rim of the crater by night, gives the appearance of a fiery

surf, or a rolling wave of fire, or the dancing along of an extended semicircular flame on the surface of the lake. When one wave has expended itself, or found its level, or otherwise become stationary, another succeeds and passes over it in like manner, and then another, sent out as it were, by the pulsations of the earth's open artery, at the top of the mound. This shows how a mound, cone, pyramid, or mountain, can be gradually built of lava, and wide plains covered at its base with the same material.

"We approached near the border of some of these waves, and reached the melted lava with a stick two yards long; and thus obtained several specimens red-hot from the flowing mass. I have since had occasion to be surprised at the absence of fear in this close contiguity with the terrible element, where the heat under our feet was as great as our shoes would bear, and the radiating heat from the moving mass was so intense that I could face it only a few seconds at a time at a distance of two or three yards. Yet having carefully observed its movements awhile, I threw a stick of wood upon the thin crust of a moving wave where I believed it would bear me, even if it should bend a little, and stood upon it a few moments. In that position, thrusting my cane down through the cooling, tough crust, about half an inch thick, I withdrew it, and forthwith there gushed up of the melted, flowing lava under my feet, enough to form a globular mass two and a half or three inches in diameter, which, as it cooled, I broke off and bore away as spoils from the ancient domain and favorite seat of the great idol goddess of the Hawaiians. Parts that were in violent action we dared not approach.

"There is a remarkable variety in the volcanic productions of Hawaii; a variety as to texture, form and size, from the vast mountain and extended plain, to the fine-drawn and most delicate vitreous fiber, the rough clinker, the smooth stream, the basaltic rock, and masses compact and hard as granite or flint, and the pumice or porous scoriæ, or cinders, which, when hot, probably formed a scum or foam on the surface of the denser molten mass. Considerable quantities of capillary glass are produced at Kilauea, though I am not aware that the article is found elsewhere on the islands. Its production has been deemed mysterious. In its appearance it resembles human hair, and among the natives is familiarly called '=Lauoho o Pele=,' the hair of Pele. It is formed, I presume, by the tossing off of small detached portions of lava of the consistence of melted glass, from the mouths of cones, when a fine vitreous thread is drawn out between the moving portion, and that from which it is detached. The fine-spun product is then blown about by the wind, both within and around the crater, and is collected in little locks or tufts.

"Sulphur is seen, but in small quantities, in and around the crater; and at a little distance from the rim there are yellow banks, on which beautiful crystals of sulphur may be found. In one place, a pool of pure distilled water, condensed from the steam that rises from a deep fissure, affords the thirsty traveler a beverage far better than that of the ordinary distiller. There is, however, a kind of sulphurous gas produced by the volcano, which is highly deleterious if breathed often or freely. This is one source of danger to the visitor, which, while I was down a thousand feet below the rim, produced a temporary coughing.

"I was, perhaps, too venturesome, but other visitors have been far more so. As one instance of this, Dr. Judd, having become familiar with the volcanic power, in his ardor to secure valuable and recent specimens for the United States exploring expedition, on the visit of Commodore Wilkes and his company to this crater, descended to the surface of the lake, and then into a _sub-crater_ in the midst of the larger. While he was busily engaged there in collecting specimens, a sudden bursting up of a huge volume of fluid lava from the bottom of the sub-crater, alarmed him, and threatened speedily to overwhelm and destroy him. He sprang to escape, but finding the rim overhanging, he could not scale it where he was; and the flowing mass was now too near to allow him to return to the place where he had descended; and its radiating heat was too intense to be faced. Escape without assistance was utterly hopeless; and the natives of the company who were about the brink, and from whom such help might have been expected, alarmed for themselves, were flying for their lives. Dr. Judd, giving himself up for lost, offered a prayer to heaven, and was about to resign himself to his fate, when a friendly and resolute Hawaiian, who had been a pupil at the mission seminary, compassionating the exposed sufferer, faced the approaching fiery volume, and braving its intense heat, exposed his own life, reached down his strong hand, and firmly grasped the doctor's, who thus, at the last available moment, through their united exertions and the blessing of heaven, escaped with his life from the horrible pit and a fiery grave! A mighty current instantly overflowed the place where they had just been standing, and they were obliged to run for their lives before the molten flood; and being able to outstrip it, they ascended from the surface of the abyss to the lofty rim, with heartfelt thanksgivings to their great deliverer.[1] This proves the real danger of descending too far into the crater of the volcano; and had it occurred in the days of unbroken superstition, it would doubtless have been ascribed to the anger of Pele, and tended to increase the number of her deluded worshipers. But now such a deliverance was justly ascribed to the kind providence of Jehovah, the knowledge of whose character, as displayed in the gospel, has introduced the Hawaiian race into a new life.

Footnote 1:

See United States Exploring Expedition, vol. iv., p. 173.

“Kilauea may be regarded as one of the safety-valves of a bottomless reservoir of melted earth, below the cooled and cooling crust on which mountains rise, rivers flow, oceans roll, and cities are multiplied as the habitations of men. It has been kept open from time immemorial, always displaying more or less of its active power. The circumambient air which carries off the caloric, sometimes aided by rain, is incessantly endeavoring to shut up this valve, or bridge over this orifice of three or four square miles of the fiery abyss. Sometimes the imperfect bridge of cooling lava is pierced with fifty or sixty large, rough, conical chimneys, emitting gas, smoke, flame, and lava; and sometimes the vast bridge is broken up, and all these cones submerged and probably fused again by the intense heat of the vast fluid mass supplied fresh from the interior. The mass rises gradually higher and higher, hundreds of feet, till by its immense pressure against the sides of the crater, aided, perhaps, by the power of gas or steam, it forces a passage for miles through the massive walls, and inundates with its fiery deluge some portion of the country below, or passing through it, as a river of fire, pours itself into the sea at the distance of twenty-five miles, thus disturbing with awful uproar the domains of old Neptune, and enlarging the dominions of the Hawaiian sovereign.

“The whole island, with its ample and towering mountains, is often shaken with awful throes, and creation here ‘groaneth and travaileth in pain.’ In July, 1840, a river of lava flowed out from Kilauea, and passing some miles under ground, burst out in the district of Puna, and inundated a portion of the country, sweeping down forests, carrying everything in its way before it, and as a river a mile wide, falling into the sea, and heating the waters of the ocean, making war upon its inhabitants, and by the united action of this volcanic flood and the sea, formed several huge, rough hills of sand and lava along the shore. And still later than the above date, a similar flood has been poured from the summit of Mauna Loa, flowing with terrific force for weeks, and thus elevating a portion of the region between Mauna Loa and Mauna Kea; and so extensive and splendid was this exhibition, that it could be seen from the missionary station at Hilo, a distance of about forty miles.

“After having spent some thirty hours on this king of all the volcanoes, we set out to return. And on our journey we passed over several large tracts of lava of different kinds, some smooth, vitreous and shining, some twisted and coiled like huge ropes, and some consisting of sharp, irregular, loose, rugged volcanic masses, of every form and size, from an ounce in weight to several tuns, thrown, I could not conceive how, into a chaos or field of the roughest surface, presenting a forbidding area of from one to forty square miles in extent; and though not precipitous, yet so horrid as to forbid a path, and to defy the approach of horses and cattle. In the crevices of the more solid lava are found the _ohelo_, which somewhat resembles the whortleberry, nourished by frequent showers and dew. At ten o’clock we halted for breakfast, and by the time the sun was setting had reached Waimea, thus completing our excursion to this vast volcano, which is truly _one of the wonders of the world_!”

THE PEAK OF DERBYSHIRE.

This peak consists of a chain of high mountains in the county of Derby, in England, and has been long celebrated, as well on account of its mineral productions, and natural curiosities in general, as of what are called its seven wonders. Six of these are natural, namely, Poole’s Hole, Elden Hole, the Peak Cavern, or the Devil’s Hole, Mam Tor, St. Ann’s Well, and the Ebbing and Flowing Well. Having described these, we shall add a more recent discovery, that of the Crystallized Cavern, which possesses an equal interest.

Poole’s Hole, lying about a mile to the westward of Buxton, is a vast cavern formed by nature in the limestone rock, and was, according to tradition, the residence of an outlaw, named Poole. The entrance is low and contracted, and the passage narrow; but this widening, at length, leads to a lofty and spacious cavern, from the roof of which stalactites or transparent crystals, formed by the constant dropping of water laden with calcareous matter, hang in spiral masses. Other portions of these petrifactions drop and attach themselves to the floor, rising in cones, and become what are termed stalagmites.

One of the dropping stalactites, of an immense size, called the Flitch of Bacon, occurs about the middle of the cavern, which here becomes very narrow, but soon spreads to a greater width, and continues large and lofty until the visitor reaches another surprisingly large mass of stalactite, to which the name of Mary Queen of Scots’ Pillar is given, from the tradition that this unfortunate queen once paid a visit to the cavern, and proceeded thus far into its recesses. As this pillar can not be passed without some difficulty, few persons venture beyond it; nor does it seem desirable, as, by proceeding thus far, a very competent idea of the

cavern may be formed. The path hitherto is along the side, and at some hight from the bottom of the cavern; but to visit and examine the interior extremity, it becomes necessary to descend a few yards by very slippery and ill-formed steps. The path at the bottom is tolerably even and level for about sixty feet, when an almost perpendicular ascent commences, which leads to the extremity of the fissure, through the eye of St. Anthony's Needle, a narrow strait, beyond which the steepness of the way is only to be surmounted by clambering over irregular masses of rock. The cavern terminates nearly three hundred feet beyond the Queen of Scots' pillar. Toward the end is an aperture through a projecting rock, behind which a candle is generally placed, when any person has reached the extremity: when seen at that distance, it appears like a dim star. The visitor returns along the bottom of the cavern, beneath a considerable portion of the road by which he entered; and, by thus changing the path, has an opportunity better to ascertain the hight and width of the cavern in every part, and to view other accumulated petrifactions, some of which are of a prodigious size, and of an extraordinary form. In one part of this passage is a fine spring of transparent water; and a small stream, which becomes more considerable in rainy seasons, runs through the whole length of the cavern. Its sound, in passing through this spacious and lofty concavity, which resembles the interior of a Gothic cathedral, has a fine effect. To the right, in a small cavern called Poole's chamber, is a curious echo.

The various masses of stalactical matter which are everywhere met with in this natural excavation, and which reflect innumerable rays from the lights carried by guides, are distinguished by the names of the objects they are fancied most to resemble. Thus we have Poole's saddle, his turtle, and his woolsack; the lion, the lady's toilet, the pillion, the bee-hive, &c. It should be noticed, however, that the forms are constantly varied by the percolation of the water through the roof and sides of the rock. The subterraneous passage is nearly a half a mile in length.

ELDEN HOLE.

Elden Hole is situated on the side of a gentle hill about a mile to the north-west of the village of Peak Forest. It is a deep chasm in the ground, surrounded by a wall, of uncemented stones, to prevent accidents. This fissure or cleft in the rock has been the subject of many exaggerated descriptions and superstitious reports, having been represented not only as unfathomable, but as teeming, at a certain depth, with so impure an air, that it could not be respired without immediate destruction. Mr. Lloyd, however, who descended it about seventy years ago, has proved the absurdity of these relations, in a paper, of which the following is a brief abstract, published in the Philosophical Transactions.

For the first sixty feet, he observes, he descended somewhat obliquely, the passage then becoming difficult from projecting crags. At the further depth of thirty feet, the inflection of his rope varied at least eighteen feet from the perpendicular. The breadth of the chink was here about nine feet, and the length eighteen; the sides being irregular, moss-grown, and wet. Within forty-two feet of the bottom, the rock opened on the east, and he swung till he reached the floor of a cave, one hundred and eighty-six feet only from the mouth, the light from which was sufficiently strong to permit the reading of any book. The interior of the chasm he describes as consisting of two parts, which communicate with each other by a small arched passage, the one resembling an oven, the other the dome of a glass-house. On the south side of the latter, was a small opening, about twelve feet in length, and four feet in hight, lined throughout with a kind of sparkling stalactite, of a fine deep yellow color, with petrifying drops hanging from the roof. Tracing the entrance he found a noble column, above ninety feet high, of the same kind of incrustation. As he proceeded to the north, he came to a large stone which was covered with the same substance; and beneath it he found a hole six feet in depth, uniformly lined with it. From the edge of this hole sprung up a rocky ascent, sloping, like a buttress, against the side of the cavern, and consisting of vast, solid, round masses of the same substance and color. Having climbed this ascent to the hight of about sixty feet, he obtained some fine pieces of stalactite, which hung from the craggy sides of the cavern. Descending with some difficulty and danger, he proceeded in the same direction, and soon came to another pile of incrustations of a brown color, above which he found a small cavern, opening into the side of the vault, which he now entered. Here he saw vast masses of stalactite, hanging like icicles from every part of the roof: several of these were four and five feet long, and thick as a man's body. The sides of the largest cavern were chiefly lined with incrustations of three kinds, the first of which was a deep yellow stalactite; the second, a thin coating which resembled a pale stone-color varnish, and reflected the light of the candle with great splendor; and the third, a rough efflorescence, the shoot of which resembled a rose flower.

Some more recent visitors have thus stated the result of their observations and inquiries relative to Elden Hole. They describe the mouth of this chasm as opening horizontally, in a direction from north to south; its shape being nearly that of an irregular ellipse, about ninety feet in length, and twenty-seven in breadth at the widest part. The northern end is fringed with small trees; and moss and underwood grow out of the crevices on each side, to the depth of forty or fifty feet. As the fissure recedes from the surface, it gradually contracts; and at the depth of about seventy feet inclines considerably to the west, so as to prevent its course from being

further traced. Notwithstanding the obstacles of the bushes and projecting masses of stone, it was sounded, and its depth found not to exceed two hundred and two feet, an estimate which corresponds with the assertion of three miners, who had descended in search of the bodies of individuals who were missing, and were supposed to have been robbed, murdered, and thrown into this frightful abyss.

PEAK CAVERN.

Peak cavern, also called the Devil's Hole, is one of those magnificent, sublime, and extraordinary productions of nature, which constantly excite the wonder and admiration of their beholders. It has accordingly been considered one of the principal wonders of Derbyshire, and has been celebrated by several poets. It lies in the vicinity of Castleton, and is approached by a path at the side of a clear rivulet, leading to the fissure, or separation of the rock, at the extremity of which the cavern is situated. It would be difficult to imagine a scene more august than that which presents itself to the visitor at its entrance: on each side, the huge gray rocks rise almost perpendicularly, to the hight of nearly three hundred feet, or about seven times the hight of a modern house, and meeting each other at right or cross angles, form a deep gloomy recess. In front, it is overhung by a vast canopy of rock, assuming the appearance of a depressed arch, and extending, in width, one hundred and twenty feet, in hight forty-two, and in receding depth about ninety. After penetrating about ninety feet into the cavern, the roof becomes lower, and a gentle descent leads, by a detached rock, to the interior entrance of this tremendous hollow. Here the light of day, having gradually diminished, wholly disappears; and the visitor is provided with a torch to illumine his further progress.

The progress now becoming extremely confined, he is obliged to proceed, in a stooping posture, about twenty yards, when he reaches a spacious opening, named the Bellhouse, and is thence led to a small lake, called the First Water, about forty feet in length, but not more than two or three feet in depth. Over this he is conveyed in a boat to the interior of the cavern, beneath a massive vault of rock, which in some parts descends to within eighteen or twenty inches of the water. "We stood some time," says M. de St. Fond, "on the brink of this lake; and the light of our dismal torches, which emitted a black smoke, reflecting our pale images from its bottom, we almost conceived we saw a troop of specters starting from an abyss to welcome us. The illusion was extremely striking."

On landing, the visitor enters a spacious vacuity, two hundred and twenty feet in length, two hundred feet in breadth, and in some parts one hundred and twenty feet in hight, opening into the bosom of the rock; but, from the want of light, neither the distant sides nor the roof of this abyss, can be seen. In a passage at the inner extremity of this vast cave, the stream which flows through the whole length of the cavern, spreads into what is called the Second Water, and near its termination is a projecting pile of rocks, known by the appellation of Roger Rain's House, from the incessant fall of water in large drops through the crevices of the roofs. Beyond this, opens another tremendous hollow, called the Chancel, where the rocks are much broken, and the sides covered with stalactical or petrified incrustations. Here the visitor is surprised by a vocal concert which bursts in discordant tones from the upper regions of the chasm. "Still," observes a tourist, "this being unexpected, and issuing from a quarter where no object can be seen, in a place where all else is still as death, is calculated to impress the imagination with solemn ideas, and can seldom be heard without that emotion of awe and pleasure, astonishment and delight, which is one of the most interesting feelings of the mind." At the conclusion of the strain, the choristers, who consist of eight or ten women and children, are seen ranged in the hollow of the rock, about fifty feet above the floor.

The path now leads to a place whimsically called the Devil's Cellar and Half-way House, and thence, by three natural and regular arches, to a vast concavity, which, from its uniform bell-like appearance, is called Great Tom of Lincoln. When illuminated by a strong light, this concavity has a very pleasing effect; the symmetrical disposition of the rocks, the stream flowing beneath, and the spiracles in the roof, forming a very interesting picture. From this point the vault gradually descends, the passage contracts, and at length does not leave more than sufficient room for the current of the stream, which continues to flow through a subterraneous channel of several miles in extent, as is proved by the small stones brought into it after great rains, from the distant mines of the Peak Forest.

The entire length of this wonderful cavern is twenty-two hundred and fifty feet, or nearly half a mile; and its depth, from the surface of the Peak mountain, about six hundred and twenty feet. A curious effect is produced by the explosion of a small quantity of gunpowder, wedged into the rock in the interior of the cavern; for the sound appears to roll along the roof and sides, like a tremendous and continued peal of thunder. The effect of the light, on returning from these dark recesses, is particularly impressive; and the gradual illumination of the rocks, which becomes brighter as the entrance is approached, is said to exhibit one of the most interesting scenes that ever employed the pencil of an artist, or fixed the admiration of a spectator.

MAM TOR.

Mam Tor or the Shivering Mountain, is a huge precipice facing the east or south-east, chiefly composed of a peculiar kind of slate, which, although very hard before it is exposed to the air, very easily crumbles to dust on such exposure. Hence it is perpetually wasted by the action of the rain and snow; while the harder and larger masses of stone being thus loosened and disengaged, necessarily fall from their positions, and this with a rushing noise which is occasionally so loud as to be heard at Castleton, a distance of two miles. The valley beneath is overwhelmed with their fragments to the extent of half a mile. In many parts of the precipice, they produce, before their descent, a cavernous appearance, and even a romantic overhanging scenery, highly dangerous to be approached. It is affirmed by the most intelligent of the neighboring inhabitants, that this mountain chiefly wastes during violent storms of snow and rain; and Mr. Martin, who published an account of Mam Tor, in the Philosophical Transactions for 1729, affirms that the decay is not constantly the same. He not only surveyed it closely, but ascended the steepest part of the precipice, without tracing any other shivering in the mountain, beside that which was occasioned by the treading of his feet in the loose crumbled earth.

THE EBBING AND FLOWING WELL.

In the vicinity of Chapel-en-le-Frith is a steep hill, rising to the hight of more than a hundred feet, immediately beneath which this natural phenomenon lies. It is of an irregular form, but nearly approaching to a square, from two or three feet in depth, and about twenty feet in width.

Its ebbings and flowings are irregular, and dependent on the quantity of rain which falls in the different seasons of the year; when it begins to rise, the current can only be perceived by the slow movement of the blades of grass, or other light bodies floating on the surface; notwithstanding which, before the expiration of a minute, the water issues with a gurgling noise, in considerable quantities, from several small apertures on the south and west sides. The interval of time between the ebbing and flowing is not always alike: consequently the proportion of water it discharges at different periods, also varies. In the space of five minutes flowing, the water occasionally rises to the hight of six inches; and, after remaining a few seconds stationary, the well assumes its former quiescent state.

The cause of the intermittent flowing of this well may be satisfactorily explained, on the principle of the action of the siphon, and on the supposition of a natural one communicating with a cavity in the hill, where the water may be supposed to accumulate; but for the phenomenon of its ebbing, no satisfactory reason has been assigned. The opinion of a second siphon, (which is ingeniously advanced by one tourist,) that begins to act when the water rises, is inconsistent with the appearance of the well, and therefore can not be just.

ST. ANNE'S WELL.

This well, the usual resort of the company who frequent Buxton to drink the waters, has been classed among the wonders of the peak, on account of this singularity, that within five feet of the hot spring by which it is supplied, a cold one arises. This is not, however, the only well of the kind, since hot and cold springs rise near each other in many parts of England, and in other countries. The water is conveyed to the well, which is an elegant classical building, in the Grecian style, from the original spring, by a narrow passage, so close and well contrived as to prevent it from losing any considerable portion of its heat, and is received in a white marble bason. It is not so warm as the Bath water, its temperature being about eighty degrees of Fahrenheit.

THE CRYSTALLIZED CAVERN.

The crystallized cavern, the new wonder of the Derbyshire Peak, was discovered some years ago in the vicinity of the village of Bradwell. We extract the following particulars of this singular and beautiful natural excavation, from Hutchinson's tour in the High Peak.

The entrance is rather terrific than grand; and the descent, for about thirty paces, very abrupt. The visitor has then to pass along the inclined way for nearly a quarter of a mile, the opening being so low that it is impossible to proceed, in particular parts, in an erect posture. The different crystallizations which now attract his attention on every side, soon make him forget the irksomeness of the road, and banish every idea of fatigue. New objects of curiosity crowd one on the other. In a place called the Music Chamber, the petrifactions take the semblance of the pipes of an organ; while in other parts, these stalactites are formed into elegant small colonnades, with as exact a symmetry as if they had been chiseled by the most skillful artist. Candles judiciously disposed within

them, give an idea of the imaginary palaces of fairies, or of sylphs and genii, who have chosen this for their magnificent abode.

Still he has seen nothing comparable to what he is now to expect; for, at the distance of about a hundred paces further, by a rugged descent, he enters what is called the Grotto of Paradise. This heavenly spot, for it can not be compared to anything terrestrial, is, of itself, a beautiful crystallized cavern, about twelve feet high, and in length twenty feet, pointed at the top, similar to a Gothic arch, with a countless number of large stalactites hanging from the roof. Candles placed among them give some idea of its being lighted up with elegant glass chandeliers; while the sides are entirely incrusted, and brilliant in the extreme. The floor is checkered with black and white spar. It has, altogether, a most novel and elegant appearance. This glittering apartment would be left by the visitor with a certain degree of regret, did he not expect to see it again on his return.

Still continuing a route similar to the one he has passed, in the course of which his attention is occasionally arrested by the curiosities of the place, and by the gentle droppings of the water, which scarcely break the solemn silence of the scene, he at length reaches the Grotto of Calypso, and the extremity of the cavern, upward of two thousand feet from the entrance. To see this grotto to advantage, he has to ascend about six feet, into a recess. There, the beautiful appearance of the different crystallizations, some of them of an azure cast, and the echoes reverberating from side to side, make him fancy he has reached the secluded retreat of some mythological deity.

Returning by the same path for a considerable distance, another cavern, which branches in a south-west direction from the one already explored, presents itself. The roads here are still more difficult of access, but the stalactites are certainly most beautiful. Many of them, more than a yard in length, are pendent from the roof, and the greater part do not exceed the dimension of the smallest reed. The top and sides of this cavern are remarkably smooth, particularly at the part called the Amphitheater. In general, the stone is of a very dark color, to which the transparent appearances before mentioned, with each a drop of water hanging at its extremity, form a fine contrast.

SPEEDWELL LEVEL.

In the Speedwell Level, or Navigation Mine, in the vicinity of Castleton, art has been combined with the subterraneous wonders of nature. Being provided with lights, the guide leads the visitor beneath an arched vault, by a flight of one hundred and six steps, to the sough or level, where a boat is ready for his reception, and is put in motion by pushing against pegs driven into the wall for that purpose. After proceeding about one-third of a mile through various caverns, the level bursts into a tremendous gulf, the roof and bottom of which are invisible, but across which the navigation has been carried, by throwing a strong arch over a part of the fissure where the rocks are least separated. Here, leaving the boat, and ascending a stage erected above the level, the attention of the visitor is directed to the dark recess of the abyss beneath his feet; and firm indeed must be his resolution, if he can contemplate the scene unmoved, and without an involuntary shudder. To the depth of ninety feet all is vacuity and gloom; but beyond that commences a pool of Stygian waters, not unaptly named the Bottomless Pit, the prodigious range of which may in some measure be conceived, by the circumstance of its having swallowed up more than forty thousand tuns of rubbish, made in blasting the rock, without any apparent diminution either of its depth or extent. The guides assert that the former has not been ascertained; but there is reason to believe that its actual depth in standing water is about three hundred and twenty feet. There can not, however, be a doubt but that this abyss has communications with others still more deeply situated in the bowels of the mountain, and into which the precipitated rubbish has found a passage. The superfluous water of the level falls through a water-gate into this profound caldron, with a noise like a rushing torrent.

This fissure is calculated to be about eight hundred feet beneath the surface of the mountain; and so great is its reach upward, that rockets of sufficient strength to ascend four hundred and fifty feet, have been fired without rendering the roof visible. The effect of a Bengal light discharged in this stupendous cavity, is extremely magnificent and interesting.

THE HIGH TOR.

This is one of the many sublime objects presented by Matlock dale, the beauties of which will be cursorily described, in proportion as these objects pass under our review.

In approaching the bath, which is nearly a mile to the south-west of the village of Matlock, a specimen of the scenery by which this charming vale is distinguished, presents itself. The entrance is through a rock, which has been blasted for the purpose of opening a convenient passage; and here a scene which blends the constituent principles of the picturesque, the beautiful and the sublime, opens suddenly on the view. Through the middle of a narrow plain flows the Derwent, overhung by a profusion of luxuriant beeches

and other drooping trees. Toward the east are gently rising grounds, and on the west the huge mural banks of the vale stretch along, the white face of the rock of which they are composed occasionally displaying itself through the woody clothing of their sides and summits. This magnificent scenery is singularly contrasted by the manufactories and lodging-houses at the bottom of the vale.

To see this magic spot to the greatest advantage, it should be entered at its northern extremity, its beauties then succeeding each other in a proper gradation, and their grandeur and effect being rendered more impressive. The chief attention is now attracted to the High Tor, a grand and stupendous rock, which appears like a vast abrupt wall of limestone, and rises almost perpendicularly from the river, to the hight of upward of three hundred and fifty feet. The lower part of this majestic feature is shaded by yew-trees, elms, limes, and underwood of various foliage; but the upper part, for fifty or sixty yards, presents a rugged front of one broad mass of perpendicular rock. From its summit the vale is seen in all its grandeur, diversified by woods of various hues and species. The windings of the Derwent, the grayish-colored rocks, and the white fronts of the houses, embosomed amid groves of trees which sprout from every crevice of the precipices, give variety and animation to a scene of wonderful beauty.

[Illustration: BRIDGE OVER THE WYE.]

CHEE TOR.

In a romantic and deep hollow, near the little village of Wormhill, the river Wye flows beneath this stupendous mass of rock, which rises perpendicularly more than three hundred and sixty feet above its level. The channel of the river, which meanders at the base, is confined between huge rocks of limestone, having such a general correspondence of situation and form, as to render it probable that they were once united. In some parts they are partially covered with brushwood, nut-trees and mountain-ash; while in others, they are totally naked, precipitous and impending. The chasm runs in a direction so nearly circular, that the sublime Chee Tor, and its dependent masses of rock, are almost insulated by the river which rolls at their feet. Its length, as far as it possesses any considerable beauty, is between five and six hundred yards; a distance which presents several picturesque and interesting views, the general effect of the fine scenery being enhanced by the plantations on the neighboring hights, and by a spring which flows into the river near the bottom of a deep descent, as well as by a romantic bridge over the river itself, a representation of which may be seen in the cut above. Not far from here is the well known Masson hill, celebrated in Darwin's "Loves of the Plants," which is so high as to overlook the country to a vast extent, and compared with which even the High Tor seems considerably diminished in grandeur and sublimity; but this effect is partly compensated by the extent of the prospect, and the variety of objects it comprehends. The hight of this eminence is about seven hundred and fifty feet, the path to its summit having been carried, in a winding direction, through a grove. About half-way in the ascent is an alcove, from which an extensive view of a great part of Matlock dale may be seen, through a fine avenue formed for that purpose.

THE CUMBERLAND CAVERN.

To the west and north-west of the village of Matlock, are three apertures in the rock, respectively named the Cumberland, Smedley, and Rutland caverns. The former of these is well deserving of a short notice.

The entrance is partly artificial, to afford a greater facility to the visitor, who has to descend fifty-four steps. The cavern now opens on him in solitary grandeur. Huge masses of stone are piled on each other with a tremendous kind of carelessness, evidently produced by some violent concussion, though at an unknown period. He is conducted to a long and wide passage, the roof of which has all the regularity of a finished ceiling, and is bespangled by spars of various descriptions. From above, from beneath, and from the sides, the rays of the lights are reflected in every direction. In an adjacent compartment, rocks are heaped on rocks in terrible array, and assume a threatening aspect. Next is an apartment decorated with what, in the language of the country, is called the snow-fossil, a petrifaction which, both in figure and color, resembles snow, as it is drifted by the winter storm into the cavities of a rock. Near the extremity of the cavern are to be seen fishes petrified and fixed in the several strata which form the surrounding recess. One of these has its back jutting out of the side of the earth, as if it had been petrified in the act of swimming. In another branch of the cavern a well has been found of a considerable depth.

REYNARD'S HOLE.

After having proceeded about a mile in Dove dale, the romantic and sublime beauties of which will be hereafter noticed, by a route constantly diversified by new fantastic forms, and uncouth combinations of rock, the visitor is led to a mass of mural rock, bearing the above name, and perforated by nature into a grand arch, nearly approaching to the shape of the sharply pointed Gothic style of architecture, about forty-five feet in hight, and in width twenty. Having passed through this arch, a steep ascent leads to a natural

cavern, called Reynard's Hall, forty-five feet in length, fifteen in breadth, and in hight thirty. From the mouth of this cavern the scenery is singular, beautiful and impressive. The face of the rock which contains the arch, rises immediately in front, and would effectually prevent the eye from ranging beyond its mighty barrier, did not its center open into the above-mentioned arch, through which is seen a small part of the opposite side of the dale, consisting of a mass of gloomy wood, from the shade of which a huge detached rock, solitary, cragged, and pointed, starts out to a great hight, and forms an object truly sublime. This rock, which has received the name of Dove Dale Church, is pleasingly contrasted by the little pastoral river, Dove, and by its verdant turfy banks. A narrow opening at the extremity of the cavern is supposed to lead to other similar cavities in the rock; and on the left is a cavern, about forty feet in length, in breadth fourteen, and in hight twenty-six, called Reynard's Kitchen, from the interior of which a pleasing view is presented of the upper part of the dale, its river and rocks.

After passing Reynard's Hole, already described, the rocks rise more abruptly on either side, and appear in shapes more wild and irregular, but diversified and softened by shrubs.

Dove dale is nearly three miles in length; but from the sinuosity of its course, and its projecting precipices, the views are limited. Throughout the whole of this majestic feature of country, the river Dove flows, in the halcyon days of summer, with soft murmurs, innocently and transparently over its pebbly bed; but swells into rage during the winter months. Little tufts of shrubs and underwood form islands in miniature within its bed, which enlarge and swell the other objects. The scenery of this dale is distinguished from almost every other in the united kingdoms, by the rugged, dissimilar, and frequently grotesque and fanciful appearance of the rocks. To employ the words of a tourist here, "It is, perhaps, on the whole one of the most pleasing sceneries of the kind anywhere to be met with. It has something peculiarly characteristic. Its detached, perpendicular rocks stamp it with an image entirely its own, and for that reason it affords the greater pleasure. For it is in scenery as in life. We are most struck with the peculiarity of an original character, provided there be nothing offensive

THOR'S HOUSE.

"Where Hamps and Manifold, their cliffs among, Each in his flinty channel winds along, With lucid lines the dusky moor divides, Hurrying to intermix their sister tides, Where still their silver-bosom'd nymphs abhor The blood-smear'd mansion of gigantic Thor— Erst fires volcanic in the marble womb Of cloud-wrapp'd Whetton rais'd the massy dome; Rocks rear'd on rocks, in huge disjointed piles, Form the tall turrets, and the lengthen'd aisles; Broad pond'rous piers sustain the roof, and wide Branch the vast rainbow ribs from side to side. While from above, descends, in milky streams, One scanty pencil of illusive beams, Suspended crags, and gaping gulfs illumes, And gilds the horrors of the deepen'd glooms. Here oft the Naiads, as they chanc'd to stray Near the dread Fane, on Thor's returning day, Saw from red altars streams of guiltless blood, Stain their green reed-beds, and pollute their flood; Heard dying babes in wicker prisons wail, And shrieks of matrons thrill the affrighted gale; While from dark caves infernal echoes mock, And fiends triumphant shout from every rock!"—DARWIN.

This spacious cavern is situated about two miles above Dove dale, near the village of Whetton; and tradition says the Druids here offered human sacrifices, inclosed in wicker idols, to Thor, the principal deity of the Saxons and Danes, in the ages of their idolatrous worship. Beneath is an extensive and romantic common, where the rivers Hamps and Manifold sink into the earth, and rise again in Islam gardens. These rivers merit a brief description. A wooden bridge has been thrown over an abyss in the rock, out of which the river Manifold bursts with surprising force, after having pursued a subterraneous course of five miles, from the point where it had engulfed itself in the earth, called Weston hill. At the further distance of twenty yards a similar phenomenon occurs; for here another fissure of a rock presents itself, whence the river Hamps throws its water into day. This river disappears at Leek-water Houses, a place between Leek and Ashbourn; thus pursuing a subterraneous course of seven miles, before it again emerges into light. On their emersion, the temperatures of the two rivers differ two degrees and a half, the Hamps being the coldest.

THE LOVERS' LEAP.

The environs of Buxton abound in romantic sites, among the most striking of which is the dale named the Lovers' Leap, on account of a vast precipice which forms one side of a narrow chasm, and from the summit of which a love-lorn female is said to have precipitated herself into the rocky gulf below. Each side of this beautiful dell is bounded by elevated rocks, the proximity of which is such, that for a considerable space there is scarcely room for the passage of the bubbling current of the Wye. Several of these rocks are perpendicular, and bare of vegetation; while others are covered with ivy, yew and ash-wood, with a craggy steep occasionally starting through the verdure. A circular road, extending in circumference about three miles, passes in view of the most romantic part of this dale, and forms a very agreeable walk or ride from Buxton. At the southern extremity the scenery assumes a

milder character, the hollow taking the name of Mill dale, from a mill which is turned by the stream. In conjunction with a rude bridge, a mountainous path, and other rural objects, this forms a very picturesque view. Another fine scene is presented by a lofty rock, called Swallow Tor, which soars over a mass of wood, the river at its base foaming and roaring over broken masses of limestone.

THE MOORS.

Derbyshire is everywhere fruitful in natural curiosities, among the most striking of which may be reckoned the moors of Hope parish, inasmuch as they afford an extraordinary instance of the preservation of human bodies interred in them. In the year 1674, a grazier and his female servant, in crossing these moors on their way to Ireland, were lost in the snow, with which they were covered from January to May, and being then discovered, the bodies were so offensive that the coroner ordered them to be buried on the spot. After a lapse of twenty-nine years, when the ground was opened, they were in no way changed, the color of the skin being fair and natural, and the flesh as soft as that of persons newly dead. For twenty succeeding years they were occasionally exposed as a spectacle, but carefully covered after being viewed. They lay at the depth of about three feet, in a moist soil or moss. The minister of Hope parish was present in 1716, forty-two years after the accident, at a particular inspection of these bodies. On the stockings being drawn off, the man's legs, which had not been uncovered before, were quite fair: the flesh, when pressed by the finger, pitted a little; and the joints played freely, without the least stiffness. Such parts of the clothing as the avidity of the country people, to possess so great a curiosity, had spared, were firm and good; and a piece of new serge, worn by the woman, did not appear to have undergone any sensible change.

OTHER ENGLISH CURIOSITIES.

Having thus brought to a conclusion our details relative to the wonders of the peak, and the various and interesting natural curiosities there to be found, we subjoin a brief notice of several others, which have, in England, attracted the notice of travelers.

Among the extraordinary caverns to be found in the mountains of the north of England, may be reckoned Yordas cave, in the vale of Kingsland, in Yorkshire, which contains a subterraneous cascade. Whethercot cave, not far from Ingleton, is divided by an arch of limestones, passing under which is seen a large cascade falling from a hight of more than sixty feet. The length of this cave is about one hundred and eighty feet, and the breadth ninety.

There are also in various parts of England many remarkable springs, of which some are impregnated either with salt, (as that of Droitwich, in Worcestershire,) or sulphur, (as the famous well of Wigan, in Lancashire,) or bituminous matter, (as that at Pitchford, in Shropshire.) Others have a petrifying quality, as that near Lutterworth, in Leicestershire, and a dropping well in the West Riding of Yorkshire. And, finally, some ebb and flow, as that of the peak described above, and Laywell near Torbay, whose waters rise and fall several times in an hour. To these we may add that remarkable fountain near Richard's Castle, in Herefordshire, commonly called Bone Well, which is generally full of small bones, like those of frogs or fishes, though often cleared out. At a cliff near Wigan, in Lancashire, is the famous burning well: the water is cold, neither has it any smell; yet so strong a vapor of sulphur issues out with the stream, that upon applying a light to it, the top of the water is covered with a flame, like that of burning spirits, which lasts several hours, and emits such a heat that meat may be boiled over it.

MOUNTAINS OF GREAT BRITAIN.

The British isles present many mountains of a bold and imposing character: when contrasted, however, with those which have been already described, they must be considered as comparatively diminutive.

BEN NEVIS.

The loftiest of these mountains is Ben Nevis, in Scotland, its elevation above the level of the sea being forty-three hundred and eighty feet, or somewhat more than four-fifths of a mile. It terminates in a point, and elevates its rugged front far above all the neighboring mountains. It is of easy ascent; and at the perpendicular hight of fifteen hundred feet, the vale beneath presents a very agreeable prospect, the vista being beautified by a diversity of bushes, shrubs, and birch woods, besides many little verdant spots. The sea and the shore are also seen.

At the summit, the view extends at once across the island, eastward toward the German sea, and westward to the Atlantic ocean. Nature here appears on a majestic scale and the vastness of the prospect engages the whole attention, at the same time the objects in view are of no common dimensions. Just over the opening of the sound, at the south-west corner of Mull, Colonsay rises

out of the sea like a shade of mist, at the distance of more than ninety miles. Shuna and Lismore appear like small spots of rich verdure, and, though nearly thirty miles distant, seem quite under the spectator. The low parts of Jura can not be discerned, nor any part of Isla; far less the coast of Ireland, as has been asserted. Such is, however, the wide extent of view, that it extends one hundred and seventy miles from the horizon of the sea at the Murray frith, on the north-east, to the island of Colonsay, on the south-west.

On the north-east side of Ben Nevis is an almost perpendicular precipice, certainly not less than fourteen hundred feet in depth; probably more, as it appears to exceed the third part of the entire hight of the mountain. A stranger is astonished at the sight of this dreadful rock, which has a quantity of snow lodged in its bosom throughout the whole year. The sound of a stone thrown over the cliff to the bottom, can not be heard when it falls, so that it is impossible to ascertain in that way the hight of the precipice.

SNOWDON.

This is the loftiest of the Welch mountains, its elevation above the level of the sea being thirty-seven hundred and twenty feet, or nearly three-quarters of a mile. It is accessible on one side only, its flanks being in every other quarter precipitous. Its aspect soon convinces the spectator that he is not to look to the Alps alone, or to the rocky regions of Altai, bordering on Siberia, for romantic scenes of wildness, confusion and disorder. Snowdon presents them in all their rude and native majesty.

In the ascent, a narrow path not more than nine feet in width, leads along the margin of a frightful precipice of nearly fifteen hundred feet in extent, so perpendicular that it can not be approached without terror; while to the north of the summit nearest to the one the most elevated, a semi-amphitheater of precipitous rocks, also of a great hight, is seen; and, behind this summit, another semicircle of equal depth and extent. The loftiest summit here appears to descend in the form of a sharp ridge, and beneath it another appears, which, on account of its color, is called the Black Rock. From the upper part of the valley, one of these summits presents a grand, vertical, and very elevated point.

The bottom of each of the amphitheaters of rocks, thirteen in number, is occupied by a small lake of a circular form, and very deep. The one known by the name of Llyn Glass is remarkable for its green hue, derived from its being impregnated with copper, several mines of which line its borders. Than this mountain, nothing in the Alps can be more arid and desert, those regions alone excepted which are too lofty to admit of vegetation. Here there is not a tree, not even a shrub; small patches of verdure, which sheep can scarcely reach, are alone to be seen. Its summit, or highest peak, is a flat of about eighteen feet only in circumference. Thence may be seen a part of Ireland, a part of Scotland, Cumberland, Lancashire, Cheshire, all North Wales, the isle of Man, and the Irish and British seas, with innumerable lakes; while the whole island of Anglesea is displayed so distinctly, that, its flat uncultivated plains, bounded by the rich Parys mountain in the vicinity of Holyhead, may be descried as on a map.

CADER IDRIS.

To the south of Dolgellau, Cader Idris towers above the subject mountains, which seem to retire, to allow its base more room to stand, and to afford to their sovereign a better display. It stands on a broad rocky base, with a gradual ascent to its brow, when the peaks elevate themselves in a manner at once abrupt, picturesque and distinct. The point emphatically named Cader, appears to the eye below to be little superior in hight to the saddle; but the third point, or apex, which has a name expressive of its sterility, is neither equal in hight, nor in beauty, to the other two. On its loftiest peak a stone pillar has lately been erected, for the purpose of a trigonometrical survey.

Cader Idris is the commencement of a chain of primitive mountains, and is computed to be twenty-eight hundred and fifty feet above the green of Dolgellau, and thirty-five hundred and fifty feet, or nearly three-fourths of a mile above the level of the sea. It has been conjectured that at some remote period it was a volcano of immense magnitude.

The tract to the south of Cader Idris, as far as Talylyn and Malwydd, is peculiarly grand. High and rugged mountains of every possible form, close in on all sides, while huge masses of rock hang over, or lie scattered in misshapen fragments by the side of the road. To add to the effect of this scene, the river Difi forms one continued cataract for five or six miles, overflowing with the innumerable tributary torrents which precipitate themselves from the highest summits of the surrounding rocks; while, to crown the whole, the shady head of Cader Idris towers, the majestic sentinel of the group.

PENMAN-MAWR.

The county of Caernarvon, in which this mountain is situated, claims precedency over every other in Wales, for the loftiness of its mountains, and the multitude of the eminences, which in a curved and indented chain, occupy nearly the whole of its extent.

In proceeding from Conway to Bangor, by a route at once picturesque and romantic, and amid a scenery which varies at every step, Penman-mawr discloses to the traveler its bulky head. It protrudes itself into the sea, and exhibits a fine contrast to the fertility which it interrupts, by a rude view of gray weather-beaten stones and precipices. The passage over the mountain was formerly terrific; but the road has been latterly widened and secured, near the verge of the precipice, by a small wall about five feet in hight. It forms the most sublime terrace in the British isles, winding round the mountain on the edge of the abrupt cliff; while the vast impending rocks above, the roaring of the waves at a great distance below, and the frequent howling of the wind, all unite to fill the mind with solemnity and awe.

SKIDDAW.

This English mountain, which has an elevation of thirty-five hundred and thirty feet, or nearly three-fourths of a mile above the level of the sea, is situated in Cumberland. It is more remarkable on account of the scenery over which it presides, and which exceeds in beauty whatever the imagination can paint, than for those bold projections and that rugged majesty which might be expected, but which will be here sought in vain. Except at such a distance as smooths the embossed work of all these rich fabrics, and where its double summit makes it a distinguished object to mark and characterize a scene, it may be considered as a tame and inanimate object.

WHARNSIDE.

In some of the maps of Yorkshire, the hight of this mountain is greatly exaggerated, its elevation above the sea not being more than twenty-five hundred feet, or nearly half a mile. As it is situated in the midst of a vast amphitheater of hills, the prospect it affords is diversified with pleasing objects. On its summit are four or five small lakes, two of which are about nine hundred feet in length, and nearly the same in breadth. A thin seam of coal also occurs near the top, and another is said to correspond with it on the summit of the lofty Colm hill, on the opposite side of Dent dale. Numerous caves and other natural curiosities abound here, as well as on Pennigent, about six miles to the eastward of Ingleborough. These latter mountains do not possess any particular interest.

STROMBOLI.

Stromboli is the principal of the cluster of small islands, lying to the north of Sicily, named the Lipari isles, the whole of which contain volcanoes. At a distance, its form appears to be that of an exact cone, but on a closer examination it is found to be a mountain having two summits of different hights, the sides of which have been torn and shattered by craters. The most elevated summit, inclining to the south-west, is, agreeably to Spallanzani, about a mile in hight.

In this volcanic mountain, the effects of a constantly active fire are everywhere visible, heaping up, destroying, changing, and overturning every instant what itself has produced, and incessantly varying in its operations. At the distance of one hundred miles, the flames it emits are visible, whence it has been aptly denominated the light-house of that part of the Mediterranean sea.

From the more elevated summit, all the inner part of the burning crater, and the mode of its eruption, may be seen. It is placed about half-way up, on the north-west side of the mountain, and has a diameter not exceeding two hundred and fifty feet. Burning stones are thrown up at regular intervals of seven or eight minutes, ascending in somewhat diverging rays. While a portion of them roll down toward the sea, the greater part fall back into the crater; and these being again cast out by a subsequent eruption, are thus tossed about until they are broken and reduced to ashes. The volcano, however, constantly supplies others, and seems inexhaustible in this species of productions. Spallanzani affirms that, in the more violent eruptions, the ejected matter rises to the hight of half a mile, or even higher, many of the ignited stones being thrown above the highest summit of the mountain.

The erupted stones, which appear black in the day-time, have at night a deep red color, and sparkle like fire-works. Each explosion is accompanied by flames or smoke, the latter resembling clouds, in the lower part black, in the upper white and shining, and separating into globular and irregular forms. In particularly high winds from the south or south-east, the smoke spreads over every part of the island. Spallanzani observed this volcano on a particular night, when the latter of these winds blew with great violence. The clear sky exhibited the appearance of a beautiful aurora borealis over that part of the mountain on which the volcano is situated, and which from time to time became more red and brilliant, in proportion as the ignited stones were thrown to a greater hight. The violence of the convulsions depends on that of the wind.

The present crater has burned for more than a century, without any apparent change having taken place in its situation. The side from which the showers of ignited matter fall into the sea, is almost perpendicular, about half a mile broad at the bottom, and a mile in length, terminating above in a point. In rolling down, the lava raises the fine sand like a cloud of dust. While this was observed by Spallanzani, the volcano suddenly made an eruption. Numerous pieces of lava of a dark red color, and enveloped in smoke, were ejected from the top of the precipice, and thrown high into the air. A part of them fell on the declivity, and rolled down, the smaller preceded by the greater; after a few bounds, dashing into the sea, giving out a sharp hissing sound. The more minute fragments, from their lightness, and the hindrance of the sand, rolled slowly down, and striking against each other, produced nearly the same sound as hail-stones falling on a roof. In a few minutes another explosion followed, without any sensible noise; and two minutes after a third eruption took place, with a much louder explosion than the first, and a far more copious ejection of lava. The eruptions, which were almost innumerable during the time Spallanzani remained there, all exhibited the same appearances.

On the night following the one above described, the volcano raged with still greater violence, and rapidly hurled to a great hight, thousands of red-hot stones, forming diverging rays in the air. Those which rolled down the precipice, produced a hail of streaming fire, which illuminated the steep descent. Independently of these ignited stones, there was in the air which hovered over the volcano, a vivid light, which was not extinguished when that was at rest. It was not properly flame, but real light reverberated by the atmosphere, impregnated by extraneous particles, and more especially by the ascending smoke. Besides varying in intensity, it appeared constantly in motion, ascending, descending, dilating and contracting, but always remaining perpendicular over the mouth of the volcano, which showed that it was occasioned by the conflagration within the crater. The detonations in the greater eruptions resembled the roaring of distant thunder, and in the lesser ones, the explosions of a mine. In the smallest they were scarcely audible. Each was some seconds later than the ejection.

Near the mouth of the volcano is a small cavern, a projection above which secures it from the entrance of the ignited stones. From this cavern Spallanzani was enabled to look down into the very bowels of the volcano. He describes the edges of the crater as of a circular form, and not more than three hundred and forty feet in circumference, the internal sides contracting as they descend, and assuming the shape of a truncated inverted cone. The crater itself, to a certain hight, is filled with a liquid red-hot matter, resembling melted brass. This is the fluid lava, which appears to be agitated by two distinct motions, the one intestine, whirling and tumultuous, and the other that by which it is impelled upward. This liquid matter is raised, sometimes with more, and sometimes with less rapidity, within the crater; and when it has reached within twenty-five or thirty feet of the upper edge, a sound is heard not unlike a short clap of thunder, while at the same moment a portion of the lava, separated into a thousand pieces, is thrown up with indescribable swiftness, accompanied by a copious eruption of smoke, ashes and sand. A few moments before the report, the superficies of the lava is inflated and covered with large bubbles, some of which are several feet in diameter; on the bursting of these the detonation and fiery shower take place. After the explosion, the lava within the crater sinks, but soon rises again as before, and new bubbles appear, which again burst and produce new explosions. When the lava sinks, it gives little or no sound; but when it rises, and particularly when it begins to be inflated with bubbles, it is accompanied by a noise similar, in proportion to the difference of magnitude, to that of liquor boiling vehemently in a caldron.

LIPARI.

This island, which has given name to the whole cluster, is deserving of notice on account of its celebrated “_stoves_.” They are the only vestiges of subterraneous conflagration now remaining, and lie to the west of the city, on the summit of a mountain of considerable elevation, called Monte della Stufe, the Mountain of Stoves. They consist of five excavations, in the form of grottos; but two of them have been abandoned on account of the great heat, an exposure to which might cause suffocation. Even the stones are so hot that they can not be touched; but still the heat varies, and experiences all the vicissitudes of volcanoes. The ground is not penetrated with hot vapors issuing from several apertures, as has been asserted. Spallanzani, however, found one from which a thin stream of smoke issued from time to time, with a strong sulphureous smell, indicating the remains of conflagration existing beneath.

It is impossible to fix the exact epoch at which the fires of Lipari were extinguished, or rather the period at which the eruptions ceased, for the existence of the former may be deduced from the hot springs and stoves. Dolomieu thinks the last eruptions are as old as the sixth century of the Christian era, and conjectures that they may have ceased since the fires found a new vent in Vulcano, since he does not entertain any doubt but that the two islands have a subterraneous communication. Of this the inhabitants of Lipari are so well convinced, that they are in the greatest agitation when Vulcano does not smoke, and when its passages are obstructed. They fear shocks and violent eruptions, suspecting even that the fires may again break out in their island.

It is a fact that the earthquakes, which are very frequent, generally cease when the eruptions of Vulcano commence.

VULCANO.

This, which is the last of the Lipari isles, bears in every part the stamp of fire. It was the superstitious belief of the ancient inhabitants that Vulcan had here established his forges, there being constant fires during the night, and a thick smoke throughout the day. It consists of a mountain in the form of a truncated cone, which is, however, merely a case opening and exposing to view a second cone within, more exact than the other, and in which the mouth of the volcano is placed. The latter is thus enveloped on three sides by the ancient cone, and is open only on that side which is immediately washed by the sea.

The base of the interior cone is separated from the steep sides of the ancient crater by a circular valley, which terminates on one side at the junction of the two mountains, and on the other sinks into the sea. In this valley, light pumice-stones are blended with fragments of black, vitreous lava, and buried in ashes perfectly white. The blow of a hammer on these stones produces a loud hollow sound, which reëchoes in the neighboring caverns, and proves that the surface is nothing more than the arch of a vault covering an immense abyss. The sound varies according to the thickness of the crust, which must have considerable solidity to support the weight of the new mountain. This, according to Dolomieu, is higher and steeper than the cone which contains the crater of Etna, and its access still more difficult; its perpendicular hight, however, is not more than twenty-six hundred and forty feet, or half a mile. He represents the crater of Vulcano as the most magnificent he ever saw; and Spallanzani observes that, with the exception of that of Etna, he does not know of any more capacious and majestic. It exceeds a mile in circuit, has an oval mouth, and its greatest diameter is from the south-east to the west, while its depth is not more than a quarter of a mile. The bottom is flat, and from many places streams of smoke exhale, emitting a strong sulphureous vapor. This vast cavity is very regular, and as its entire contents are displayed to the eye, presents one of the grandest and most imposing spectacles in nature. On large stones being rolled down, the mountain reëchoes; and on their reaching the bottom, they appear to sink in fluid. Indeed, with the aid of a glass, two small lakes, supposed to be filled with melted sulphur, have been discovered. The declivity of the interior walls is so great, that, even when there is not any danger from fire, the descent is next to impossible. After considerable difficulty, however, this was accomplished by Spallanzani on the south-east side, the only one accessible. He found the bottom to be somewhat more than one-third of a mile in circumference, and of an oval form. The subterraneous noise was here much louder than on the summit, sounding like an impetuous river foaming beneath, or, rather, like a conflict of agitated waves meeting and clashing furiously together. The ground was likewise in some places perforated with apertures, from which hissing sounds issued, resembling those produced by the bellows of a furnace. It shook when pressed by the feet; and a large piece of lava, let fall five or six feet, produced a subterraneous echoing sound, which continued some time, and was loudest in the center. These circumstances, combined with its burning heat, and the strong stench of sulphur it emits, prove that the fires of the volcano are still active.

Its eruptions have been most considerable during the earthquakes which have desolated Sicily and a greater part of Italy. In the month of March, 1786, after subterraneous thunders and roarings, which were heard over all the islands, to the great terror of the inhabitants, and were accompanied by frequent concussions, the crater threw out a prodigious quantity of sand, mixed with immense volumes of smoke and fire. This eruption continued fifteen days, and so great was the quantity of sand ejected that the circumjacent places were entirely covered with it to a considerable hight. The lava did not flow at the time, at least over the edges of the crater; and indeed, such a current is not remembered by any living person.

THE HIMALAYA MOUNTAINS. BETWEEN INDIA AND THIBET.

“The great Himalayan snowy range,” says Mr. Fraser, “is only the high elevated crest of the mountainous tract that divides the plains of Hindoostan from those of Thibet, or Lesser Tartary. Far as they predominate over, and precipitously as they rear themselves above the rest, all the hills that appear in distant ranges, when viewed from the plains, are indeed only the roots and branches of this great stem; and, however difficult to trace, the connection can always be detected between each inferior mountain and some particular member of its great origin.

“The horizontal depth of this mountainous tract, on that side which overlooks Hindoostan, is no doubt various; but, from the difficulty of the country, a traveler performs a journey of many days before he reaches the foot of the immediate snowy cliffs. The best observations and surveys do not authorize the allowance of more than an average depth of about sixty miles from the plains to the commencement of these, in that part of the country that forms the subject of this narrative. The breadth of the snowy zone itself in all probability varies still more; for huge masses advance in some places into the lower districts, and in others the crest recedes in long ravines, that are the beds of torrents, while behind they are clothed by a succession of the loftier cliffs. Every account we

receive of a passage through them, (and this is no doubt found most commonly where the belt is narrowest,) gives a detail of many days' journey through the deserts of snow and rocks; and it is to be inferred, that on the north-east side they advance to, and retreat from the low ground in an equally irregular manner. Indeed, some accounts would induce the belief, that long ranges, crowned with snow-clad peaks, project in various places from the great spine, and include habitable and milder districts; for, in all the routes of which we have accounts, that proceed, in various directions toward the Trans-Himalayan countries, hills covered with snow are occasionally mentioned as occurring, even after the great deserts are passed, and the grazing country entered. The breadth, then, of this crest of snow-clad rock itself, can not fairly be estimated at less than from seventy to eighty miles.

"The great snowy belt, although its loftiest crest is broken into numberless cliffs and ravines, nevertheless presents a barrier perfectly impracticable, except in those places where hollows that become the beds of rivers have in some degree intersected it, and facilitated approach to its more remote recesses, or courageous and attentive perseverance has here and there, discovered a dangerous and difficult path, by which a possibility exists of penetrating across the range. Few rivers hold their course wholly through it: indeed, in the upper part the Sutlej alone has been traced beyond this rocky barrier; and there is a path along its stream, from different parts of which roads diverge, that lead in various directions through the mountain. No reasonable doubt can now exist of the very long and extraordinary course which this river takes.

"Captain Webb of the Bengal establishment, was at one time employed on a survey of a province of Kumaoon. On the twenty-first day of June, his camp was eleven thousand, six hundred and eighty feet above Calcutta. The surface was covered with very rich vegetation as high as the knee; there were very extensive beds of strawberries in full flower; and plenty of currant-bushes in blossom all around, in a clear spot of rich black mold soil, surrounded by a noble forest of pine, oak and rhododendron. On the twenty-second of June he reached the top of Pilgoenta-Churhaee, (or ascent,) twelve thousand, six hundred and forty-two feet above Calcutta. He was prevented from distinguishing very distant objects by a dense fog; but there was not the smallest patch of snow near him; and the surface, a fat black mold through which the rock peeped, was covered with strawberry plants, (not yet in flower,) butter-cups, dandelions, and a profusion of other flowers. The shoulders of the hill above him, about four hundred and fifty feet more elevated, were covered with the same to the top; and above five hundred feet below was a forest of pine, rhododendron and birch. There was some snow seen below in deep hollows, but it dissolves in the course of the season. These facts led Captain Webb to infer, that the inferior limit of perpetual congelation on the Himalaya mountains is beyond thirteen thousand, five hundred feet, at least, above the level of Calcutta: and that the level of the table-land of Tartary, immediately bordering on their range, is very far elevated beyond eight thousand feet, the hight at which it has been estimated.

"On the night of the sixteenth of July, we slept at Bheemkeudar, near the source of the Coonoo and Bheem streams. There is no wood near this place, even in the very bottom of the valley, and we had left even the stunted birch at a considerable distance below; but there was a profusion of flowers, ferns, thistles, &c., and luxuriant pasturage. Captain Webb's limit of wood is at least as high as twelve thousand to twelve thousand, three hundred feet. I would, therefore, presume the site of Bheemkeudar to be considerably above that level; say thirteen thousand to thirteen thousand, three hundred feet, above the level of Calcutta. From thence we ascended at first rather gradually, and then very rapidly, till we left all luxuriant vegetation, and entered the region of stripped and scattered and partially melting snow. From calculating the distance passed, and adverting to the elevation we had attained, I would presume that this was at least fifteen hundred feet above Bheemkeudar, or from fourteen thousand, five hundred, to fifteen thousand feet above Calcutta.

"We proceeded onward, ascending very rapidly, while vegetation decreased gradually to a mere green moss, with here and there a few snow-flowers starting through it; snow fast increasing, till at length we entered on what I presume was the perennial and unmelting snow, entirely beyond the line of vegetation, where the rock was bare even of lichens: and in this we ascended, as I think, about eight hundred feet; for, though Bamsooroo Ghat may not be so far above this line, we continued ascending, even after crossing that point, and I would incline to estimate this utmost extent of ascent at two thousand feet more, or nearly seventeen thousand feet above the level of Calcutta.

"Whilst proposing to consider the point of sixteen thousand to sixteen thousand, five hundred feet, as that of inferior congelation, I must observe that there was no feeling of _frost_ in the air, and the snow was moist, though hard, chiefly through the influence of a thick mist, which, in fact, amounted to a very small drizzling rain, which fell around: all which would seem to indicate, that the true line of congelation had not there been attained; but we were surrounded by snow which evidently never melted. To a great depth below it extended all over the hills, very little broken, while on the valleys from whence the Coonoo and Bheem streams issue, at full two thousand feet below, it lay covering them and the surrounding mountains in an unbroken mass, many hundred feet thick. Thus, though it may seem contradictory, the line of perpetual congelation, in fact seems fixable at even below the point I have

ventured to indicate, and, I presume, might, on these grounds, be placed somewhere between fifteen and sixteen thousand feet above the level of Calcutta.

“The result of all the considerations that arise out of the foregoing remarks is a belief, that the loftiest peaks of the Himalaya range will be found to fall considerably short of the hight attributed to them by Mr. Colebrooke; and that their loftiest peaks do not more than range from eighteen thousand to twenty-two or twenty-three thousand feet above the level of the sea.

“Having reached the top of an ascent, we looked down upon a very deep and dark glen, called Palia Gadh, which is the outlet to the waters of one of the most terrific and gloomy valleys I have ever seen. But it would not be easy to convey by any description a just idea of the peculiarly rugged and gloomy wildness of this glen: it looks like the ruins of nature, and appears, as it is said to be, completely impracticable and impenetrable. Little is to be seen except dark rock: wood only fringes the lower parts and the waters’ edge: perhaps the spots and streaks of snow, contrasting with the general blackness of the scene, highten the appearance of desolation. No living thing is seen; no motion is visible but that of the waters; no sound is heard but their roar. Such a spot is suited to engender superstition, and here it is accordingly found in full growth. Many wild traditions are preserved, and many extravagant stories related of it.

“The glen above described, is by far the most gloomy, savage scene we have yet met with. I regret that the weather did not permit a sketch of it to be attempted. Beyond this we could see nothing in the course of the river but rocky banks. The opposite side is particularly precipitous; yet along its face a road is carried, which is frequented as much as this, and leads to villages still farther up. By the time we had reached the village, the clouds which had lowered around and sunk down on the hills, began to burst with loud thunder and heavy rain. The noise was fearfully reverberated among the hills; and during the night more than once the sound was heard of fragments from the brows of the mountains, crashing down to the depths below with a terrific din. Our quarters were good. I slept in a temple, neat, clean and secure from the weather.”

[Illustration: SOURCE OF THE JUMNA.]

GUNGOTREE, THE SOURCE OF THE JUMNA, A BRANCH OF THE GANGES, IN THE HIMALAYA MOUNTAINS.

Gungotree, the source of the Jumna, represented in the cut below, the most sacred branch of the Ganges, ought to hold, and does hold the first rank among its holy places. Here all is mythological ground. Here Mahadeo sits enthroned in clouds and mist, amid rocks that defy the approach of living thing, and snows that make desolation more awful. Gods, goddesses and saints here continually adore him at mysterious distance, and you traverse their familiar haunts. But, although Gungotree be the most sacred, it is not the most frequented shrine, access to it being far more difficult than to Buddrinauth; and consequently to this latter, pilgrims flock in crowds, appalled at the remoteness and danger of the former place of worship. This may pretty fully account for the superior riches and splendor of Buddrinauth. Here are temples of considerable extent, priests and officials in abundance, who preserve an imposing exterior, and an appearance venerable from power and comparative magnificence, and consequently procure rich and ample offerings to keep up their comfortable dignity.

The temple of Bhadrinath, is situated on the west bank of the Alackunda, in a valley four miles long, and one mile in its greatest breadth. The east bank rises considerably higher than the west bank, and is on a level with the top of the temple. The position of the sanctuary is considered equidistant from two lofty mountains, which are designated by the names of the Nar and the Narayena Purvatas. The former is to the east, the latter to the west, and completely covered with snow from the summit to the base.

The temple of Bhadri-Nath has more beneficed lands attached to it than any sacred Hindoo establishment in this part of India. It is said to possess seven hundred villages in different parts of Gurwhal and Kumaoon: many of them have been conferred by the government; others have been given in pledge for loans; and some few, purchased by individuals, have been presented as religious offerings.

The annual ceremony of carrying the images of their gods to wash in the sacred stream of the Jumna, is, it appears, one of much solemnity among the inhabitants of the neighborhood; and the concourse of people that here assemble, are busily engaged, and continue to be fully occupied in doing honor to it. They dance to the sound of strange music, and intoxicate themselves with a sort of vile spirit, brewed from grain and particular roots, sometimes, it is said, sharpened by pepper. The dance is most grotesque and savage; a multitude of men taking hands sometimes in a circle, sometimes in a line, beating time with their feet, bend with one accord, first nearly to the earth with their faces, then backward, and then sidewise, with various wild contortions. These, and their uncouth dress of black and gray blankets, give a peculiar air of brutal ferocity to the assemblage. The men dance all day, and in the

evening they are joined by the women, who mix indiscriminately with them, and keep up dancing and intoxication till the night is far advanced. They continue this frantic kind of worship for several days; and, in truth, it is much in unison with their general manners and habits, savage and inconsistent. At a place so sacred, the residence of so many Brahmins, and the resort of so many pilgrims, we might expect to find a strict attention to the forms of religion, and a scrupulous observance of the privations and austerities enjoined by it. So far, however, is this from the truth, that much is met with, shocking even to those Hindoos who are less bigoted.

“There were several points to be arranged,” says Mr. Fraser, “before we could set off for Gungotree, the source of the Jumna. I did not deem it proper to go unarmed; but agreed that only five men should be accoutered to attend us, and that I should myself carry my gun. But all these weapons of war were to be put aside before we got within sight of the holy spot, and deposited in a cave near it, under a guard. I also pledged myself that no use should be made of these instruments, nor any life sacrificed for the purpose of food, either by myself or by any of my people, after leaving the village, until we returned; moreover, that I would not even carry meat of any sort, dead or alive, along with me, but eat only rice and bread. As to the putting off my shoes, they did not even propose it to me, and it could not have been done; but I volunteered to put them off, when entering into the precincts of the temple and holier places, which pleased them greatly. All the Hindoos, including the Ghoorkhas, went from the village barefoot.

“Just at the end of the bridge there is an overhanging rock, under which worship is performed to Bhyram, and a black stone partly painted red, is the image of the god; and here not only were prayers and worship performed, but every one was obliged to bathe and eat bread baked by the Brahmins, as preparatory to the great and effectual ablutions at the holier Gungotree. This occupied a considerable time, as the party was numerous: in the mean time I took a very imperfect sketch of the scene, after which I bathed myself at the proper place, which is the junction of the two streams, while the Brahmin prayed over me. Among the ceremonies performed, he made me hold a tuft of grass while he prayed, which at the conclusion he directed me to throw into the eddy occasioned by the meeting of the two waters.

“By an unpleasant path we reached a step, or level spot on the first stage of the mountain, where, in a thick grove of fir-trees, is placed a small temple to Bhyram, a plain white building, built by order of Umur Sing T’happa, who gave a sum of money to repair the road, and erect places of worship here, and at Gungotree. Having paid our respects to Byramjee, we proceeded along the side of the hill on the right bank, north of the river, gradually ascending by a path equally difficult and dangerous as the first part of our ascent, but more fearful, as the precipice to the river, which rolls below us, increases in hight, and exceedingly toilsome from the nature of the ground over which it passes, and which consists wholly of sharp fragments from the cliffs above, with fallen trunks and broken branches of trees.

“The path increases in difficulty from the very irregular nature of the ground, as well as the steepness of the hill face across which it leads, ascending and descending as the small, though deep water-courses furrow the mountain side, in loose soil, formed of small fragments fallen from above, and which slip down, threatening to carry the traveler to the gulf below. The shapeless blocks of rock now more completely obstruct the way, and for hundreds of yards, at times, the passenger must clamber over these masses, heaped as they are one upon another, in monstrous confusion, and so uncertain and unsteady, that, huge though they are, they shake and move even under the burden of a man’s weight. So painful indeed is this track, that it might be conceived as meant to serve as a penance to the unfortunate pilgrims with bare feet, thus to prepare them for the special and conclusive act of piety they have in view, as the object of their journey to these extreme wilds.

“The spot which bears the name of Gungotree, is concealed by the roughness of the ground, and the masses of fallen rock, so as not to be seen till the traveler comes close upon it. The temple is situated precisely on the sacred stone on which Bhagirutte used to worship Mahadeo, and is a small building of a square shape for about twelve feet high, and rounding in, in the usual form of pagodas, to the top. It is quite plain, painted white, with red moldings, and surmounted with the usual melon-shaped ornaments of these buildings. From the eastern face of the square, which is turned nearly to the sacred source, there is a small projection covered with a stone roof, in which is the entrance facing the east, and just opposite this there is a small pagoda-shaped temple to Bhyramjee. The whole is surrounded by a wall of unhewn stone and lime, and the space this contains is paved with flat stones. In this space too, there is a comfortable but small house for the residence of the Brahmins who come to officiate. Without the inclosure there are two or three sheds constructed of wood, called _dhurum sallahs_, built for the accommodation of pilgrims who resort here; and there are many caves around formed by overhanging stones, which yield a shelter to those who can not find accommodation in the sheds.

“The scene in which this holy place is situated, is worthy of the mysterious sanctity attributed to it, and the reverence with which it is regarded. We have not here the confined gloominess of Bhyram Gattee: the actual dread which can not but be inspired by the

precipices and torrents, and perils of the place, here gives way to a sensation of awe, imposing but not embarrassing, that might be compared to the dark and dangerous pass to the center of the ruins of a former world; for, most truly, there is little here that recalls the recollection of that which we seem to have quitted. The bare and peaked cliffs which shoot to the skies, yield not in ruggedness or elevation to any we have seen; their ruins lie in wild chaotic masses at their feet, and scantier wood imperfectly relieves their nakedness: even the dark pine more rarely roots itself in the deep chasms which time has worn. Thus on all sides is the prospect closed, except in front to the eastward; where, from behind a mass of bare spires, four huge, lofty, snowy peaks arise: these are the peaks of Roodroo-Himala. There could be no finer finishing, no grander close to such a scene, as is visible in the engraving.

“We approach it through a labyrinth of enormous shapeless masses of granite, which during ages have fallen from the cliffs above, that frown over the very temple, and in all probability will some day themselves descend in ruins and crush it. Around the inclosure, and among these masses, for some distance up the mountain, a few fine old pine-trees throw a dark shade and form a magnificent foreground; while the river runs impetuously in its shingly bed, and the stifled but fearful sound of the stones which it rolls along with it, crushing together, mixes with the roar of its waters.

“It is easy to write of rocks and wilds, of torrents and precipices; it is easy to tell of the awe such scenes inspire: this style and these descriptions are common and hackneyed. But it is not so simple, to many surely not very possible, to convey an adequate idea of the stern and rugged majesty of some scenes; to paint their lonely desertness, or describe the undefinable sensation of reverence and dread that steals over the mind while contemplating the death-like, ghastly calm that is shed over them: and when at such a moment we remember our homes, our friends, our firesides, and all social intercourse with our fellows, and feel our present solitude, and far distance from all these dear ties, how vain it is to strive at description! Surely such a scene is Gungotree. [See cut, page 109.] Nor is it, independently of the nature of the surrounding scenery, a spot which lightly calls forth powerful feelings. We were now in the center of the stupendous Himalaya, the loftiest and perhaps most rugged range of mountains in the world. We were at the acknowledged source of that noble river, which is equally an object of veneration and a source of fertility, plenty and opulence to Hindoostan; and we had now reached the holiest shrine of Hindoo worship which these holy hills contain. These are surely striking considerations, combining with the solemn grandeur of the place, to move the feelings strongly.

“The fortuitous circumstance of being the first European that ever penetrated to this spot, was no matter of boast, for no great danger had been braved, no extraordinary fatigues undergone; the road is now open to any other who chooses to attempt it; but it was a matter of satisfaction to myself. The first object of inquiry that naturally occurs to the traveler, after casting a glance over the general landscape, is the source of the river. Here, as at Jumnotree, you are told that no mortal has gone, or can go further toward its extreme origin than this spot; and the difficulty is indeed very apparent. I made a trial to gain a point about two furlongs beyond the temple, both for the purpose of observing the course of the river, and of seeing Gungotree in another point of view. But having with considerable difficulty made my way over the unsteady fragments for some hundred yards, at the risk of being precipitated into the stream, I was forced to turn back.

“The source is not more than five miles’ horizontal distance from the temple, and in a direction south-east, eighty-five degrees nearly; and beyond this place it is in all probability chiefly supplied by the melting of the great bosom of snow which terminates the valley, and which lies between the peaks of the great mountain above mentioned.

“This mountain, which is considered to be the loftiest and greatest of the snowy range in this quarter, and probably yields to none in the whole Himalaya, obtains the name of Roodroo Himala, and is held to be the throne or residence of Mahadeo himself. It is also indiscriminately called Pauch Purbut, from its five peaks, and Soomeroo Purbot, which is not to be confounded with the mountain so called near Bunderbouch; and sometimes the general appellation of Kylas is given, which literally signifies any snowy hill, but is applied to this mountain by way of preëminence. It has five principal peaks, called Roodroo Himala, Burrumpooree, Bissenpooree, Oodgurre Kanta and Soorga Rounee. These form a sort of semicircular hollow of very considerable extent, filled with eternal snow, from the gradual dissolution of the lower parts of which the principal part of the stream is generated: probably there may be smaller hollows beyond the point to the right above Gungotree, which also supply a portion.

“Within the temple there are three images; one, that of Kali; and the elevated stone shelf on which they were placed was wet and soiled with the offerings made; there was a peculiar smell, but I know not whence it proceeded. The place, as usual, was lighted by a small lamp: no daylight had admittance. Just below the temple, on the river side, grew three poplar trees, and a few small larches; above there are the remains of a fine old silver fir-tree, which overshadows some of the caves and sheds. The whole people also bathed, and contributed something to the priesthood; and it was a matter of serious importance, as well as of great joy to every one, that we had thus happily reached a place of such supereminent sanctity: such, indeed, that the act of bathing here is supposed to

cleanse from every sin heretofore committed, and the difficulty of which is so great, that few, except professional devotees, ever attempt reaching the holy place.

“It is customary that those who have lost their father and mother, or either of these, shall be shaved at this spot; and it was curious to observe the whimsical changes produced by the operation, which numbers underwent. It appears also, that one chief ordinance was the going frequently round the holy temple; and we particularly observed that those who were noted as the greatest rogues were most forward in this pious exercise: one man, in particular, who had been a notorious thief, was unwearied in his perseverance.

“Well, indeed, do they say, that Seeva has made these recesses which he inhabits, inaccessible to all but those whom true devotion leads to his shrine. That man must have been indeed strongly impelled by devotion, ambition, or curiosity, who first explored the way to Gungotree. It were unavailing to inquire, and perhaps of little use, if known, to which of these motives we owe the enterprise; but patience, perseverance, and courage, must have been strongly united with it to lead him safely and successfully through those awful cliffs, that would bar the way to most men. Another omen of favor pointed out was, the increase of the river after bathing, as at Jumnotree; and it is singular enough, that during the time we remained here, I remarked several increases and decreases of the water, without any obvious causes; but these may fairly be referred to the effects of sudden changes of temperature occurring frequently among the hills, and acting on the body of snow that feeds the river.”

ASIATIC VOLCANOES.

Among the Asiatic burning mountains, a brief account of which we introduce after the above interesting notice of the grand Himalaya chain, those of Japan are both remarkable and numerous. On the summit of a mountain in the province of Figo, is a large cavern, formerly the mouth of a volcano, but the flame of which has ceased, probably for want of combustible matter. In the same province, near a religious structure called the Temple of the Jealous God of Aso, a perpetual flame issues from the top of a mountain. In the province of Tsickusen is another burning mountain, where was formerly a coal-pit, which having been set on fire by the carelessness of the workmen, has been burning ever since. Sometimes a black smoke, accompanied by a very disagreeable stench, is observed to issue from the summit of a famous mountain called Fesi, in the province of Seruga. This mountain is said to be nearly as high as the peak of Teneriffe, but in shape and beauty is supposed not to have an equal. Its top is covered with perpetual snow. Belonging to the Japanese cluster, and not far from Piranda, is a small rocky island, which has been burning and trembling for many centuries; and in another small island, opposite to Santzuma, is a volcano which has been burning at different intervals for many ages.

Captain Gore, when leaving Japan, passed by great quantities of pumice-stone, several pieces of which were taken up, and found to weigh from one ounce to three pounds. It was conjectured that these stones had been thrown into the sea by eruptions at various times, as many of them were covered by barnacles (small shells) and others were quite bare.

VOLCANIC MOUNTAINS OF KAMTSCHATKA.

There are three burning mountains of Kamtschatka, which for many years have thrown out a considerable smoke, but do not often burst into a flame. One of these is situated in the vicinity of Awatska; and another, named the volcano of Tolbatchiek, on a neck of land between the river Kamtschatka and the Tolbatchiek. In the beginning of the year 1739, the flames issued with such violence from the crater, as to reduce to ashes the forests on the neighboring mountains. This was succeeded by a cloud of smoke, which overspread and darkened the whole country, until it was dissipated by a shower of cinders, which covered the ground to the distance of thirty miles. The third volcano is on the top of the particular mountain of Kamtschatka, which is described as by far the highest in the peninsula. It rises from two rows of hills, somewhat in the form of a sugar-loaf, to a very great hight. It usually throws out ashes twice or thrice a year, sometimes in such quantities, that for three hundred versts, (one hundred and sixty-five English miles,) the earth is covered with them. In the year 1737, at the latter end of September, a conflagration, which lasted for a week, was so violent and terrific, that the mountain appeared, to those who were fishing at sea, like one red-hot rock; and the flames which burst through several openings, with a dreadful noise, resembled rivers of fire. From the inside of the mountains were heard thunderings, crackings, and blasts like those of the strongest bellows, shaking all the neighboring territory. During the night it was most terrible; but at length the conflagration ended by the mountain’s casting forth a prodigious quantity of cinders and ashes, among which were porous stones, and glass of various colors. When Captain Clarke sailed out of the harbor of St. Peter and St. Paul, in June, 1778, to the northward, an eruption of the first of these volcanoes was observed. A rumbling noise, resembling distant hollow thunder, was heard before daylight; and when the day broke, the decks and sides of the ships were covered with a

fine dust, resembling emery, nearly an inch thick, the air at the same time being charged with this substance to such a degree, that toward the mountain, which is situated to the north of the harbor, the surrounding objects were not to be distinguished. About twelve o'clock, and during the afternoon, the explosions became louder, and were followed by showers of cinders, which were in general about the size of peas, though many were picked up on the deck larger than a hazel-nut. Along with the cinders fell several small stones which had not undergone any change from the action of fire.

VOLCANIC MOUNTAIN OF ALBAY.

The following details of the dreadful eruption of the volcano of Albay, in the island of Luconia, one of the Philippines, on the first of February, 1814, are from an eye-witness of the dreadful scenes it presented.

"During thirteen years the volcano of Albay had preserved a profound silence. It was no longer viewed with that distrust and horror with which volcanoes usually inspire those who inhabit the vicinity. Its extensive and spacious brow had been converted into highly cultivated and beautiful gardens. On the first day of January last, no person reflected, in the slightest degree, upon the damages and losses which so bad a neighbor had once occasioned. Previously to the former eruptions there had been heard certain subterraneous sounds, which were presages of them. But upon the present occasion we remarked nothing, except that on the last day of January we perceived some slight shocks. In the night the shocks increased. At two in the morning one was felt more violent than those hitherto experienced. It was repeated at four, and from that time they were almost continual until the eruption commenced.

"The day broke, and I scarcely ever remarked in Camarines a more serene and pleasant morning. I observed, however, that the ridges nearest to the volcano were covered with mist, which I supposed to be the smoke of some house that might have been on fire in the night. But at eight o'clock the volcano began suddenly to emit a thick column of stones, sand, and ashes, which with the greatest velocity, was elevated into the highest regions of the atmosphere. At this sight we were filled with the utmost dread, especially when we observed that in an instant the brow of the volcano was quite covered. We had never seen a similar eruption, but were convinced that a river of fire was flowing toward us, and was about to consume us. The first thing which was done in my village was to secure some things esteemed sacred, and then we betook ourselves to flight. The swiftness with which the dreadful tide rolled toward us, did not give us time either for reflection or consultation. The frightful noise of the volcano caused great terror even in the stoutest hearts. We all ran, filled with dismay and consternation, endeavoring to reach the highest and most distant places, to preserve ourselves from so imminent a danger. The horizon began to darken, and our anxieties redoubled. The noise of the volcano continually increased, the darkness augmented, and we continued our flight. But, notwithstanding our swiftness, we were overtaken by a heavy shower of huge stones, by the violence of which many unfortunate persons were in a moment killed. This cruel circumstance obliged us to make a pause in our career, and to shelter ourselves under the houses; but the flames and burnt stones which fell from above, in a short time reduced them to ashes.

"The sky was now completely overcast, and we remained enveloped and immersed in a thick and palpable darkness. From that moment reflection was at an end. The mother abandoned her children, the husband his wife, and the children forgot their parents.

"In the houses we had no longer any shelter. It was necessary to abandon, or perish with them; yet, to go out uncovered, was to expose one's self to a danger not less imminent, because many of the stones were of an enormous size; and they fell as thick as drops of rain. It was necessary to defend ourselves as well as we could. Some covered themselves with hides, others with tables and chairs, and others with boards and tea-trays. Many took refuge in the trunks of trees, others among the canes and hedges, and some hid themselves in a cave, where the brow of a mountain protected them.

"About ten o'clock the heavy stones ceased to fall, and a rain of thick sand succeeded. At half past one the noise of the volcano began to diminish, and the horizon to clear a little; and at two it became quite tranquil; and we now began to perceive the dreadful ravages which the darkness had hitherto concealed from us. The ground was covered with dead bodies, part of whom had been killed by the stones, and the others consumed by the fire. Two hundred perished in the church of Budiao, and thirty-five in a single house in that village. The joy the living felt at having preserved themselves, was in many converted into the extremity of sorrow at finding themselves deprived of their relations and friends. Fathers found their children dead, husbands their wives, and wives their husbands, in the village of Budiao, where there were very few who had not lost some of their nearest connections. In other places we found many persons extended upon the ground, wounded or bruised in a thousand ways. Some with their legs broken, some without arms, some with their skulls fractured, and others covered with wounds. Many died immediately, others on the following days, and the rest were abandoned to the most melancholy fate, without physicians, without medicines, and in want even of

necessary food.

“Five populous towns were entirely destroyed by the eruption; more than twelve hundred of the inhabitants perished amidst the ruins; and twenty thousand who survived the awful catastrophe, were stripped of their possessions and reduced to beggary.

“The subsequent appearance of the volcanic mountain was most melancholy and terrific. Its side, formerly so well cultivated, and which afforded a prospect the most picturesque, is now become a barren sand. The stones, sand and ashes, which cover it, in some places exceed the depth of ten and twelve yards; and on the ground where lately stood the village of Budiao, there are spots in which the cocoa-trees are almost covered. In the ruined villages, and through the whole extent of the eruption, the ground remains buried in the sand to the depth of half a yard, and scarcely a single tree is left alive. The crater of the volcano has lowered more than one hundred and twenty feet; and the south side discovers a spacious and horrid mouth, which is frightful to the view. Three new ones have opened at a considerable distance from the principal crater, through which also smoke and ashes are incessantly emitted. In short, the most beautiful villages of Camarines, and the principal part of that fine province, are deeply covered with barren sand.”

ISLANDS WHICH HAVE RISEN FROM THE SEA.

Besides the convulsions of nature displayed in volcanoes, the most remarkable particulars of which we have given in our history of mountains, other operations are carried on below the fathomless depths of the sea, the nature of which can only be conjectured by the effects produced. Nor is it more astonishing that inflammable substances should be found beneath the bottom of the sea, than at similar depths on land, and that there also the impetuous force of fire should cause the imprisoned air and elastic gases to expand, and, by its mighty force, should drive the earth at the bottom of the sea above its surface. These marine volcanoes are perhaps more frequent, though they do not so often come within the reach of human observation, as those on land; and stupendous must be the operations carried on, when matter is thrown up to an extent which the ingenuity of man does not enable him to reach by fathoming.

Many instances have occurred, as well in ancient as in modern times, of islands having been formed in the midst of the sea; and their sudden appearance has constantly been preceded by violent agitations of the surrounding waters, accompanied by dreadful noises, and in some instances by fiery eruptions from the newly formed isles, which are composed of various substances, frequently intermixed with a considerable quantity of volcanic lava. Such islands remain for ages barren, but in a long course of time become abundantly fruitful. It is a matter of curious inquiry, whether springs are found on such newly created spots, when the convulsions which gave them birth have subsided; but on this point it would seem that we are not possessed of any certain information, as it does not appear that they have been visited by any naturalist with the express view of recording their properties.

Among the writers of antiquity who have transmitted accounts of islands which have thus started up to the view of the astonished spectator, Seneca asserts that, in his time, the island of Therasea, in the Egean sea, was seen to rise in this manner by several mariners, who were sailing near the point of its ascent. Pliny’s relation is still more extraordinary; for he says that in the Mediterranean, thirteen islands emerged at once from the sea, the cause of which he ascribes rather to the retiring of the waters, than to any subterraneous operation of nature: but he speaks at the same time of the island of Hiera, in the vicinity of Therasea, as having been formed by subterraneous explosions, and enumerates several others said to have been derived from a similar origin, in one of which he says, a great abundance of fishes were found, of which, however, all who ate, perished soon afterward.

It is to the Grecian archipelago, and the Azores, or Western isles, that we are to look for the grandest and most surprising instances of this phenomenon. We will select an example from each of these groups of islands, beginning with the latter.

In December, 1720, a violent earthquake was felt on the island of Tercera, one of the Azores. And on the following morning, a new island, which had sprung up in the night, made its appearance, and a huge column of smoke was seen rising from it. The pilot of a ship which attempted to approach it, sounded on one of these newly formed islands, with a line of sixty fathoms, but could not find a bottom. On the opposite side, the sea was deeply tinged with various colors, white, blue and green; and was very shallow. This island was larger on its first appearance than at some distance of time afterward; it at length sunk beneath the level of the sea, and is now no longer visible.

What can be more surprising than to see fire, not only force its way out of the bowels of the earth, but likewise make for itself a passage through the waters of the sea! What can be more extraordinary, or foreign to our common notions of things, than to observe the bottom of the sea rise up in a mountain above its surface, and become so firm an island as to be able to resist the

violence of the greatest storms! We know that subterraneous fires, when pent up in a narrow passage, are able to elevate a mass of earth as large as an island; but that this should be done in so regular and precise a manner, that the water of the sea should not be able to penetrate and extinguish those fires; and that, after they should have exhausted themselves, the mass of earth should not fall down, or sink again with its own weight, but still remain in a manner suspended over the great arch below; this seems more surprising than any of the facts which have been related of Mount Etna, Vesuvius, or any other volcano.

In the first part of the Transactions of the Royal Society for the year 1812, Captain Tillard, of the British navy, has published a very interesting narrative of a similar phenomenon, which occurred in the same sea near the Azores. We give this narrative in his own words.

“Approaching the island of St. Michael’s, on Sunday, the twelfth of June, 1811, in his majesty’s sloop Sabrina, under my command, we occasionally observed, rising in the horizon, two or three columns of smoke, such as would have been occasioned by an action between two ships, to which cause we universally attributed its origin. This opinion was, however, in a very short time changed, from the smoke increasing and ascending in much larger bodies than could possibly have been produced by such an event; and having heard an account, prior to our sailing from Lisbon, that in the preceding January or February, a volcano had burst out within the sea near St. Michael’s, we immediately concluded that the smoke we saw proceeded from that cause, and, on our anchoring the next morning in the road of Ponta del Gada, we found this conjecture correct as to the cause, but not as to the time; the eruption of January having totally subsided, and the present one having only burst forth two days prior to our approach, and about three miles distant from the one before alluded to.

“Desirous of examining as minutely as possible a contention so extraordinary between two such powerful elements, I set off from the city of Ponta del Gada on the morning of the fourteenth, in company with Mr. Read, the consul-general of the Azores, and two other gentlemen. After riding about twenty miles across the north-west end of the island of St. Michael’s, we came to the edge of the cliff, whence the volcano burst suddenly upon our view in the most terrific and awful grandeur. [See cut, page 122.] It was only a short mile from the base of the cliff, which was nearly perpendicular, and formed the margin of the sea; this cliff being, as nearly as I could judge, from three to four hundred feet high. To give you an adequate idea of the scene by description, is far beyond my powers; but for your satisfaction, I shall attempt it.

[Illustration: ST. MICHAEL’S VOLCANO.]

“Imagine an immense body of smoke rising from the sea, the surface of which was marked by the slippery rippling of the waves, occasioned by the light and steady breezes incidental to these climates in summer. In a quiescent state, it had the appearance of a circular cloud revolving on the water like a horizontal wheel, in various and irregular involutions, expanding itself gradually on the lee side, when suddenly a column of the blackest cinders, ashes and stones would shoot up in the form of a spire, at an angle of from ten to twenty degrees from a perpendicular line, the angle of inclination being universally to windward; this was rapidly succeeded by a second, third and fourth shower, each acquiring greater velocity, and overtopping the other till they had attained an altitude as much above the level of our eye, as the sea was below it.

“As the impetus with which the columns were severally propelled diminished, and their ascending motion had nearly ceased, they broke into various branches resembling a group of pines; these again forming themselves into festoons of white feathery smoke, in the most fanciful manner imaginable, intermixed with the finest particles of falling ashes, which at one time assumed the appearance of innumerable plumes of black and white ostrich feathers, surmounting each other, and another, that of the light wavy branches of a weeping-willow.

“During these bursts, the most vivid flashes of lightning continually issued from the densest part of the volcano; and the cloud of smoke, now ascending to an altitude much above the highest point to which the ashes were projected, rolled off in large masses of fleecy clouds, gradually expanding themselves before the wind in a direction nearly horizontal, and drawing up to them a quantity of water-spouts, which formed a most beautiful and striking addition to the general appearance of the scene.

“That part of the sea where the volcano was situated, was upward of thirty fathoms deep, and at the time of our viewing it the volcano was only four days old. Soon after our arrival on the cliff, a peasant observed he could discern a peak above the water: we looked but could not see it; however, in less than half an hour it was plainly visible, and before we quitted the place, which was about three hours from the time of our arrival, a complete crater was formed above the water, not less than twenty feet high on the side where the greatest quantity of ashes fell; the diameter of the crater being apparently about four or five hundred feet.

“The great eruptions were generally attended with a noise like the continued firing of cannon and musketry intermixed, as also with slight shocks of earthquakes; several of which having been felt by my companions, but none by myself, I had become half skeptical, and thought their opinion arose merely from the force of imagination; but while we were sitting within five or six yards of the edge of the cliff, partaking of a slight repast which had been brought with us, and were all busily engaged, one of the most magnificent bursts took place which we had yet witnessed, accompanied by a very severe shock of an earthquake. The instantaneous and involuntary movement of each was to spring upon his feet; and I said, ‘This admits of no doubt.’ The words had scarcely passed my lips, before we observed a large portion of the face of the cliff, about fifty yards on our left, falling, which it did with a violent crash. So soon as our first consternation had a little subsided, we removed about ten or a dozen yards further from the edge of the cliff, and finished our dinner.

“On the succeeding day, June fifteenth, having the consul and some other friends on board, I weighed, and proceeded with the ship toward the volcano, with the intention of witnessing a night view; but in this expectation we were greatly disappointed, from the wind freshening, and the weather becoming thick and hazy, and also from the volcano itself being more quiescent than it was the preceding day. It seldom emitted any lightning, but occasionally as much flame as may be seen to issue from the top of a glass-house or foundry chimney. On passing directly under the great cloud of smoke, about three or four miles distant from the volcano, the decks of the ship were covered with fine black ashes, which fell intermixed with small rain. We returned the next morning, and late on the evening of the same day I took leave of St. Michael’s, to complete my cruise.

“On the opening of the volcano clear of the north-west part of the island, after dark on the sixteenth, we witnessed one or two eruptions that, had the ship been near enough, would have been awfully grand. It appeared one continued blaze of lightning; but its distance from the ship, upward of twenty miles, prevented our seeing it with effect. Returning again toward St. Michael’s, on the fourth of July, I was obliged, by the state of the wind, to pass with the ship very close to the island, which was now completely formed by the volcano, being nearly the hight of Matlock High Tor, about eighty yards above the sea. At this time it was perfectly tranquil; which circumstance determined me to land, and explore it more narrowly. I left the ship in one of the boats, accompanied by some of the officers. As we approached we perceived that it was still smoking in many parts, and, upon our reaching the island, found the surf on the beach very high. Rowing round to the lee-side, with some little difficulty, by the aid of an oar as a pole, I jumped on shore, and was followed by the other officers. We found a narrow beach of black ashes, from which the side of the island rose in general too steep to admit of our ascending; and where we could have clambered up, the mass of matter was much too hot to allow our proceeding more than a few yards in the ascent.

“The declivity below the surface of the sea was equally steep, having seven fathoms of water at scarcely the boat’s length from the shore, and at the distance of twenty or thirty yards we sounded twenty-five fathoms. From walking round it in about twelve minutes, I should judge that it was something less than a mile in circumference; but the most extraordinary part was the crater, the mouth of which, on the side facing St. Michael’s, was nearly level with the sea. It was filled with water, at that time boiling, and was emptying itself into the sea by a small stream about six yards over, and by which I should suppose it was continually filled again at high water. This stream, close to the edge of the sea, was so hot, as only to admit the finger to be dipped suddenly in, and taken out again immediately.

“It appeared evident, by the formation of this part of the island, that the sea had, during the eruptions, broken into the crater in two places, as the east side of the small stream was bounded by a precipice; a cliff between twenty and thirty feet high, forming a peninsula of about the same dimension in width, and from fifty to sixty feet long, connected with the other part of the island by a narrow ridge of cinders and lava, as an isthmus, of from forty to fifty feet in length, from which the crater rose in the form of an amphitheater.

“This cliff, at two or three miles’ distance from the island, had the appearance of a work of art, resembling a small fort or block-house. The top of this we were determined, if possible, to attain; but the difficulty we had to encounter in doing so, was considerable: the only way to attempt it was up the side of the isthmus, which was so steep that the only mode by which we could effect it, was by fixing the end of an oar at the base, with the assistance of which we forced ourselves up in nearly a backward direction.

[Illustration: SABRINA ISLAND.]

“Having reached the summit of the isthmus, we found another difficulty: for it was impossible to walk upon it, as the descent on the other side was immediate, and as steep as the one we had ascended; but by throwing our legs across it, as would be done on the

ridge of a house, and moving ourselves forward by our hands, we at length reached that part of it where it gradually widened itself, and formed the summit of the cliff, which we found to have a perfectly flat surface, of the dimensions before stated. Judging this to be the most conspicuous situation, we here planted the union, and left a bottle sealed up, containing a short account of the origin of the island, and of our having landed upon it, and naming it Sabrina island.

“Within the crater I found the complete skeleton of a guard-fish, the bones of which, being perfectly burnt, fell to pieces upon attempting to take them up; and, by the account of the inhabitants on the coast of St. Michael’s, great numbers of fish had been destroyed during the early part of the eruption, as large quantities, probably suffocated or poisoned, were occasionally found drifted into the small inlets or bays. The island, like other volcanic productions, is composed principally of porous substances, generally burnt to complete cinders, with occasional masses of a stone, which I should suppose to be a mixture of iron and limestone.”

Sabrina island has gradually disappeared, since the month of October, 1811, leaving an extensive shoal. Smoke was discovered still issuing out of the sea in the month of February, 1812, near the spot where this wonderful phenomenon appeared.

Having thus spoken of the Azores, we now pass to some similar phenomena in the Grecian archipelago. Before entering, however, on the details which are here furnished on this curious and most interesting subject, it may not be improper to observe, that the island of Acroteri, of great celebrity in ancient history, appears to have its surface composed of pumice-stone, incrusted by a surface of fertile earth; and that it is represented by the ancients as having risen, during a violent earthquake, from the sea. Four neighboring islands are described as having a similar origin, notwithstanding the sea is in that part of the archipelago of such a depth as to be unfathomable by any sounding line. These arose at different times: the first long before the commencement of the Christian era; the second in the first century; the third in the eighth; and the fourth in 1573.

We now proceed to a phenomenon of a similar nature, belonging to the same cluster of islands, which being of a more recent date, we are enabled to enter into all its particulars. They are such as can not fail to interest and surprise.

On the twenty-second of May, 1707, a severe earthquake was felt at Stanchio, an island of the archipelago; and on the ensuing morning a party of seamen, discovering not far off what they believed to be a wreck, rapidly rowed toward it; but finding rocks and earth instead of the remains of a ship, hastened back, and spread the news of what they had seen, in Santorini, another of these islands. However great the apprehensions of the inhabitants were at the first sight, their surprise soon abated, and in a few days, seeing no appearance of fire or smoke, some of them ventured to land on the new island. Their curiosity led them from rock to rock, where they found a kind of white stone, which yielded to the knife like bread, and nearly resembled that substance in color and consistence. They also found many oysters sticking to the rocks: but while they were employed in collecting them, the island moved and shook under their feet, on which they ran with precipitation to their boats. Amid these motions and tremblings the island increased, not only in hight, but in length and breadth: still occasionally, while it was raised and extended on the one side, it sunk and diminished on the other. One person observed a rock to rise out of the sea, forty or fifty paces from the island, which, having been thus visible for four days, sunk, and appeared no more: several others appeared and disappeared alternately, till at length they remained fixed and unmoved. In the mean time the color of the surrounding sea was changed: at first it was of a light green, then reddish, and afterward of a pale yellow, accompanied by a noisome stench, which spread itself over a part of the island of Santorini.

On the sixteenth of July, smoke first appeared, not indeed on the island, but issuing from a ridge of black stones which suddenly rose about sixty paces from it, where the depth of the sea was unfathomable. Thus there were two separate islands, one called the White, and the other the Black island, from the different appearances they exhibited. This thick smoke was of a whitish color, like that of a lime-kiln, and was carried by the wind to Santorini, where it penetrated the houses of the inhabitants.

In the night between the nineteenth and twentieth of July, flames began to issue with the smoke, to the great terror of the inhabitants of Santorini, especially of those occupying the castle of Scaro, who were distant about a mile and a half only from the burning island, which now increased very fast, large rocks daily springing up, which sometimes added to its length, and sometimes to its breadth. The smoke, also increased, and there not being any wind, ascended so high as to be seen at Candia, and other distant islands. During the night, it resembled a column of five, fifteen, or twenty feet in hight; and the sea was then covered with a scurf or froth, in some places reddish, and in others yellowish, from which proceeded such a stench, that the inhabitants throughout the whole island of Santorini burnt perfumes in their houses, and made fires in the streets, to prevent infection. This, indeed, did not last above a day or two; for a strong gale of wind dispersed the froth, but drove the smoke on the vineyards of Santorini, by which the grapes were, in one night, parched up and destroyed. This smoke also caused violent head-aches, attended with retchings.

On the thirty-first of July, the sea smoked and bubbled in two different places near the island, where the water formed a perfect circle, and looked like oil when beginning to simmer. This continued above a month, during which time many fishes were found dead on the shore of Santorini. On the following night a dull hollow noise was heard, like the distant report of several cannon, which was instantly followed by flames of fire, shooting up to a great hight in the air, where they suddenly disappeared. The next day the same hollow sound was several times heard, and succeeded by a blackish smoke, which, notwithstanding a fresh gale blew at the time, rose up to a prodigious hight, in the form of a column, and would probably in the night have appeared as if on fire.

On the seventh of August, a different noise was heard, resembling that of large stones thrown, at very short intervals, into a deep well. This noise, having lasted for some days, was succeeded by another much louder, so nearly resembling thunder, as scarcely to be distinguished from three or four real claps, which were heard at the same time.

On the twenty-first, the fire and smoke were very considerably diminished; but the next morning they broke out with still greater fury than before. The smoke was red, and very thick, the heat at the same time being so intense, that all around the island the sea smoked and bubbled surprisingly. At night, by the means of a telescope, sixty small openings or funnels, all emitting a very bright flame, were discovered on the highest part of the island, conjointly resembling a large furnace; and on the other side of the great volcano there appeared to be as many.

On the morning of the twenty-third, the island was much higher than on the preceding day, and its breadth increased by a chain of rocks which had sprung up in the night nearly fifty feet above the water. The sea was also again covered with reddish froth, which always appeared when the island seemed to have received any considerable additions, and occasioned an intolerable stench, until it was dispersed by the wind and the motion of the waves.

On the fifth of September, the fire opened another vent at the extremity of the Black island, from which it issued for several days. During that time little was discharged from the large furnace; but from this new passage the astonished spectator beheld the fire dart up three several times to a vast hight, resembling so many prodigious sky-rockets of a glowing, lively red. The following night the sub-aqueous fire made a terrible noise, and immediately, after a thousand sheaves of fire darted into the air, where breaking and dispersing, they fell like a shower of stars on the island, which appeared in a blaze, presenting to the amazed spectator at once a most dreadful and beautiful illumination. To these natural fire-works, succeeded a kind of meteor, which for some time hung over the castle of Scaro, and which, having a resemblance to a flaming sword, served to increase the consternation of the inhabitants of Santorini.

On the ninth of September, the White and Black islands united; after which the western end of the island grew daily in bulk. There were now four openings only which emitted flames; these issued forth with great impetuosity, sometimes attended with a noise like that of a large organ-pipe, and sometimes like the howling of wild beasts.

On the twelfth, the subterraneous noise was much augmented, having never been so frequent or so dreadful as on that and the following day. The bursts of this subterraneous thunder, like a general discharge of the artillery of an army, were repeated ten or twelve times within twenty-four hours, and, immediately after each clap, the large furnace threw up huge red-hot stones, which fell into the sea at a great distance. These claps were always followed by a thick smoke, which spread clouds of ashes over the sea and the neighboring islands.

On the eighteenth of September, an earthquake was felt at Santorini. It did but little damage, although it considerably enlarged the burning island, and in several places gave vent to the fire and smoke. The claps were also more terrible than ever; and, in the midst of a thick smoke, which appeared like a mountain, large pieces of rock, which afterward fell on the island, or into the sea, were thrown up with as much noise and force as balls from the mouth of a cannon. One of the small neighboring islands was covered with these fiery stones, which being thinly crusted over with sulphur, gave a bright light, and continued burning until that was consumed.

On the twenty-first, a dreadful clap of subterraneous thunder was followed by very powerful lightnings, and at the same instant the new island was so violently shaken, that part of the great furnace fell down, and huge burning rocks were thrown to the distance of two miles and upward. This seemed to be the last effort of the volcano, and appeared to have exhausted the combustible matter, as all was quiet for several days after: but on the twenty-fifth, the fire broke out again with still greater fury, and among the claps one was so terrible, that the churches of Santorini were soon filled with crowds of people, expecting every moment to be their last; and the castle and town of Scaro suffered such a shock, that the doors and windows of the houses flew open. The volcano continued to rage during the remaining part of the year; and in the month of January, 1708, the large furnace, without one day’s

intermission, threw out stones and flames, at least once or twice, but generally five or six times a day.

On the tenth of February, in the morning, a pretty strong earthquake was felt at Santorini, which the inhabitants considered as a prelude to greater commotions in the burning island; nor were they deceived, for soon after the fire and smoke issued in prodigious quantities. The thunder-like claps were redoubled, and all was horror and confusion: rocks of an amazing size were raised up to a great hight above the water; and the sea raged and boiled to such a degree as to occasion great consternation. The subterraneous bellowings were heard without intermission, and sometimes in less than a quarter of an hour, there were six or seven eruptions from the large furnace. The noise of repeated claps, the quantity of huge stones which flew about on every side, the houses at Santorini tottering to their very foundations, and the fire, which now appeared in open day, surpassed all that had hitherto happened, and formed a scene terrific and astonishing beyond description.

The fifteenth of April was rendered memorable by the number and violence of the bellowings and eruptions, by one of which nearly a hundred stones were thrown at the same instant into the air, and fell again into the sea at about two miles distant. From that day until the twenty-second of May, which may be considered as the anniversary of the birth of the new island, things continued much in the same state, but afterward the fire and smoke subsided by degrees, and the subterraneous thunders became less terrible.

On the fifteenth of July, 1709, the Bishop of Santorini, accompanied by several friars, hired a boat to take a near view of the island. They made directly toward it on that side where the sea did not bubble, but where it smoked very much. Being within the range of this vapor, they felt a close, suffocating heat, and found the water very hot; on which they directed their course toward a part of the island at the furthest distance from the large furnace. The fires, which still continued to burn, and the boiling of the sea, obliged them to make a great circuit, notwithstanding which they felt the air about them to be very hot and sultry. Having encompassed the island, and surveyed it carefully from an adjacent one, they judged it to be two hundred feet above the sea, about a mile broad, and five miles in circumference; but, not being thoroughly satisfied, they resolved to make an attempt at landing, and accordingly rowed toward that part of the island where they perceived neither fire nor smoke. When, however, they had proceeded to within the distance of a hundred yards, the great furnace discharged itself with its usual fury, and the wind blew upon them so dense a smoke, and so heavy a shower of ashes, that they were obliged to abandon their design. Having retired somewhat further, they let down their sounding lead, with a line ninety-five fathoms in length, but it was too short to reach the bottom. On their return to Santorini, they observed that the heat of the water had melted the greater part of the pitch employed in calking their boat, which had now become very leaky.

From that time until the fifteenth of August, the fire, smoke and noises continued, but not in so great a degree; and it appears that for several years after, the island still increased, but that the fire and subterraneous noises were much abated. The most recent account we have been enabled to collect, is that of a traveler, who, in 1811, passed this island at some distance. It appeared to him like a stupendous mass of rock, but was not inhabited or cultivated. It had then long ceased to burn.

SUBTERRANEAN WONDERS.

THE GROTTA DEL CANE.

“Give me, ye powers, the wondrous scenes to show, Concealed in darkness in the caves below.”

Among the various subterranean wonders of the world, which are worthy of special notice, we would first mention the “Grotta del Cane.” This name has been given to a small cavern between Naples and Pozzuoli, on this account, that if a dog be brought into it, and his nose held to the ground, a difficulty of respiration instantly ensues, and he loses all sensation and even life, if he be not speedily removed into purer air. There are other grottos endowed with the same deleterious quality, especially in volcanic countries; and the pestiferous vapors they exhale, are quickly fatal both to animals and man, though they do not offer to the eye the slightest indication of their presence. These vapors are, however, for the greater part temporary; while that of the Grotta del Cane is perpetual, and seems to have produced its deadly effects even in the time of Pliny. A man standing erect within, does not suffer from it, the mephitic vapor rising to a small hight only from the ground. It may, therefore, be entered without danger.

The smoke of a torch extinguished in this vapor, or gas, sinks downward, assumes a whitish color, and passes out at the bottom of the door. The reason of this is, that the fumes which proceed from the torch mix more readily with the gas than with the

atmospherical air. It has been supposed, that the mischievous effects of the vapor were the result of the air being deprived of its elasticity; but it has been clearly demonstrated by M. Adolphus Murray, that they are solely to be attributed to the existence of carbonic acid gas.

The person who is the keeper, or guide, at the grotto, and who shows to strangers the experiment of the dog for a gratuity, takes the animal, when he is half dead and panting, into the open air, and then proceeds to throw him into the neighboring lake of Agnano, thus insinuating that this short immersion in the water is necessary to his complete restoration. This, however, is a mere trick, to render the experiment more specious, and to obtain a handsome present from the credulous, the atmospherical air alone sufficing for that purpose.

The celebrated naturalist, the Abbe Spallanzani, projected a regular series of experiments on the mephitic vapor of this grotto, from a persuasion that they would tend to throw a new light on physiology and natural philosophy. Being, however, prevented from undertaking this, by his duties as a professor, his friend, the Abbe Breislak, who resided near the spot, engaged in the task; and the following is an abstract of his learned memoir on this subject.

It is well known, the abbe observes, that the mephitic vapor occupies the floor of a small grotto near the lake Agnano, a place highly interesting to naturalists from the phenomena its environs present, and the hills within which it is included. This grotto is situated on the south-east side of the lake, at a little distance from it. Its length is about twelve feet, and its breadth from four to five. It appears to have been originally a small excavation, made for the purpose of obtaining pozzuolana, an earth which, being applied as mortar, becomes a powerful cement. In the sides of the grotto, among the earthy volcanic matters, are found pieces of lava, of the same kind with those which are met with scattered near the lake.

The abbe is persuaded that, if new excavations were to be made in the vicinity of the grotto, at a level with its floor, or a little lower, the same mephitic vapor would be found; and thinks it would be curious to ascertain the limits of its extent. It would also be advantageous to physical observations, if the grotto were to be somewhat enlarged, and its floor reduced to a level horizontal plane, by sinking it two or three feet, and surrounding it by a low wall, with steps at the entrance. In its present state it is extremely inconvenient for experiments, and the inclination of the ground toward the door causes a great part of the vapor, from the effect of its specific gravity, to make its way out close to the ground.

When the narrow limits of this place are considered, and the small quantity of the vapor which has rendered it so celebrated, there can not be any doubt but that it has undergone considerable changes; since it does not appear probable that Pliny refers to the present confined vapor only, when, in enumerating many places from which a deadly air exhaled, he mentions the territory of Pozzuoli. The internal fermentations by which it is caused, are certainly much diminished in the vicinity of the lake Agnano. The water near its banks is no longer seen to bubble up, from the disengagement of a gas, as it appears from accounts, not of very remote antiquity, to have done. The borders of the lake were attentively examined by the abbe, when its waters were at the highest, and after heavy rains; but he could never discover a single bubble of air. A number of aquatic insects which sport on the surface, may at first sight occasion some deception; but a slight observation soon detects the error. If, therefore, we do not suppose those authors who have described the ebullition of the water near the banks of the lake Agnano to have been deceived, it must at least be confessed, that this phenomenon has now ceased. The quantity of the sulphureous vapors which rise in the contiguous stoves, called the stoves of St. Germano, must likewise be greatly diminished from what it anciently was: for, adjoining to the present stoves, we still find the remains of a spacious ancient fabric, with tubes of _terra cotta_ inserted in the walls, which, by their direction, show for what purpose they were intended. It appears certain, that this was a building in which, by the means of pipes properly disposed, the vapors of the place were introduced into different rooms for the use of patients. To these ruins, however, the vapors no longer extend; so that, if this edifice had remained entire, it could not have been employed for the purpose for which it was intended. The veins of pyrites which produced the more ancient conflagrations of the Phlegrean fields, between Naples and Cuma, and which, in some places, are entirely consumed, approach their total extinction. We will now proceed to the experiments within the grotto.

The object of the first was to determine the hight of the mephitic vapor at the center of the grotto, that is, at the intersection of the line of its greatest length with that of its greatest breadth. The hight varies according to the different dispositions and temperatures of the atmosphere, the diversity of winds, and the accidental variations which take place in the internal fermentations by which the vapor is produced. It may, however, be estimated at a mean, at nearly nine English inches.

The second set of experiments regarded the degree of heat on entering into the mephitis: it was slightly sensible in the feet and lower part of the legs; notwithstanding which, on taking out of the vapor several substances which had remained in it for a long time, such as stones, leaves, the carcasses of animals, &c., the abbe found that these were of the same temperature with the atmospheric air. Feeling in his body a slight degree of heat, which he could not perceive in the substances removed from the mephitic vapor, he was led by comparison to conclude, that the temperature of the latter was the same with the atmospherical air, agreeably to the principles of Dr. Crauford. He was, however, mistaken; for in subsequent experiments, he found a very distinct degree of heat. He was now provided with a thermometer, his former one having been broken, and, having suspended it at the aperture of the grotto, three feet above the surface of the vapor, found the mercury to stand at from sixty-two to sixty-four degrees of Fahrenheit; but, on placing the ball on the ground so as to immerse it in the vapor, the mercury rose to eighty, and even eighty-two degrees. That the substances taken out of the mephitis did not exhibit this diversity of temperature, was, he thinks, owing to the quantity of humidity with which they are always loaded, and which produces on their surface a constant evaporation. He was the more particular in repeating these experiments, because the naturalists who had, before him, made similar ones in the Grotta del Cane, had not observed the vapor to produce any effect on the mercury in the thermometer.

Thirdly. He repeated for his own satisfaction, the usual experiments made by naturalists, with the tincture of turnsole, lime-water, the crystallizations of alkalies, the absorption of water, and the acidulous taste communicated to it; which prove, beyond all doubt, the existence of fixed air, or carbonic acid gas, in the vapor of the grotto. He ascertained that it was not formed of fixed air alone, as might have been conjectured; but that the relative quantities of the different gases which compose its mephitic air, are as follows: in one hundred parts there are ten of vital air, or oxygen gas; forty of fixed air, or carbonic acid gas; and fifty of phlogisticated air, or azotic gas.

Fourthly. The phenomena of magnetism and electricity were investigated by the abbe in this grotto. With respect to the former, there was not any new appearance: the magnetic needle, being placed on the ground, and consequently immersed in the mephitis, rested in the direction of its meridian, and, at the approach of a magnetized bar, exhibited the usual effects of attraction and repulsion, in proportion as either pole was presented. As to the latter, electricity, it was impossible to make the experiments within the mephitis, not because this kind of air is a conductor of the electric fluid, as has been imagined, but because the humidity by which it is constantly accompanied, disperses the electric matter; and this, not being collected in a conductor, can not be rendered sensible. He attempted several times to fire inflammable gas, with electric sparks, in the mephitic vapor, by means of the conductor of the electrophus; but, notwithstanding his utmost endeavors to animate the electricity, he could never obtain a single spark, the non-conductor becoming a conductor the moment it entered into the mephitis, on account of the humidity which adhered to its surface.

Fifthly. His latest experiments were directed to the theory of the combustion of bodies. He first endeavored to ascertain whether those spontaneous inflammations that result from the mixture of concentrated acids with essential oils, could be obtained within the grotto. He placed on the ground a small vessel, in such a situation that the mephitis rose six inches above its edges, employing oil of turpentine, and the vitriolic and nitrous acids: the same inflammation, accompanied by a lively flame, followed, as would have taken place in the open atmospheric air. The dense smoke which always accompanies these inflammations, being attracted by the humidity of the mephitis, presented its undulations to the eye, and formed a very pleasing object. As he had put a considerable quantity of acid in the vessel, he repeatedly poured in a little of the oil, and the flame appeared in the mouth of the vessel fifteen times successively. The oxygenous principle contained in the acids, and with which the nitrous acid principally abounds, undoubtedly contributed to the production and duration of this flame, though enveloped in an atmosphere inimical to inflammation.

The abbe had, in the district of Latera, observed that in a mephitis of hydrogenous sulphurated or hepatic gas a slow combustion of phosphorus took place, with the same resplendence as in the atmospheric air. On the present occasion, his first experiment, in the mephitis of Agnano, was made with common phosphoric matches, five of which he broke, holding them to the ground, and consequently immersed in the mephitis. They produced a short and transient flame, which became extinguished the moment it was communicated to the wick of a candle. His second experiment was as follows: he placed on the ground, within the grotto, a long table, in such a manner that one extremity was without the mephitis, while the other, and four-fifths of its length, were immersed in it. Along this table he laid a train of gunpowder, beginning from the end without the mephitis; and, at the other end, which was immersed in it to the depth of seven inches, he placed, adjoining to the gunpowder, a cylinder of phosphorus, eight lines in length. The gunpowder, without the mephitis, being fired, the combustion was soon communicated to the other extremity of the train, and to the phosphorus, which took fire with decrepitation, burned rapidly with a bright flame, slightly colored with yellow and green, and left on the wood a black mark, as of charcoal. The combustion lasted nearly two minutes, when the whole phosphoric matter was

consumed.

In succeeding experiments not any alteration was perceptible in the flame, or manner of burning, of the lighted phosphorus, either at the moment of its entrance into the mephitis, or during its continuance in it. When suddenly withdrawn, it ignited gunpowder equally well. Hence the abbe deduces, that the mephitic gas of Grotta del Cane, however it may be utterly unfit for the respiration of animals, and for the inflammation of common combustible substances, readily allows that of phosphorus, which not only burns in it, but emits, as usual, luminous sparks.

[Illustration: GROTTO OF ANTIPAROS.]

GROTTO OF ANTIPAROS.

Antiparos, one of the Cyclades, is situated in the Egean sea, or Grecian archipelago. It is a small island, about sixteen miles in circumference, and lies two miles to the west of the celebrated Paros, from which circumstance it derives its name, _anti_ in the Greek language signifying _opposite to_. Its singular and most interesting grotto, though so inferior in size to the cavern in Kentucky of which we shall soon speak, has attracted the attention of an infinite number of travelers. The entrance to this superb grotto is on the side of a rock, and is a large arch, formed of craggy stones, overhung with brambles and creeping plants, which bestow on it a gloominess at once awful and agreeable. Having proceeded about thirty paces within it, the traveler enters a low, narrow alley, surrounded on every side by stones, which, by the light of torches, glitter like diamonds; the whole being covered and lined throughout with small crystals, which give by their different reflections, a variety of colors. At the end of this alley or passage, having a rope tied round his waist, he is led to the brink of an awful precipice, and is thence lowered into a deep abyss, the gloom pervading which makes him regret the “alley of diamonds” he has just quitted. He has not yet, however, reached the grotto, but is led forward about forty paces, beneath a roof of rugged rocks, amid a scene of terrible darkness, and at a vast depth from the surface of the earth, to the brink of another precipice, much deeper and more awful than the former.

Having descended this precipice, which is not accomplished without considerable difficulty, the traveler enters a passage, the grandeur and beauty of which can be but imperfectly described. It is one hundred and twenty feet in length, about nine feet high, and in width seven, with a bottom of a fine green glossy marble. The walls and arched roof are as smooth and polished as if they had been wrought by art, and are composed of a fine glittering red and white granite, supported at intervals by columns of a deep blood-red shining porphyry, which, by the reflection of the lights, presents an appearance inconceivably grand. At the extremity of this passage is a sloping wall, formed of a single mass of purple marble, studded with sprigs of rock crystal, which, from the glow of the purple behind, appear like a continued range of amethysts.

Another slanting passage, filled with petrifactions, representing the figures of snakes and other animals, and having toward its extremity two pillars of beautiful yellow marble, which seem to support the roof, leads to the last precipice, which is descended by means of a ladder. The traveler, who has descended to the depth of nearly fifteen hundred feet beneath the surface, now enters the magnificent grotto, to procure a sight of which he has endured so much fatigue. It is in width three hundred and sixty feet; in length three hundred and forty; and in most places one hundred and eighty in hight. By the aid of torch-light, he finds himself beneath an immense and finely vaulted arch, overspread with icicles of white shining marble, many of them ten feet in length, and of a proportionate thickness. Among these are suspended a thousand festoons of leaves and flowers, of the same substance, but so glittering as to dazzle the sight. The sides are planted with petrifactions, also of white marble, representing trees; these rise in rows one above the other, and often inclose the points of the icicles. From them also hang festoons, tied as it were one to another, in great abundance; and in some places rivers of marble seem to wind through them. In short, these petrifactions, the result of the dripping of water for a long series of ages, nicely resemble trees and brooks turned to marble. The floor is paved with crystals of different colors, such as red, blue, green and yellow, projecting from it, and rendering it rugged and uneven. These are again interspersed with icicles of white marble, which have apparently fallen from the roof, and are there fixed. To these the guides fasten their torches; and the glare of splendor and beauty which results from such an illumination, may be better conceived than described.

To the above description we subjoin an extract from the one given by Dr. Clarke, a learned traveler, who visited this celebrated grotto.

“The mode of descent is by ropes, which, on the different declivities, are either held by the guides, or are joined to a cable which is fastened at the entrance around a stalactite pillar. In this manner, we were conducted, first down one declivity, and then down another, until we entered the spacious chambers of this truly enchanted grotto. The roof, the floor, the sides, of a whole series of

magnificent caverns, were entirely invested with a dazzling incrustation as white as snow. Columns, some of which were five and twenty feet in length, pended in fine icicle forms above our heads: fortunately some of them are so far above the reach of the numerous travelers, who during many ages, have visited this place, that no one has been able to injure or remove them. Others extended from the roof to the floor, with diameters equal to that of the mast of a first-rate ship of the line. The incrustations of the floor, caused by falling drops from the stalactites above, had grown up into dendritic and vegetable forms, which first suggested to Tournefort the strange notion of his having here discovered the vegetation of stones. Vegetation itself has been considered as a species of crystallization; and as the process of crystallization is so surprisingly manifested by several phenomena in this grotto, some analogy may perhaps be allowed to exist between the plant and the stone; but it can not be said, that a principle of life existing in the former has been imparted to the latter. The last chamber into which we descended surprised us more by the grandeur of its exhibition than any other. Probably there are many other chambers below this, yet unexplored, for no attempt has been made to penetrate further: and, if this be true, the new caverns, when opened, would appear in perfect splendor, unsullied, in any part of them, by the smoke of torches, or by the hands of intruders."

CAVERNS IN GERMANY AND HUNGARY,

CONTAINING FOSSIL BONES.

Among the most remarkable of these caverns are those of Gaylenreuth, on the confines of Bayreuth. The opening to these, which is about seven feet and a half high, is at the foot of a rock of limestone of considerable magnitude, and in its eastern side. Immediately beyond the opening is a magnificent grotto, of about three hundred feet in circumference, which has been naturally divided by the form of the roof into four caves. The first is about twenty-five feet long and wide, and varies in hight from nine to eighteen feet, the roof being formed into irregular arches. Beyond this is the second cave, about twenty-eight feet long, and of nearly the same width and hight with the former.

A low and very rugged passage, the roof of which is formed of projecting pieces of rocks, leads to the third grotto, the opening into which is a hole three feet high, and four feet wide. This grotto is more regular in its form, and is about thirty feet in diameter, and nearly round; its hight is from five to six feet. It is very richly and fantastically adorned by the varying forms of its stalactitic hangings. The floor is also covered with a wet and slippery glazing, in which several teeth and jaws appear to have been fixed.

From this grotto commences the descent to the inferior caverns. Within only about five or six feet an opening in the floor is seen, which is partly vaulted over by a projecting piece of rock. The descent is about twenty feet. This cavern is about thirty feet in hight, about fifteen feet in width, and nearly circular; the sides, roof and floor, displaying the remains of animals. The rock itself is thickly beset with teeth and bones, and the floor is covered with a loose earth, the evident result of animal decomposition, and in which numerous bones are imbedded.

A gradual descent leads to another grotto, which, with its passage, is forty feet in length, and twenty feet in hight. Its sides and top are beautifully adorned with stalactites. Nearly twenty feet further is a frightful gulf, the opening of which is about fifteen feet in diameter; and, upon descending about twenty feet, another grotto, about the same diameter with the former, but forty feet in hight, is seen. Here the bones are dispersed about; and the floor, which is formed of animal earth, has great numbers of them imbedded in it. The bones which are here found, seem to be of different animals; but in this, as well as in the former caverns, perfect and unbroken bones are very seldom found. Sometimes a tooth is seen projecting from the solid rock, through the stalactitic covering, showing that many of these wonderful remains may here be concealed. A specimen of this kind has been preserved, and is rendered particularly interesting, by the first molar tooth of the lower jaw, with its enamel quite perfect, rising through the stalactitic mass which invests the bone. In this cavern the stalactites begin to be of a larger size, and of a more columnar form.

Passing on through a narrow opening in the rock, a small cave, seven feet long, and five feet high, is discovered; another narrow opening leads to another small cave; from which a sloping descent leads to a cave twenty-five feet in hight, and about half as much in its diameter, in which is a truncated columnar stalactite, eight feet in circumference.

A narrow and most difficult passage, twenty feet in length, leads from this cavern to another, twenty-five feet in hight, which is everywhere beset with teeth, bones and stalactitic projections. This cavern is suddenly contracted, so as to form a vestibule of six feet wide, ten long, and nine high, terminating in an opening close to the floor, only three feet wide and two high, through which it is necessary to writhe, with the body on the ground. This leads into a small cave, eight feet high and wide, which is the passage into a grotto, twenty-eight feet high, and about forty-three feet long and wide. Here the prodigious quantity of animal earth, the vast number of teeth, jaws and other bones, and the heavy grouping of the stalactites, produce so dismal an appearance, as to become

a perfect model of a temple for a god of the dead. Here hundreds of cart-loads of bony remains might be removed, pockets might be filled with fossil teeth, and animal earth was found to reach to the utmost depth to which the workmen dug. A piece of stalactite, being here broken down, was found to contain pieces of bones within it, the remnants of which were left imbedded in the rock. From this principal cave is a very narrow passage, terminating in the last cave, which is about six feet in width, fifteen in hight, and the same in length. In this cave were no animal remains, and the floor was the naked rock.

Thus far only can these natural sepulchers be traced; but there is every reason to suppose, that these animal remains are disposed through a greater part of this rock. Whence this immense quantity of the remains of carnivorous animals could have been collected, is a question which naturally arises; but the difficulty of answering it appears to be almost insurmountable.

[Illustration: THE MAMMOTH CAVE.]

THE MAMMOTH CAVE.

For one of the earliest accounts of this stupendous cavern, which is unparalleled in the entire history of subterranean wonders, we are indebted to Dr. Nahum Ward, who published it in a monthly magazine, in October, 1816. It is in what was formerly Warren, but now Edmonson county, in the state of Kentucky, about ten miles from the great Louisville and Nashville turnpike. The territory is not mountainous but broken, differing in this respect from the vicinity of most other caverns of the same general kind. Not far from the entrance, a hotel is now kept for the accommodation of visitors, as the cave is quite a fashionable resort for travelers during the summer season. Perhaps we shall best gain correct ideas of this wonderful cavern, which is almost a world in itself, having its own seas, mountains, lakes, rivers, &c., by reading first the account given by Dr. Ward, and then that of a visitor who explored it in 1854.

Dr. Ward, provided with guides, two large lamps, a compass and refreshments, descended a pit forty feet in depth, and one hundred and twenty in circumference; having a spring of fine water at the bottom, and conducting to the entrance of the cavern. The opening, which is to the north, is from forty to fifty feet high, and about thirty in width. It narrows shortly after, but again expands to a width of thirty or forty feet, and a hight of twenty, continuing these dimensions for about a mile, to the first _hoppers_,[2] where a manufactory of saltpeter had recently been established. Thence to the second of these hoppers, two miles from the entrance, it is forty feet in width, and sixty in hight. Throughout nearly the whole of the distance handsome walls had been made by the manufacturers, of the loose limestone. The road was hard, and as smooth as a flag pavement. In every passage which the doctor traversed, the sides of the cavern were perpendicular, and the arches, which have bid defiance even to earthquakes, were regular. In 1802, when the heavy shocks of earthquakes came on which were so severely felt in this part of Kentucky, the workmen stationed at the second hoppers, heard about five minutes before each shock, a heavy rumbling noise issue from the cave, like a strong wind. When that ceased, the rocks cracked, and the whole appeared to be going in a moment to final destruction. However, no one was injured, although large portions of rock fell in different parts of the cavern.

Footnote 2:

A hopper is an inverted cone, into which corn is put at a mill before it runs between the stones.

In advancing into the cavern, the avenue leads from the second hoppers, west, one mile; and thence, south-west, to the chief area or city, which is six miles from the entrance. This avenue, throughout its whole extent from the above station to the cross-roads, or chief area, is from sixty to one hundred feet in hight, of a similar width, and nearly on a level, the floor or bottom being covered with loose limestone and saltpeter earth. “When,” observes the doctor, “I reached this immense area (called the chief city) which contains upward of eight acres, without a single pillar to support the arch, which is entire over the whole, I was struck dumb with astonishment. Nothing can be more sublime and grand than this place, of which but a faint idea can be conveyed, covered with one solid arch at least one hundred feet high, and to all appearance entire.”

Having entered the area, the doctor perceived five large avenues leading from it, from sixty to one hundred feet in width, and about forty in hight. The stone walls are arched, and were from forty to eighty feet perpendicular in hight before the commencement of the arch.

In exploring these avenues, the precaution was taken to cut arrows, pointing to the mouth of the cave, on the stones beneath the feet, to prevent any difficulty in the return. The first which was traversed, took a southerly direction for more than two miles; when a

second was taken, which led first east, and then north, for more than two miles further. These windings at length brought the party, by another avenue, to the chief city again, after having traversed different avenues for more than five miles. Having reposed for a few moments on slabs of limestone near the center of this gloomy area, and refreshed themselves and trimmed their lamps, they departed a second time, through an avenue almost north, parallel with the one leading from the chief city to the mouth of the cavern; and, having proceeded upward of two miles, came to the second city. This is covered with a single arch, nearly two hundred feet high in the center, and is very similar to the chief city, except in the number of its avenues, which are two only. They crossed it, over a very considerable rise in the center, and descended through an avenue which bore to the east, to the distance of nearly a mile, when they came to a third area, or city, about one hundred feet square, and fifty in hight, which had a pure and delightful stream of water issuing from the side of a wall about thirty feet high, and which fell on a broken surface of stone, and was afterward entirely lost to view.

Having passed a few yards beyond this beautiful sheet of water, so as to reach the end of the avenue, the party returned about one hundred yards, and passing over a considerable mass of stone, entered another, but smaller avenue to the right, which carried them south, through a third, of an uncommonly black hue, somewhat more than a mile; when they ascended a very steep hill about sixty yards, which conducted them to within the walls of the fourth city. It is not inferior to the second, having an arch which covers at least six acres. In this last avenue, the extremity of which can not be less than four miles from the chief city, and ten from the mouth of the cavern, are upward of twenty large piles of saltpeter earth on the one side, and broken limestone heaped up on the other, evidently the work of human hands.

From the course of his needle, the doctor expected that this avenue would have led circuitously to the chief city; but was much disappointed when he reached the extremity, a few hundred yards' distance from the fourth city. In retracing his steps, not having paid a due attention to mark the entrances of the different avenues, he was greatly bewildered, and once completely lost himself for nearly fifteen or twenty minutes. Thus, faint and wearied, he did not reach the chief area till ten at night; but was still determined to explore the cavern so long as his light should last. Having entered the fifth and last avenue from the chief area, and proceeded south-east about nine hundred yards, he came to the fifth area, the arch of which covers upward of four acres of level ground, strewed with limestone, and having fire-beds of an uncommon size, surrounded with brands of cane, interspersed. Another avenue on the opposite side, led to one of still greater capacity, the walls or sides of which were more perfect than any that had been noticed, running almost due south for nearly a mile and a half, and being very level and straight, with an elegant arch. While the doctor was employed, at the extremity of this avenue, in sketching a plan of the cave, one of his guides, who had strayed to a distance, called on him to follow. Leaving the other guide, he was led to a vertical passage, which opened into a chamber at least eighteen hundred feet in circumference, and the center of the arch of which was one hundred and fifty feet in hight.

It was past midnight when he entered this chamber of eternal darkness; and when he reflected on the different avenues through which he had passed since he had penetrated the cave at eight in the morning, and now found himself buried several miles in the dark recesses of this awful cavern—the grave, perhaps, of thousands of human beings—he felt a shivering horror. The avenue, or passage, which led from it was as large as any he had entered; and it is uncertain how far he might have traveled had his lights not failed him. All those who have any knowledge of this cave, he observes, conjecture that Green river, a stream navigable several hundred miles, passes over three of its branches.

After a lapse of nearly an hour, he descended by what is called the "passage of the chimney," and joined the other guide. Thence returning to the chief area or city, where the lamps were trimmed for the last time, he entered the spacious avenue which led to the second hoppers. Here he met with various curiosities, such as spars, petrifactions, &c.; and these he brought away, together with _a mummy_ which was found at the second hoppers. He reached the mouth of the cave about three in the morning, nearly exhausted with nineteen hours of constant fatigue. He nearly fainted on leaving it, and on inhaling the vapid air of the atmosphere, after having so long breathed the pure air occasioned by the niter of the cave. His pulse beat stronger when in the cave, but not so quick as when on the surface.

Here the doctor observes that he has hardly described half the cave, not having named the avenues between its mouth and the second hoppers. This part of his narrative is of equal interest with what has been already given. He states that there is a passage in the main avenue, upward of nine hundred feet from the entrance, like that of a trap-door. By sliding aside a large flat stone, you can descend sixteen or eighteen feet in a very narrow defile, where the passage comes on a level, and winds about in such a manner, as to pass under the main passage without having any communication with it, at length opening into the main cave by two large passages just beyond the second hoppers. This is called the "glauber-salt room," from salts of that kind being found there. Next come the sick room, the bat-room, and the flint-room, together with a winding avenue, which, branching off at the second hoppers,

runs west and south-west for more than two miles. It is called the “haunted chamber,” from the echo within: its arch is very beautifully incrusted with limestone spar; and in many places the columns of spar are truly elegant, extending from the ceiling to the floor. Near the center of this arch is a dome, apparently fifty feet high, hung in rich drapery, festooned in the most fanciful manner for six or eight feet from the hangings, and in colors the most rich and brilliant. By the reflection of one or two lights, the columns of spar and the stalactites have a very romantic appearance. Of this spar, a large elevation, called “Wilkin’s arm-chair,” has been formed in the center of the avenue and encircled with many smaller ones. The columns of the spar, fluted and studded with knobs of spar and stalactites; the drapery of the various colors superbly festooned and hung in the most graceful manner, these are shown with the greatest brilliancy by the reflection of the lamps.

In the vicinity of the haunted chamber, the sound of a cataract was heard; and at the extremity of the avenue was a reservoir of water, very clear and grateful to the taste, having, apparently, neither inlet nor outlet. Here the air, as in many other parts of the cave, was pure and delightful. Not far from the reservoir, an avenue presented itself, within which were several columns of the most brilliant spar, sixty or seventy feet in hight, and almost perpendicular, standing in basins of water; which, as well as the columns, were of surpassing splendor and beauty.

So far we have followed the brief and general account of Dr. Ward. Turning now to other accounts, we find that the cave extends for miles under the earth, and that the end of it has never yet been reached by any explorer. The air is not only pure, but delightful and exhilarating, and has been highly recommended for diseases of the lungs, so much so, that quite a number of small houses have been built within to accommodate consumptive persons, who at times have resided there with benefit. The temperature there is uniformly the same, being in both winter and summer, from fifty-five degrees to fifty-nine degrees Fahrenheit. Combustion is perfect in all parts of the cave, and decomposition is nowhere observable. No reptiles, of any description, have ever been seen within it. The loudest thunder can not be heard a quarter of a mile within, and the only sound is the roar of the waterfalls, of which there are some seven or eight.

The entire cave, so far as explored, contains two hundred and fifty or more avenues, nearly fifty domes, twenty-two pits and three rivers. Many of the avenues contain large and magnificent stalagmite columns, extending from the floor to the ceiling, and some of very grotesque and fanciful shape. Graceful stalactites may likewise be seen pendant from the ceilings, as uniform and regular as if they were cut by the hand of man. The engraving gives a view of one of those avenues where the stalagmites and stalactites abound in great profusion. In another part of this avenue, in what is called the Gothic Chapel, these stalactic formations are still more striking, very much resembling a monkish cathedral. In the Fairy Grotto, the formations likewise assume a great many fanciful shapes.

Passing now to the second account of a visit to the cave, to which we have already alluded, we find the visitor saying, that the cave is every way so wonderful, that it is impossible to give more than a faint idea of its magnificence and splendor. “As in exploring the cave,” he continues, “there are three rivers to cross and a great deal of climbing over rocks and crawling through narrow places, ladies adopt the Bloomer costume from necessity, and gentlemen are provided with dresses according to their fancy, so that a party starting out for a trip through the cave, present a most grotesque and comical appearance. On arriving at the mouth, the visitor is provided with a lamp, and makes an abrupt, though comparatively easy descent of some seventy or eighty feet. Here he enters a dark avenue, about five rods wide, called the Narrows, and soon finds himself far beyond where daylight ever shone. At the distance of about six hundred yards from the mouth, this avenue expands and forms a large circular room, called the Rotunda, or Great Vestibule. The guide stops here, and ignites a light, a compound of sulphur, saltpeter and antimony, prepared for illuminating the various points of special interest through the cave. This forms a most brilliant light, and reveals a room some two or three hundred feet wide, and forty-seven feet high. The view revealed by this first illumination is most imposing and sublime. I told my guide that he was certainly right in his ideas about describing the cave. As he saw me getting my paper and pencil ready at the mouth, he began laughing very significantly, and said, ‘Writin ’bout the cave aint no use, sir. Most everybody that goes in writes, but they gin’ally throws it away when they comes out. Writin don’t do no good. If anybody wants to know ’bout the cave, they must come and see it.’ Although I had barely commenced my journey through it, I told my guide that I could heartily subscribe to the whole of his speech on this subject.

“And right here, in the great vestibule, I will stop to say a few words about my guide. There are four guides to the cave, all of whom are said to be entirely familiar with it, and to give the most perfect satisfaction to visitors. At all events, I was entirely satisfied with ‘Alfred,’ with whom I made four different journeys through the cave, traveling under ground through various avenues more than fifty miles. Alfred formerly belonged to Miss Mary Croghan, whose elopement from a boarding-school on Staten Island about a dozen years ago, with Captain Shinley, created so great a sensation in New York and elsewhere. After she went to England, she gave

Alfred to some of her relatives, and he belonged to Dr. Croghan at the time of his death, who was the owner of the cave. By the terms of Dr. Croghan's will, Alfred and his wife and children will be free in about eighteen months. He is now drawing wages for his services, which, with the liberal presents he receives from visitors, will enable him to make a very fine start in the world. Alfred has evidently been a great pet, as he learned to read when very small; and he astonishes visitors by his use of scientific terms, and his knowledge of chemistry and geology. He has now been a guide to the cave about sixteen years; has visited it with a great many scientific men; has most of the standard works on geology, and is altogether an interesting character. He sees persons from all parts of the union, and understands all the excitements at the north, from that created by Uncle Tom's Cabin, down to the Forrest divorce trial. He was anxious to buy Uncle Tom's Cabin, and was told that he had better buy a Bible. So he paid four dollars and a half for a Bible, and bought Uncle Tom too. I can not do less than recommend all my friends who may visit the cave, to try and secure Alfred for a guide.

"Leaving the vestibule and passing the Kentucky cliffs, so called from their likeness to the cliffs in Kentucky river, we come to what is very appropriately named the Church and Galleries. At various points upon the route thus far, we have seen the leaching vats and other remains of the saltpeter works that were erected in the cave nearly fifty years ago. The manufacture of saltpeter was carried on quite extensively in the cave for several years, and the guide says the saltpeter was manufactured here with which the powder was made which was used in the battle of New Orleans. There is a very plain cart-path through this part of the cave, and we saw the tracks of oxen which were made forty-seven years ago. The church is the point in the cave where the miners assembled for worship. The rude pulpit or stand from which the preacher addressed his congregation, still remains. But besides this there is a natural pulpit and galleries which are easily ascended by steps in the wall, from which sermons are now frequently preached to visitors, for whom seats are provided. When illuminated, this church is more awfully imposing and solemn, than any temple built by human hands. The cave is more than one hundred feet wide, its massive rocky walls about fifteen feet high, and stretching away in each direction until lost in the most impenetrable darkness. For myself, I could not understand how any man would consent to lift his puny voice where God speaks so impressively. But there is a difference in tastes, and many, I doubt not, are persuaded against their own will to gratify the strong desire of the visitors to hear preaching in the cave. Going on from this point we pass the Grand Arch, a natural arch sixty-six feet high, and about seventy yards wide, and one hundred and fifty yards long; and some distance beyond are shown the Giant's Coffin. This is a huge rock, so formed that the top of it is a fine representation of a coffin. The shape is almost precisely that of a modern metallic coffin. This rock lies exactly east and west, by the compass, and is fifty-seven and a half feet long.

"Here we left the broad main cave in which we had thus far been traveling, and which stretched on indefinitely before us, and turned off into a narrow, circuitous, irregular avenue, and wandered indefinitely. Clambering over rocks, going down precipitous steeps, passing a great variety of rooms, lofty domes, intricate labyrinths, pits from seventy-five to one hundred and seventy-five feet deep, and a great many other points, all appropriately and often very significantly named, we at length came to Gorin's Dome, so called from the name of its discoverer, by far the most imposing I had yet seen. Coming to the end of a narrow avenue, the guide directed me to look through an opening in the wall, a kind of window, and our lamps revealed hights above and depths below, that seemed interminable! He then kindled one of the lights that I have already described, and placing it upon a board, thrust it through the opening and told me to look, first below and then above. The view was utterly indescribable and almost overpowering. The opening was not more than thirty feet in circumference, and I have already forgotten the hight and depth as given me by the guide. But I felt for hours and still feel the tremblings of those emotions that thrilled through my whole frame as I peered into those abysmal depths, and looked up into those giddy hights. None but Jehovah could build such a dome.

"I can not undertake to give the details of our route from avenue to avenue, nor mention the various points of interest that we passed. We were at length in a vast open space; the guide took our lamps, and going a short distance from us, told us to look up, and we at once discovered that we were in the far-famed Star Chamber. The cave here is some twenty or thirty yards wide, and about sixty or seventy feet high, and in a dim light the arch above presents the appearance of the sky in a very starry night. On looking up you see innumerable stars, and as you gaze for a long time the sky seems to be very distant, the stars increase in number, and it seems quite as if you were really looking through an opening in the cave into the heavens. Our guide Alfred was with Professor Silliman when he examined this arch by the aid of a Drummond light, to discover the cause of this appearance, and found that it was crystals embedded in the wall. After we had satisfied ourselves with viewing this artificial sky, Alfred took all our lamps and going into a cave below us, by the shadows from his lamps gave us a representation of clouds passing over the sky, obscuring the stars, thunder-clouds rolling over and the stars appearing again, and other interesting illusions. After this he went still deeper in the cave below us, leaving us in the most pitchy darkness. We were so deep in the bowels of the earth that the loudest thunder has never been heard there, and the silence and darkness were awfully impressive. Suddenly we saw in the direction in

which our guide had disappeared, a light like the rising of the moon, which grew larger and larger, until Alfred emerged through some opening from the regions below, and appeared in the distance in the same cave in which we were standing.

“After leaving this chamber, which was more beautiful than any we had entered, we made our way to the Gothic Gallery. This avenue was unlike anything we had yet seen. It is some four or five rods wide and three-quarters of a mile long, the path over which we walked being much more level than the most of those we had walked over, and much of the wall over our heads looking almost as smooth as if it had been plastered. In this avenue we visited the Haunted Chamber, so called from the fact that two mummies were discovered here many years ago; Vulcan’s Forge, so called from being very dark, and a formation resembling cinders; and near its end the Gothic Gallery. This room has a great variety of stalactite and stalagmite formations, many of which have formed solid massive pillars. As we approached the Chapel, our guide made us all stay behind, while he went ahead, taking all our lamps with him; and when we went forward at his call, we found each of our lamps hung upon some one of these pillars, and illuminating a room, compared with which Taylor’s saloon on Broadway, or the most gorgeous saloon New York can boast, is simplicity itself. These formations are a wonderful curiosity. They are of a very light color, are nearly as hard as granite, and are said to be formed by the drippings of lime water. They are in a great variety of shapes, to which a great many fanciful names have been given, such as the Pulpit, the Devil’s Arm-Chair, the Pillars of Hercules, &c.

“I had intended in this letter to speak of the chief points of interest in what is called the short route through the cave; that is, the portion of the cave that is visited without crossing either of the rivers. I made two visits on this side of the rivers, the first time traveling about six miles, and the second time traveling ten miles and a half. But I am the more willing to pass by the Bandit’s Hall, Mammoth Dome, Persico Avenue, Crockett’s Dome, Snowball Arch, Bunyan’s Way, and other places of special interest, with a mere mention of their names, from the fact that it is so entirely impossible to describe them. Some of these are but rarely visited, and it costs no little effort to reach them. But however narrow the fissures in the rocks through which we squeezed, however steep and slippery the ascent, however long the distance we had to crawl on our hands and knees, we were always more than paid for our pains.

“Omitting, then, any detailed account of what is called the short route, I pass to a notice of the long route, to which most of our time was given. In taking this we entered the cave as before, passed through the great vestibule, and on for a mile or two through the main branch, over the same route we had already traveled. It seems impossible to realize that this is a cave, it is so high, so wide, so vast. Several of our company remarked this fact. We seemed rather to be in some deep, dark ravine or mountain gorge, wandering by the light of our dim lamps, in some night that was utterly rayless and starless. We at length reached the Bottomless Pit, where we entered upon a path that was new to us. This pit is a deep, dark, fearful chasm, and received its name before anything like bottom had been found. It has now been measured to the depth of one hundred and seventy-five feet, and there may be fissures in the rock descending indefinitely below. Near this pit, we passed over an artificial bridge, and entered the Valley of Humility, through which we made our way, stooping and crawling, until we reached what is the most comical and laughable point in the cave, which is most appropriately named the Winding Way, or Fat Man’s Misery. This is an exceedingly circuitous opening in the rock, about eighteen inches wide, and between three and four hundred feet long. At the entrance of this way, the fissure through which we pass is not more than about two feet deep, and the ceiling above us is so high that we could stand erect without difficulty; but in advancing, the fissure becomes deeper, the rocks on either hand are higher and higher, and the ceiling above becomes lower and lower, and it seems to be, indeed, not only fat, but tall men’s misery. It is a most laughable sight to see a party edging their way through this zigzag path; a path that gives every indication of having been washed and worn by the action of the water for innumerable years. Our party was a decidedly lean one, so that we did not, like many others, have the amusement of seeing some one of aldermanic proportions squeeze and worry his way through. Finally, however, we got through, and came into a large open space, which our guide called Great Relief, and a _relief_ it was, sure enough. Passing on, we entered a large, roomy avenue called River Hall, where we were shown the high-water mark in the cave; where, in times of freshets, the river rises fifty-seven feet, perpendicularly, above low-water mark in the cave. We turned aside from this hall into a large room, to witness a great curiosity called the Bacon Chamber. Here the formations overhead are such as to make the room look remarkably like a large smoke-house filled with hams; and near by we were shown a smooth circular excavation in the wall above us, which was pointed out as the _kettle_ for boiling these hams, now turned bottom upward. Returning to the Hall, we went forward, passing several points of interest, until we came to a pure and beautiful body of water called Lake Lethe, upon which we embarked in a small boat provided for the purpose. We were now all on the look-out for the eyeless fish that are found in the waters of the cave, and were so fortunate as to catch in a small net, first, what was called a clawfish, having legs like a lobster, but eyeless and apparently bloodless, being almost precisely the color of potato sprouts that have grown in the spring in a dark cellar. Afterward we caught a very small fish of the same color, and having no eyes. Where the eyes should grow, the flesh was smooth and just like the rest of

the body. Whatever our doubts might have been before, we here had ocular demonstration that the fish in these waters, which are never illumined except by lamplight, are entirely without sight.

“Leaving Lake Lethe, we entered a most grand and imposing avenue, with lofty rocky walls towering about two hundred and fifty feet high, called the Great Walk. This leads to the Echo River, one of the greatest of these subterranean wonders. We sailed down this river a distance of _three-quarters of a mile_, and such a sail! Where on the earth or under the earth, could another such a sail be taken? The water was cold, clear and pure, and in color remarkably like the Niagara, as it plunges over the falls. At many places we could see the bottom, and in others it seemed of very great depth. It flowed in placid stillness, unrippled by a single breeze, between, above and beneath walls of massive and eternal rock. Now the channel was deep, narrow and tortuous, and now it spread out into a broad, pellucid stream. Now the massive ceiling above us was high, and smooth, and beautifully arched; and now it was so rough, broken and low, that we had to stoop as we sat in our boat, in order to pass under it. We did not pass rapidly down this stream. None of us were in a hurry. We seemed scarcely to belong to this driving, go-ahead world. Now a shout echoed wildly and magnificently through the rocky chambers; and now we sat entranced while one of our company, a splendid musician, sang some beautiful song, never as beautiful as now, when it echoed and reëchoed along these walls, and died away in the darkness that our dim lamps could not penetrate. This river, too, is most appropriately named. The echoes are most perfect and beautiful. We experimented in a great variety of ways, singing alone and in concert, shouting, whistling, clapping our hands, and finally, the whole company sung Ortonville. But there was one thing more impressive than all these, and that was silence! We sat in our boat as quietly as possible, no one speaking or moving for some time; and the stillness and the darkness by which we were surrounded, were solemn and awful beyond all description. We were deep in the bowels of the earth, I know not how many feet below its surface, but so low that no ray of light from the sun had ever penetrated its depths, and no voice of loudest thunder had ever waked an echo there. The silence was perfect, save the sound of breathing which each one tried to suppress, and the throbbing of our hearts that

‘Still like muffled drums were beating, Funeral marches to the grave.’

“God spoke in that stillness with a voice such as I had never heard before. I had never before so realized how awfully impressive were darkness and silence. I had entirely new ideas of the awful solitude of that period when the ‘earth was without form and void, and darkness was upon the face of the deep.’

“On getting beyond this river, we entered a region of avenues of incredible if not of interminable length, which have been discovered within the last twelve or fifteen years. One of the first of these is called Silliman Avenue, in honor of Professor Silliman, who has made very thorough explorations of the cave. This avenue is a mile and a half long, about three rods wide, and has various interesting features which I have not time to notice. At the termination of this avenue, the cave widens into a large room, several rods wide, and some fifty or sixty feet high, which is called Ole Bull’s concert-room, from the fact that this musician gave a free concert there to the visitors who were at the cave at the time of his visit.

“Beyond this room, we entered an avenue two miles long, called the Pass of El Gor. This is an exceedingly rocky and uneven avenue, leading, by a most circuitous path up and down great piles of rock, along a most rugged and desolate way, near deep holes and fissures in the rocks, until at length we come to a fine sulphur spring called Hebe’s Spring, which we found very refreshing. Here, through a narrow opening in the rocks, we climb a ladder eighteen feet high, and find a scene that abundantly compensates for the rough walk we have taken to reach it. On reaching the top of this ladder, we find ourselves in Martha’s Vineyard. Here is a vast room, the sides of which are covered over with a formation resembling grapes. They hang on the wall above, plump, round and perfect in form, and in the greatest profusion. They are so solid and hard that it is difficult to break off any of the clusters, and are said to be formed by the drippings of the water through the rocks. Near the head of the ladder there is a fine representation of a vine, of solid rock, running along the wall; and apparently connected with this vine, there are seemingly cart-loads of these rocky grapes. Our guide illumined the vineyard with one of his Bengal lights, and the view was magnificent.

“Going on from this point through Elindo’s Avenue and Washington’s Hall, we reached another of the remarkable rooms of the cave, called the Snowball Room. The cave is here about a hundred feet wide, ten or fifteen feet high, and the ceiling quite even and beautifully arched. Nature has here played most fantastic tricks. I know of no way so good to describe this room, as to say that its walls and ceiling overhead look like the end of some building that a score of school-boys have completely covered over with snowballs. We examined these formations for some time with our lamps, and then Alfred gave us the benefit of an illumination. But of its appearance when thus lighted up, I will attempt no description.

“We were now about seven miles from the mouth of the cave; and with appetites sharpened by our long walk, we sat down to the dinner which our host had sent along for us. It was a magnificent dining-saloon in which we were seated. Taylor’s saloon on Broadway is splendid, and has dazzled and bewildered multitudes, when they first entered it; but neither Taylor, nor prince, nor potentate, ever built a room so gorgeous as that in which we were seated. None but the God who built the skies, and bent and decorated the arch above us, could build another comparable to it.

“The Snowball Room is at the entrance of an avenue more extensive and beautiful than any other in the cave. This is called Cleveland’s Cabinet, and is altogether indescribable. It is about five rods wide and two miles long! Think of its dimensions a moment! About as long as Broadway from the Battery to Union Square, and with walls, not of brick, granite and marble, shaped and graven by art and man’s device, but with walls and ceiling above covered all over with the exquisite and beautiful workmanship of its divine builder.

“We passed slowly through this cabinet, two miles long, the guide conducting us from point to point of remarkable interest, and all the way along showing us new and strange developments. We went to Mary’s Bower, Virginia’s Festoons, Saint Cecelia’s Grotto, Flora’s Garden, where were roses and lilies, rosettes and wreaths, as perfect as though they had been chiseled there by the most accomplished sculptor. The formation on the wall in which these various flowers and other beautiful things are developed, is gypsum of the most snowy whiteness; and our guide said it was in three separate layers, and that the forming process was constantly going on, the inner layers crowding off the outer. The floor was covered with tuns of these layers, which had been crowded off, and which visitors are at liberty to carry off as specimens, while they are strictly prohibited from breaking anything from the walls. But still it is with the utmost difficulty that the guides can preserve some of the most beautiful views in the cave from the destruction of vandal visitors. This part of the cave is less beautiful than formerly, having become a good deal smoked by the lamps of the thousands of visitors who have examined it. But our guide took us into an avenue immediately under this, which is but rarely visited, and conducted us to a most enchanting spot called Egeria’s Grotto. Here the formations were as pure, and beautiful and white, as if fresh from the hand of their Maker. Here were formations, not only of the purest white, but of other most exquisite coloring. We remained a long time in this grotto, examining its various wonders, and deemed ourselves very fortunate in seeing it, as from this we could better understand how Cleveland’s Cabinet above us appeared during the long ages that intervened before it was polluted by the presence of man. Another beautiful grotto was perfectly brilliant and gorgeous, and looked as though its rough walls were a solid mass of diamonds. The most gorgeous and brilliant room ever built in the palace of an earthly monarch, is tameness itself compared with this diamond grotto.

“Emerging again into Cleveland’s Cabinet, we passed on to its termination, where we ascended the Rocky Mountains, a vast pile of loose, broken rocks, one hundred and sixty feet high, which have apparently dropped down from the cave above, leaving a vast vaulted opening in the cave above, to indicate the place from which they have fallen. Beyond these mountains, the cave branches in three directions. We took the branch leading to Croghan’s Hall, the remotest point in the cave that has yet been visited, and _nine miles from its mouth_. On the right of this room there is a deep, awful pit, into which we threw stones, as we had into many others, and heard them roll and bound from rock to rock, down a distance of one hundred and eighty-five feet. The water from some point below us runs over these rocks, and flows off, no mortal knows where. This hall contains large, massive pillars, elaborately carved and ornamented by the Invisible Architect, stalactites and stalagmites of various beautiful forms, and its walls are festooned with that rich drapery which no art can imitate, and which only decks the grottos, bowers and halls of this wonderful cave.

“After refreshing ourselves here from a pleasant spring, we started on our nine-mile tramp for the mouth of the cave, taking only a hurried glance of the varied objects of interest as we passed them. We, however, sailed very leisurely down Echo River, or the Jordan, as it is also called. We again had solos and choruses, and drank in rich delights from this enchanting sail. When we reached Lethe, some of our party determined to send their clothes across in our boat and swim over. They accordingly plunged in very boldly, but hurried out in the quickest time possible; and the chattering of teeth, shivering, leaping and running to get warm again, seemed more befitting a bath in February, than in one of the hottest days in August.

“I had now made four different visits to the cave, traveling, according to the reckoning of my guide, about fifty-four miles. Very few visitors explore it as thoroughly, and yet I had not gone over one-third of the space that has already been explored. The guide says that two hundred and fifty different avenues are already known, measuring the distance of one hundred and sixty-five miles. The temperature of the cave is uniformly about fifty-five degrees, and its bracing, invigorating character may be judged from the fact that ladies, some of them quite delicate, are constantly taking this ‘long route,’ traveling a greater number of miles than most men would think of going on foot above ground.

“We felt but little fatigue from our rough, clambering walk of some twenty miles, until we emerged from the cave, and came in contact with outer air. After breathing the air of the cave from eight A. M. till five P. M., the atmosphere seemed very impure. We could smell every tree, and plant, and old log; and the air was so sultry and sickening, that we had to rest awhile at the mouth before starting for the hotel, some fifty rods distant.

“I have thus attempted to redeem my promise in regard to writing you from the cave. I had no thought of writing at so great length. If the cave were possessed of mind and sensibility, I would take off my hat to it, and feelingly ask its pardon for the great injustice I have done it in these letters. But as it is, I will only say that I have over and over again assented to the truthfulness and justice of my guide Alfred’s idea of all descriptions of the cave: ‘Writin don’t do no good. If anybody wants to know how the cave looks, they must come and see it.’ And I can not conceive of any journey for this purpose so long and toilsome, that those making it would not be abundantly compensated for their pains, by a view of this wonderful work of a wonder-working God.”

Still another visitor, writing to a friend in Europe, says of this wonderful cave, “I had heard and read descriptions of it, long since; but the half, the quarter, was not told. Its vastness, its lofty arches, its immense reach into the bosom of the solid earth, fill me with astonishment. It is, like Mont Blanc, Chimborazo, and the falls of Niagara, one of God’s mightiest works. Shall I compare it with anything of a similar description, which you have seen on the other side of the Atlantic? with the grotto of Neptune, or that of the Sibyl, at Tivoli, or with any of Virgil’s poetic Italian machinery? No comparison can be instituted. I speak, as you are aware, from personal knowledge. You, seated on the opposite bank of the Arno, have seen me clamber up, from the noisy waters below, to the entrance of the far-famed grotto of Neptune, which I leisurely explored. In point of capaciousness, that grotto has little more to boast of than the cellar of a large hotel, and, like that, was, as I think, excavated by human hands. That of the Tiburtine Sibyl is still more limited in its dimensions. Indeed, every cavern which I have ever seen, if placed along side of this, would dwindle into insignificance.”

The same writer says, “I can not refrain from giving you an account of an incident that happened in this cave last spring. A wedding party went to the cave to spend the honeymoon. While there, they went to visit those beautiful portions of the cave which lie beyond the river ‘Jordan.’ In order to do this, a person has to sail down the river nearly a mile before reaching the avenue which leads off from the river on the opposite side, for there is no shore, or landing-place, between the point above on this side, where you come to the river, and that below on the other; for the river fills the whole width of one avenue of the cave, and is several feet deep where the side walls descend into the water. This party had descended the river, visited the cave beyond, and had again embarked on the water for their return homeward. After they had ascended the river about half-way, some of the party, who were in a high glee, got into a romp and overturned the boat. Their lights were all extinguished, their matches wet, the boat filled with water and sunk immediately; and _there they were_, in ‘the blackness of darkness,’ up to their chins in water. No doubt, they would all have been lost, had it not been for the guide’s great presence of mind. He charged them to remain perfectly still; for, if they moved a single step, they might get out of their depth in water; and swimming would not avail them, for they could not see where to swim to. He knew that, if they could bear the coldness of the water any length of time, they would be safe; for another guide would be sent from the cave house, to see what had become of them. And in this perilous condition, up to their mouths in water, in the midst of darkness ‘more than night,’ _four miles under ground_, they remained for upward of five hours; at the end of which time, another guide came to their relief. Matthew, or Mat, the guide who rescued them, told me that, when he got to where they were, his fellow-guide, Stephen, (the Columbus of the cave,) was swimming around the rest of the party, cheering them, and directing his movements, while swimming, by the sound of their voices, which were raised, one and all, in prayer and supplication for deliverance!”

In conclusion it may be interesting to state, that Colonel Croghan, to whose family the Mammoth cave belongs, was a resident of Louisville, Kentucky. He went to Europe some twenty years ago, and found himself frequently questioned of the wonders of the Mammoth cave, a place he had never visited, and of which he had heard but little at home, though living within ninety miles of it. He went there on his return, and the idea struck him to purchase it, and make it a family inheritance. In fifteen minutes’ bargaining he bought it for ten thousand dollars, and shortly after he was offered one hundred thousand dollars for his purchase. In his will he tied it up in such a way that it must remain in his family for two generations, thus appending its celebrity to his name. There are nineteen hundred acres in the estate, though the cave probably runs under the property of a great number of other land owners. For fear of those who might dig down and establish an entrance to the cave on their own property, (a man’s farm extending up to the zenith and down to the nadir,) great vigilance is exercised to prevent such subterranean surveys and measurements as would enable one to sink a shaft with any certainty. The cave extends ten or twelve miles in several directions, and there is probably many a back-woodsman sitting in his hut within ten miles of the cave, quite unconscious that the most fashionable ladies and gentlemen of

Europe and America are walking without leave under his potatoes and corn.

THE GREAT CAVERN OF GUACHARO.

Passing from the Mammoth cave in North America, let us next notice the great cavern of Guacharo in South America, as described in the narrative of Humboldt, which is abridged in the account that follows.

“In a country where the people are fond of the marvelous, a cavern that gives birth to a river, and which is inhabited by thousands of nocturnal birds, the fat of which is used to dress the food of the inhabitants, is a ceaseless topic of conversation and discussion. Scarcely has a stranger arrived at Cumana, when he is told of the stone of Araya for the eyes; of the laborer of Arenas who suckled his child; and of the cavern of Guacharo, which is said to be several leagues in length; till he is tired of hearing of them.

“The Cueva del Guacharo is pierced in the vertical profile of a rock. The entrance is toward the south, and forms a vault eighty feet broad, and seventy-two feet high. The rock, that surmounts the grotto, is covered with trees of gigantic hight. The mammee-tree, and the genipa with large and shining leaves, raise their branches vertically toward the sky; while those of the courbaril and the erythrina form, as they extend themselves, a thick vault of verdure. Plants of the family of pothos with succulent stems, oxalises, and orchideæ of a singular structure, rise in the driest cliffs of the rocks; while creeping plants, waving in the winds, are interwoven in festoons before the opening of the cavern. We distinguished in these festoons a bignonia of a violet blue, the purple dolichos, and for the first time that magnificent olandra, the orange flower of which has a fleshy tube more than four inches long. The entrances of grottos, like the view of cascades, derive their principal charm from the situation, more or less majestic, in which they are placed, and which in some sort determines the character of the landscape. What a contrast between the Cueva of Caripe, and those caverns of the north crowned with oaks and gloomy larch-trees!

“But this luxury of vegetation embellishes not only the outside of the vault, it appears even in the vestibule of the grotto. One sees with astonishment plantain-leaved heliconias eighteen feet high, the praga palm-tree, and arborescent arums, follow the banks of the river even to those subterranean places. The vegetation continues in the cave of Caripe, as in the deep crevices of the Andes, half excluded from the light of day; and does not disappear, till, advancing into the interior, we reach thirty or forty paces from the entrance. We measured the way by means of a cord; and we went on about four hundred and thirty feet, without being obliged to light our torches.

“Daylight penetrates into this region, because the grotto forms but one single channel, which keeps the same direction from south-east to north-west. Where the light begins to fail, are heard from afar the hoarse sounds of the nocturnal birds, sounds which the natives think belong exclusively to those subterraneous places. The guacharo is of the size of our fowls, has the mouth of the goatsuckers and procnias, and the port of those vultures, the crooked beak of which is surrounded with stiff silky hairs. It forms a new genus, very different from the goatsucker by the force of its voice, by the considerable strength of its beak, containing a double tooth, and by its feet without the membranes that unite the anterior phalanxes of the claws. In its manners it has analogies both to the goatsuckers and the alpine crow. The plumage of the guacharo is of a dark bluish-gray, mixed with small streaks and specks of black. It is difficult to form an idea of the horrible noise occasioned by thousands of these birds in the dark part of the cavern, and which can only be compared to the croaking of our crows, which, in the pine forests of the north, live in society, and construct their nests upon trees, the tops of which touch each other. The shrill and piercing cries of the guacharoes strike upon the vaults of the rocks, and are repeated by the echo in the depth of the cavern. The Indians showed us the nests of these birds, by fixing torches to the end of a long pole. These nests were fifty or sixty feet high above our heads, in holes in the shape of funnels, with which the roof of the grotto is pierced like a sieve. The noise increased as we advanced, and the birds were affrighted by the light of the torches of copal. When this noise ceased around us, we heard at a distance the plaintive cries of the birds roosting in other ramifications of the cavern. It seemed as if these bands answered each other alternately.

“The Indians enter into the Cueva del Guacharo once a year, near midsummer, armed with poles, by means of which they destroy the greater part of the nests. At this season several thousands of birds are killed; and the old ones, to defend their brood, hover around the heads of the savage Indians, uttering terrible cries, which would appall any heart but that of man in an untutored state.

“We followed, as we continued our progress through the cavern, the banks of the small river which issued from it, and is from twenty-eight to thirty feet wide. We walked on the banks, as far as the hills formed of calcareous incrustations permitted us. When the torrent wound among very high masses of stalactites, we were often obliged to descend into its bed, which is only two feet in depth. We learned with surprise, that this subterraneous rivulet is the origin of the river Caripe, which, at a few leagues’ distance, after having joined the small river of Santa Maria, is navigable for canoes. It enters into the river Areo under the name of Canno de

Terezen. We found on the banks of the subterraneous rivulet a great quantity of palm-tree wood, the remains of trunks, on which the Indians climb to reach the nests hanging to the roofs of the cavern. The rings, formed by the vestiges of the old footstalks of the leaves, furnish as it were the footsteps of a ladder perpendicularly placed.

“The grotto of Caripe preserves the same direction, the same breadth, and its primitive hight of sixty or seventy feet, to the distance of fourteen hundred and fifty-eight feet, accurately measured. I have never seen a cavern in either continent, of so uniform and regular a construction. We had great difficulty in persuading the Indians to pass beyond the outer part of the grotto, the only part which they annually visit to collect the fat. The whole authority of the priests was necessary, to induce them to advance as far as the spot where the soil rises abruptly at an inclination of sixty degrees, and where the torrent forms a small subterraneous cascade.[3] The natives connect mystic ideas with this cave, inhabited by nocturnal birds; they believe, that the souls of their ancestors sojourn in the deep recesses of the cavern. ‘Man,’ say they, ‘should avoid places which are enlightened neither by the sun nor by the moon.’ To go and join the guacharoes, is to rejoin their fathers, is to die. The magicians and the poisoners perform their nocturnal tricks at the entrance of the cavern, to conjure the chief of the evil spirits.

Footnote 3:

We find this phenomenon of a subterranean cascade, but on a much larger scale, in England, at Yordas cave, near Kingsdale, in Yorkshire.

“At the point where the river forms the subterraneous cascade, a hill covered with vegetation, which is opposite the opening of the grotto, presents itself in a very picturesque manner. It appears at the extremity of a straight passage, two hundred and forty toises in length. The stalactites, which descend from the vault, and which resemble columns suspended in the air, display themselves on a back-ground of verdure. The opening of the cavern appeared singularly contracted, when we saw it about the middle of the day, illumined by the vivid light reflected at once from the sky, the plants, and the rocks. The distant light of day formed somewhat of a magical contrast with the darkness that surrounded us in those vast caverns. We climbed, not without some difficulty, the small hill, whence the subterraneous rivulet descends. We saw that the grotto was perceptibly contracted, retaining only forty feet in its hight; and that it continued stretching to the northeast, without deviating from its primitive direction, which is parallel to that of the great valley of Caripe.

“The missionaries, with all their authority, could not prevail on the Indians to penetrate farther into the cavern. As the vault grew lower, the cries of the guacharoes became more shrill. We were obliged to yield to the pusillanimity of our guides, and trace back our steps. We followed the course of the torrent to go out of the cavern. Before our eyes were dazzled with the light of day, we saw without the grotto, the water of the river sparkling amid the foliage of the trees that concealed it. It was like a picture placed in the distance, and to which the mouth of the cavern served as a frame. Having at length reached the entrance, and seated ourselves on the bank of the rivulet, we rested after our fatigues. We were glad to be beyond the hoarse cries of the birds, and to leave a place where darkness does not offer even the charms of silence and tranquillity.”

FINGAL’S CAVE,

OR GRAND STAFFA CAVERN.

Staffa, about seven miles north-north-east of Jona, and equidistant westward from the shores of Mull, about one mile in length, and half a mile in breadth, is noted for the basaltic pillars which support the major part of the island, and for the magnificent spectacle afforded by the cave of Fingal, one of the most splendid works of nature.

Notwithstanding the contiguity of this wonderful island to Mull and Iona, and the numerous vessels which navigate these seas, it was unknown to the world in general, and even to most of the neighboring islanders, until near the close of the last century, when Sir Joseph Banks, then on his voyage to Iceland, in consequence of information received in the sound of Iona, from some gentlemen of Mull, was induced to sail thither. It is, indeed, slightly mentioned by Buchanan; but assuredly it was not equally dead to fame at the time the Norwegians had sway in these parts, for from them it derives its name of Staffa.

The basaltic pillars stand in natural colonnades, mostly above fifty feet high, in the south-western part, upon a firm basis of solid unshapen rock: above these, the stratum, which reaches to the soil of the island, varies in thickness, in proportion to the distribution

of the surface into hill and valley. The pillars are of three, four and more sides; but the number of those with five and six exceeds that of the others; one of seven sides measured by Sir Joseph, was four feet and five inches in diameter.

On the west side of Staffa is a small bay, the spot where boats usually land. In this neighborhood occurs the first group of pillars: they are small, and instead of being placed upright, are recumbent on their sides, and form a segment of a circle. Further on is a small cave, above which pillars again are seen, of somewhat larger dimensions, which incline in all directions; in one place in particular, a small mass of them much resembles the ribs of a ship. Beyond the cave is the first continued range of pillars, larger than the former, and opposite to them is a small island called Bhuachaile, (pronounced Boo-sha-'lay,) or the Herdsman's isle, separated from the main by a channel not many fathoms wide. The whole of this islet is composed of pillars without any strata above them; they are small, but by much the neatest formed of any in this quarter.

The first division of this islet, for at high tide it is divided into two parts, makes a kind of cone, the pillars converging together toward the center. On the other side the pillars are in general recumbent; and in the front, next the main, the beautiful manner in which they are joined is visible from their even extremities: all these have their transverse sections exact, and their surfaces smooth; but with the larger pillars the reverse is the case, and they are cracked in all directions.

The main island opposite the Boo-sha-'lay, and thence toward the north-west, is entirely supported by ranges of pillars, pretty erect, which, although not apparently tall, from their not being uncovered to the base, are of large diameter; at their feet is an irregular pavement, made by the upper sides of such as have been broken off. This extends as far under the water as the eye can reach.

In proceeding along the shore, the superb cavern of Fingal appears, for such is the denomination given it by the Highlanders, to whom it is known. It is supported on each side by ranges of columns, and is roofed by the bottoms of such as have been broken away. From the interstices of the roof a yellow stalactitic matter has exuded, which precisely defines the different angles; and, varying the color, tends to augment the elegance of its appearance. What adds to the grandeur of the scene, the whole cave is lighted from without, in such a manner, that the furthest extremity is plainly distinguished; while the air within, being constantly in motion, owing to the flux and reflux of the tides, is perfectly dry and wholesome, and entirely exempt from the damp vapors to which natural caverns are generally subject. The following are its dimensions:

Feet. In. Length of the cave from the rock without, 371 6 Length of the cave from the pitch of the arch, 250 0 Breadth of the cave at the mouth, 53 7 Breadth of the cave at the further end, 20 0 Hight of the arch at the mouth, 117 6 Hight of the arch at the end, 70 0 Hight of an outside pillar, 39 6 Hight of one at the north-west corner, 54 0 Depth of water at the mouth, 18 0 Depth of water at the extremity, 9 0

The cave runs to the rock in the direction, by compass, north-north-east.

The mind can hardly form an idea more magnificent than such a space. And, indeed, speaking of the general aspect of Staffa, Sir Joseph is led, by his enthusiasm, to make the following reflections: "Compared to this, what are the cathedrals or the palaces built by man! mere models or playthings, imitations as diminutive as his works will always be, when compared to those of Nature. Where is now the boast of the architect! regularity, the only part in which he fancied himself to exceed his mistress, Nature, is here found in her possession, and here it has been left undescribed for ages. Is not this the school where the art was originally studied? And what has been added to this by the whole Grecian school? A capital to ornament the column of Nature, of which they could execute a model only; and for that very capital they were obliged to a bush of acanthus. How amply does Nature repay those who study her wonderful works."

Such were his feelings, and in this way did he moralize, when proceeding along shore, and treading as it were on another Giant's Causeway, he arrived at the mouth of the cave.

To the north-west are found the highest range of pillars. Here they are bare to their base, and the stratum beneath is visible, as it rises several feet above the water. The surface of it is rough, with frequent large pieces of stone sticking in it, as if half immersed. The base, when broken, appears to be composed of many heterogenous parts, and much resembles lava. Many of the floating stones are of a similar substance with the pillars, a coarse kind of basalt, less beautiful than that of the Giant's Causeway: the color is a dirty brown. The whole of this stratum dips gradually to the south-east.

The thickness of the stratum of lava-like matter below the pillars, the hight of the pillars, and the thickness of the superincumbent stratum, at three different places westward of the mouth of the cave, beginning with the corner pillar of the cave, are described as follows by Sir Joseph Banks:

Feet. In. Feet. In. Feet. In. Stratum below, 11 0 17 1 19 8 Hight of pillars, 54 0 50 0 55 1 Stratum above, 61 6 51 1 54 7

The stratum above the columns is uniformly the same, consisting of numberless small pillars, bending and inclining in all directions, sometimes so irregularly, that the stones can only be said to have an inclination to assume a columnar form; in others more regularly; but never breaking into, or disturbing the stratum of large pillars, whose tops keep everywhere an uniform line. On the opposite side of the island is a cavern, called Oua-na-scarve, or the Cormorant's cave; here the stratum under the pillars is lifted up very high, and the pillars are considerably less than at the north-west side. Beyond, a bay cuts deep into the island, rendering it not more than a quarter of a mile across. On the sides of this bay, especially beyond a little valley, which almost divides the island, are two stages of small pillars, with a stratum between, exactly resembling that above, formed of innumerable little pillars shaken out of their places, and leaning in all directions. Beyond this, the pillars totally cease. The rock is of a dark-brown stone, without regularity, from the bay along the south-east end of the island; beyond which, a disposition to columnar formation is again manifested, extending from the west side, but in an irregular manner, to the bending pillars first described.

OTHER GROTTOS AND CAVERNS.

There are few countries which have not to boast of a variety of natural excavations; and these have, from their extent, structure, and the curious phenomena they exhibit, in the formation of petrifactions, &c., been at all times objects of popular attention. Among those particularly deserving of notice are the following.

The volcanic country bordering on Rome, is peculiarly diversified by natural cavities of great extent and coolness; on which last account it is related by Seneca, that the Romans were accustomed to erect seats in their vicinity, to enjoy their refreshing chillness in the summer season. He gives a particular account of two such grottos belonging to the villa of Vatia; and it was in a place of this kind that Tiberius was nearly destroyed while at supper. Its roof suddenly gave way, and buried several of his attendants in its ruins; which so alarmed the others, that they fled and abandoned the emperor, with the exception of Sejanus, who, stooping on his hands and knees, and covering the body of Tiberius with his own, received all the stones which fell at that part from the roof, insomuch that, although he himself sustained considerable injury, the emperor escaped unhurt.

The grottos of the Cevennes mountains, in lower Languedoc, are both numerous and extensive. The principal one is not to be explored without much precaution, and without a safe guide. The entrance, which is low and narrow, leads to a spacious amphitheater, the petrifactions hanging from the roof of which have a most splendid effect by the light of torches. Hence the visitor has to descend to several chambers, one of which is named the Chamber of the Winds; another, of Echo; another, of the Cascade; another, again, of the Statue, &c.; on account of their exhibiting these different phenomena. In the grotto of Valori, at a small distance, the different natural curiosities which are to be found at every step, may be viewed at leisure, and without apprehension, as the visitor never loses sight of the light at the entrance, and is, therefore, not under any dread of not returning in safety. Here he is gratified by a view of the most singular petrifactions, representing flowers, fruits, bee-hives, and, in short, a variety of objects, in many of which the resemblance is nearly as accurate as if they had been sculptured.

In a wood, about five leagues from Besançon, in the province of France called Franche Comte, an opening, formed by two masses of rock, leads to a cavern more than nine hundred feet beneath the level of the country. It is in width sixty feet, and eighty feet high at the entrance, and exhibits inside an oval cavity of one hundred and thirty-five feet in breadth, and one hundred and sixty-eight in length. To the right of the entrance is a deep and narrow opening, bordered with festoons of ice, which, distilling in successive drops on the bottom of the cavern, form a mass of about thirty feet in diameter. A similar one, but somewhat smaller, produced by the water which drips in less abundance from the imperceptible fissures in the roof, is seen on the left. The ground of the cavern is perfectly smooth, and covered with ice eighteen inches thick; but the top, on the outside, is a dry and stony soil, covered with trees, and on a level with the rest of the wood. The cold within this cavern is so great, that, however warm the external atmosphere may be when it is visited, it is impossible to remain in it for any length of time.

These natural ice-houses are not unfrequent in France and Italy, and supply this agreeable luxury at a very cheap rate. Thus, in the same province, in the vicinity of Vesoul, is a cavern which, in the hot season, when it is eagerly sought, produces more ice in one day, than can be carried away in eight. It measures thirty-five feet in length, and in width sixty. The large masses of ice which hang pendent from the roof, have a very pleasing effect. When mists are observed in this cavern, they are regarded by the neighboring peasantry as infallible prognostics of rain; and it is worthy of observation, that although the water in the interior is always frozen in the summer, it becomes liquid in the winter season.

A grotto near Douse, also in Franche Comte, forms a similar ice-house, and is remarkable on account of the various forms of its congelations, which represent a series of columns, sustaining a curious vault, which appears to be carved with figures of men, animals, trees, &c.

The caverns of Gibraltar are numerous, and several of them of great extent. The one more particularly deserving attention is called St. Michael's cave, situated on the southern part of the mountain. Its entrance is one thousand feet above the level of the sea, and is formed by a rapid slope of earth, which has fallen in at various periods, and which leads to a spacious hall, incrusted with spar, and apparently supported in the center by a large stalactitical pillar. To this succeeds a long series of caves, of difficult access. The passages leading from the one to the other are over precipices, which can not be passed without the aid of ropes and scaling-ladders. Several of these caves are three hundred feet beneath the upper one; but at this depth the smoke of the torches carried by the guides becomes so disagreeable, that the visitor is obliged reluctantly to give up the pursuit, and leave other caves unexplored. In these cavernous recesses, the process and formation of the stalactites is to be traced, from the flimsy quilt-like cone suspended from the roof, to the robust trunk of a pillar, three feet in diameter, which rises from the floor, and seems intended by nature to support the roof from which it originated.

The variety of forms which this matter takes in its different situations and directions, renders this subterraneous scenery strikingly grotesque, and in some places beautifully picturesque. The stalactites of these caves, when near the surface of the mountain, are of a brownish yellow color; but, in descending toward the lower caves, they lose the darkness of their color, which is by degrees shaded off to a pale yellow. Fragments are broken off, and, when wrought into different forms, and polished, are beautifully streaked and marbled.

About seven English miles from Adlersberg, in Carniola, is a remarkable cavern, named St. Magdalen's cave. The road being covered with stones and bushes, is very painful; but the great fatigue it occasions is overbalanced by the satisfaction of seeing so uncommon a cavern. The visitor first descends into a hole, where the earth appears to have fallen in for ten paces, when he reaches the entrance, which resembles a fissure caused by an earthquake, in a huge rock. The torches are here lighted, the cave being extremely dark. This wonderful natural excavation is divided into several large halls, and other apartments. The vast number of pillars by which it is ornamented give it a superb appearance, and are extremely beautiful: they are as white as snow, and have a semi-transparent luster. The bottom is of the same materials; insomuch that the visitor may fancy he is walking beneath the ruins of some stately palace, amid noble pillars and columns, partly mutilated, and partly entire. Sparry icicles are everywhere seen suspended from the roof, in some places resembling wax tapers, which, from their radiant whiteness, appear extremely beautiful. All the inconvenience here arises from the inequality of the surface, which may make the spectator stumble while he is contemplating the beauties above and around him.

In the neighborhood of the village of Szelitze, in Upper Hungary, there is a very singular excavation. The adjacent country is hilly, and abounds with woods, the air being cold and penetrating. The entrance into this cavern, fronting the south, is upward of one hundred feet in hight, and forty-eight in breadth, consequently sufficiently wide to receive the south wind, which here generally blows with great violence; but the subterraneous passages, which consist entirely of solid rock, winding round, stretch still farther to the south. As far as they have been explored, their hight has been found to be three hundred feet, and their breadth about one hundred and fifty. The most inexplicable singularity, however, is, that in the midst of winter the air in this cavern is warm; and when the heat of the sun without is scarcely supportable, the cold within is not only very piercing, but so intense, that the roof is covered with icicles of the size of a large cask, which, spreading into ramifications, form very grotesque figures. When the snow melts in spring, the inside of the cave, where its surface is exposed to the south sun, emits a pellucid water, which congeals instantly as it drops, and thus forms the above icicles: even the water which falls from them on the sandy ground, freezes in an instant. It is observed, that the greater the heat is without, the more intense is the cold within; so that, in the dog-days, every part of this cavern is covered with ice. In autumn, when the nights become cold, the ice begins to dissolve, insomuch that, when the winter sets in, it is no longer to be seen; the cavern then is perfectly dry, and has a mild and gentle warmth. It is, therefore, not surprising that swarms of flies, gnats, bats, owls, and even great numbers of foxes and hares, resort thither, as to their winter retreat, and remain there till the return of spring.

MINES, METALS, GEMS, &C.

"Through dark retreats pursue the winding ore, Search nature's depths, and view the boundless store; The secret cause in tuneful numbers sing, How metals first were framed, and whence they spring: Whether the active sun, with chymic flames, Through porous earth transmits his genial beams With heat impregnating the womb of night The offspring shines with his paternal light: Or whether,

urged by subterraneous flames, The earth ferments and flows in liquid streams; Purged from their dross, the nobler parts refine, Receive new forms, and with new beauty shine: Or whether by creation first they sprung, When yet unpoised the world's great fabric hung: Metals the bases of the earth were made, The bars on which its fixed foundation's laid: All second causes they disdain to own, And from the Almighty's fiat sprung alone."

The transition from the caverns and caves of the earth, to its MINES, and the various metals and gems they contain, is both natural and easy; and having dwelt on the former, we propose next to advert to the latter. By the word "_mines_" we understand those excavations, in which metals, minerals and precious stones are sought and found; and according to the substances which they yield they are variously spoken of as "gold mines," "silver mines," "lead mines," &c., &c. The richest and most celebrated gold and silver mines are those of Mexico and Peru, in South America, and those lately discovered in California and Australia. Iron mines are more abundant, or at least more abundantly worked, in Europe than elsewhere, though the rapid increase of iron mining in the United States gives promise that our country may in this respect some day rival the old world. Copper mines have been found chiefly in England, Sweden and Denmark; and of late years copper has been found to be abundant in the region of our northern lakes. Lead and tin mines are numerous in England, the latter chiefly in the county of Cornwall; and lead is also found in abundance in the United States. Quicksilver mines abound principally in Hungary, Spain, Friuli, in the Venetian territories, and in Peru. Diamond mines are mainly in Brazil, and some in the East Indies; and salt mines are in Poland.

To explain the structure of mines, it should be observed that the internal parts of the earth, as far as they have been investigated, do not consist of any one uniform substance, but of various strata, or beds of substances, extremely different in their appearances, specific gravities and chemical qualities, one from another. Neither are these strata similar to each other, either in their nature or appearance, in different countries; insomuch that, even in the short extent of half a mile, sometimes, the strata will be found quite different in one from what they are in another place. As little are they the same either in depth or solidity. Innumerable cracks and fissures are found in all of them; and these again are so entirely different in size and shape, that it is impossible to form any inference from what may have been met with, relative to that which remains to be explored.

In Cornwall, the most common opinion entertained by the miners, is, that crude and immature minerals nourish and feed the ores with which they are intermixed in the mines; and that the minerals themselves will, in process of time, be converted into ores productive of those metals to which they have the nearest affinity, and with which they are most closely intermingled. And a distinguished professor, who is familiar alike with geology, chemistry and mineralogy, after visiting the mining districts of California, has given it as his opinion, that gold is constantly being formed there, by some powerful agency of nature which is still and steadily at work. And as a somewhat kindred view, Mr. Price, in his mineralogy of Cornwall, thinks it is most reasonable to conclude, that metals were made and planted in veins, at, or very soon after, the creation of the world; but that, in common with all other matter, they are subject to a degree of fluctuation, approaching to, or receding from, their ultimate degree of perfection, either quicker or slower, as they are of greater or less solid and durable frame and constitution. He supposes in every metal a peculiar magnetism, and an approximation of particles of the same specific nature, by which its component principles are drawn and united together; more particularly the matters left by the decomposition of the waters passing through the contiguous earths or strata, and deposited in their proper nidus or receptacle, until, by the accretion of more or less of its homogeneous particles, the metallic vein may be denominated either rich or barren.

DIAMOND MINES.

The word _diamond_, is supposed to be a corruption of the word _adamant_, in allusion to the great hardness of this gem, which is the most valuable of all the precious stones. Diamonds were originally discovered in Bengal, and in the island of Borneo; and about the year 1720, were found in Brazil. They are found of all colors; and those which are colorless, or of some decided tint, are most esteemed, though the latter kind are very rare. Those which are slightly discolored are the least valuable.

The specific gravity of the diamond, is, to that of water, in the proportion of about three and a half to one. It is the hardest of all known substances, and can only be cut and polished by its own dust or powder. The art of splitting or cutting and polishing this gem, though probably of remote antiquity in Asia, was first introduced into Europe in 1486, by Louis Berghan, of Bruges, who accidentally discovered that by rubbing two diamonds together, their surfaces might be rendered smooth. And the fine powder which is rubbed off by such friction, serves to grind and polish them. The diamond is of the nature of _charcoal_, or pure carbon, and is combustible: under the blow-pipe it burns away in a blue, lambent flame.

The high value attached to diamonds does not depend so much on their beauty and hardness, as on their great scarcity, and the labor and expense necessary in procuring them. Hitherto they have been observed only in the torrid zone; and Brazil is the only part of America in which they have been found. The historical account of their discovery in that country is as follows. Near the capital of the territory of Serro do Frio flows the river Milho Verde, where it was the custom to dig for gold, or rather to extract it from the alluvial soil. The miners, during their search for gold, found several diamonds, which they were induced to lay aside in consequence of their particular shape and great beauty, although they were ignorant of their intrinsic value.

The diamond works on the river Jigitonhonha are described by Mr. Mawe as the most important in the Brazilian territory. The river, in depth from three to nine feet, is intersected by a canal, beneath the head of which it is stopped by an embankment of several thousand bags of sand, its deeper parts being laid dry by chain-pumps. The mud is now washed away, and the =cascalhao=, or earth which contains the diamonds, dug up, and removed to a convenient place for washing. The process, which is as follows, is seen in the cut on the next page. A shed, consisting of upright posts which support a thatched roof, is erected in the form of a parallelogram, in length about ninety feet, and in width forty-five. Down the middle of its area a current of water is conveyed through a canal covered with strong planks, on which the earth is laid to the thickness of two or three feet. On the other side of the area is a flooring of planks, from twelve to fifteen feet in length, imbedded in clay, extending the whole length of the shed, and having a gentle slope from the canal. This flooring is divided into about twenty compartments, or troughs, each about three feet wide, by means of planks placed on their edges; and the upper ends of these troughs communicate with the canal, being so formed that water is admitted into them between two planks about an inch separate from each other. Through this opening the current falls about six inches into the trough, and may be directed to any part of it, or stopped at pleasure, by means of a small quantity of clay. Along the lower ends of the troughs a small channel is dug, to carry off the water.

[Illustration: DIAMOND WASHING IN BRAZIL.]

On the heap of earth, at equal distances, three high chairs are placed for the overseers, who are no sooner seated than the negroes enter the troughs, each provided with a rake of a peculiar form, and having a short handle, with which he rakes into the trough from fifty to eighty pounds' weight of the earth. The water being then allowed to pass in by degrees, the earth is spread abroad, and continually raked up to the head of the trough, so as to be kept in constant motion. This operation is continued for a quarter of an hour, when the water begins to run clearer; and, the earthy particles having been washed away, the gravel-like matter is raked up to the end of the trough. At length the current flowing quite clear, the largest stones are thrown out, and afterward those of an inferior size; the whole is then examined with great care for diamonds. When a negro finds one, he instantly stands upright, and claps his hands; he then extends them, holding the gem between the fore-finger and the thumb. An overseer receives it from him, and deposits it in a bowl, suspended from the center of the structure, and half filled with water. In this vessel all the diamonds found in the course of the day are deposited, and at the close of the work are taken out and delivered to the principal overseer, who, after they have been weighed, registers the particulars in a book kept for that purpose.

When a negro is so fortunate as to find a diamond of the weight of seventeen carats and a half, the following ceremony takes place: he is crowned with a wreath of flowers, and carried in procession to the administrator, who gives him his freedom by paying his owner for it. He also receives a present of new clothes, and is permitted to work on his own account. For small stones proportionate premiums are given; while many precautions are taken to prevent the negroes from stealing the diamonds, with which view they are frequently changed by the overseers, lest these precious gems should be concealed in the corners of the troughs. When a negro is suspected of swallowing a diamond, he is confined in a solitary apartment, and means taken to bring the gem to light.

In the East Indies, the kingdom of Golconda, extending two hundred and sixty miles along the bay of Bengal, and having a breadth of two hundred miles from east to west, abounds in diamond mines. They are chiefly in the vicinity of the rocky hills and mountains which intersect the country, and in the whole of which diamonds are supposed to be contained. In several of the mines they are found scattered in the earth, within two or three fathoms of the surface, and in others are met with in a mineral substance in the body of the rocks, forty or fifty fathoms deep. The laborers having dug five or six feet into the rock, soften the stone by fire, and proceed till they find the vein, which often runs two or three furlongs under the rock. The earth being brought out and carefully searched, affords stones of various shapes, and of a good water. This earth is of a yellowish, and sometimes of a reddish color, frequently adhering to the diamond with so strong a crust that the separation becomes difficult.

To find the diamonds, the workmen form a cistern of a kind of clay, with a small vent on one side, a little above the bottom; in this vent they place a plug, and throwing into the cistern the earth they have dug, pour in water to dissolve it. They then break the clods, and stir the wet earth in the cistern, allowing the lighter part to be carried off in the form of mud, when the vent-hole is opened to let

out the water. They thus continue washing, until what remains in the cistern is pretty clean; and then, in the middle of the day, when the sun shines bright, carefully look over all the sand, at which practice they are so expert, that the smallest stone can not escape them. The brightness of the sun being reflected by the diamonds, aids them in their research, which would be foiled if a cloud were to intervene.

The largest known diamond was found in Brazil, and belongs to the king of Portugal. It weighs sixteen hundred and eighty carats; and, although uncut, it is valued at the enormous sum of two hundred and twenty-four millions sterling, which gives an estimate of nearly eighty pounds sterling for each carat, the multiplicand of the square of its whole weight being taken. The one next in magnitude and value, is probably that mentioned by Tavernier, in possession of the Great Mogul. It was found in Golconda in 1550; is of the size of half a hen's egg, and is said to weigh nine hundred carats. This diamond is the same as the famous "_Koh-i-noor_," or "Mountain of Light," now belonging to the queen of England, and which attracted so much attention in the great exhibition at London, in 1851. The one supposed to be next in value, is that belonging to the crown jewels of Russia, which weighs seven hundred and seventy-nine carats, and has been estimated at five millions sterling. But perhaps the most perfect and beautiful diamond hitherto found, is the one known as the Pitt diamond, which was brought from India by a gentleman of that name, who sold it to the Duke of Orleans for one hundred thousand pounds sterling. It was worn by Bonaparte in the hilt of his sword. It weighs about one hundred and thirty-six carats, or five hundred and forty-four grains. It ought, however, to be observed, that these estimates, founded on the magnitude and brilliancy of the gems, are very different from the prices which the most princely fortunes can afford to pay for them. The Russian diamond cost about one hundred and thirty five thousand pounds sterling; and the one called the Pitt or Regent, although it weighed one hundred and thirty-six carats only, was, on account of its greater brilliancy, purchased of a Greek merchant, for one hundred thousand pounds sterling. Several other large diamonds are preserved in the cabinets of the sovereigns and princes of Europe.

Why such immense value should be attached to diamonds, in all civilized countries, and by a kind of common consent, is one of those singular things that seem inexplicable. That a magnificent house, with a large estate, and the means of living not only in comfort but splendor, should be set in competition with, and even deemed inadequate to the purchase of, a transparent crystallized stone, not half the size of a hen's egg, seems almost a kind of insanity! If for the mere consciousness of possessing a diamond of less than the weight of an ounce, any private gentleman were to pay four hundred and fifty thousand dollars in ready money, and an annuity of twenty thousand dollars besides, he would probably be thought beside himself. And yet not only was the above sum given, but a patent of nobility into the bargain, by the empress Catharine, of Russia, for the famous diamond "Nadir Shah." In this case, however, though the seller acquired much, the purchaser did not suffer any personal privation; and in reality, notwithstanding the costliness and high estimation of diamonds, they are not put in competition with the substantial comforts and conveniences of life. Among ornaments and luxuries, however, they unquestionably occupy, and have ever occupied, the highest rank. Even Fashion, proverbially capricious as she is, has remained steady in this, one of her earliest attachments, during probably three or four thousand years. There must be, therefore, in the nature of things, some adequate reason for this universal consent; which becomes a curious object of inquiry.

The utility of the diamond, great as it is in some respects, enters for little or nothing into the calculation of its price; at least all that portion of its value which constitutes the difference between the cost of an entire diamond and an equal weight of diamond powder, must be attributed to other causes.

The beauty of this gem, depending on its unrivaled luster, is, no doubt, the circumstance which originally brought it into notice, and still continues to uphold it in the public estimation; and certainly, notwithstanding the smallness of its bulk, there is not any substance, natural or artificial, which can sustain any comparison with it in this respect. The vivid and various refractions of the opal, the refreshing tints of the emerald, the singular and beautiful light which streams from the six-rayed star of the girasol, the various colors, combined with high luster, which distinguish the ruby, the sapphire, and the topaz, beautiful as they are on a near inspection, are almost entirely lost to a distant beholder; whereas the diamond, without any essential color of its own, imbibes the pure solar ray, and then reflects it, either with undiminished intensity, too white and too vivid to be sustained for more than an instant by the most insensible eye, or decomposed by refraction into those prismatic colors, which paint the rainbow, and the morning and evening clouds, combined with a brilliancy which hardly yields to that of the meridian sun. Other gems, inserted into rings and bracelets, are best seen by the wearer; and if they attract the notice of the bystanders, divide their attention, and withdraw those regards which ought to be concentered on the person, to the merely accessory ornaments. The diamond, on the contrary, whether blazing on the crown of state, or diffusing its starry radiance from the breast of titled merit, or "in courts of feasts and high solemnities," wreathing itself with the hair, illustrating the shape and color of the neck, and entering ambitiously into contest with the

lively luster of those eyes that “rain influence” on all beholders, blends harmoniously with the general effect, and proclaims to the most distant ring of the surrounding crowd, the person of the monarch, of the knight, or of the beauty.

Another circumstance tending to enhance the value of the diamond is, that although small stones are sufficiently abundant to be within the reach of moderate expenditure, and therefore afford, to all those who are in easy circumstances an opportunity to acquire a taste for diamonds, yet those of a larger size are, and ever have been, rather rare; and of those which are celebrated for their size and beauty, the whole number, at least in Europe, scarcely amounts to half a dozen, all of them being in possession of sovereign princes. Hence, the acquisition even of a moderately large diamond, is what mere money can not always command; and many are the favors, both political and of other kinds, for which a diamond of a large size, or of uncommon beauty, may be offered as a compensation, where its commercial price, in money, neither can be tendered, nor would be received. In many circumstances also, it is a matter of no small importance for a person to have a considerable part of his property in the most portable form possible; and in this respect what is there that can be compared to diamonds, which possess the portability, without the risk of bills of exchange? It may further be remarked, in favor of this species of property, that it is but little liable to fluctuation, and has gone on pretty regularly increasing in value, insomuch that the price of stones of good quality is considerably higher than it was some years ago.

The art of cutting and polishing diamonds, has a twofold object; first, to divide the natural surface of the stone in a symmetrical manner by means of highly polished polygonal planes, and thus to bring out, to the best advantage, the wonderful refulgence of this beautiful gem; and, secondly, by cutting out such flaws as may happen to be near the surface, to remove those blemishes which materially detract from its beauty, and consequently from its value. The removal of such flaws is a matter of great importance; for, owing to the form in which the diamond is cut, and its high degree of refrangibility, the smallest fault is magnified, and becomes obtrusively visible to all. For this reason, also, it is by no means an easy matter, at all times, to ascertain whether a flaw is or is not superficial; and a person with a correct and well-practiced eye, may often purchase to great advantage, stones which appear to be flawed quite through, but which are in fact only superficially blemished.

Before leaving the subject of diamonds, it may be well to notice some other valuable stones that are much sought and prized for ornament. One of these is the _oriental ruby_. This, in its most esteemed color, is pure carmine, or a blood-red of considerable intensity, forming, when well polished, a blaze of the most exquisite and unrivaled tint. It is, however, more or less pale, and mixed with blue in various proportions; and hence it occurs rose-red, and reddish-white, crimson, peach-blossom red, and lilac-blue, the latter variety being named the _oriental amethyst_. It is a native of Pegu, and is said to be found in the sand of certain streams near the capital of the country; and it also occurs, with the sapphire, in the sands of the rivers of Ceylon. A ruby which is perfect both in color and transparency, is much less common than a good diamond; and when of the weight of three or four carats, is even more valuable than a diamond of the same size. The king of Pegu, and the monarchs of Asia and Siam, monopolize the finest rubies, in the same way as the sovereigns of India make a monopoly of diamonds. The finest ruby in the world is in possession of the first of these kings. Its purity has passed into a proverb, and its worth, when compared with gold, is inestimable. The dubah of Deccan, also, possesses a remarkably fine one, which is a full inch in diameter. The princes of Europe can not boast of any rubies of first-rate magnitude.

The _oriental sapphire_ ranks next in value to the ruby. When it is perfect, its color is a clear and bright Prussian blue, united to a high degree of transparency. The _astoria_ or _star-stone_, is a remarkable variety of this beautiful gem: it is semi-transparent, with a reddish purple tinge. And beside these, there are the _red_ sapphire, often called the oriental ruby, and the _yellow_ sapphire, which is called the oriental topaz. And in addition to these precious stones, or gems, there are also the _emerald_, of a beautiful green color; the _topaz_, which is of a yellow or light wine-color, and which by being heated, sometimes becomes rose-red, so as to be passed off as a ruby; the _jasper_ and _chalcedony_, which are of various colors; the _onyx_, which is a regularly banded agate, much prized for cameos, especially where the colors are very distinct and different; the _cornelian_, which is properly a red or flesh-colored chalcedony, much valued for seal-stones, &c.; and the _blood-stone_, or _heliotrope_, which is deep green, and somewhat translucent, and variegated by blood-red spots: all of which are much used in the various departments of jewelry.

We have reserved for this place, a notice of the hot-well at Clifton, England, which would have been mentioned in connection with the Geysers and other hot springs, but from its connection with the beautiful crystals known as _Bristol stones_ or _diamonds_, some of which are so hard as to cut glass, and are exceedingly clear, colorless and brilliant. When set in rings, in their natural state, these stones often appear of as high a polish and luster, as if they had been wrought by the most skillful lapidary.

The warm spring, or fountain, in the vicinity of which they are found, is called the _hot-well_. It is in the parish of Clifton, and is so copious as to discharge sixty gallons of water in a minute. It rises forcibly from an opening in the solid rock, at about twenty-six feet

below high-water mark. On its immediate influx from the rock, the water is much warmer than when it is pumped up for drinking, for it is raised by pumps some thirty feet. Its qualities in a medicinal point of view are supposed to be valuable; but it is not on this point that we propose to dwell, and therefore we pass on to the rocks in the neighborhood, near which the _Bristol stones_ are found. Just below the hot-well, there rises a noble range of hills, which are not more remarkable for their hight, than for their being equally so on both sides the river, the strata in some places answering on each side for about a mile and a half in a serpentine course. These constitute one of the greatest natural curiosities in England. The rock beyond the hot-well, and on the same side, is named St. Vincent's, a chapel dedicated to that saint having been formerly built on its summit. It is in hight three hundred feet, and has a majestic appearance. It supplies the naturalist with many curious fossils, the botanist with a variety of scarce plants, the antiquary with the remains of a Roman camp, and the less curious inquirer with a view of a most dreadful and surprising precipice.

The rocks in general, when broken up, are of a dusky red, brown or chocolate colored marble, very hard and close-grained, and which, on being struck with a hammer, emit a strong sulphureous smell. It will bear a polish equal to any foreign marble; and, when sawed into slabs and polished, appears beautifully variegated with veins of white, bluish-gray, or yellow. It is often employed for chimney-pieces; but it is principally used for making lime, for which purpose there is no stone in England so well calculated, nor is there any lime so strong, fine, and white, which excellent qualities occasion great demand for foreign consumption.

Here, and in the vicinity, laborers are daily employed in blowing up the rocks with gunpowder, by which process vast fragments are frequently thrown down, and repeatedly strike the precipice with a dreadful crash, which, combined with the loud report of the explosion, reëchoed from side to side by the lofty cliffs, makes a noise resembling thunder, for which it is frequently mistaken by strangers. It is the opinion of the greater part of those who have viewed these rocks, that they were once united, and were separated by some terrible convulsion of nature. A bridge of one arch, from rock to rock, over the Avon, has long been in contemplation; but if the blowing up of these rocks should still be persisted in, the design will be rendered impracticable. This is the more to be regretted, because stone of the same quality is to be procured lower down the river.

Now it is in the fissures and cavities of these rocks, that the beautiful crystals called _Bristol stones_, or _diamonds_, already mentioned, are found. They are clear and brilliant, and being without color, so richly and brilliantly reflect the light, as to be almost next to the diamond in appearance, and are often palmed off on the unpracticed for the latter gem. They are extensively used in many of the plainer kinds of jewelry, and when set over gold-leaf, or thin paper of delicate tinges, are often made closely to resemble some of the richest gems known.

GOLD AND SILVER MINES.[4]

The mines of La Plata, so denominated on account of the abundance of silver they contain, are chiefly situated in the provinces which were formerly attached to the Spanish viceroyalty of Rio de la Plata; but which, since the South American states revolted from the mother country, have been included in the republic of Bolivia, or Upper Peru as it is sometimes called. With the exception of Mexico, Bolivia is the richest country in silver which has yet been discovered, and contains innumerable mines both of that metal and of gold. All its northern provinces teem with mineral opulence; and those of Laricaja and Carabaya, have been distinguished by the production of the latter, and still nobler metal, in its virgin state. In consequence, however, of the recent political convulsions, mining, once the richest source of revenue, is in a depressed state; many of the mines being filled with water and totally neglected.

Footnote 4:

The account of the mines of South America and Mexico is mostly from Humboldt, and as will be obvious to the reader, has reference in many things to their past history and progress, rather than to their present condition.

The mountain of Potosi formerly produced weekly about five thousand marks of silver, that is, from thirty to forty thousand dollars; a surprising produce, when it is considered that it has been wrought since 1545, at which time it was accidentally discovered by an Indian, or native, as represented in the cut. In hunting some goats, he slipped from a slight elevation, and to save himself caught hold of a shrub, which coming away from the ground, laid bare the silver at its root. At the commencement it was still more abundant, and the metal was dug up in a purer state.

[Illustration: DISCOVERY OF SILVER IN PERU.]

The silver was often found in shoots like roots, imbedded in the earth. Six thousand Indians were sent every eighteen months, from the provinces of the viceroyalty, to work this mine. The expedition was called _mita_; and these Indians, having been enrolled and formed into parties, were distributed by the governor of Potosi, and received a small daily stipend, (equal to about thirty-four cents

of our currency,) until the period of their labor was completed. They were thus doomed to a forced service, nothing less than slavery, so long as it lasted, which the Spaniards have endeavored to justify by the plea that laborers could not otherwise be procured.

Lumps of pure gold and silver, called =papas=, from their resemblance to the potato, were often found in the sands. The poor likewise occupied themselves in =lavaderos=, or in washing the sands of the rivers and rivulets, in order to find particles of the precious metals.

To compensate for the mines rendered useless by the irruption of water, or other accidents, rich and new ones were daily discovered. They were all found in the chains of mountains, commonly in dry and barren spots, and sometimes in the sides of the =quebredas=, or astonishing precipitous breaks in the ridges. However certain this rule might be in the region of Bolivia, it was contradicted in that of Peru, where, at three leagues' distance from the Pacific ocean, not far from Tagna, in the province of Arica, there was discovered the famous mine of Huantajaya, in a sandy plain at a distance from the mountains, of such exuberant wealth that the pure metal was cut out with a chisel. From this mine a large specimen of virgin silver is preserved in the royal cabinet of natural history at Madrid. It attracted a considerable population, although neither water nor the common conveniences for labor could be found there, neither any pasturage for the cattle.

In the mint of Potosi, about six millions of dollars were annually coined; and the mines of the old viceroyalty of La Plata, taken collectively, are reckoned to have yielded about sixteen millions.

The mines of Mexico, or what was formerly called New Spain, have been more celebrated for their riches than those of La Plata, notwithstanding which they are remarkable for the poverty of the mineral they contain. A quintal, or sixteen hundred ounces of silver ore, affords, at a medium, not more than three or four ounces of pure silver, about one-third of what is yielded by the same quantity of mineral in Saxony. It is not, therefore, on account of the richness of the ore, but from its abundance and the facility of working it, that these mines have been so much superior to those of Europe.

The fact of the small number of persons employed in working them, is not less contrary to the commonly received opinion on this subject. The mines of Guanaxuato, infinitely richer than those of Potosi ever were, afforded from 1706 to 1803, nearly forty millions of dollars in gold and silver, or very nearly five millions of dollars annually, being somewhat less than one-fourth of the whole quantity of gold and silver from New Spain; notwithstanding which, these mines, productive as they were, did not employ more than five thousand workmen of every description. In Mexico, the labor of the mines was perfectly free, and better paid than any other kind of industry, a miner earning from five to five dollars and a half weekly, while the wages of the common laborer did not exceed a dollar and a half. The =tenateros=, or persons who carried the ore on their backs, from the spot where it was dug out of the mine, to that where it was collected in heaps, had a sum equal to a dollar and ten cents for a day's work of six hours. Neither slaves, criminals, nor forced laborers, were employed in the Mexican mines.

In consequence of the clumsy, imperfect and expensive mode of clearing them from water, several of the richest of these mines have been overflowed and abandoned; while the lack of method in the arrangement of the galleries, and the absence of lateral communications, have added to the risk, and greatly increased the expense of working them. Labor has not been, as in the working of the European mines, abridged, nor the transportation of materials facilitated. When new works were undertaken, a due consideration was not bestowed on the preliminary arrangements; and they were always conducted on too large and expensive a scale.

More than three-fourths of the silver obtained from America is extricated from the ore by means of quicksilver, the loss of which, in the process of amalgamation, is immense. The quantity that used to be consumed annually in Mexico alone, was about sixteen thousand quintals; and in the whole of South America, about twenty-five thousand quintals were yearly expended, the cost of which there, has been estimated at more than a million dollars. The greater part of this quicksilver, in later years, was furnished by the mine of Almaden in Spain, and that of Istria in Carniola, the celebrated quicksilver mine of Huancavelica in Peru, having greatly fallen off in its produce since the sixteenth century, when it was highly flourishing. The prosperity of the silver mines, both in Mexico and Peru, therefore depended very much on the supplies of quicksilver from Spain, Germany and Italy; for such was the abundance of the ore in those provinces, that apparently the only limit to the amount of silver obtained there, was the want of mercury for amalgamation.

In taking a general view of the riches of the other portions of America, Humboldt, who has supplied these details, remarks that, in Peru, silver ore exists in as great abundance as in Mexico, the mines of Lauricocha being capable of yielding as great a produce as

those of Guanaxuato; but that the art of mining, and the methods of separating the silver from its ore, are still more defective than in Mexico. Notwithstanding this imperfect system, the total amount of the precious metals annually furnished by America, was at one time estimated at upward of forty-two million dollars; the gold being in proportion to the silver as one to forty-six. From 1492 to 1803, the quantity of gold and silver extracted from the American mines, was equal in value to five billion, seven hundred and six million, seven hundred thousand dollars; of which immense sum, the portion carried to Europe, including the booty gathered by the conquerors of America, is estimated at five billion, four hundred and forty-five million dollars, averaging seventeen million and a half of dollars yearly. The annual importation up to 1803, being divided into six periods, appears to have constantly augmented, and in the following progressive ratio. From 1492 to 1500, it did not exceed two hundred and fifty thousand dollars. From 1500 to 1545, it amounted to three millions of dollars. From 1545 to 1600, to eleven millions. From 1600 to 1700, to sixteen millions. From 1700 to 1750, to twenty-two millions and a half. And, lastly, from 1750 to 1803, to the prodigious sum of thirty-five million, three hundred thousand dollars.

The first period was that of exchange with the natives, or of mere rapine. The second was distinguished by the conquest and plunder of Mexico, Peru and New Granada, and by the opening of the first mines. The third began with the discovery of the rich mines of Potosi; and in the course of it the conquest of Chili was completed, and various mines opened in Mexico. At the commencement of the fourth period, the mines of Potosi began to be exhausted; but those of Lauricocha were discovered, and the produce of Mexico rose from two millions to five millions of dollars annually. The fifth period began with the discovery of gold in Brazil; and the sixth was distinguished by the prodigious increase of the mines of Mexico, while those of every other part of America, with the exception of Brazil, were then constantly improving.

The gold mines of Brazil have been very productive. Those called general, were about seventy-five leagues from Rio Janeiro, the staple and principal outlet of the riches of the Brazilian territory. They formerly yielded to the king, annually, for his right of fifths, at least one hundred and twelve arobas (weighing twenty-five pounds each) of gold; so that their yearly produce might then have been estimated at upward of three and a half millions of dollars, and that of the more distant mines at about one-third the sum.

The gold drawn from them could not be carried to Rio Janeiro, without being first brought to the smelting-houses established in each district, where the right of the crown was received. What belonged to private persons was remitted in bars, with their weight, number, and an impression of the royal arms. The gold was then assayed, and its standard imprinted on each bar. When these bars were carried to the mint, their value was paid to the possessor in coin, commonly in half-doubloons, each worth eight Spanish dollars. Upon each of these half-doubloons the king gained a dollar, by the alloy and right of coinage. The mint of Rio Janeiro was one of the most beautiful in existence, and furnished with every convenience for working with the greatest celerity. As the gold came from the mines at the same time that the fleets came from Portugal, the operations of the mint and the coinage proceeded with surprising quickness.

In Africa, the kingdom of Mozambique abounds in gold, which is washed down by the rivers, and forms a chief part of the commerce of the country. The kingdoms of Monomotara and Sofala likewise furnish considerable quantities of gold; and the Portuguese residing in the latter territory, half a century ago, reported that it yielded annually two millions of =metigals=, equal to somewhat more than a million sterling. The merchants exported from Mecca, and other parts, about the same quantity of gold. The soldiers were paid in gold dust, in the state in which it was collected; and this was so pure, and of so fine a yellow, as not to be exceeded, when wrought, by any other gold beside that of Japan. Gold is likewise found on the island of Madagascar. The Gold Coast is so denominated from the abundance of gold found among the sands: it is not, however, so productive as has been generally supposed, owing to the intense heats, which, in a great measure, prevent the natives from prosecuting their researches.

In Asia, the island of Japan is most productive of gold, which is found in several of its provinces, and is, in by far the greater proportion, melted from its ore. It is also procured by washing the sands, and a small quantity is likewise found in the ore of copper. The emperor claims a supreme jurisdiction, not only over the gold mines, but over all the mines of the empire, which are not allowed to be worked without a license from him. Two-thirds of their produce belong to him, and the other third is left to the governor of the province in which the mines are situated. But the richest gold ore, and that which yields the finest gold, is dug in one of the northern provinces of the island of Niphon, a dependency of Japan, where the gold mines have, in past times, been highly productive, though now they have much fallen off. In the Japanese province of Tsckungo, a rich gold mine, having been filled with water, was no longer worked: as it was, however, so situated, that by cutting the rock and making an opening beneath the mine, the water could be easily drawn off, this was attempted. At the moment of beginning the operation, so violent a storm of thunder and lightning arose, that the workmen were obliged to seek shelter elsewhere; and these superstitious people imagining that the tutelar god and protector of the spot, unwilling to have the bowels of the earth thus rifled, had raised the storm to make them sensible of

his great displeasure at such an undertaking, desisted from all further attempts, through the fear of incurring his displeasure, and could not be induced to go on with it.

Thibet, a mountainous country of India, contains a great abundance of gold, which is traced in the rivers flowing from that territory into the Ganges. In Hindoostan there are not any mines of gold; but in the Irnada district gold is collected in the river which passes Nelambur in the Mangery Talui, a nair having the exclusive privilege of this collection, for which he pays a small annual tribute. Silver is in general rare throughout the oriental regions, and there is not any indication of this metal in India; but in Japan there are several silver mines, more particularly in the northern provinces, and the metal extracted from them is very pure and fine.

Turning to Europe, Dalmatia is said in ancient times to have produced an abundance of gold. Pliny reports that in the reign of the emperor Nero, fifty pounds of this precious metal were daily taken from the mines of that province; and that it was found on the surface of the ground. It is added, that Vibius, who was sent by Augustus to subdue the Dalmatians, obliged that hardy and warlike people to work in the mines, and to separate the gold from the ore.

Bossina, in Sclavonia, contains many mineral mountains, and has rich mines of gold and silver. The district in which the latter are found, is named the =Srebrarniza=, being derived from the word =srebr=, which signifies silver in all the Sclavonian dialects. Their produce resembles the native silver of Potosi, and is found, combined with pure quartz, in small, thin leaves, resembling moss.

The kingdom of Norway formerly produced gold; but the expense of working the mines, and procuring the pure ore, being greater than the profit, these have been neglected. There are, however, silver mines, which are extremely valuable, and give employment to several thousands of persons. The principal of these is at Königsberg, and was discovered in 1623, when the town was immediately built, and peopled with German miners. In 1751, forty-one shafts and twelve veins, were wrought in this mine, and gave employment to thirty-five hundred officers, artificers and laborers. A view of one part of this mine is given in the cut on the next page.

The silver ore is not, as was at first imagined, confined to the mountain between Königsberg and the river Jordal, but extends its veins for several miles throughout the adjacent districts, in consequence of which new mines have been undertaken in several places, and prosperously carried on. One of the richest and most ancient of the mines, named “Old God’s blessing,” has sometimes, in the space of a week, yielded several hundred pounds’ weight of rich ore. The astonishing depth of this mine, which is not less than a hundred and eighty fathoms, perpendicularly, fills the mind of the beholder with amazement; and the circumference at the bottom forms a clear space of several hundreds of fathoms. Here the sight of thirty or forty fires, burning on all sides in this gloomy cavern, and continually fed to soften the stone in the prosecution of the labors, seems, according to the notions commonly entertained, an apt image of hell; and the swarms of miners, covered with soot, and bustling about in habits according to their several employments, may well remind one of so many evil spirits; more especially when, at a given signal that the mine is to be sprung in this or that direction, they exclaim aloud: “=Berg-livet, berg-livet=!” “Take care of your lives.”

[Illustration: SILVER MINE AT KÖNIGSBERG.]

The gold mines of Cremnitz, in Hungary, lie forty miles south of the Carpathian hills; and twenty miles further to the south are the silver mines of Shemnitz. These are called mining towns; and the former is the principal, its rich ores being found in what is styled metallic rock. Its mines also produce a certain proportion of silver. Hungary is beside enriched by a mineral peculiar to itself, or one, at least, which has not hitherto been discovered elsewhere, namely, the _opal_, a gem preferred to all others by the oriental nations. The opal mines are situated at Ozerwiniza, where they are found in a hill consisting of decomposed porphyry, a few fathoms beneath the surface. Their produce is of various qualities, from the opaque-white, or semi-opal, to the utmost refulgence of the lively colors by which this noble gem is distinguished.

Transylvania and the Bannet, contain numerous and valuable mines, consisting chiefly of gray gold ore, and white gold ore. The finest gold is found at Olapian, not far from Zalathna, intermixed with gravel and sand. The sands of the Rhine, also, in various places contain traces of gold.

The mountains of Spain were, according to ancient writers, very rich in gold and silver; and accordingly Gibbon calls that kingdom, “the Peru and Mexico of the old world.” He adds, that “the discovery of the rich western continent of the Phenicians, and the oppression of the simple natives, who were compelled to labor in their own mines for the benefit of strangers, form an exact type of the more recent history of Spanish America.” The Phenicians were acquainted only with the sea-coasts of Spain; but avarice, as well as ambition, carried the arms of Rome and Carthage into the heart of the country, and almost every part of the soil was found

pregnant with gold, silver and copper. A mine near Carthagena, is said to have yielded daily twenty-five thousand drams of silver, or over thirteen hundred thousand dollars a year. The provinces of Asturia, Gallicia and Lusitania, yielded twenty thousand pounds' weight of gold annually: but rich as these mines are, the modern Spaniards have chosen rather to import the precious metals from America, than to seek them at home.

Portugal is in many parts mountainous; and these mountains contain, beside others, rich ores of silver. But the Portuguese, like the Spaniards, having been supplied with metals from South America, and particularly with an abundance of gold and silver from Brazil, have not worked the mines in their own country. Gems of all kinds, as turkoises and hyacinths, are also found in these mountains, together with beautifully variegated marbles, and many curious fossils.

But the richest and most productive gold mines of Europe, at the present time, are probably those of Russia. It had long been known that gold was to be found in the Russian dominions; but in 1829, Baron Humboldt, with two scientific associates, at the request of the emperor of Russia, made a mineralogical tour to the Ural and Altai mountains. In this journey, they not only discovered new localities of gold and silver, but from the geological features of the country suggested that, at certain localities, diamonds would also probably be found, which accordingly happened. And as the result of the report they made to the Russian government, mining operations were commenced on a large scale in these mountains, which have now become one of the most prolific gold regions in the world. The increase of these sources of gold, in extent and amount, has been such, that from the value of about ten thousand dollars in 1836, the amount received in 1843, was some eighteen millions of dollars; and the supply has since increased annually, until at present, 1855, it amounts to about twenty million dollars a year. Most of this large amount of gold is gathered from washing the sand and loose earth, and not from deep mines; and as it is every year becoming greater and greater, it must add immensely to the wealth and resources of the Russian empire.

But by far the greatest gold-field in the world, has been opened by the discoveries of the last few years in California. At the close of the late war with Mexico, the United States acquired, by conquest and purchase, a tract of country of some five hundred thousand square miles in extent, known as the Mexican territory of upper California. And from the western portion of this region, Congress, in 1850, created and admitted into the American confederacy, the thirty-first state, under the name of California. It is almost superfluous to say, that California is one of the most important mineral regions in the world, particularly in its deposits of gold. Vague notions of the existence of this gold, had from time to time been spread abroad; but it was not till 1848, that an accident discovered the marvelous fact of its abundance. In that year, a Mr. Sutter, a native of Switzerland, was settled near the mouth of the American fork of the Sacramento river, at the head of navigation, one hundred and fifty miles from its mouth. Here he had founded New Helvetia, and obtained a grant of thirty miles round. He had sent some men to the upper part of the American fork, to clear out a mill-race. The soil was washed down in the process, and some shining scales laid bare. These proved to be gold, and on investigation, not only the valley of this stream, but the beds of all the other streams running into the Sacramento, were found to have a soil full of gold, in minute scales and in bits, from a grain to many ounces in weight. New "placers," as the "washings," or "dry diggings" are called, have constantly been discovered, and people have rushed to these hills from all quarters, with pans, tubs, pickaxes, shovels, hoes, filtering-machines, and energetic sinews, till they have extracted, by digging, washing, &c., millions on millions of dollars' worth of the yellow treasure. Gold is now found over an extent of many hundred miles, and also on the Gila, and throughout the great central plateau, north and north-east of it.

In a favorable locality, the lucky finder of a placer will sift out hundreds of dollars' worth in a day. Persons with not a shirt to their backs, and scarcely a whole garment upon them, are seen with bags of gold in their hands. Prices of everything went up at once to an enormous rate: laborer's wages became eight or ten dollars a day; cooks at the diggings, ten dollars a day; clerks, fifteen hundred dollars to six thousand dollars =per annum=, &c., &c. As all the productive industry of the country is now turned to gold-digging, and as such vast numbers of consumers are flocking in from all parts, prices continue to range high for every article of necessity, although such large quantities of goods have been sent.

[Illustration: GOLD WASHING IN CALIFORNIA.]

The gold first discovered was evidently not in its original place, but had been washed down from higher regions; and when all that is thus spread through the sands of California shall have been exhausted, if it ever shall be, there are large bodies of auriferous quartz, which (with greater labor and expense) will doubtless afford large supplies of gold for generations to come. The amount of capital invested in quartz-mining, according to the state census of 1852, was about six millions, and in placer and other mining operations, about four millions of dollars; and the sum total of these amounts has been greatly increased since that date. Up to the close of 1851, there had been deposited in the United States mint, $98,407,990 of California gold; and the deposits of 1852

amounted to $46,528,076, making a total of $145,000,000. But all this falls far short of the real amount produced; as probably quite as much more has been sent to Europe in the shape of dust or bullion, not to mention the unreported sums which have been privately taken out of the state. An official estimate states the production of American gold in 1853, at $109,156,748; and of this sum nearly the whole is from the mines of California. And this vast amount is steadily on the increase, in about the proportion of the increase of the mining population, so that California not only is, but is likely to continue to be _the great gold-field_ of the world.

Before leaving California, it may not be amiss to add, that the country abounds in mines of almost every kind, as well as gold. Quicksilver, plaster, lead, iron, silver, copper, asphaltum and marble, are found in Butte, and also in Marion county; rich silver mines and coal, in San Louis Obispo; copious salt springs, in Shasta; bituminous springs, in many places along the coast; hot sulphur springs, in Santa Barbara; warm soda springs, near Benicia; and platina is said to be widely distributed in almost every section where gold has been found. Silver has been discovered in several mines in the southern district; copper is widely distributed in other sections beside those above-mentioned; chromium occurs in large quantities in the serpentine rocks; and diamonds are reported to have been recently found in several localities.

[Illustration: PLACE WHERE GOLD WAS FIRST DISCOVERED IN AUSTRALIA.]

At a date still later than the discovery of gold in California, the same precious metal was discovered in Australia. The cut on the following page gives a view of the place where it was first found, in the county of Bathurst, not far from Sydney in New South Wales. It is worthy of note that we owe the discovery of gold in Australia to the high state of geological science. Sir R. Murchison, in his address to the London Geographical Society in 1844, alluded to the possibly auriferous character of the great eastern chain of Australia, being led thereto by his knowledge of the auriferous chain of the Ural, and by his examination of Count Strzelecki's specimens, maps and sections. Some of Sir R. Murchison's observations having found their way to the Australian papers, a Mr. Smith, at that time engaged in some iron works at Berrima, was induced by them in the year 1849 to search for gold, and he found it. He sent the gold to the colonial government, and offered to disclose its locality on payment of five hundred pounds sterling. The government, however, not putting full faith in the statement, and being, moreover, unwilling to encourage a gold fever without sufficient reason, declined to grant the sum, but offered, if Mr. Smith would mention the locality, and the discovery was found to be valuable, to reward him accordingly. Very unwisely, as it turned out, Mr. Smith did not accept this offer; and it remained for Mr. Hargraves, who came with the prestige of his California experience, to make the discovery anew, and get the reward from the English government on their own conditions. The first discovery was made in the banks of the Summer Hill creek and the Lewis Ponds river, small streams which run from the northern flank of the Conobalas down to the Macquarrie. The gold was found in the sand and gravel accumulated, especially on the inside of the bends of the brook, and at the junction of the two water-courses, where the stream of each would be often checked by the other. It was coarse gold, showing its parent site to be at no great distance, and probably in the quartz veins traversing the metamorphic rocks of the Conobalas. Mr. Stutchbury, the government geologist, reported on the truth of the discovery, and shortly afterward found gold in several other localities, especially on the banks of the Turon, some distance north-east of the Conobalas. This was a much wider and more open valley than the Summer Hill creek, and the gold accordingly was much finer, occurring in small scales and flakes. It was, however, more regularly and equably distributed through the soil, so that a man might reckon with the greatest certainty on the quantity his daily labor would return him. At the head of the Turon river, among the dark glens and gullies in which it collects its head-waters, in the flanks of the Blue mountains, the gold got "coarser," occurred in large lumps or nuggets, but these were more sparingly scattered.

As already said, the discovery was made by Mr. Hargraves, in May, 1850; and before the end of June, there were more than twenty thousand persons at the mines. When it was known in the town of Bathurst, that the discovery had been made, and that the country, from the mountain ranges, back to an indefinite extent in the interior, was probably one immense goldfield, the excitement was intense and universal. A complete phrensy seemed to seize on the entire population; the business of the town was paralyzed; and there was a universal rush to the diggings. People of all trades, callings and pursuits were quickly transformed into miners; and many a hand which had been trained to kid gloves, or accustomed only to the quill, became nervous to clutch the pick or crowbar, or to "rock the cradle" at the newly discovered mines. The roads were literally alive with the crowds pressing on from every quarter, some armed with pickaxes, others shouldering crowbars and shovels, and not a few strung round with hand-basins, tin-pots and cullenders. Scores rushed from their homes, with only a blanket, and a pick or grubbing-hoe, full of hope that a few days would give them heaps of the precious metal. Everything at once rose in price, and the whole face of society was speedily changed in almost every aspect.

The first pieces found were in grains. Soon a piece was picked up weighing some eleven ounces; and soon after, several lumps weighing together about three pounds. Gold was speedily discovered in almost every place where it was looked for; in the beds of

the streams, and in veins of quartz, in grains, in scales, and in lumps of various weights. Some, as might be expected, were successful, and some comparatively unsuccessful in seeking it; the great mass of the miners averaging not more than four or five dollars a day, while in some rare cases a single individual gathered to the value of a thousand dollars in the same time. Gold was soon discovered in the Wellington district, and in various other places. One piece was picked up weighing almost five pounds; and from a single cleft in a rock, a miner took out eleven pounds' weight of gold, in separate pieces of various sizes. A Scotchman gathered fourteen hundred dollars' worth in four days, and eight of his associates averaged from thirty to forty dollars' worth a day. Apparently there is no end to the supply, at least for years to come; and all this within forty miles of a town where every comfort, not to say luxury, can be obtained, with a good post-road all the way to Sydney, and in the midst of tracts of the most fertile land, partly occupied, and where food may be supplied for millions of inhabitants, if needed. An official statement estimates the supply of Australian gold at sixty million dollars a year; and in addition to the gold, diamonds and platinum have also been found. Australia and California are likely to be the great sources of the supply of gold, compared with which all others will be relatively unimportant.

Before leaving the subject of gold, it may be interesting to the reader to trace the process of its coinage, which may thus be briefly stated. The metal, after being received in the deposit-room, is carefully weighed, and a receipt given. Each deposit is then melted separately in the melting-room, and molded into bars. These bars next pass through the hands of the assayer, who with a chisel chips a small fragment from each one. Each chip is then rolled into a thin ribbon, and filed down until it weighs exactly ten grains. It is then melted into a little cup made of calcined bone ashes, and all the base metals, copper, tin, &c., are absorbed by the porous material of the cup or carried off by oxydation. The gold is then boiled in nitric acid, which dissolves the silver which it contains, and leaves the gold pure. It is then weighed, and the amount which it has lost gives the exact proportion of impurity in the original bar, and a certificate of the amount of coin due the depositor is made out accordingly. After being assayed, the bars are melted with a certain proportion of silver, and being poured into a dilution of nitric acid and water, assume a granulated form. In this state the gold is thoroughly boiled in nitric acid, and rendered perfectly free from silver or any other baser metals which may happen to cling to it. It is next melted with one-ninth its weight of copper, and, thus alloyed, is run into bars, and delivered to the coiner for coinage. The bars are rolled out in a rolling-mill until nearly as thin as the coin which is to be made from them. By a process of annealing they are rendered sufficiently ductile to be drawn through a longitudinal orifice in a piece of steel, thus reducing the whole to a regular width and thickness. A cutting-machine next punches small round pieces from the bar, about the size of the coin. These pieces are weighed separately by the "adjusters," and if too heavy are filed down; if too light they are melted again. The pieces which have been adjusted are run through a milling-machine, which compresses them to the right diameter and raises the edge. Two hundred and fifty are milled in a minute by the machine. They are then again softened by the process of annealing, and after a thorough cleaning are placed in a tube connecting with the stamping instrument, and are taken thence one at a time by the machinery, and stamped between the dies. They are now finished, and, being thrown into a box, are delivered to the treasurer for circulation. The machinery, of course, for all those processes, must be of the nicest kind. When in full operation, a mint like that of England, or that of the United States at Philadelphia, can coin millions on millions in a year.

QUICKSILVER MINES.

Quicksilver, or mercury, is the only metal which remains liquid at ordinary temperatures. It is white and very brilliant, as may be seen in common thermometers. It boils at six hundred and sixty degrees of heat; and freezes, and assumes a crystalline texture, at forty degrees below zero. It is extensively used in its various forms in the arts, and also for medicinal purposes. The thermometer and barometer illustrate some of its uses in its pure state; the backs of our common mirrors are covered with it, which gives them their reflecting power; it is used extensively in separating some of the purer metals from the mixtures with which they are found; and in some of its forms or combinations, it is the basis of calomel, corrosive sublimate, vermilion, &c.

Mercury is found in various parts of the world. Among its principal mines are those of Almaden, near Cordova, in Spain, and of Idria, near Carniola, in Austria; though it is also found in Peru, California, Italy and China. Formerly most of the quicksilver came from Germany; but more recently the largest production is probably in Spain. So extensively is it used, that in 1831, over three hundred thousand pounds were brought from the continent into England; and for the fourteen years ending in 1828, the imports of it into Canton, by the English and Americans, averaged nearly six hundred and fifty thousand pounds a year, worth some three hundred and fifty thousand dollars.

Of all the quicksilver mines, those of Idria, mentioned above, are some of the most interesting, and demand a particular description, as they have been celebrated in natural history, poetry and romance. The ban of Idria, is a district of Austria, lying west of Carniola. The town, which is small, is seated in a deep valley, amid high mountains, on the river of the same name, and at the bottom of so

steep a descent, that its approach is a task of great difficulty, and sometimes of danger.

The mines were discovered in 1497, before which time that part of the country was inhabited by a few coopers only, and other artificers in wood, with which the territory abounds. One evening, a cooper having placed a new tub under a dropping spring, to try if it would hold water, on returning the next morning, found it so heavy that he could scarcely move it. He at first was led by his superstition to suspect that the tub was bewitched; but spying, at length, a shining fluid at the bottom, with the nature of which he was unacquainted, he collected it, and proceeded to an apothecary at Laubach, who, being an artful man, dismissed him with a small recompense, requesting that he would not fail to bring him further supplies. From this small beginning, the product of these mines has steadily increased; and now might easily be made six hundred tuns per year, though to uphold the price of the metal, the Austrian government has restricted the annual production to one hundred and fifty tuns. In 1803, a disastrous fire took place in these mines, which was extinguished only by drowning all the underground workings. The mercury, sublimed by the heat in this catastrophe, occasioned diseases and nervous tremblings in more than nine hundred persons in the neighborhood.

The subterraneous passages of the great mine are so extensive, that it would require several hours to pass through them. The greatest perpendicular depth, computing from the entrance of the shaft, is eight hundred and forty feet; but as these passages advance horizontally, under a high mountain, the depth would be much greater if the measure were taken from the surface. One mode of descending the shaft is by a bucket, but as the entrance is narrow, the bucket is liable to strike against the sides, or to be stopped by some obstacle, so that it may be readily overset. A second mode of descending, which is safer, is by means of a great number of ladders, placed obliquely, in a kind of zigzag: as the ladders, however, are wet and narrow, a person must be very cautious how he steps, to prevent his falling. In the course of the descent, there are several resting-places, which are extremely welcome to the wearied traveler. In some of the subterraneous passages, the heat is so intense as to occasion a profuse sweat; and in several of the shafts the air was formerly so confined, that several miners were suffocated by an igneous vapor, or gaseous exhalation, called the fire-damp. This has been prevented by sinking the main shaft deeper. Near to it is a large wheel, and a hydraulic machine, by which the mine is cleared of water.

To these pernicious and deadly caverns, criminals are occasionally banished by the Austrian government; and it has sometimes happened that this punishment has been allotted to persons of considerable rank and family. The case of Count Alberti is an interesting instance of this kind.

The count, having fought a duel with an Austrian general, against the emperor’s command, and having left him for dead, was obliged to seek refuge in one of the forests of Istria, where he was apprehended, and afterward rescued by a band of robbers who had long infested that quarter. With these banditti he spent nine months, until, by a close investment of the place in which they were concealed, and after a very obstinate resistance, in which the greater part of them were killed, he was taken and carried to Vienna, to be broken alive on the wheel. This punishment was, by the intercession of his friends, changed into that of perpetual confinement and labor in the mines of Idria; a sentence which, to a noble mind, was worse than death. To these mines he was accompanied by the countess, his lady, who belonged to one of the first families in Germany, and who, having tried every means to procure her husband’s pardon without effect, resolved at length to share his miseries, as she could not relieve them. They were terminated, however, through the mediation of the general with whom the duel had been fought, who as soon as he recovered from his wounds, obtained a pardon for his unfortunate opponent; and Alberti, on his return to Vienna, was again taken into favor, and restored to his fortune and rank.

IRON MINES.

The metal which is called iron, is familiar to all, both for its value and its various uses. It is capable of being cast in molds of any form; of being drawn in wires, extended in plates or sheets, of being bent in every direction, and of being sharpened, hardened, or softened at pleasure. It accommodates itself to all our wants, desires, and even caprices; it is equally serviceable to the arts, the sciences, to agriculture, and to war; and the same ore furnishes the sword, the plowshare, the scythe, the pruning-hook, the needle, the graver, the spring of the watch or that of the carriage, the chisel, the chain, the anchor, the compass, the cannon, the bomb, the edge of the finest knife or razor, and the ponderous trip-hammer of enormous weight. It is a medicine of much virtue, and the only metal which is always useful, and tends to no injury to mankind.

The ores of iron are scattered over the entire crust of the globe in beneficent profusion, and in proportion to the utility of the metal itself: they are found in every latitude and zone, in every mineral formation, and in every soil and clime. These ores are nineteen in number, ten of which are worked to profit by the miner, either for the sake of the iron they contain, for use in their native state, or for

extracting from them some principle or material, useful in manufactures or the arts.

Native iron, the existence of which was formerly questioned, has been found in several places: it is, however, far from being common, though it occurs in several mines. A mass of this description of iron was discovered in the district of Santiago del Estero, in South America, by a party of Indians, in the midst of a widely extended plain. It projected about a foot above the ground, nearly the whole of its upper surface being visible; and the news of its having been found in a country where there are not any mountains, nor even the smallest stone, within the circumference of a hundred leagues, was considered as truly surprising. Although the journey was attended with great danger, on account of the want of water, and abundance of wild beasts in these deserts, several individuals, in the hope of gain, undertook to visit this mass; and, having accomplished their journey, sent a specimen of the metal to Lima and Madrid, where it was found to be very pure soft iron.

As it was reported that this mass was the extremity of an immense vein of the metal, a metallurgist was sent to examine the spot, and by him it was found buried in pure clay and ashes. Externally it had the appearance of very compact iron, but was internally full of cavities, as if the whole had been formerly in a liquid state. This idea was confirmed by its having, on its surface, the impression of human feet and hands of a large size, as well as that of the feet of a description of large birds, very common in South America. Although these impressions seemed very perfect, it was concluded either that they were =lusus naturæ=, or that impressions of this kind were previously on the ground, and that the liquid mass of iron, in falling on it, received them. It had the greatest resemblance to a mass of dough; which, having been stamped with impressions of hands and feet, and marked with a finger, had afterward been converted into iron.

On digging round the mass, the under surface was found covered with a coat of scoriæ from four to six inches thick, undoubtedly occasioned by the moisture of the earth, the upper surface being clean. No appearance of the formation of iron was observed in the earth, below or round it, for a great distance. About two leagues to the eastward was a brackish mineral spring, and a very gentle ascent of from four to six feet in hight, running from north to south: with this exception, the adjacent territory was a perfect level. About the spring, as well as near the mass, the earth was very light, loose, and greatly resembling ashes, even in color. The grass in the vicinity was very short, small, and extremely unpalatable to the cattle; but that at a distance was long, and extremely grateful to them. From these concurrent circumstances it was concluded, that this mass of native iron, which was estimated to weigh about three hundred quintals, was produced by a volcanic explosion. It is stated as an undoubted fact, that in one of the forests of the above district of Santiago del Estero, there exists a mass of pure native iron, in the shape of a tree with its branches. At a little depth in the earth are found stones of quartz, of a beautiful red color, which the honey-gatherers, the only persons who frequent this rude territory, employ as flints to light their fires. Several of these were selected on account of their peculiar beauty, they being spotted and studded, as it were, with gold: one of them, weighing about an ounce, was ground by the governor of the district, who extracted from it a dram of gold.

A fibrous kind of native iron has been found at Ebenstock, in Saxony, and also in Siberia, where one particular mass weighed sixteen hundred pounds. It resembled forged iron in its composition, and was malleable when cold, but brittle when red-hot. In Senegal, where it is most common, it is of a cubical form, and is employed by the natives in the manufacture of different kinds of vessels. Native meteoric iron, called also nickeliferous, from its containing nickel, and native steel iron, which has many of the characters of cast steel, have also been found.

Iron, although one of the imperfect metals, is susceptible of a very high polish, and more capable than any other metal of having its hardness increased or diminished by certain chemical processes. It is often manufactured in such a way as to be _one hundred and fifty times_, and, as will now be seen, in some cases, to be even above _six hundred and thirty times_ more valuable than gold. On weighing several common watch-pendulum springs, such as are sold for ordinary work by the London artists, at half a crown, ten of them were found to weigh but one single grain. Hence one pound avoirdupois, equal to seven thousand grains, contains ten times that number of these springs, which amount, at half a crown each, to eight thousand, seven hundred and fifty pounds sterling. Reckoning the troy ounce of gold at four pounds sterling, and the pound equal to fifty-seven hundred and sixty grains, at forty-eight pounds sterling, the value of an avoirdupois pound of gold is over fifty-eight pounds sterling. The above amount of the value of the watch-springs weighing an avoirdupois pound, being divided by that sum, will give a ratio of somewhat more than one hundred and fifty to one. But the pendulum-springs of the best kind of watches sell at half a guinea each; and at this price the above-mentioned value is increased in the ratio of four and one-fifth to one; which gives an amount of thirty-six thousand, seven hundred and fifty pounds sterling. This sum being divided by the value of the avoirdupois pound of gold, gives a quotient of more than six hundred and thirty to one.

It is one of the valuable properties of iron, after it is reduced into the state of steel, that, although it is sufficiently soft when hot, or when gradually cooled, to be formed without difficulty into various tools and utensils, still it may be afterward rendered more or less hard, even to an extreme degree, by simply plunging it, when red-hot, into cold water. This is called tempering, the hardness produced being greater in proportion as the steel is hotter and the water cooler. Hence arises the superiority of this metal for making mechanics' instruments or tools, by which all other metals, and even itself, are filed, drilled and cut. The various degrees of hardness given to iron, depend on the quantity of ignition it possesses at the moment of being tempered, which is manifested by the succession of color exhibited on the surface of the metal, in the progress of its receiving the increasing heat. These are, the yellowish white, yellow, gold-color, purple, violet, and deep blue; after the exhibition of which the complete ignition takes place. These colors proceed from a kind of scorification on the surface of the heated metal.

The largest iron-works in England are carried on in Colebrookdale, in Shropshire. This spot, which is situated between two towering and variegated hills, covered with wood, possesses peculiar advantages, the ore being obtained from the adjacent hills, the coals from the vale, and abundance of limestone from the quarries in the vicinity. The romantic scenery which nature here exhibits, and the works which are carried on, seem to realize the ancient fable of the Cyclops. The noise of the forges, mills, &c., with all their vast machinery, the flames bursting from the furnaces, with the burning coal, and the smoke of the lime-kilns, are altogether horribly sublime. To complete the peculiarities of the spot, a bridge, entirely constructed of iron, is here thrown over the Severn. In one place it has parted, and a chasm is formed; but such is its firm basis, that the fissure has neither injured its strength nor utility.

The great superiority of Swedish iron over that of all other countries, for the manufacture of steel, is well known, and is ascribed to the great purity of the ore from which the iron is smelted. The British steel-makers have found it difficult to employ British iron in their processes, it being too brittle to bear cementation; but attempts have been made at Sheffield, with some success. Wootz, a species of steel from India, has been successfully used for nicer kinds of cutlery. One of the most remarkable of the Swedish mines, if the name can with propriety be applied to it, is Tabern, a mountain of a considerable size, composed entirely of pure iron ore, and occurring in a large tract of sand, over which it seems to have been deposited. This mountain has been wrought for nearly three centuries, notwithstanding which its size is scarcely diminished.

But the richest iron mine of Sweden is that of Danmora, in the province of Upland. It is in depth eighty fathoms; occupies a considerable extent of territory; and its ore is conveyed to the surface of the earth, through several pits or openings made for that purpose, by means of casks fixed to large cables, which are put in motion by horses. The workmen standing on the edges of these casks, and having their arms clasped round the cable, descend and ascend with the utmost composure. The water is drawn from the bottom by a wheel sixty-six feet in diameter, and is afterward conveyed along an aqueduct nearly a mile and a half in length. At certain distances from Danmora, are several furnaces, with large and populous villages exclusively inhabited by the miners.

In Wraxall's tour through the north of Europe, the mine of Danmora is described as yielding the finest iron ore in Europe, its produce being exported to every country, and constituting one of the most important sources of national wealth and royal revenue. The ore is not dug, as is usual in other mines, but is torn up by the force of gunpowder, an operation which is performed every day at noon, and is one of the most awful and tremendous that can possibly be conceived. "We arrived," observes the tourist, "at the mouth of the great mine, which is nearly half an English mile in circumference, in time to be present at it. Soon after twelve the first explosion took place, and could not be so aptly compared to anything as to subterraneous thunder, or rather volleys of artillery discharged under ground. The stones were thrown up, by the violence of the gunpowder, to a vast hight above the surface of the ground, and the concussion was so great as to shake the surrounding earth or rock on every side.

"As soon as the explosion had ceased, I determined to descend into the mine, to effect which I had to seat myself in a large, deep bucket, capable of containing three persons, and fastened by chains to a rope. When I found myself thus suspended between heaven and earth by a rope, and looked down into the dark and deep abyss beneath me, to which I could see no termination, I shuddered with apprehension, and half repented my curiosity. This was, however, only a momentary sensation, and before I had descended a hundred feet, I looked round on the scene with very tolerable composure. It was nearly nine minutes before I reached the bottom; and when I set my foot on the earth, the view of the mine was awful and sublime in the highest degree. Whether, as I surveyed it, terror or pleasure formed the predominant feeling, is hard to say. The light of the day was very faintly admitted into these subterraneous caverns: in many places it was absolutely lost, and flambeaux were kindled in its stead. Beams of wood were laid across some parts, from one side of the rock to the other; and on these the miners sat, employed in boring holes for the admission of gunpowder, with the most perfect unconcern, although the least dizziness, or even a failure in preserving their equilibrium, must have made them lose their seat, and have dashed them against the rugged surface of the rock beneath. The fragments torn up by the explosion, previously to my descent, lay in vast heaps on all sides, and the whole scene was calculated to

inspire a gloomy admiration.

“I remained three-quarters of an hour in these frightful and gloomy caverns, which find employment for not less than thirteen hundred workmen, and traversed every part of them which was accessible, conducted by my guides. The weather above was very warm, but here the ice covered the whole surface of the ground, and I found myself surrounded with the colds of the most rigorous winter, amid darkness and caves of iron. In one of these, which ran a considerable way beneath the rock, were eight wretched beings warming themselves round a charcoal fire, and eating the little scanty subsistence arising from their miserable occupation. They rose with surprise at seeing so unexpected a guest among them, and I was not a little pleased to dry my feet, which were wet with treading on the melted ice, at their fire.

“Having gratified my curiosity with a view of these subterraneous apartments, I made the signal for being drawn up, and felt so little terror while reascending, compared with that of being let down, that I am convinced, after five or six repetitions, I should have been perfectly indifferent to the undertaking. So strong is the effect of custom on the human mind, and so contemptible does danger or horror become when familiarized by repeated trials!”

Throughout the whole extent of Sweden, the iron mines at present wrought, employ thousands of persons, and yield annually upward of one hundred thousand tuns of metal. There are said to be between five and six hundred mines in the entire country, nearly half of which are situated in the central provinces: this, however, includes mines of all descriptions, though by far the most are of iron. The products of all these mines would be vastly greater than they are, were it not for the multiplied and unreasonable restrictions of the government.

The iron trade of the United States, and the domestic manufacture of iron, were spoken of by Mr. Gallatin, in a report to Congress, in 1810, as being firmly established. He was able to obtain very imperfect information about it, but it was known that iron ore was plentiful; that numerous forges and furnaces had been erected, supplying “a sufficient quantity of hollow-ware, and of castings of every description.” From Russia, about forty-five hundred tuns of bar iron were imported yearly, and perhaps another forty-five hundred from Sweden and England. A vague estimate gave fifty thousand tuns of bar iron as the annual consumption of the union, of which he considered forty thousand as the product of the republic. Some good iron was made in Virginia and Pennsylvania, but much inferior iron, carelessly manufactured, was brought into market. Of sheet, slit, and hoop iron, about five hundred and sixty-five tuns were annually imported; about seven thousand tuns were rolled and slit in the United States. Massachusetts had thirteen rolling and slitting mills, and the value of cut nails and brads made within the republic in a year, was estimated at twelve hundred thousand dollars. Nearly three hundred tuns of cut nails were exported. Agricultural implements were made at home, and much coarse ironmongery; but cutlery, fine hardware, and steel work, were brought from Britain. About forty thousand muskets were yearly made in New England and at Harper’s Ferry: also balls, shells, and brass and iron cannon, in various places. There were several iron founderies for machinery castings, and steam-engines had begun to be made at Philadelphia. Mr. Gallatin valued the iron and manufactures of iron then annually made at home, at from twelve to fifteen millions of dollars, and the imports at near four millions, as prices went.

Adam Seybert enumerates the domestic products of 1810, at 53,908 tuns of pig iron, from 153 furnaces; 24,541 tuns of bar iron from 330 forges; 15,727,914 pounds of nails (partly out of imported iron) from 410 naileries; and 6,500 tuns of iron were required at 316 trip-hammers and thirty-four rolling and slitting mills. His estimate of the value of the home manufacture is $14,364,526. In 1806 or 1807, Chancellor Livingston, then our minister to France, had to apply repeatedly to the British ministry for permission to buy in England, and export to New York, the steam-engine which Fulton put on board his first steamboat on the Hudson. Now, the manufacture of steam-engines is an important branch of our home industry.

In 1827-8, it was given in evidence before a committee of Congress, that Pennsylvania had made, during the past year, 21,800 tuns of bar iron, and 47,075 tuns of cast iron; that 3,000 tuns of bar iron were made near Lake Champlain; that three counties in New Jersey had made 2,050 tuns, and that in a circle of thirty miles’ diameter, in New York, there were one hundred and ten forge fires, each of them able to produce twenty-five to thirty-five tuns yearly. In 1830, a committee of Congress reported on the iron trade, and from their report and other later sources, we learn that that year 112,866 tuns of bar, and 191,537 of pig iron, worth $13,327,760, employing 29,254 men, who received $8,776,420 in wages, were made. Perhaps the quantity and number of workmen are overstated. In 1840, with improved machinery, only 30,497 men produced 484,136 tuns.

Without coal and iron, the United States and Britain never could have risen to the rank of first-rate powers. In fact, without iron, civilization must have made very slow progress, as must be evident to any one who will take the trouble to try seriously to

enumerate the various articles _essential_ to society, of which iron is an indispensable part.

In 1839-40, according to the official returns, which are imperfect, the United States produced, with 804 furnaces, 286,903 tuns of cast iron, and with 795 blomaries, forges and rolling-mills, 187,233 tuns of bar iron. The capital invested was nearly twenty and a half millions of dollars; the men employed, miners included, were 30,497, and 1,528,110 tuns of fuel were employed in these operations. The value of iron and steel, and their manufactures, imported in 1839-40, as per official returns, was $7,241,407. The estimated value of the iron made in the United States that year, was $22,778,635; of which sum $15,585,730 were for labor, including mining, transportation, coaling, hauling, &c. The persons employed in the iron manufacture, and their families, were estimated at 213,505, which, at twelve and a half cents each, per day, for agricultural products consumed, would give $9,741,166.

In 1845, the product of the union was estimated thus: 540 blast furnaces, yielding 486,000 tuns of pig iron; 954 blomaries, forges, rolling-mills, &c. yielding 291,600 tuns of bar, hoop, sheet, boiler, and other wrought iron, 30,000 tuns of blooms and 121,500 tuns of castings; value of the whole nearly forty-two millions of dollars.

The United States imported of iron, chiefly bar and bolt, rolled, hammered, or otherwise manufactured, and pig, hoop and sheet, in 1838-9, 115,637 tuns; in 1839-40, 72,769; 1840-1, 112,111; in 1841-2, 107,392; in 1842-3, 38,405.

In 1846-7, we find by the treasury report, that the United States exported of domestic manufactures, 3,197,135 pounds of nails, worth $168,817, of which Cuba took 2,317,550 pounds; also other articles of iron and steel to the value of $998,667, of which $478,681 to Cuba, and $162,020 to British North America. In that year, among the imports, chiefly from England, were 549 tuns of steel, value $1,126,458; 55,599 tuns of bar iron; 28,083 tuns of pig; 1,893 tuns of scraps; 6,167,720 pounds of chain cables; 13,410,556 pounds of sheet and hoop; 1,412,332 pounds of anvils; 921,845 pounds of nails; 361,423 pounds of anchors; 975,256 pounds of castings; 170,909 pounds of cast-iron butts; 431,916 pounds of band; 660,133 pounds of round or square; 347,737 pounds of nail or spike rods.

Official tables show that the imports of manufactures of steel and iron in 1839, were worth $6,507,510; in 1843, $1,012,086; in 1844, $3,313,796; in 1845, $5,077,788; and that in 1839, the value of pig and bar iron and steel imported was $6,302,539; in 1842 and 1845, nearly four millions each year; in 1843, $1,091,598; and in 1844, $2,380,027.

Some idea of the extent of the iron trade inland may be formed from the quantities carried on the canals. In 1847, there came to the Hudson on the New York canals, pig iron, 21,608,000 pounds; bloom and bar 26,348,000 pounds; iron ware, 3,014,000 pounds: 340 tuns of iron and iron ware were cleared on the canals at Buffalo and Oswego; St. Lawrence county, N. Y., shipped 515 tuns of pig, a surplus made there; 7,716 tuns of pig iron reached Buffalo _via_ Lake Erie, and 1,256 kegs of nails; 15,103,565 pounds of iron and nails arrived at Cleveland _via_ the Ohio canal, and 4,085 tuns of iron and 12,537 kegs of nails were shipped from Cleveland coastwise. There were cleared at Portsmouth, Chilicothe, Massillon, and Akron, in 1847, about 5,713 tuns of iron; 5,269,055 pounds of nails were shipped at Akron. The trade in coal and iron on the western rivers and lakes is very large.

Iron canal-boats were in common use in Wales thirty years ago: they are beginning to be made here; also war-steamers. Fences, and even porches to houses, are often of iron. The pipes for the Croton water in New York required many thousand tuns. The annual value of 150,000 tuns of iron ore of Maryland is worth $600,000 at Baltimore. A single foundery in Tennessee sold, in 1844, of sugar-kettles, $50,000 worth.

Child's statistics show that in Pennsylvania, in 1847, there were made, at 213 furnaces, 98,395 tuns of cast iron, and at 169 blomaries, forges, &c., 87,244 tuns of bar iron, 11,522 men being employed, including limestone miners, and a capital of $7,751,470 invested. In 1846, there were 173,369 tuns manufactured, seven of the furnaces using anthracite coal. Forty furnaces, in 1847, were in blast, using anthracite, and producing 121,800 tuns of iron, at a reduced price, which price had induced capitalists to put up extensive rolling-mills. The American Quarterly Register has a list of nineteen anthracite rolling-mills in Pennsylvania, which make iron rails and plate, bar and rod, nails, axle and small iron.

The first bar of railroad iron ever manufactured in the United States, was made in 1841, and now it is said, one hundred thousand tuns could be made easily; while the annual product of iron from all the furnaces, which are said to be some three hundred in number, is estimated at over four hundred thousand tuns.

The yearly manufacture of iron in Great Britain, is now estimated at nearly three millions of tuns. In 1828, there were in Russia, nineteen founderies, forges and mines, and in 1804, that country exported to America over nine million pounds of iron. In 1819, France produced seventy-four million pounds of iron, and in 1845, this had increased to three hundred and forty-two millions, or

over one hundred and fifty thousand tuns. Of iron and steel, and the various manufactures from them, Great Britain exported in 1845, to the extent of thirty-three millions.

COPPER MINES.

Copper (from =cuprum=, a corruption of =cuprium=, from the island of Cyprus, whence it was formerly brought) was known at a very remote period; and in the early ages of the world, before iron was extensively in use, was the chief ingredient in domestic utensils and instruments of war. It is abundant; and is found both native and in many ores, the most important of which are the varieties of _pyrites_, which are sulphurets of copper and iron. The genus copper includes some thirteen species, and each of these contains several varieties.

The purest copper obtained in Europe, is the produce of the mines of the Swedish province of Dalecarlia. The following is a brief description of the principal of these immense and gloomy caverns, all of which boast a high antiquity.

The traveler's curiosity is first attracted by the hydraulic machines which convey the water to the different quarters, and the power of which is such, that one of the wheels has a diameter of not less than forty-four feet. Another wheel, of proportionate magnitude, is employed to raise the ore from the mine to the surface of the earth, and is admirably constructed. Regular circles are placed on each side, and round these the chain rises, taking a larger or smaller circumference, in proportion to the necessary circle to be made, so as to counterbalance the weight, and consequently the increased motion of the bucket.

Exteriorly, a vast chasm of a tremendous depth presents itself to the view. This being the part of the mine which was first opened, either through the ignorance or neglect of those who had then the management of the works, the excavations so weakened the foundations of the hill, that the whole fell in, leaving a most chaotic scene of precipitated rocks, and a gaping gulf resembling the mouth of a volcano. Great care has been since taken that no such disaster should again occur. Plans and sections are drawn of all the galleries, &c.; and where the prosecution of the works in the same direction might be dangerous, orders are issued for the miners to stop, and an iron crown is fixed on the spot, as a prohibition ever to proceed further. The workmen then explore in a different direction, while every subterraneous excavation is nicely watched.

The traveler passes into the great chasm by a range of wooden steps, which cross, in a variety of directions, the rough masses of fallen rocks, of gravel, and of the ancient machinery. Ere he reaches the entrance of the cavern, he has to descend nearly two hundred feet, and this being accomplished, proceeds horizontally to a considerable distance within. He now loses the pure air of day, and gradually breathes an oppressive vapor, which rolls toward him, in volumes, from the mouths of a hundred caves leading into the main passage. He now feels as if he were inhaling the atmosphere of Tartarus. The Swedish iron mines which have been described, are mere purgatories when compared with this satanic dwelling. The descent is performed entirely by steps laid in the winding rock; and, in following the subterraneous declivity, the traveler reaches the tremendous depths of these truly Stygian dominions.

The pestilential vapors which environ him with increasing clouds, and the style of the entrance, remind him of Virgil's description of the descent of Eneas to the infernal regions. Here are to be seen the same caverned portico, the rocky, rough descent, and the steaming sulphur, with all the deadly stenches of Avernus. The wretched inmates of this gloomy cavern, appear to him like so many specters, as poetic fiction has described them: and he is induced by the length of the way, joined to the excessive heat and its suffocating quality, to fancy that he will be made to pay dearly for his curiosity. In one part the steam is so excessively hot, as to scorch at the distance of twelve paces, at the same time that the sulphureous smell is intolerable. Near this spot a volcanic fire broke out some years ago, in consequence of which strong walls were constructed, as barriers to its power, and several contiguous passages, which, had it spread, would have proved dangerous to the mine, closed up.

The visitor has now to traverse many long and winding galleries, as well as large vaulted caverns, where the workmen are dispersed on all sides, employed in hewing vast masses of the rock, and preparing other parts for explosion. Others wheel the brazen ore toward the black abyss, where the suspended buckets hang ready to draw it upward. From the effect of such violent exercise, combined with the heat, they are obliged to work almost naked. Their groups, occupations, and primitive appearance, scantily lighted by the trembling rays of torches, form a curious and interesting scene.

The depth of the mine being at least twelve hundred feet, a full hour is required to reach to the bottom. The mass of copper lies in the form of an inverted cone. Five hundred men are employed daily; but females are not admitted, on account of the deleterious quality of the vapors. This mine was anciently a state prison, in which criminals, slaves and prisoners of war toiled out their

wretched existence. Near the bottom is a rocky saloon, furnished with benches. It is called the Hall of the Senate, on account of its having been the resting-place of several Swedish kings, who came, attended by the senators, to examine the works, and here took refreshments. It was in this mine that the immortal Gustavus Vasa, disguised as a peasant, labored for his bread, during a long concealment, after having been robbed by his guide; and his first adherents in the struggle which placed him on the throne, were from the miners and peasants of Dalecarlia.

In the year 1751, a very rich copper mine was wrought in the county of Wicklow, Ireland. From this mine ran a stream of blue-colored water, of so deleterious a nature as to destroy all the fish in the river Arklow, into which it flowed. One of the workmen, having left an iron shovel in this stream, found it some days after incrusted with copper. This led one of the proprietors of the mine to institute a set of experiments, from which he concluded that the blue water contained an acid holding copper in solution; that iron had a stronger affinity for the acid than copper; and that the consequence of this affinity was the precipitation of the copper, and the solution of the iron, when pieces of that metal were thrown into the blue water. These ideas induced the miners to dig several pits for the reception of this water, and to put bars of iron into them. The result was, that they obtained an abundance of copper, much purer and more valuable than that which they had procured from the ore itself by smelting.

On the island of Anglesea, near Dulas bay, on the north coast, is Parys mountain, which contains the most considerable quantity of copper ore perhaps ever known. The external aspect of the hill is extremely rude, and it is surrounded by enormous rocks of coarse white quartz. The ore is lodged in a basin, or hollow, and has on one side a small lake, over the waves of which, as over those of Avernus, fatal to the feathered tribe, it is said that birds are never known to pass. The effect of the mineral operations has been, that the whole of this tract has assumed a wild and savage appearance. Suffocating fumes of the burning heaps of copper arise in all parts, and extend their baneful influence for miles around. That the ore was worked in a very remote period, appears by vestiges of the ancient operations, which were carried on by trenching, and by heating the rocks intensely, when water was suddenly poured on them, so as to cause them to crack or scale. In the year 1768, after a long search, which was so little profitable that it was on the eve of being abandoned, a large body of copper ore was found; and this has ever since been worked to great advantage, still promising a vast supply. The water lodged in the bottom of the bed of ore, being strongly impregnated with the metal, is drawn up and distributed in pits, where the same process is employed as in the Wicklow mine. The copper thus procured differs little from native copper, and is very highly prized.

In the Parys mine, eight tuns of gunpowder are annually expended in blasting the rock. Nature has here been profuse in bestowing her mineral favors; for, above the copper ore, and not more than two feet beneath the soil, is a bed of yellowish greasy clay, from three to twelve feet in thickness, containing lead ore, from a tun of which metal, upward of fifty ounces of silver are generally obtained.

[Illustration: COPPER MINE IN CORNWALL.]

The copper mines of Cornwall, a view of one of which is given in the cut, are very numerous, and several of them large and very rich in ore. It is remarkable that in various parts of this country the earth has produced such an exuberance of this metal, as to afford it in large massy lumps of malleable copper, several pieces of which are shown in very curious vegetable forms. The particular ore named _mundic_, found in the tin mines, was for many ages considered of no other use but to nourish that metal while in the mine. In the reign of Queen Elizabeth, a laudable curiosity tempted several private individuals to examine into its nature; but the design miscarried, and the mundic was thrown, as useless, into the old pits in which the rubbish was collected. However, about a century ago, this purpose was effected by degrees; and the copper extracted from the ore now produces, on an average, upward of twelve thousand tuns, valued at between four and five millions of dollars, annually, equaling in goodness the best Swedish copper, while the ore itself yields a proportionate quantity of =lapis calaminaris=, for the making of brass.

At Ecton hill, near the river Dove, in Derbyshire, a valuable copper mine was discovered some years ago, and has since been worked to great advantage. In its position, situation and inclination, it differs from any mine yet discovered in Europe, Asia, Africa or America; the wonderful mass of copper ore not running in regular veins or courses, but sinking perpendicularly down, widening and swelling out at the bottom in the form of a bell. The works are four hundred and fifty feet beneath the river Dove, it being the deepest mine in Great Britain. On the opposite side of Ecton hill is a valuable lead mine, the veins of which approach very nearly to the copper mine.

Copper is converted into brass by the agency of calamine, an oxyd of zinc. It occurs frequently in beds, and in some places exists in great abundance. The Mendip hills, in Somersetshire, were once celebrated for their mines of calamine, which are now in a great

measure exhausted. It is dug out of the earth, and being broken into small pieces, is exposed to the action of a current of water, which washes away the light earthy matter, and leaves the calamine. The whole is then thrown into deep wooden vessels filled with water, and agitated for a considerable time. The galena sinks to the bottom, the calamine is deposited in the center, and the earthy matter lies on the surface. The calamine, thus separated from its impurities, is ground to powder, and becomes fit for use.

Hungary abounds in valuable ores and minerals, and is most celebrated for its vast copper works, at a town called Herrengrund, built on the summit of a mountain, and exclusively inhabited by miners. Here the process, noticed above, of apparently converting iron into copper, is pursued with great success, several hundred weight of iron being thus transmuted every year. The vitriol, with which the blue water is strongly impregnated, can not be strictly said to convert the iron into copper, but insinuates into it the copper particles with which it is saturated; and this seeming transmutation requires a fortnight or three weeks only: but if the iron be suffered to lie too long in this vitriolic solution, it becomes at length reduced to powder.

In Japan, copper is the most common of all the metals, and is considered as the finest and most malleable anywhere to be found. Much of this copper is not only of the purest quality, but is blended with a considerable proportion of gold, which the Japanese separate and refine. The whole is brought to Saccin, one of the five principal cities of Japan; and it is there purified, and cast into small cylinders, about a span and a half in length, and a finger's breadth in thickness. Brass is there very scarce, and much dearer than copper, the calamine employed in making it being imported from Tonquin in flat cakes, and sold at a very high price.

In addition to the copper mines thus described, copper has, within a few years, been found in the richest abundance in the vicinity of Lake Superior. The existence of copper there, was, indeed, known as early as 1636; and the trace of these early discoveries was never entirely lost. But the first scientific researches were made in 1842, by Dr. Douglas Houghton, who was acting as geological surveyor for the state of Michigan. According to his report, native copper exists in two or three different deposits about Lake Superior, where it is found in the richest abundance, both in veins and in large masses in the native state. Dr. Jackson also states, that he has seen one of these masses, twenty feet long, nine feet wide, and from four to six inches in thickness, and weighing about twenty tuns. He adds, that in a single year, thirty-three men, of whom only twenty were properly miners, had taken out forty-three tuns of ore, yielding thirty tuns of pure copper. Among the masses of copper obtained from these mines as early as 1848, were four, the weights of which, respectively, were seven thousand and eighteen, seven thousand four hundred and eighty-four, seven thousand six hundred and seventy-eight, and fourteen thousand pounds. Since that date new openings have been made; new mining companies formed, and the products of the mines very greatly increased: and it may yet be, that these mines will prove some of the richest and most valuable of the world.

TIN MINES.

Tin, in its pure state, has nearly the color and luster of silver. In hardness, it is midway between gold and lead. It was known to the ancients, who procured it from Spain and Britain, and appears to have been in use in the time of Moses. It is rather a scarce metal, being found in but few parts of the world in any considerable quantity. Cornwall is its most productive source; it also occurs in the mountains between Gallicia and Portugal, and in those between Saxony and Bohemia. It has, also, been brought from Malacca, in India, and from Chili and Mexico. There are but two ores of tin; one of which, the native peroxyd, is the chief source of all the supplies of this metal, as the other ore, which is the double sulphuret of tin and copper, sometimes called _bell-metal ore_, is extremely rare.

Cornwall has been in all ages, famous for its numerous mines of tin, which are in general very large, and rich in ore. The tin-works are of different kinds, dependent on the various forms in which the metal appears. In many places its ore so nearly resembles common stones, that it can only be distinguished from them by its superior weight. In other parts, the ore is a compound of tin and earth, concreted into a substance almost as hard as stone, of a bluish or grayish color, and to which the mundic, impregnated with copper, frequently gives a yellowish cast. This ore is always found in a continued stratum, which the miners call lode; and this, for the greater part, is found running through the solid substance of the hardest rocks, beginning in small veins near the surface, perhaps not above half an inch or an inch wide, and increasing, as they proceed, into large dimensions, branching out into several ramifications, and bending downward in a direction which is, generally, nearly east and west. These lodes, or veins, are sometimes white, very wide, and so thick, that large lumps of the ore are frequently drawn up of more than twenty pounds' weight. The lodes of tin ore are not always contiguous, but sometimes break off so entirely, that they seem to terminate; but the sagacious miner knows by experience, that, by digging at a small distance on one side, he will meet with a separated part of the lode, apparently tallying with the other end, as nicely as if it had been broken off by some sudden shock of the rock.

The miners of Cornwall follow the lode, or vein, in all its rich and meandering curves through the bowels of the flinty earth. The waters are sometimes drained from the mines, by subterraneous passages, formed from the body of the mountain to the level country. These passages are called _adits_, and are occasionally the labor of many years; but when effected, they save the constant expense of large water-works and fire-engines. From the surface of the earth the workmen sink a passage to the mine, which they call a shaft, and place over it a large winch, or, in works of greater magnitude, a wheel and axle, by which means they draw up large quantities of ore at a time, in vessels called _kibbuls_. This ore is thrown into heaps, which great numbers of poor people are employed in breaking to pieces, and fitting the ore for the stamping-mills.

A third form in which tin appears is that of crystals; for this metal will, under proper circumstances, readily crystallize. Hence, in many parts of the mineral rocks, are found the most perfectly transparent and beautiful crystals of pure tin. Beside these crystals, in many of the cavernous parts of the rocks, are found those transparent crystals, called Cornish diamonds, they being extremely brilliant when well polished. The form is that of a six-sided prism pointed on the top, and they are sometimes four or five inches in length. The value of the tin exported from Great Britain, in 1853, the greater part of which came from the Cornwall mines, was nearly six million dollars.

LEAD MINES.

Lead is one of the metals most anciently known, being mentioned in the books of Moses. It is found in some thirteen species of ore, only one of which (_galena_) occurs in masses sufficiently large to make it valuable as an object of mining and metallurgy. The uses of lead are so familiar that they need not be mentioned: they are known to all.

Among the most remarkable lead mines of the world, may be mentioned those of the state of Illinois, including also parts of Iowa and Wisconsin, which have been, and still are immensely productive, extending over thousands of acres, and furnishing the mineral in the richest abundance. These mines were formerly known as the mines of “Upper Louisiana.” They are now chiefly worked in the vicinity of Galena, a city which has sprung up, and is almost entirely supported by the trade in lead. So vast is the production of these mines, that forty million pounds of lead, valued at sixteen hundred thousand dollars, were shipped from Galena alone, in 1853. The mineral in one of the earliest opened mines, is said to be of two kinds, the gravel and fossil. The gravel mineral is found immediately under the soil, intermixed with gravel, in pieces of solid mineral weighing from one to fifty pounds. Beneath the gravel is a sand rock, which being broken, crumbles to a fine sand, and contains mineral nearly of the same quality as that of the gravel. But the mineral of the first quality is found in a bed of red clay, under the sand rock, in pieces of from ten to five hundred pounds’ weight, on the outside of which is a spar, or fossil, of a bright, glittering appearance, resembling spangles of gold and silver, as solid as the mineral itself, and of a greater specific gravity. This being taken off, the mineral is solid, unconnected with any other substance, of a broad grain, and what mineralogists call potters’ ore. In other mines, in the vicinity of the above, the lead is found in regular veins, from two to four feet in thickness, containing about fifty ounces of silver in a tun.

In Great Britain, there are numerous and exceedingly valuable lead mines, among which may be cited that of Arkingdale, in Yorkshire, and those with which Shropshire abounds. In the south of Lanarkshire, and in the vicinity of Wanlock-head, Scotland, are two celebrated lead mines, which yield annually above two thousand tuns of metal. The Susannah-vein lead-hills, have been worked for many years, and have been productive of great wealth. The above are considered as the richest lead mines of Europe.

Several of the Irish lead mines have yielded a considerable proportion of silver; and mention is made of one, in the county of Antrim, which afforded, in thirty pounds of lead, a pound of that metal. Another, less productive of silver, was found at Ballysadare, near the harbor of Sligo, in Connaught; and a third in the county of Tipperary, thirty miles from Limerick. The ores of this last were of two kinds, most usually of a reddish color, hard and glittering; the other, which was the richest in silver, resembled a blue marl. The works were destroyed in the Irish insurrections in the reign of Charles I. The mine, however, is still wrought on account of the lead it contains.

COAL MINES.

Coal is one of the most valuable of all mineral treasures, and one that is of the highest service in making the others available to the use and comfort of man. And hence it has been searched after with unremitting diligence, and worked with all the lights of science and the resources of art. It is found in beds or strata, in that group of the secondary rocks which includes the red sandstone and mountain limestone formations, commonly called the _carboniferous group_, or the _coal measures_. From the peculiarities of their position, they are often spoken of as _coal-basins_, and _coal-fields_.

There are two or three points of some theoretical interest and importance as to the origin of coal, on which geological authorities are nearly unanimous. One is, that our present coal is exclusively of vegetable origin, formed apparently from the destruction of vast forests and immense quantities of leaves and shrubs; another, that it was formed when the climate of the regions where it is found was not merely tropical, but ultra-tropical, instead of being as now, temperate; and a third, that its deposits, though originally regular, have evidently been since elevated, and often singularly dislocated and contorted by forces acting from below, and probably of a volcanic nature. Each of these points will more or less appear in the progress of the following remarks.

That the coal formations are of vegetable origin, is perfectly evident from even a slight examination, especially with the microscope. Let a piece of coal be cut in very thin slices, or plates, and its appearance will be like that seen in the following cut. The vegetable fossils thus shown are, indeed, very different from any existing species, unless it be a few which are the productions only of torrid climates. And while the cut gives the appearance of but a _single leaf_ in each specimen, the masses of coal are generally more like one thick imbedded mass of leaves, not so much _crushed together_, as _overlaying_ and _mixed with_ each other. According to Dr. Linley, the coal vegetation consisted of ferns, in great abundance; of large coniferous trees, of a species resembling =lycopodiacæ=, but of most gigantic dimensions; of a numerous tribe apparently analogous to =cactæ=, but probably not identical with them; of palm, and other _monocotyledones_; and finally, of numerous vines, plants, &c., the exact nature of which is uncertain. Where _leaves_ most abound, the coal is said to be of the best quality; though as any one kind of coal hardens, the impressions of such leaves become gradually less distinct, until finally they can hardly be traced, even with a powerful magnifier. A hundred and twenty varieties of these vegetable impressions have been found in the vicinity of Pottsville, in the course of a few months, each as distinctly marked as the most delicate tracings of an artist's pencil; and in almost any coal formation, there are so many hundreds of different plants, trees, and flowers, that a single representative of each kind would form a vast museum. Specimens which exhibit impressions of the bark, limbs, or trunks of trees, are, of course, correspondingly large and heavy, and could not easily be sketched in a small engraving, while the variety of leaves and flowers is so great, that it would be tedious to mention and describe them.

[Illustration: THIN PLATES OF COAL.]

With these few remarks, we proceed to notice first, some of the coal mines of Great Britain, and then some of our own country. Perhaps there is no country where coal mines are so rich, so frequent, and so successfully worked thus far, as those of Great Britain; and it is to this cause that the opulence of that country has often been chiefly ascribed. It is, in truth, the coal of her mines, that is the very life of her manufactures, and consequently of her commerce, every manufacturing town being established in the midst of a coal country. Of this striking instances are afforded by Bristol, Birmingham, Wolverhampton, Sheffield, Newcastle, and Glasgow.

The coals of Whitehaven and Wigan are esteemed the purest; and the cannel and peacock coals of Lancashire are so beautiful, that they are suspected by some to have constituted the _gagates_, or jet, which the ancients ascribed to Great Britain. In Somersetshire, the Mendip coal mines are distinguished by their productiveness: they occur there, as indeed in every other part, in the _low_ country, and are not to be found in the hills. The beds of coal are not horizontal, but sloping, dipping to the south-east at the rate of about twenty-two inches per fathom. Hence they would speedily sink so deep that it would not be possible to work them, were it not that they are intersected at intervals by perpendicular dikes or veins, of a different kind of mineral, on the other side of which these beds are found considerably raised up. They are seven in number, lying at regular distances beneath each other, and separated by beds of a different kind of substance, the deepest being placed more than two hundred feet beneath the surface of the earth.

The town of Newcastle, in Northumberland, has been celebrated during several centuries for its very extensive trade in coal. It was first made a borough by William the Conqueror, and the earliest charter for digging coals, granted to the inhabitants, was in the reign of Henry III., in 1239; but in 1306, the use of coal for fuel was prohibited in London, by royal proclamation, chiefly because it injured the sale of wood, with which the environs of the capital were then overspread. This interdict did not, however, continue long in force; and coals may be considered as having been dug for exportation at Newcastle for more than four centuries. It has been estimated that there are twenty-four considerable collieries lying at different distances from the river, from five to eighteen miles; and that they produced, for an average of six years, up to the close of 1776, an annual consumption of three hundred and eighty thousand chaldrons, Newcastle measure, (equal to seven hundred and seventeen thousand, six hundred and fifteen chaldrons, London measure,) of which about thirty thousand chaldrons were exported to foreign parts. The boats employed in the colliery are called _keels_, and are described as strong, clumsy, and oval, each carrying about twenty tuns; and of these four hundred and fifty are kept constantly employed. In the year 1776 an estimate was made of the shipping employed in the Newcastle coal trade; and

from this estimate it appears, that three thousand, five hundred and eighty-five ships, were during that year engaged in the coasting trade, and three hundred and sixty-three in the trade to foreign ports, their joint tunnage amounting to seven hundred and thirty-eight thousand, two hundred and fourteen tuns.

As already said, it is a common opinion among geologists, that coal is of vegetable origin, and that it has been brought to its present state by the means of some chemical process, not at this time understood. This opinion is abundantly supported by the existence of vast depositions of matter, halfway, as it were, between perfect wood and perfect coal; which, while it obviously betrays its vegetable nature, has in several respects so near an approximation to coal, as to have been generally distinguished by the name of coal. One of the most remarkable of these depositions exists in Devonshire, about thirteen miles south-west of Exeter, and is well known under the name of Bovey coal. Its vegetable nature has been ascertained by Mr. Hatchet, in a set of experiments in which he found both extractive matter and resin, substances which belong to the vegetable kingdom.

The beds of this coal are seventy feet in thickness, and are interspersed with beds of clay. On the north side they lie within a foot of the surface, and dip south at the rate of about twenty inches per fathom. The deepest beds are the blackest and heaviest, and have the closest resemblance to coal, while the upper ones strongly resemble wood, and are considered as such by those who dig them. They are brown, and become extremely friable when dry, burning with a flame similar to that of wood, and assuming the appearance of wood which has been rendered soft by some unknown cause, and, while in that state, has been crushed flat by the weight of the incumbent earth. This is the case, not only with the Bovey coal, but also with all the beds of wood-coal which have been hitherto examined in different parts of Europe.[5]

Footnote 5:

We are informed by Liebig and other eminent chemists, that when wood and other vegetable matter are buried in the earth, exposed to moisture, and partially or entirely excluded from the air, they decompose slowly, and evolve carbonic acid gas; thus parting with a portion of their original oxygen. By this means they are gradually converted into lignite, or wood-coal, which contains a larger proportion of hydrogen than wood does. A continuance of decomposition changes this lignite into common or bituminous coal, chiefly by the discharge of carbureted hydrogen, or the gas by which we illuminate our streets and houses. According to Birchoff, the inflammable gases which are always escaping from mineral coal, and are so often the cause of fatal accidents in mines, always contain carbonic acid, carbureted hydrogen, nitrogen, and olefiant gas. The disengagement of all these gradually transforms ordinary or bituminous coal into anthracite, to which the various names of splint-coal, glance-coal, culm, and many others, have been given.

The coal mines of Whitehaven may be considered as among the most extraordinary in the known world. They are excavations which have, in their structure, a considerable resemblance to the gypsum quarries of Paris, and are of such magnitude and extent, that in one of them alone, a sum exceeding half a million sterling, was, in the course of a century, expended by the proprietors. Their principal entrance is by an opening at the bottom of a hill, through a long passage hewn in the rock, leading to the lowest vein of coal. The greater part of this descent is through spacious galleries, which continually intersect other galleries, all the coal being cut away, with the exception of large pillars, which, where the mine runs to a considerable depth, are nine feet in hight, and about thirty-six feet square at the base. Such is the strength there required to support the ponderous roof.

The mines are sunk to the depth of one hundred and thirty fathoms, and are extended under the sea to places where there is, above them, sufficient depth of water for ships of large burden. These are the deepest coal mines which have hitherto been wrought; and perhaps the miners have not, in any other part of the globe, penetrated to so great a depth beneath the surface of the sea, the very deep mines in Hungary, Peru and elsewhere, being situated in mountainous countries, where the surface of the earth is elevated to a great hight above the level of the ocean.

In these mines there are three strata of coal, which lie at a considerable distance one above the other, and are made to communicate by pits; but the vein is not always continued in the same regularly inclined plane, the miners frequently meeting with hard rock, by which their further progress is interrupted. At such places there seem to have been breaks in the earth, from the surface downward, one portion appearing to have sunk down, while the adjoining part has preserved its ancient situation. In some of these places the earth has sunk ten, twenty fathoms, and even more; while in others the depression has been less than one fathom. These breaks the miners call _dikes_, and when they reach one of them, their first care is to discover whether the strata in the adjoining part are higher or lower than in the part where they have been working; or, according to their own phrase, whether the coal be _cast down_ or _cast up_. In the former case they sink a pit; but if it be cast up to any considerable hight, they are

frequently obliged, with great labor and expense, to carry forward a level, or long gallery, through the rock, until they again reach the stratum of coal.

Coal, the chief mineral of Scotland, has been there worked for a succession of ages. Pope Pius II., in his description of Europe, written about 1450, mentions that he beheld with wonder black stones given as alms to the poor of Scotland. This mineral may, however, be traced to the twelfth century; and a very early account of the Scottish coal mines, explains with great precision, the manner of working the coal, not neglecting to mention the subterraneous walls of _whin_ which intersect the strata, particularly a remarkable one, visible from the river Tyne, where it forms a cataract, and passes by Prestonpans, to the shore of Fife. The Lothians and Fifeshire, particularly abound with this useful mineral, which also extends into Ayrshire; and near Irwin is found a curious variety, named ribbon-coal. A singular coal, in veins of mineral, has been found at Castle Leod, in the east of Ross-shire; and it is conjectured that the largest untouched field of coal in Europe, exists in a barren tract of country in Lanarkshire.

The process of mining coal is a combination of boring and digging. Shafts are sunk, levels are driven, and drains are carried off, by the help of picks or pickaxes, wedges and hammers, the rocks being also sometimes loosened by blasting with gunpowder. In searching for coal, a shaft is sunk through the uppermost soft stratum, and the rock is then bored, by striking it continually with an iron borer terminating in an edge of steel, which is in the mean time turned partly round; and, at proper intervals, a scoop is let down to draw up the loose fragments. In this manner a perforation is sometimes made for more than an hundred fathoms, the borer being lengthened by pieces screwed on; it is then partly supported by a counterpoise, and worked by machinery. Should it happen to break, the piece is raised by a rod furnished with a hollow cone, as an extinguisher, which is driven down on it. The borer is sometimes furnished with knives, which are made to act on any part at pleasure, and to scrape off a portion of the surrounding substance, which is collected in a proper receptacle.

Those who have the direction of deep and extensive coal mines, are obliged, with great art and care, to keep them ventilated with perpetual currents of fresh air, which afford the miners a constant supply of that vital fluid, and expel from the mines damps and other noxious exhalations, together with such other burnt and foul air, as has become deleterious and unfit for respiration. In the deserted mines, which are not thus ventilated with currents of fresh air, large quantities of these damps are frequently collected; and in such works they often remain for a long time without doing any mischief. But when, by some accident, they are set on fire, they then produce dreadful explosions, and, bursting out of the pits with great impetuosity, like the fiery eruptions from burning mountains, force along with them ponderous bodies to a great hight in the air.

Various instances have occurred in which the coal has been set on fire by the fulminating damp, and has continued burning for several months, until large streams of water were conducted into the mine, so as to inundate the parts where the conflagration existed. By such fires several collieries have been entirely destroyed, in the vicinity of Newcastle, and in other parts of England, as well as in Fifeshire, in Scotland. In some of these places the fire has continued to burn for ages. To prevent, therefore, as much as possible, the collieries from being filled with these pernicious damps, it has been found necessary carefully to search for the crevices in the coal whence they issue, and, at those places, to confine them within a narrow space, conducting them through large pipes into the open air, where, being set on fire, they consume in perpetual flame as they continually arise out of the earth.

Mr. Spelling, an engineer of the Whitehaven coal mines, having observed that the fulminating damp could only be kindled by flame, and that it was not liable to be set on fire by red-hot iron, nor by the sparks produced by the collision of flint and steel, invented a machine called a steel-mill, in which a wheel of that metal is turned round with a very rapid motion, and, by the application of flints, great plenty of sparks are emitted, which afford the miners such a light as enables them to carry on their work in close places, where the flame of a candle, or a lamp, would, as has already happened in various instances, occasion violent explosions. In that dreadful catastrophe, the explosion of the Felling colliery, the particulars of which will be hereafter detailed, it will be seen that mills of this description were employed, in searching for the remains of the victims of the sad disaster; but this event happened before the invention of Sir Humphrey Davy’s safety-lamp, a discovery which, while it affords a more certain light, holds out every security to the miner against accidents which, without such a resource, might still be superadded to those already recorded, as arising from the flame of a candle or lamp.

A greater number of mines have, however, been ruined by inundations than by fires; and here that noble invention, the fire-engine, displays its beneficial effects. It appears from nice calculations, that it would require about five hundred and fifty men, or a power equal to that of one hundred and ten horses, to work the pumps of one of the largest fire-engines, having a cylinder seventy inches in diameter, now in use, and thrice that number of men to keep an engine of that size constantly at work. It also appears that as much water may be raised by such an engine, as can be drawn, within the same space of time, by twenty-five hundred and twenty

men with rollers and buckets, after the manner long practiced in many mines; or as much as can be borne on the shoulders of twice that number of men, as is said to be done in several of the mines of Peru. So great is the power of the elastic steam of the boiling water in those engines, and of the outward atmosphere, which, by their alternate actions give force and motion to the beam, and through it to the pump rods which elevate the water through tubes, and discharge it from the mine!

Years since there were four fire-engines belonging to the Whitehaven colliery, which when all at work, discharged from it about twelve hundred and twenty-eight gallons of water every minute, at thirteen strokes; and at the same rate, one million, seven hundred and sixty-eight thousand, three hundred and twenty gallons, upward of seven thousand tuns, every twenty-four hours. By these engines nearly twice the above-mentioned quantity of water might be discharged from mines not more than sixty or seventy fathoms deep, which depth is rarely exceeded in the Newcastle collieries, or in any other English collieries, with the exception of the above.

Coal pits have sometimes taken fire by accident, and have continued to burn for a considerable length of time. About the year 1648, a coal mine at Benwell, a village near Newcastle-upon-Tyne, was accidentally kindled by a candle: at first the fire was so feeble, that a reward of half a crown, which was asked by a person who offered to extinguish it, was refused. It gradually increased, however, and had continued burning for thirty years, when the account was drawn up and published in the Philosophical Transactions: it was not finally extinguished until all the fuel was consumed. Examples of a similar kind have happened in Scotland and in Germany.

But of all the recorded accidents relative to coal mines, that of Felling colliery, near Sunderland, a concise narrative of which here follows, was the most disastrous.

Felling is a manor about a mile and a half east of Gateshead. It contains several strata of coal, the uppermost of which were extensively wrought in the beginning of the last century. The stratum called the high-main, was begun in 1779, and continued to be wrought till the nineteenth of January, 1811, when it was entirely excavated. The present colliery was in the seam called the low-main. It commenced in October, 1810, and was at full work in May, 1812. This mine was considered by the workmen as a model of perfection in the purity of its air, and orderly arrangements; its inclined plane was saving the daily expense of at least thirteen horses; the concern wore the features of the greatest possible prosperity, and no accident, except a trifling explosion of fire-damp, slightly burning two or three workmen, had occurred. Two _shifts_, or sets of men, were constantly employed, except on Sundays. Twenty-five acres of coal had been excavated. The first shift entered the mine at four o’clock, A. M., and were relieved at their working-posts by the next at eleven o’clock in the morning. The establishment employed under ground, consisted of about one hundred and twenty-eight persons, who, from the eleventh to the twenty-fifth of May, 1812, wrought six hundred and twenty-four scores of coal, equal to thirteen hundred Newcastle, or twenty-four hundred and fifty-five London chaldrons.

About half past eleven o’clock, on the morning of the twenty-fifth of May, 1812, the neighboring villages were alarmed by a tremendous explosion in this colliery. The subterraneous fire broke forth with two heavy discharges from the low-main, which were almost instantaneously followed by one from the high-main. A slight trembling, as from an earthquake, was felt for about half a mile around the workings; and the noise of the explosion, though dull, was heard to three or four miles’ distance, and much resembled an unsteady fire of infantry. Immense quantities of dust and small coal accompanied these blasts, and rose high into the air, in the form of an inverted cone. The heaviest part of the ejected matter, such as corves, pieces of wood, and small coal, fell near the pits; but the dust, borne away by a strong west wind, fell in a continued shower from the pit to the distance of a mile and a half. As soon as the explosion was heard, the wives and children of the workmen ran to the pit; the scene was distressing beyond the power of description.

Of one hundred and twenty-eight persons in the mine at the time of the explosion, only thirty-two were brought to daylight: twenty-nine survived the fatal combustion; the rest were destroyed. Nor from the time of the explosion till the eighth of July, could any person descend. But after many unsuccessful attempts to explore the burning mine, it was reclosed, to prevent the atmospheric air from entering it: this being done, no attempt was afterward made to explore it, till the morning of the last-mentioned day; from which time to the nineteenth of September, the heart-rending scene of mothers and widows examining the putrid bodies of their sons and husbands, for marks by which to identify them, was almost daily renewed; but very few of them were known by any personal mark; they were too much mangled and scorched to retain any of their features. Their clothes, tobacco-boxes, shoes, &c., were, therefore, the only indexes by which they could be recognized.

At the crane twenty-one bodies lay in ghastly confusion: some like mummies, scorched as dry as if they were baked. One wanted its head, another an arm. The scene was truly frightful. The power of fire was visible upon them all; but its effects were extremely variable: while some were almost torn to pieces, there were others who appeared as if they had sunk down overpowered with sleep. The ventilation concluded on Saturday the nineteenth of September, when the ninety-first body was dug from under a heap of stones. At six o'clock in the morning the pit was visited by candle-light, which had not been used in it for the space of one hundred and seventeen days; and at eleven o'clock in the morning the tube furnace was lighted. From this time the colliery has been regularly at work; but the ninety-second body has never yet been found. All these persons, except four, who were buried in single graves, were interred in Heworth chapel-yard, in a trench, side by side, two coffins deep, with a partition of brick and lime between every four coffins.

Having thus glanced at some of the coal mines of Great Britain, we now pass to some of those of the United States. In these coal is found in _four_ different forms: _first_, the _genuine_ anthracite, or _glance_ coal, as near Worcester, Mass., and Newport, R. I.; _second_, coal destitute of bitumen, commonly called anthracite, but which is more properly anasphaltic, which is found at Pottsville, Mauch Chunk, Lackawanna, Wilkesbarre, &c.; _third_, bituminous coal, usually found in the slate rock, as at Tioga, Lycoming, etc.; and _fourth_, the lignite coal, found along the south shore of the bay of South Amboy, New Jersey. From the state of Alabama to Pictou, Nova Scotia, the coal beds can be followed in a north-east direction, for fifteen hundred miles; and from Richmond, in Virginia, to Rock River, in Illinois, they are continually crossed at right angles, for about eight hundred miles. At Richmond, the coal is bituminous; on the Alleghany belt, it is anthracite. Geologists think that the anthracite was lifted out of its horizontal position when the great Alleghany belt was upheaved, and that its non-bituminous quality is owing to the influence of the intense heat that accompanied its upheaval.

Taylor, in his book on coal, estimates the area of bituminous coal in the United States, east of the Mississippi river, at one hundred and twenty-four thousand, seven hundred and thirty-five square miles, and west of the Mississippi, at eight thousand, three hundred and ninety-seven square miles; British North America, eighteen thousand square miles bituminous. More than one-third of the area of Pennsylvania, is more or less marked by coal formations; one-third of Kentucky, Ohio and Virginia, one-fifth of Indiana, and three-fourths of Illinois, are occupied by carboniferous strata. Western Pennsylvania abounds in bituminous coal, and it is found also in several counties of New York. By the census of 1839-40, we find that the quantity of bituminous coal produced that year in the United States, was twenty-seven million, six hundred and three thousand, one hundred and ninety-one bushels, employing about four thousand men, and a capital of some two million dollars; and that about four million dollars of capital were invested in raising anthracite coal, of which some nine hundred thousand tuns (of about twenty-eight bushels each) were produced by the labors of about three thousand men. Most of this was from Pennsylvania.

In 1819, the anthracite coal trade had no existence; in 1820, this kind of coal was first used as fuel, and just three hundred and sixty-five tuns were sent to market; in 1845, the amount was two million tuns; in 1850, about three million, five hundred thousand tuns, and the present year (1854) the amount will probably be between six and seven million tuns. The demand and supply so steadily and rapidly increase that it is impossible to estimate the vast extent the business of coal mining is yet to attain.

Glancing for a moment at other countries, we find that Belgium, in 1845, had two hundred and twelve mines, employing thirty-eight thousand miners and five hundred steam-engines, and producing five million tuns; France, four hundred and forty-nine mines, employing thirty thousand miners, and producing five million tuns; Prussia, in 1840, seven hundred and fifty-two mines, employing twenty-four thousand miners, and raising three million, five hundred thousand tuns; and that Great Britain, in 1846, produced thirty-five million tuns, valued at forty-five million dollars at the mines. Austria and Spain, also, have excellent mines, though less productive. And as a late and interesting discovery, it may be added, that the recent Arctic expedition sent out from England, found coal in those northern regions, on the island of Disco, outcropping near the shore. They also, in another locality not far off, discovered some curious specimens of petrified trees, and near them extensive quarries of anthracite coal, of good quality. There appeared to be no limit to the quantity that might be thrown into a boat with ease, and in the space of three hours they conveyed not less than twelve tuns to the steamer, three-quarters of a mile distant. It proved, on trial, to be of good quality, the combustion was perfect, and the coal as economical as the Welsh.

We will conclude the subject of coal mines, with the statement of a recent tourist, as to some of the wonders of the Cornish mines in England, as he saw them in 1854. He says: "Some of the mines are truly grand undertakings. The 'consolidated mines,' the largest of the Cornish group, employ upward of three thousand persons. One of the engines pumps water from a direct depth of sixteen hundred feet, the weight of the pumping apparatus alone being upward of five hundred tuns; the pumping-rod is one thousand, seven hundred and forty feet long, and it raises about two million gallons of water in a week, from a depth equal to five times the

hight of St. Paul's. These are, indeed, wonders to marvel at! The consolidated and united mines, both belonging to one company, are stated to have used the following vast quantities of materials in a year: coals, fifteen thousand, two hundred and seventy tuns; candles, one hundred and thirty-two thousand, one hundred and forty-four pounds; gunpowder, eighty-two thousand pounds; leather, for straps, &c., thirteen thousand, four hundred and ninety-three pounds; pick and shovel handles, sixteen thousand, six hundred and ninety-eight dozens. Sir Charles Lemon has estimated, that in the whole of the Cornish mines, thirteen thousand pounds' worth of gunpowder is used annually; that the timber employed in the underground works, equals the growth of one hundred and forty square miles of Norwegian forest; and that thirty-seven million tuns of water are raised annually from the mines."

SALT MINES.

Hence with diffusive salt old Ocean steeps, His emerald shallows, and his sapphire deeps. Oft in wide lakes, around their warmer brim, In hollow pyramids the crystals swim; Or, fused by earth-born fires, in cubic blocks Shoot their wide forms, and harden into rocks.—DARWIN.

Culinary salt, or, as it is termed in chemistry, muriate of soda, exists abundantly in a native state, both in a solid form, and dissolved in water. It occurs, in solution, not only throughout the wide range of the ocean, but in various springs, rivers and lakes; and is known, in its solid form, as a peculiar mineral, under the names of _rock-salt_, _fossil salt_, and _salt-gem_. Its beds are mostly beneath the surface of the ground, but sometimes rise into hills of considerable elevation. At Cordova, in Spain, a hill, between four and five hundred feet in hight, is nearly composed of this mineral. But the most celebrated salt mines are those of Wielicza, in Gallicia, commonly called the salt mines of Cracow, those of Tyrol, of Castile, (in Spain,) and of Cheshire, in England. In the province of Lahore, in Hindoostan, is a hill of rock-salt, of equal magnitude with that near Cordova. The mines of Iletski, in Russia, yield vast quantities of this substance. It is so plentiful in the desert of Caramania, and the air so dry, that it is there used as a material for building. It forms the surface of a large part of the northern desert of Lybia; and is found in great abundance in the mountains of Peru. It has a pure saline taste, without any mixture of bitterness; and crystallizes in cubes when obtained by slow evaporation from its solution. In Germany the mines of this kind are numerous: one of the largest is that of Hallein, near Saltzburg, in which the salt is hewn out from subterraneous caverns of a considerable range, and exhibits almost every diversity of color, as yellow, red, blue and white; in consequence of which it is dissolved in water, to be liberated from its impurities, and afterward recrystallized. The salt mines of Cracow, and those of Cheshire, merit a particular description.

SALT MINES OF CRACOW.

Thus, cavern'd round, in Cracow's mighty mines, With crystal walls a gorgeous city shines; Scoop'd in the briny rock long streets extend Their hoary course, and glittering domes ascend: Down their bright steeps, emerging into day, Impetuous fountains burst their headlong way, O'er milk-white vales in ivory channels spread, And wondering seek their subterraneous bed. Form'd in pellucid salt, with chisel nice, The pale lamp glittering through the sculptur'd ice, With wild reverted eyes fair Lotta stands, And spreads to heaven, in vain, her glassy hands; Cold dews condense upon her pearly breast, And the big tear rolls lucid down her vest. Far gleaming o'er the town, transparent fanes Rear their white towers, and wave their golden vanes: Long lines of lusters pour their trembling rays, And the bright vault resounds with mingled blaze.—DARWIN.

These celebrated excavations are about five miles distant from the city of Cracow, in a small town named Wielicza, which is entirely undermined, the cavities reaching to a considerable extent beyond its limits. The length of the great mine, a view of which is seen on the next page, from east to west, is six thousand feet; its breadth, from north to south, two thousand; and its greatest depth eight hundred; but the veins of salt are not limited to this extent, the depth and length of them, from east to west, being yet unknown, and their breadth only, hitherto determined. There are at present ten shafts; and not a single spring has been discovered throughout the extent of the mine.

In descending to the bottom, the visitor is surprised to find a kind of subterraneous commonwealth, consisting of many families, who have their peculiar laws and polity. Here are likewise public roads and carriages, horses being employed to draw the salt to the mouths of the mine, where it is taken up by engines. These horses, when once arrived at their destination, never more see the light of the sun; and many of the people seem buried alive in this strange abyss, having been born there, and never stirring out; while others are not denied frequent opportunities of breathing the fresh air in the fields, and enjoying the surrounding prospects. The subterraneous passages, or galleries, are very spacious, and in many of them chapels are hewn out of the rock-salt. In these passages crucifixes are set up, together with the images of saints, before which a light is kept constantly burning. The places where the salt is hewn out, and the empty cavities whence it has been removed, are called chambers, in several of which, where the water

has stagnated, the bottoms and sides are covered with very thick incrustations of thousands of salt crystals, lying one on the other, and many of them weighing half a pound and upward. When candles are placed before them, the numerous rays of light reflected by these crystals emit a surprising luster.

[Illustration: GREAT SALT MINE OF CRACOW.]

In several parts of the mine, huge columns of salt are left standing, to support the rock; and these are very fancifully ornamented. But the most curious object in the inhabited part, or subterraneous town, is a statue which is considered by the immured inhabitants as the actual transmutation of Lot's wife into a pillar of salt; and in proportion as this statue appears either dry or moist, the state of the weather above ground is inferred. The windings in this mine are so numerous and intricate, that the workmen have frequently lost their way; and several, whose lights have been extinguished, have thus perished. The number of miners to whom it gives employment, is computed at between four and five hundred; but the whole amount of the men employed in it is about seven hundred.

The salt lies near the surface, in large, shapeless masses, from which blocks of sixty, eighty, or a hundred feet square, may be hewn; but at a considerable depth it is found in smaller lumps. About six hundred thousand quintals of salt are dug annually out of the mines of Cracow. The worst and cheapest is called green salt, from its greenish color, occasioned by a heterogenous mixture of a grayish mineral, or clay, and entirely consists of salt crystals of different dimensions. A finer sort is dug out in large blocks; and the third kind is the _sal gemmæ_, or crystal salt, which is found in small pieces interspersed in the rock, and, when detached from it, breaks into cubes of rectangular prisms. This is usually sold unprepared. The color of the salt stone is a dark gray mixed with yellow.

SALT MINES AND SPRINGS OF CHESHIRE, ENGLAND.

The Cheshire rock-salt, with very few exceptions, has hitherto been ascertained to exist only in the valleys bordering on the river Weaver and its tributary streams; in some places manifesting its presence by springs impregnated with salt, and in others being known by mines actually carried down into the substance of the salt strata. Between the source of the Weaver and Nantwich, many brine springs make their appearance; and occur again at several places, in proceeding down the stream. At Moulton, a mine has been sunk into the body of rock-salt, and a similar mine is wrought near Middlewich. At Northwich, brine springs are very abundant; and there also many mines have been sunk for the purpose of working out the fossil salt. In that vicinity a body of rock-salt has been met with in searching for coal.

The brines in this district are formed by the penetration of spring or rain waters to the upper surface of the rock-salt, in passing over which they acquire such a degree of strength, that one hundred parts have yielded twenty-seven of pure salt, thus nearly approaching to the perfect saturation of brine. Their strength is therefore much greater than that of the salt springs met with in Hungary, Germany and France. The brine having been pumped out of the pits, is first conveyed into large reservoirs, and afterward drawn off as it is needed, into pans made of wrought iron. Here heat is applied in a degree determined by the nature of the salt to be manufactured, and various additions are made to the brine, with a view either to assist the crystallization of the salt, or to promote the separation of the earthy particles, which exist in a very small proportion. The importance of the manufacture of Cheshire salt will be sufficiently obvious from the statement, that, besides the salt made for home consumption, the annual amount of which has exceeded sixteen thousand tuns, the average of the quantity sent yearly to Liverpool for exportation, has not been less than one hundred and forty thousand tuns.

The mine of rock-salt first worked was discovered by accident at Marbury, near Northwich about a century and a half ago; and this bed had been wrought for more than a century, when, in the same neighborhood, a second and inferior stratum was fallen in with, separated from the former by a bed of indurated clay. This lower stratum was ascertained to possess a very great degree of purity, and freedom from earthy admixture; on which account, and from the local advantages of Northwich for exportation, the fossil salt is worked in the vicinity of that place only. It occurs in two great strata or beds, lying nearly horizontally, and separated, the superincumbent from the subjacent stratum, by several layers of indurated clay, or argillaceous stone. These intervening beds possess, in conjunction, a very uniform thickness of from thirty to thirty-five feet, and are irregularly penetrated by veins of fossil salt. There is every reason to believe that the beds of rock-salt at Northwich, are perfectly distinct from any others in the salt district, and form what are termed by mineralogists _incumbent bodies_ or _masses of mineral_.

These enormous masses stretch a mile and a half in a longitudinal direction from north-east to south-west; but their transverse extent, as measured by a line at right angles from the former, does not exceed forty-two hundred feet, somewhat more than

three-quarters of a mile. Without this area, the brine which is met with, is of a very weak and inferior quality, and at a short distance disappears altogether. The thickness of the upper bed varies from sixty to ninety feet; and a general estimate made from its level, shows that its upper surface, which is ninety feet beneath that of the earth, is at least thirty-six feet beneath the low-water mark of the sea at Liverpool; a fact not unimportant in determining the nature of the formation of this mineral. The thickness of the lower bed has not hitherto been ascertained; but the workings are usually begun at the depth of from sixty to seventy-five feet, and are carried down for the space of fifteen or eighteen feet, through what forms the purest portion of the bed. In one of the mines a shaft has been sunk to a level of forty-two feet still lower, without passing through the body of rock-salt. There is thus an ascertained thickness of this bed of about a hundred and twenty feet, and without any direct evidence that it may not extend to a considerably greater depth.

Although two distinct beds, only, of fossil salt have been met with at Northwich, it has been ascertained that the same limitations do not exist throughout the whole of the salt district. At Lawton, near the source of the river Wheelock, three distinct beds have been found, separated by strata of indurated clay: one at the depth of one hundred and twenty-six feet, four feet in thickness; a second, thirty feet lower, twelve feet in thickness; and a third, forty-five feet further down, which was sunk into seventy-two feet, without passing through its substance. The intervening clay, the structure of which is very peculiar, is called the shaggy metal, and the fresh water which passes through its pores has the expressive appellation of Roaring Meg. This epithet will not appear too strong, when it is mentioned that in a mine in which the section of strata was taken, and where the “shaggy metal” was found at the depth of about eighty feet, the quantity of water ascertained to issue from its pores in one minute, was not less than three hundred and sixty gallons; a circumstance which greatly enhances the difficulty of passing a shaft down to the body of rock-salt.

In many of these beds of argillaceous stone, a portion of salt, sufficiently strong to affect the taste, is found to exist; and this saltness increases, as might be expected, in proportion as the body of rock-salt is approached. In the strata or layers immediately above the rock, which in all the mines are perfectly uniform in their appearance and structure, this is particularly remarkable, notwithstanding there are not, in these strata, any veins of rock-salt connected with the great mass below. On the contrary, the line between the clay and rock-salt is drawn with great distinctness in every instance, without presenting any of those inequalities which would arise from a mutual penetration of the strata. Not any marine exuviæ, or organic remains, are found in the strata above the rock-salt; and the almost universal occurrence of gypsum, in connection with beds of fossil salt, is a fact still more deserving of observation, because it appears, not only in these mines, but also in the salt mines of Hungary, Poland and Transylvania; on which account Werner, in his geognostic system, assigns to the rock-salt and fletz gypsum a conjunct situation.

The fossil salt extracted from the Northwich mines is of different degrees of purity, and more or less blended with earthy and metallic substances. The purer portion of the lower bed yields a rock-salt, which, being principally exported to the Baltic, obtains the name of Prussian rock. The extent of the cavity formed by the workings, varies in different mines, the average depth being about sixteen feet. In some of the pits, where pillars from eighteen to twenty-four feet square form the supports of the mine, the appearance of the cavity is singularly striking, and the brilliancy of the effect is greatly increased when the mine is illuminated by candles fixed to the sides of the rock. The scene thus formed almost appears to realize the magic palaces of eastern poets. Some of the pits are worked in aisles or streets, but the choice here is wholly arbitrary. Among the methods employed in working out the rock-salt, the operation of blasting is applied to the separation of large masses from the body of the rock, and these are afterward broken down by the mechanical implements in common use. The present number of mines is eleven or twelve, from which there are raised, on an annual average, fifty or sixty thousand tuns of rock-salt. The greater part of this quantity is exported to Ireland and the Baltic, the remainder being employed in the Cheshire district, in the manufacture of white salt, by solution and subsequent evaporation.

The general situation occupied by the rock-salt in Cheshire is very similar to that of the Transylvanian and Polish mines, the beds of this mineral being disposed in small plains, bounded by hills of inconsiderable hight, forming a kind of basin or hollow, from which there is usually only a narrow egress for the waters. The situation of the Austrian salt mines near Saltzburg is, however, very different. The mineral there appears to be disposed in beds of great thickness, which occur near the summits of limestone hills, at a great elevation above the adjoining country. This is a singular fact; and if the hypothesis be allowed that rock-salt is formed from the waters of the sea, it is necessary to suppose the occurrence on this spot of the most vast and surprising changes!

Though there are no salt _mines_ in the United States, there are salt _springs_ in several places. By far the most important and valuable of these, are in the neighborhood of Syracuse, in the state of New York. The land containing these springs, is owned by the state, and is leased free of rent, to be used only for the manufacture of salt. The wells are dug, and the water pumped up at the expense of the state, and the manufacturer pays a duty of one cent on each bushel he makes. Some of the wells are sunk to the

depth of four hundred feet. Fine salt is prepared by boiling; and coarse by solar evaporation. In 1850, the number of salt manufactories in this vicinity was one hundred and ninety-two; and the quantity of salt produced in 1853, amounted to more than five million bushels. The salt of this region has been thoroughly tested, and found to be fully equal to any of foreign manufacture.

PHENOMENA OF THE OCEAN.

“They that go down to the sea in ships, that do business in great waters; these see the works of the Lord, and his wonders in the deep.”—PSALMS.

“With wonder mark the moving wilderness of waves, From pole to pole through boundless space diffused, Magnificently dreadful! where, at large, Leviathan, with each inferior name Of sea-born kinds, ten thousand thousand tribes, Find endless range for pasture and for sport. Adoring own The Hand Almighty, who in channeled bed Immeasurable sunk, and poured abroad, Fenced with eternal mounds, the fluid sphere; With every wind to waft large commerce on. Join pole to pole, consociate severed worlds, And link in bonds of intercourse and love Earth’s universal family.”—MALLET.

That huge mass of waters impregnated with salt, which encompasses all parts of the globe, and by the means of which, in the present improved state of navigation, an easy intercourse subsists between the most distant nations, is denominated the ocean, and has three grand divisions assigned to it. First, that vast expanse of water which lies to the westward of the northern and southern continents of America, and by which those continents are divided from Asia. On account of the uniform and temperate gales which sweep its surface within the tropics, it is named the Pacific ocean; and has again been distinguished into the northern and southern Pacific, (the equator being considered as the dividing line,) and the Southern ocean, or South sea, being consequently that part of the general assemblage of waters which is contained between the fortieth degree of south latitude and the south pole. Its general width is estimated at about ten thousand miles. Secondly, the Atlantic ocean, which divides Europe and Africa from the two American continents, and has a general width of about three thousand miles; while the waters which occupy the polar regions are named the Northern sea. And, lastly, the Indian ocean, which extends from the eastern shores of Africa along the southern coasts of Asia, and has the same general width with the preceding one.

Among the chief of those less expansive sheets of water, properly called seas, may be mentioned the Baltic, the Mediterranean sea, and the Black and Red seas. The Caspian sea, being entirely encompassed by land, might, with more propriety, have been styled a lake; but as its water possesses the quality of saltness, it is ranked among the seas. It is, notwithstanding, certain that Lake Superior has a still greater circumference, extending around its shores at least fourteen hundred miles, while the extent of the Caspian does not exceed twelve hundred.

Of the origin of this division into different seas, and seas of different depths, little is known; but it is highly probable that many of the larger excavations and partitions now met with, have existed, without much change as to their extent, from the creation. Others have undoubtedly been the result of that conflict which is perpetually taking place between the elements of land and water, and which has, for the greater part, given rise to islands, isthmuses and peninsulas; while subterraneous volcanoes, and the truly surprising and indefatigable exertions of coral, madrepores, tubipores, and other restless and multitudinous zoöphytes, have laid, and are daily laying, the foundation of new islands and continents in the middle of the widest and deepest seas.

The quantity of water in the ocean, not only remains constantly the same, but, notwithstanding its most violent and incessant motion, continues stable within certain limits. This, however, can not be inferred from observation; for, although in the almost infinite variety of disturbances to which the ocean is liable, from the action of irregular causes, it may appear to return to its former state of equilibrium, still it may be apprehended that some extraordinary cause may communicate to it a shock, which, though inconsiderable at first, may augment continually, and elevate it above the highest mountains. It is, therefore, interesting to investigate the conditions which are necessary for the absolute stability of the ocean. This has been effected by the celebrated Laplace, who has demonstrated that the equilibrium of the ocean _must_ be stable, if the density be _less_ than the mean density of the earth, which is known to be the case. He has likewise determined, by means of his refined analysis, that this stability would cease to exist, if the mean density of the sea _were to exceed_ that of the earth; so that the stability of the equilibrium of the ocean, and the excess of the density of the terrestrial globe above that of the waters which cover it, are reciprocally connected with each

other, and indicate infinite wisdom and contrivance in such an adjustment.

SALTNESS OF THE SEA.

Of the various phenomena of the sea, that of its _saltness_ is one of the most obvious. No questions concerning the natural history of our globe have been discussed with more attention, or decided with less satisfaction, than that concerning its primary cause, which had perplexed the philosophers before the time of Aristotle, and surpassed even the great genius of that profound inquirer into natural causes. Kircher, after having consulted not less than thirty-three authors on this subject, could not help remarking, that the fluctuations of the ocean itself were scarcely more various than the opinions concerning the origin of its saline impregnation.

This question does not seem capable of admitting an illustration from experiment; at least, not from any experiments hitherto made for that purpose: it is, therefore, not surprising, that it remains nearly as problematical in the present age, as it has been in any of the preceding. Had observations been made three or four centuries ago, to ascertain the saltness of the sea, then, at any particular time and place, we might now, by making similar observations at the same place, in the same season, have been able to know, whether the saltness, at that particular place, was increasing or decreasing, or an invariable quantity. This kind and degree of knowledge would have served as a clue to direct us to a full investigation of this matter in general. It is to be regretted, however, that observations of this nature have not, in former days, been made with any degree of precision.

One of the principal opinions maintained on this subject by modern philosophers, and more particularly supported by Halley, is, that since river-water, in almost every part of the globe, is impregnated in a greater or less degree by sea-salt, the sea must have gradually acquired its present quantity of salt from the long continued influx of rivers. The water which is carried into the sea by these rivers, is again separated from it by evaporation, and being dispersed over the atmosphere by winds, soon descends in rain or vapor upon the surface of the earth, whence it hastens to pour into the bosom of the ocean the fresh tribute of salt it has collected in its inland progress. Thus the salt conveyed into the sea not being a volatile substance, nor performing an incessant circulation, must be a perpetually increasing quantity; and sufficient time, it is contended, has elapsed since the creation, for the sea to acquire, from this source, its present quantity of salt.

This opinion has been successfully combated; and it is denied that freshwater rivers could, in the course of thousands or even millions of years, have produced saltness in the sea. If this were the case, every sea, or great body of water, which receives rivers, must have been salt, and have possessed a degree of saltness in proportion to the quantity of water which these rivers discharge. But so far is this from being true, that the Palus Mæotis, and our great American lakes, do not contain salt water, but fresh. It may indeed be objected, that the quantity of salt which rivers carry along with them, and deposit in the sea, must depend on the nature of the soil through which they flow, which may in some places not contain any salt; and that this is the reason why the great lakes in America and the Palus Mæotis are fresh. But to this opinion, which is merely hypothetical, there are insurmountable objections. It is a curious fact, that the saltness of the sea is greatest under the equator, and diminishes gradually toward the poles; but it can not therefore be assumed that the earth contains more salt in the tropical regions than in the temperate zones, and more in these again than in the frigid zones. On the other hand, if it be allowed that the sea receives its saltness from the rivers, it must be equally salt, or nearly so, in every part of the earth; since, according to a simple and well-known principle in chemistry, _when any substance is dissolved in water with the assistance of agitation, at whatever part of the water it is introduced, it will be equally diffused through the whole liquid_. Now, though it were true that a greater quantity of salt should have been introduced into the sea under the equator, than toward the poles, from the constant agitation occasioned by the wind and tide, the salt must have soon pervaded the whole mass of water. Neither is this greater proportion of saltness owing to a superior degree of heat, since it is an established principle in chemistry, that cold water and hot water dissolve nearly the same proportion of salt.

The saltness of the sea has also been ascribed to the solution of subterraneous mines of salt, that are supposed to abound in the bottom of the sea, and along its shores. But this hypothesis can not be supported. If the sea were constantly dissolving salt, it would soon become saturated; for it can not be said that it is deprived of any portion of its salt by evaporation, since rain-water is fresh. If the sea were to become saturated, neither fishes nor vegetables could live in it. It may hence be inferred that the saltness of the sea can not be accounted for by secondary causes, and _that it has been salt since the beginning of time_. It is indeed impossible to suppose that the waters of the sea were at any time fresh since the formation of fishes and sea-plants; neither will they live in water which is fresh. It may hence be concluded that the saltness of the sea has, with some few exceptions, perhaps arising from mines of rock-salt dispersed near its shores, been nearly the same in all ages. This hypothesis, which is the simplest, and is involved in the fewest difficulties, best explains the various phenomena dependent on the saltness of the sea.

Although this saline property may be one of the causes by which the waters of the sea are preserved from putridity, still it can not be considered as the principal cause. The ocean has, like rivers, its currents, by which its contents are circulated round the globe; and these may be said to be the great agents which keep it sweet and wholesome. A very enlightened navigator, Sir John Hawkins, speaks of a calm, in which the sea, having continued for some time without motion, assumed a very formidable aspect. “Were it not,” he observes, “for the moving of the sea by the force of winds, tides and currents, it would corrupt all the world. The experiment of this I saw in the year 1590, lying with a fleet about the islands of the Azores, almost six months, the greater part of which time we were becalmed. Upon which, all the sea became so replenished with various sorts of gellies, and forms of serpents, adders and snakes, as seemed wonderful; some green, some black, some yellow, some white, some of divers colors, and many of them had life; and some there were a yard and a half, and two yards long; which, had I not seen, I could hardly have believed. And hereof are witnesses all the companies of the ships which were then present; so that hardly a man could draw a bucket of water clear of some corruption. In which voyage, toward the end thereof, many of every ship fell sick, and began to die apace. But the speedy passage into our country, was a remedy to the diseased, and a preservative to those who were not touched.”

CONGELATION OF SEA-WATER.

Although the assertion that salt water never freezes, has been contradicted by repeated experience, it is still certain that it requires a much greater degree of cold to produce its congelation, than fresh water. It is, therefore, one of the greatest blessings which we derive from this element, that when we find all the stores of nature locked up to us on the land, the sea is, with few exceptions, ever open to our necessities. It is well known that at particular seasons, the mouth of the river St. Lawrence, the entrance into the Baltic sea, &c., are so much frozen over as to be impassable by ships; while the vast mountains and fields of ice in the polar regions, have for ages past been insurmountable obstructions to the daring researches of modern navigators. These exceptions, however, will appear of comparatively trifling importance to navigation, when the number of ports which are, in almost every region, open at all seasons of the year, are considered; and this facility of intercourse would certainly not have been afforded, if sea-water had admitted of as easy a congelation as that of water not impregnated with salt.

On the origin of ice in the frozen seas, different opinions have been entertained. The authority of Capt. Cook and Lord Mulgrave, has been cited by Bishop Watson, to show that good fresh water may be procured from ice found in those seas; but he observes that, notwithstanding the testimonies of these very able navigators, it may still be doubted whether the ice from which the water was obtained, had been formed in the sea, and, consequently, whether sea-water itself would, when frozen, yield fresh water. He thinks it probable that the ice had either been formed at the mouths of large fresh-water rivers, and had thence, by tides or torrents been drifted into the sea, or that it had been broken by its own weight, from the immense cliffs of ice and frozen snow which, in countries where there are few rivers, are found in high latitudes to project a great way into the sea. An early navigator, Fotherbye, in the relation of his voyage toward the south pole, in 1614, considers snow to be the original cause of the ice found at sea, he himself having observed it to lie an inch thick on the surface; and Captain Cook, from his own observation in the South sea, was disposed to think that the vast floats of ice he met with in the spring, were formed from the congelation of snow. It is certain that the snow which falls upon the surface of the sea, being in a solid state, and, bulk for bulk, lighter than sea-water, will not readily combine with it, but may, by a due degree of cold in the atmosphere, be speedily converted into a layer of ice. The upper layer of this first surface of ice being elevated above the surface of the sea, will receive all the fresh water which falls from the atmosphere in the form of snow, sleet, rain or dew, by the successive congelation of which, the largest fields of ice may at length be formed.

It is a matter of little consequence to a navigator, whence the ice which supplies him with fresh water is produced. Leaving, therefore, these hypotheses relative to the formation of ice in frozen seas, it should be observed that the question, whether congealed sea-water will, when thawed, yield fresh water, has been satisfactorily decided by experiments made with every suitable attention. A quantity of sea-water having been taken up off the English coast, was exposed to a freezing atmosphere, and afforded an ice perfectly free from any taste of salt; and it has likewise been found, that not only sea-water, but water containing double the proportion of salt commonly found in our sea-water, and more than is contained in the sea-water of any climate, may be frozen by the cold prevailing in our atmosphere.

[Illustration: ICEBERGS, OR ICE-ISLANDS.]

ICE-ISLANDS.

Ice-islands, or icebergs, as they are commonly called, is the name given by seamen to the huge, solid masses of ice which abound in the sea near or within the polar circles, and which often float down nearer to the equator, till they are gradually dissolved by the

increasing warmth of the air and water. The cut gives a view of them as seen by Dr. Scoresby, who counted five hundred of them between latitude sixty-nine degrees and seventy degrees north, which were from one hundred to two hundred feet high, and from a few yards to a mile in circumference. Many of these fluctuating islands are met with on the coasts of Spitzbergen, to the great danger of the vessels employed in the Greenland fishery. In the midst of these tremendous masses, navigators have been arrested and frozen to death. In this manner the brave Sir Hugh Willoughby perished, with all his crew, in 1553; and in the year 1773, Lord Mulgrave, after every effort which the most accomplished seaman could make, to reach the termination of his voyage, was caught in the ice, and nearly experienced the same unhappy fate. The scene he describes, divested of the horrors attendant on the eventful expectation of change, was most beautiful and picturesque. Two large ships becalmed in a vast basin, surrounded on all sides by ice-islands of various forms; the weather clear; the sun gilding the circumambient ice, which was smooth, low, even, and covered with snow, except where pools of water, on a portion of the surface, shot forth new icy crystals, and on the smooth surface of the comparatively small space of sea in which they were hemmed. Such is the picture drawn by our navigator, amid the perils by which lie was surrounded.

After fruitless attempts to force their way through the fields of ice, the limits of these became at length so contracted, that the ships were immovably fixed. The smooth extent of surface was soon lost; the pressure of the pieces of ice, by the violence of the swell, caused them to pack; and fragment rose upon fragment, until they were in many places higher than the main-yard. The movements of the ships were tremendous and involuntary, in conjunction with the surrounding ice, actuated by the currents. The water having shoaled to fourteen fathoms, great apprehensions were entertained, as the grounding of the ice, or of the ships, would have been equally fatal: the force of the ice might have crushed them to atoms, or have lifted them out of the water, and have overset them; or, again, have left them suspended on the summits of the pieces of ice, at a tremendous hight, exposed to the fury of the winds, or to the risk of being dashed to pieces by the failure of their frozen dock. An attempt was made to cut a passage through the ice; but after a perseverance truly worthy of Britons, it proved ineffectual. The commander, who was at all times master of himself, directed the boats to be made ready to be hauled over the ice, till they should reach navigable water, proposing in them to make the voyage to England; but after they had thus been drawn over the ice, for three progressive days, a wind having sprung up, the ice separated sufficiently to yield to the pressure of the ships in full sail. After having labored against the resisting fields of ice, they at length reached the harbor of Smeerinberg, at the west end of Spitzbergen.

The vast islands of floating ice which abound in the high southern latitudes, are a proof that they are visited by a much severer degree of cold than equal latitudes toward the north pole. Captain Cook, in his second voyage, fell in with one of these islands in latitude fifty degrees, forty minutes, south. It was about fifty feet high, and half a mile in circuit, being flat on the top, while its sides, against which the sea broke exceedingly high, rose in a perpendicular direction. In the afternoon of the same day, the tenth of December, 1773, he fell in with another large cubical mass of ice, about two thousand feet in length, four hundred feet in breadth, and in hight two hundred feet. Mr. Foster, the naturalist of the voyage, remarks that, according to the experiments of Boyle and Marian, the volume of ice is to that of sea-water as ten to nine: consequently, by the known rules of hydrostatics, the volume of ice which rises above the surface of the water, is to that which sinks below it as one to nine. Supposing, therefore, this mass of ice to have been of a regular figure, its depth under water must have been eighteen hundred feet, and its whole hight, twenty hundred feet: estimating its length, as above, at twenty hundred feet, and its breadth at four hundred feet, the entire mass must have contained sixteen hundred millions of cubic feet of ice.

Two days after, several other ice-islands were seen, some of them nearly two miles in circuit, and six hundred feet high; and yet such was the force of the waves, that the sea broke quite over them. They exhibited for a few moments a view very pleasing to the eye; but a sense of danger soon filled the mind with horror; for had the ship struck against the weather-side of one of these islands, when the sea ran high, she must in an instant have been dashed to pieces. The route to the southward was afterward impeded by an immense field of low ice, the termination of which could not be seen, either to the east, west or south. In different parts of this field were islands, or hills of ice, like those which had before been found floating in the sea.

At length these ice-islands became as familiar to those on board as the clouds and the sea. Whenever a strong reflection of white was seen on the skirts of the sky, near the horizon, then ice was sure to be encountered; notwithstanding which, that substance itself was not entirely white, but often tinged, especially near the surface of the sea, with a most beautiful sapphirine, or rather berylline blue, evidently reflected from the water. This blue color sometimes appeared twenty or thirty feet above the surface, and was probably produced by particles of sea-water which had been dashed against the mass in tempestuous weather, and had penetrated into its interstices. In the evening, the sun setting just behind one of these masses, tinged its edges with gold, and reflected on the entire mass a beautiful suffusion of purple. In the larger masses, were frequently observed shades or casts of

white, lying above each other in strata, sometimes of six inches, and at other times of a foot in hight. This appearance seemed to confirm the opinion entertained relative to the increase and accumulation of such huge masses of ice, by heavy falls of snow at different intervals; for snow being of various kinds, small-grained, large-grained, in light feathery locks, &c., the various degrees of its compactness may account for the different colors of the strata.

In his third attempt to proceed southward, in January, 1774, Capt. Cook was led, by the mildest sunshine which was, perhaps, ever experienced in the frigid zone, to entertain hopes of penetrating as far toward the south pole as other navigators have done toward the north pole; but on the twenty-sixth of that month, at four in the morning, his officers discovered a solid ice-field of immense extent before them, bearing from east to west. A bed of fragments floated around this field, which was raised several feet above the surface of the water. While in this situation, the southern part of the horizon was illuminated by the rays of light reflected from the ice, to a considerable hight. Ninety-seven ice-islands were distinctly seen within the field, besides those on the outside; many of them very large, and looking like a ridge of mountains, rising one above the other until they were lost in the clouds. The most elevated and most ragged of these ice-islands, were surmounted by peaks, and were from two to three hundred feet in hight, with perpendicular cliffs or sides astonishing to behold. The largest of them terminated in a peak not unlike the cupola of St. Paul's.

The outer, or northern edge of this immense field of ice, was composed of loose or broken ice, closely packed together, so that it was not possible to find any entrance. Such mountains of ice, Captain Cook was persuaded, were never seen in the Greenland seas, so that no comparison could be drawn; and it was the opinion of most of the persons on board, that this ice extended quite to the pole, from which they were then less than nineteen degrees; or, perhaps, that it was joined to some land to which it had been fixed from the earliest time. Our navigator was of opinion that it is to the south of this parallel that all the ice is formed which is found scattered up and down to the northward, and afterward broken off by gales of wind, or other causes, and brought forward by the currents which are always found to set in that direction in high latitudes. "Should there," he observes, "be land to the south behind this ice, it can afford no better retreat for birds, or any other animals, than the ice itself, with which it must be wholly covered. I, who was ambitious, not only to go further than any one had been before, but as far as it was possible for man to go, was not sorry at meeting with this interruption; as it in some measure relieved us, or at least shortened the dangers and hardships inseparable from the navigation of the southern polar regions."

The approximation of several fields of ice of different magnitudes, produces a very singular phenomenon. The smaller of these masses are forced out of the water, and thrown on the larger ones, until at length an aggregate is formed of a tremendous hight. These accumulated bodies of ice float in the sea like so many rugged mountains, and are continually increased in hight by the freezing of the spray of the sea, and the melting and then freezing of the snow which falls on them. While their growth is thus augmented, the smaller fields, of a less elevation, are the meadows of the seals, on which these animals at times frolic by hundreds.

The collision of great fields of ice, in high latitudes, is often attended by a noise, which, for a time, takes away the sense of hearing anything beside; and that of the smaller fields, with a grinding of unspeakable horror. The water which dashes against the mountainous ice, freezes into an infinite variety of forms, and presents to the admiring view of the voyager ideal towns, streets, churches, steeples, and almost every form which imagination can picture to itself.

After such notices of the ice-islands from the earlier voyagers, it may be interesting to know how they have appeared to later beholders; and this may be seen in the following account from the journal of a seaman who was in the well known "Arctic Expedition," in 1850-51. Under the date of the thirtieth of June, 1850, he writes: "Moored to an iceberg; weather calm; sky cloudless, and 'beautifully blue;' surrounded by a vast number of stupendous bergs, glittering and glistening beneath the refulgent rays of a midday sun. A great portion of the crew had gone on shore to gather the eggs of the wild sea-birds that frequent the lonely ice-bound precipices of Baffin's bay, while those on board had retired to rest, wearied with the harassing toils of the preceding day. To me, walking the deck and alone, all nature seemed hushed in universal repose. Whilst thus contemplating the stillness of the monotonous scene around me, I observed in the offing a large iceberg, completely perforated, exhibiting in the distance an arch, or tunnel, apparently so uniform in its conformation, that I was induced to call two of the seamen to look at it, at the same time telling them, that I had never read or heard of any of our arctic voyagers passing through one of these arches, so frequently seen through large bergs, and that there would be a novelty in doing so; and if they chose to accompany me, I would get permission to take the small boat, and endeavor to accomplish the unprecedented feat.

"They readily agreed, and away we went. On nearing the arch, and ascertaining that there was a sufficiency of water for the boat to pass through, we rowed slowly and silently under, when there burst upon our view one of the most magnificent specimens of

nature's handiwork ever exhibited to mortal eyes; the sublimity and grandeur of which no language can describe, no imagination conceive. Fancy an immense arch of eighty feet span, fifty feet high, and upward of one hundred feet in breadth, as correct in its conformation as if it had been constructed by the most scientific artist, formed of solid ice, of a beautiful emerald green, its whole expanse of surface smoother than the most polished alabaster, and you may form some slight conception of the architectural beauties of this icy temple, the wonderful workmanship of time and the elements. When we had got about half-way through the mighty structure, on looking upward, I observed that the berg was rent the whole breadth of the arch, and in a perpendicular direction to its summit, showing two vertical sections of irregular surfaces, 'darkly, deeply, beautifully blue,' here and there illuminated by an arctic sun, which darted its golden rays between, presenting to the eye a picture of ethereal grandeur, which no poet could describe, no painter portray. I was so enraptured with the sight, that for a moment I fancied the 'blue vault of heaven' had opened, and that I actually gazed upon the celestial splendor of a world beyond this. But, alas! in an instant the scene changed, and I awoke as it were from a delightful dream, to experience all the horrors of a terrible reality. I observed the fracture rapidly close, then again slowly open. This stupendous mass of ice, millions of tuns in weight, was afloat, consequently in motion, and apparently about to lose its equilibrium, capsize, or burst into fragments.

"Our position was truly awful. My feelings at the moment may be conceived, but can not be described. I looked downward and around me; the sight was equally appalling; the very sea seemed agitated. I at last shut my eyes from a scene so terrible, the men at the oars, as if by instinct, 'gave way,' and our little craft swiftly glided from beneath the gigantic mass. We then rowed round the berg, keeping at a respectful distance from it, in order to judge of its magnitude. I supposed it to be about a mile in circumference, and its highest pinnacle two hundred and fifty feet. Thus ended an excursion, the bare recollection of which, at this moment, awakens in me a shudder; nevertheless, I would not have lost the opportunity of witnessing a scene so awfully sublime, so tragically grand, for thousands of pounds, but I would not again run such a risk for a world. We passed through the berg about two P. M., and at ten o'clock the same night, it burst, agitating the sea for miles around. I may also observe, that the two men who were with me in the boat, did not observe that the berg was rent until I told them, after we were out of danger, we having agreed, previously to entering the arch, not to speak a word to each other, lest echo itself should disturb the fragile mass."

As further describing the appearances of icebergs, we give the following narrative by Mr. Abbott, who himself was a witness of the splendid scenery he so graphically describes. He says: "The trip of the Baltic, in March, 1854, is likely to be somewhat memorable. We left Sandy Hook, on Sunday morning, the fifth, and had a propitious and rapid run, until Friday the tenth, about three o'clock. When in latitude forty-six degrees and longitude forty-eight degrees, our attention was arrested by some small pieces of broken ice, floating in every direction around us. The weather was thick and hazy, so that we could nowhere see the horizon. In the course of an hour or two, the fog partly disappeared, and we found ourselves nearly half-surrounded by an immense field of drift-ice, and large numbers of icebergs, extending from north-east by south to south-west.

"Our speed was immediately slackened, and the course of the ship changed to the northward and westward. It soon appeared that we were completely hemmed in on every side, by immense fields of floating drift, sometimes in loose and broken masses, sometimes in a compact and immovable jam, and everywhere studded with vast and towering icebergs, of almost every conceivable form and size.

"The fog gradually lifted, now in one direction, and now in another, just sufficient to discover to us, that we were fairly surrounded, and that, to whatever point of the compass we could turn the eye or the ship, interminable masses of drift-ice, of uplift, and icebergs, seemed to cover the sea. So sudden and unexpected was this discovery, that it seemed more like fairy work than reality. Surprise and astonishment, at the novel and wonderful scene around us, seemed at first to make us all unconscious of our own critical situation. Separating from it the idea of danger, it would be difficult to imagine a scene combining and blending more of the elements of beauty, grandeur and sublimity. Far as the eye could reach, it was no longer sea and sky, but ice, ice, ice, floating like an archipelago of a thousand isles, great and small, of highland and lowland, mountain, peninsula, promontory, and Gibraltar rock.

"Running in countless directions through these masses, the ocean waves appeared in narrow but doubly dark currents, forming the most crooked and irregular passages, of rivulet and river, and endless indentations of inlet and bay. Through these labyrinthine passages, perpetually opening and closing by the action of winds and waves, our escape was to be made. Once, in attempting to force a passage through a long but narrow neck of broken blocks of ice, which had drifted across our way, the cutwater, bows and wheels of the ship, were pretty seriously battered.

"All night long the ship was kept running slowly, threading her way through these little passages of clear water, until four o'clock in the morning, when she was so pressed on every side, with sheets of ice, crowded and packed far above the surface of the water,

and urged on by the momentum of vast masses of iceberg, that prudence required to stop the engine and wait for daylight. The morning brought little cheering prospect. The man at mast-head reported no clear water, as far as the eye could reach, excepting in narrow and scarcely navigable patches and veins. The surface of the sea all around the horizon, seemed an almost unbroken plain of field and mountain ice. As early as light allowed, the ship was again under way for the largest space of clear water that could be seen, and continued all day long to retrace her path to the westward, veering her course, however, through every point of the compass, to find the intricate passages toward the open sea. The wind, fresh from the north-west, came with intense and piercing cold. The man at the mast-head could not stand its severity more than half an hour. The masts, shrouds and cordage of the ship, were completely incrusted, and altogether what with field-ice, drift, and icebergs, snow, rain and hail, gale and storm, these days in the ice will not soon be forgotten.

“The different aspects of these scenes by day and night furnished an incessant source of interest. The vast fields of drift, in their varied forms, by daylight and by moonlight, were picturesque and beautiful in the highest degree. They ranged in extent from a quarter of a mile, to perhaps ten miles square. In some cases, the entire field seemed to be composed of small broken fragments, floating in close proximity to each other, yet yielding readily to the play of the waves, rising and falling with the swell of the sea. The superincumbent weight upon the surface of the water, diminished the elevation of the waves, but the reflected light from its uneven silver surface, revealed far more distinctly and beautifully, the extent of motion and the action of the waves. The long swells of the sea stretched away in graceful curves for miles, resembling more than anything else I can suggest, some of the rolling prairies of the west, as they must appear in snow, with this difference, that the swells seemed ‘all alive,’ as if some mighty monsters of the deep were working their way beneath, perpetually shifting their position, and vainly endeavoring to lift the load that covers them, to find a breathing in the open air. In other instances, these vast fields, stretching as far as the eye could reach over half the visible horizon, were one compact and apparently motionless mass of solid ice, as fixed as a ‘rock-bound coast.’

“Another form of peculiar interest was that of a wide field, of many miles in extent, apparently formed by a long succession of ‘uplifts.’ The action of the waves had gradually forced large blocks of ice beneath one edge, and the long continuation of this process, had lifted as it would seem, almost the entire mass, many feet out of water. The outer edge of these uplifts presented an abrupt and perpendicular wall. In one case, at night, the captain estimated that he had sailed for ten miles, along such a wall, the hight of the wheel-house, about forty feet. A very beautiful effect was once produced by a small mass of this kind. It was several miles distant, and of very considerable length. As it rolled and pitched, one side, apparently fifteen or twenty feet high, dipped in the waves, and rising again, lifted an immense volume of water, which then ran off, in a beautiful and magnificent torrent, over the rising edge. I watched with my glass for an hour, the graceful evolutions of this interesting cataract, which is probably still performing, by its regular rise and fall, a very respectable, but intermittent Niagara, in the middle of the Atlantic, with all the regularity of a pendulum.

“The icebergs, themselves, which we saw, were very numerous, and of almost every conceivable form and size. During our passage through three hundred miles, the number we observed was variously estimated from five hundred to one thousand. I counted at one time thirty-six, and at another forty-five, all of notable magnitude. They sometimes were of most curious and fantastic shapes. Hill and mountain of every imaginable outline, castle and tower, turret, and out-jutting and overhanging crags, magnificent needle forms shooting to the sky, like the spire of Trinity, crouching lions, and polar bears, trees of ice, and natural bridges, in short, you can scarcely fancy anything odd, that snow and ice can be made to resemble, that had not its type around us.

“But, perhaps, the most wonderful of all, was the great ‘plunging iceberg.’ It was a round, oblong mass of ice, estimated by careful comparison with our wheel-house, to be fifty by seventy-five feet. A side view made it appear about as large as the front of a large, double, four story dwelling. But it was as true and perfect an oval, as the most exquisitely beautiful bald head you have ever seen. It looked exactly like the upper part of a head of some gigantic being. This, as it floated past us, gradually descended in the waves, until it sunk beneath the surface. It then rose with a most majestic movement, lifting the pure white crown, to the hight of fifty feet. It presented on the whole, one of the grandest sights I ever beheld. It continued thus sinking and rising till it was out of our sight. It seemed like a creature of life, paying its respects to our noble ship.”

ICEBERGS.

Analogous to the ice-fields described above, are those large bodies of ice, perhaps more properly named icebergs, which fill the valleys between the high mountains in northern latitudes. Among the most remarkable, are those of the east coast of Spitzbergen. They are seven in number, and lie at considerable distances from each other, extending through tracts unknown, in a region totally inaccessible in the internal parts. The most distant of them exhibits over the sea a front three hundred feet in hight, emulating the

color of the emerald; cataracts of melted snow fall down in various parts; and black, spiral mountains, streaked with white, bound the sides, rising crag above crag, as far as the eye can reach in the background. At times immense fragments break off, and precipitate themselves into the water with a most alarming dashing. A portion of this vivid green substance was seen by Lord Mulgrave, in the voyage above referred to, to fall into the sea; and, notwithstanding it grounded in twenty-four fathoms of water, it spired above the surface fifty feet. Similar icebergs are frequent in all the arctic regions; and to their fall is owing the solid mountainous ice which infests those seas.

The frost sports wonderfully with these icebergs, and gives them majestic, as well as other most singular forms. Masses have been seen to assume the shape of a Gothic church, with arches, windows and doors, and all the rich drapery of that style of architecture, composed of what the writer of an Arabian tale would scarcely have ventured to introduce among the marvelous suggestions of his fancy, _crystals of the richest sapphirine blue_. Tables with one or more feet; and often immense flat-roofed temples, like those of Luxor, on the bank of the Nile, supported by round transparent columns of cerulean hue, float by the astonished spectator. These icebergs are the creation of ages, and acquire annually additional hight by falls of snow and rain, which latter often freezes instantly, and more than repairs the loss occasioned by the influence of the sun's heat.

LUMINOUS POINTS IN THE SEA.

Among the phenomena which have long exercised the sagacity of philosophers, that of the luminous appearance of the surface of the sea, during the obscurity of the night, is highly curious. A variety of experiments were made by a French naturalist at Cayenne, at different seasons, to ascertain its true cause; and to him it appeared that these luminous points were produced by motion and friction alone, as he could not, with the help of the best glasses, perceive any insects floating in the water. But it would seem, from the experiments and observations of many learned men, that this phenomenon is produced by various causes, both jointly and separately. It has been proved by one set of experiments, that the putrefaction of animal substances produces light and scintillation in the sea. A little white fish placed in seawater rendered it luminous in the space of twenty-eight hours. On another hand, it is certain that there is in the sea a prodigious quantity of shining insects or animalcules, which contribute to this phenomenon. A French astronomer, M. Dangelet, who returned from Terra Australis in 1774, brought with him several kinds of worms which shine in water, when it is set in motion; and M. Rigaud affirms, that the luminous surface of the sea, from Brest to the Antilles, contains a great quantity of little, round, shining polypi, of about a quarter of a line in diameter. Other learned men, who acknowledge the existence of these luminous animals, can not, however, be persuaded to consider them as the cause of all that light and scintillation which appear on the surface of the ocean. They imagine that some substance of a phosphoric nature, arising from putrefaction, must be admitted as one of the causes of this phenomenon. By other naturalists it has been ascribed to the oily and greasy substances with which the sea is impregnated; in proof of which a kind of fish, resembling the tunny, is cited, as being provided with an oil which shines with considerable luster.

The Abbe Nollent was convinced, by a series of experiments, that this phenomenon is caused by small animals, either by their luminous aspect, or by some liquor or effluvium which they emit. He did not, however, exclude other causes; and among these, the spawn or fry of fishes is deserving of attention. M. Dangelet, in sailing into the bay of Antongil, in the island of Madagascar, observed a prodigious quantity of fry, which covered the surface of the sea for the extent of more than a mile, and which he at first, on account of its color, mistook for a bank of sand. This immense accumulation of spawn or fry exhaled a disagreeable odor; and it should be remarked that the sea had, for some days before, appeared with uncommon splendor. The same accurate observer, perceiving the sea remarkably luminous in the road of the cape of Good Hope, during a perfect calm, remarked that the oars of the canoes produced a whitish and pearly kind of luster: when he took in his hand the water, which contained phosphorus, he discerned in it, for some minutes, globules of light as large as the heads of pins. On pressing these globules, they appeared to his touch like a soft and thin pulp; and some days after the sea was covered with entire banks of small fishes, in innumerable multitudes.

From all these facts it may be deduced, that various causes contribute to the light and scintillation of the sea; and that the light which the Cayenne naturalist attributed to agitation and friction, differs from that which is extended far and near, seeming to cover the whole surface of the ocean, and producing a very beautiful and striking appearance, particularly in the torrid zone, and in the summer season.

TIDES AND CURRENTS.

Alternate tides in sacred order run.—BLACKMORE.

Among the most wonderful phenomena of nature may be reckoned the tides of the sea. They were but little understood by the ancients, although Pliny, Ptolemy and Macrobius, were of opinion that they were influenced by the sun and moon. The former expressly says, that the cause of the ebb and flow is in the sun, which attracts the waters of the ocean; and he adds, that the waters rise in proportion to the proximity of the moon to the earth.

The phenomena of the tides have been ascribed to the principle of innate gravitation; but Sir Richard Phillips, in his theory of the system of the universe, refers them to that general law of motion which he considers as the primary and proximate cause of all phenomena, operating, in a descending series, from the rotation of the sun round the fulcrum of the solar system, to the fall of an apple to the earth. This motion being transferred through all nature from its source, serves as the efficient cause of every species of vitality, of every organic arrangement, and of all those accidents of body heretofore ascribed to attraction.

The waters of the ocean are observed to flow and rise twice a day, in which motion, or flux, which in the same direction lasts nearly six hours, the sea gradually swells, and, entering the mouths of rivers, drives back the river-waters toward their head. After a continued flux of six hours, it seems to repose for a quarter of an hour, and then begins to ebb, or retire back, for six hours more; in which time, by the subsidence of the waters, the rivers resume their usual course. After a quarter of an hour, the sea again flows and rises as before.

According to the theory of Newton, these phenomena were supposed to be produced by an imaginary power called attraction. The moon was supposed to attract the waters by the influence of an occult power inherent in all matter; just as the earth was supposed to attract the moon, the moon the earth, and the planets one another. Others, again, ridicule this idea, as unsustained and visionary, giving in their turn some theory that has no better argument to sustain it. And it is probable the time is yet future when we shall have any theory that will fully account for all the phenomena of the tides. On account of the shallowness of some seas, and the narrowness of the straits in others, there arises a great diversity in the phenomena, only to be accounted for by an exact knowledge of the place. For instance, in the English channel and the German ocean, the tide is found to flow strongest in those places that are narrowest, the same quantity of water being, in this case, driven through a smaller passage. It is often seen, therefore, rushing through a strait with great force, and considerably raised, by its rapidity, above that part of the ocean through which it runs.

The shallowness and narrowness of many parts of the sea, give rise also to a peculiarity in the tides of some parts of the world: for in many places, in the British seas in particular, the greatest swell of the tide is not while the moon is in its meridian hight, and directly over the place, but some time after it has declined thence. The sea, in this case, being obstructed, pursues the moon with what dispatch it can, but does not arrive with all its waters, until after the moon has ceased to operate. Lastly, from this shallowness of the sea, and from its being obstructed by shoals and straits, it happens that the Mediterranean, the Baltic and the Black sea, have not any sensible tides, to raise or depress them in a considerable degree.

Among the phenomena of the tides, one of the most singular is the bore, peculiar to several rivers: it is ascribed to the waters, which were before expansive, being suddenly pent up, and confined within a narrow space. This bore or impetuous rush of waters, accompanies the first flowing of the tide in the Ferret, in Somersetshire, and in the Seine, in France. It is also one of the peculiarities of the Severn, the most rapid river in England.

One of the greatest known tides is that of the Bristol channel, which sometimes flows upward of forty feet. At the mouth of the river Indus, the water rises thirty feet. The tides also are remarkably high on the coasts of Malay, in the straits of Sunda, in the Red sea, at the mouth of the river St. Lawrence, along the coasts of China and Japan, at Panama, and in the gulf of Bengal. The most remarkable tides, however, are those at Batsha, in the kingdom of Tonquin, in twenty degrees, fifty minutes, north latitude. In that port, the sea ebbs and flows once only in twenty-four hours, while in all other places there are two tides within that space. What is still more extraordinary, twice in each month, when the moon is near the equinoctial, there is not any tide, the water being for some time quite stagnant. These, with other anomalies of the tides there, Sir Isaac Newton, with peculiar sagacity, ascertained to arise from the concurrence of two tides, one from the South sea, and the other from the Indian ocean. Of each of these two tides there come successively two every day; two at one time greater, and two at another which are less. The time between the arrival of the two greater was considered by him as high tide; that between the two less, as ebb. In short, with these simple facts in his possession, that great mathematician solved every appearance, and so established his theory as to silence every opposer.

Besides the common and periodical tides, a variety of local currents are met with in different seas, on different parts of the ocean, and for the greater part at an inconsiderable distance from land. They have been usually ascribed to particular winds; but their

origin is not easy to trace, as they have been occasionally found beneath the surface of the water, running in a contrary direction to the stratum above, and can not, therefore, have been owing to winds or monsoons. These particular currents have been ascribed to the immense masses of polar ice, which produce a greater degree of cold in the under than in the upper stratum of waters; and it has been suspected that there is an under-current of cold water flowing perpetually from the poles toward the equator, even where the water above flows toward the poles. The great disparity of temperature which is frequently found in deep and superficial soundings of the same space of water, is thus accounted for.

The most extraordinary current of this kind, is that of the gulf of Florida, usually called the Gulf stream, which sets along the coast of North America to the northward and eastward, and flows with an uninterrupted rapidity. It is ascribed to the trade-winds, which, blowing from the eastern quarter into the great Mexican gulf, cause there an accumulation above the common level of the sea. The water, therefore, constantly runs out by the channel where it finds least resistance, that is, through the gulf of Florida, with such force as to continue a distinct stream to a very great distance. A proof of its having thus originated is, that the water in the Gulf stream has been found to have retained a great portion of the heat it had acquired in the torrid zone.

A very singular upper current often prevails to the westward of Scilly, and is highly dangerous to ships which approach the British channel. Currents of this description are, however more frequently met with about the straits of Gibraltar, and near the West India islands, the coasts of which are so subject to counter-tides, or extraordinary currents, that it is often dangerous for boats to land. They proceed to the westward, along the coasts of Yucatan and Mexico, and running round into the gulf, return into the great ocean by the straits of Bahama, along the coasts of Florida, in order to pursue, in the north, the course ordained them by the great Author of nature. In this course the waters run with an extraordinary rapidity, passing on, however, by a motion so even and imperceptible, that their speed is not realized by the spectator. But against the shores and coasts of the various islands in their way, their progress becomes very manifest, and even dangerous, interrupting the navigation, and rendering it hardly possible to stem them in their course.

In addition to these regular currents, there are others, called counter-tides, which are observable on the sea-coasts and shores. In places where these flow, the sea rolls and dashes in an extraordinary manner, becoming furious without any apparent cause, and without being moved by any wind. The waves rise and open very high, breaking on the shore with such violence, that it is impossible for vessels to land. These counter-tides have been, by some, ascribed to the pressure of the heavy black wind-clouds which are occasionally seen to hang over an island, or over the sea where they occur, though it is far more probable that in every case they are caused by under-currents and hidden shoals, by which the ordinary currents are checked and broken so as to cause the effects described.

Somewhat similar to these, at least in its hidden cause, is the celebrated Maelstrom on the coast of Norway, a view of which is given in the cut. This is caused by the tides, in their violent passage between the Loffoden islands; and its terrors, though at all times great, are sometimes greatly increased by the winds. The roar of the sea, when the Maelstrom is in full action, is said to be terrific. It is stated that not only ships, but even whales, have been sucked into this vortex, and killed by being dashed against the hidden rocks. The following description, though imaginary, gives a correct idea of the destruction of a ship in this whirlpool.

[Illustration: THE MAELSTROM.]

“The breeze, which had been long flagging, now lulled into a calm, and soon a low continual hum, like that of an army of bees, which seemed to rise out of the stilled ocean, became audible to every ear. Not a word was spoken; every one held his breath whilst he listened with an intensity of eagerness that betokened the awe that was fast filling the heart. ‘It is the Moskoestrom!’ cried the boatswain. ‘The Moskoestrom!’ echoed the crew. ‘Away, men!’ shouted the mate; ‘down to the hold, bring up the spare sails, clear the deck, set up a spar for a mast; away, away!’

“The din of preparation drowned the stern hum of the distant whirlpool: there was, however, an anxious pause when the new sail was set into the air; and experienced sailors suffered themselves to be cheated with the hope that there was still breeze enough to make the good ship answer her helm. But, alas! the heavy canvas refused to expand its folds, and not a breath of wind ruffled the dull surface of the sullen waters. They had not another hope; the sailors looked on one another with blank dismay, and now they heard, with awful distinctness, the roar of the terrible Maelstrom, and the frowning rocks of Loffoden were but too plainly visible on the right. It became evident to all, that the ship, borne along by the tide, was fast drawing near the dreadful whirlpool. The vessel continued slowly to approach, and the certainty of unavoidable death became every moment more overpowering and intense. At first the sailors stood together in a group, gazing gloomily upon one another; but as the roar of the whirlpool became louder and

louder, and the conviction of inevitable destruction became stronger, they all dispersed to various parts of the ship. * * *

“It was a beautiful day; the sun shone forth without a cloud to dim his luster, the waves sparkled beneath his influence, and the white plumage of a thousand busy sea-birds became more dazzling with his rays. The isle of Moskoe was close at hand, and looked cheerful and inviting, but the ship was not to approach nearer to its shores; the stream which bore her along never suffered any vessel to pause in its career. And now there arose at some distance ahead of the vessel, a horrible and dismal bellowing. It was the voice of the leviathan in his agony; and when those on deck who had still ears for exterior sounds looked forward to ascertain its cause, they beheld a huge black monster upon the surface of the sea, struggling against the irresistible stream, and with his immense tail lashing the waters into foam, as he vainly strove to escape from destruction. They beheld him borne away by the might of his furious enemy; and they heard his last roar above the noise of the whirlpool, as he was sucked down into the never satisfied abyss, and disappeared from their eyes to be torn to atoms; for such is the fate of everything that seeks the depths of the Maelstrom.

“The ship glides along faster and faster; she begins to toss and roll uneasily in the angry rapids that boil around her; her race is nearly run. Terrible! terrible moment! The ship hurries on to her doom with mad impetuosity. She is in the rapids! she hurries along swift as a flash of fire. She is in the whirl of water! round, round, round she goes; her inmates catch hold of her bulwarks and of each other, to steady themselves. And now her bow sprit is under the waves, and a wild shriek of despair rises into the sky! The whirlpool, with greedy jaws, has sucked her under.”

The water of the whirlpool is said to be two hundred and fifty feet deep, and at ebb its noise is as loud as a cataract. In 1645, it was so violently agitated by a storm, that in Moskoe the houses were so shaken as to cause the stones to fall to the ground. Fragments of vessels wrecked in the Maelstrom are frequently seen on the coast, brought up by the return of the tide, their edges mashed and jagged as with a saw, which would induce the belief that the bottom is composed of sharp rocks.

Similar in its cause to the Maelstrom, though on a much inferior scale, is the current, or whirlpool, called _Hurlgate_ or _Hellgate_, between the East river and Long Island sound, near New York. In the narrow channel here, the tide flows backward and forward with great force; and there being large, irregular rocks in this channel, the water is thrown into the most violent agitation. In passing through the place, it is easy to see the waves seeming to boil as if in a pot. This place is dangerous to vessels, and many have been wrecked here; though the navigation is now so well understood, that fewer accidents happen than formerly. The steamboats generally pass in safety, but still the superb Oregon got upon the rocks here, within a few years, and came near being lost.

Between Sicily and the main land are the straits of Messina, where the current is rapid. Ancient mariners deemed this a terrible place; one side they called Scylla, and the other Charybdis. The poets depicted the sailor in this rapid, as beset by horrors; for if he escaped Scylla on one side, Charybdis was ready to dash him in pieces on the other. This idea has come down to our day, and has even passed into a proverb.

CATARACTS AND CASCADES

It has often been remarked that no one is insensible to the beauty of flowing water. When it glides quietly on in a stream, its character is that of gentleness, and it suggests only the ideas of calm and tranquil beauty. But when it expands to a greater width, and its floods are poured forth in an impetuous tide, then it assumes the aspect of grandeur, and wakens in the beholder the emotions of sublimity.

The beauty of running water has, indeed, long been celebrated, and the river has often suggested an image illustrative of human life. Even Pliny, who wrote some two thousand years ago, likens a river to the progress of man. “Its beginnings,” he says, “are insignificant, and its infancy is frivolous; it plays among the flowers of a meadow, it waters a garden, or turns a mill. Gathering strength in its growth, it becomes wild and impetuous. Impatient of the restraint it meets with in the hollows of the mountains, it is restless and fretful, quick in its turnings, and unsteady in its course. Now it is a roaring cataract, tearing up and overturning whatever opposes its progress, and it shoots headlong down a rock; then it becomes a gloomy, sullen pool, buried in the bottom of

a glen. Recovering breath by repose, it again dashes along, till, tired of uproar and mischief, it quits all that it has swept along, and leaves the opening of the valley strewed with the rejected waste. Now, quitting its retirement, it comes abroad into the world, journeying with more prudence and discretion through cultivated fields, yielding to circumstances, and winding round what would trouble it to overwhelm or remove. It passes through the populous cities, and all the busy haunts of man, tenders its services on every side, and becomes the support and ornament of the country. Increased by numerous alliances, and advanced in its course, it becomes grave and stately in its motions, loves peace and quiet, and in majestic silence rolls on its mighty waters, till it is laid to rest in the vast abyss."

FALLS OF NIAGARA.

Cataracts or falls are formed by the descent of rivers over rocks, from a higher to a lower level. That of Niagara, is situated on the river Niagara, between Canada and the United States, which takes its rise in the eastern extremity of Lake Erie, and, after flowing for thirty-five miles, empties itself into Lake Ontario. Its breadth is nine hundred feet, and its depth very considerable; but its current is so exceedingly strong and irregular, and its channel so frequently interspersed with rocks, that it is navigable for small boats only. Proceeding lower, the stream widens, and the rocks gradually recede from the view, and the current though strong, is smooth and regular. At Fort Chippewa, however, situated one league above the cataracts, the scene is again changed, and the river so agitated, that a boat would be inevitably dashed in pieces, were it permitted to pass Fort Niagara, situated on its bank. So impetuously do the waves break among the rocks, that the mere sight of them, from the adjacent shore, is sufficient to strike terror in the spectator. As it approaches the falls, the stream rushes along, with redoubled fury, until it reaches the edge of the stupendous precipice, when it tumbles suddenly to the bottom, without meeting with any obstruction in its descent. Precisely at this place, the river strikes off to the right, and the line of cataracts winds obliquely across, instead of extending, in the shortest direction, from the one bank to the other. It ought to be observed, that the water does not precipitate itself down the vast abyss in one entire sheet, but, being separated by islands, forms three distinct, collateral falls.

One of these is called the great or Horseshoe fall, from the similarity of its form to that of a horseshoe. It is situated on the north-west extremity of the river, and is most deserving of the attention of the spectator, as probably seven-eighths of the water passes over it, and as its grandeur is evidently superior to that of the adjacent cataracts, although its hight may be somewhat less. As the extent of this fall can be ascertained by the eye only, it is impossible precisely to describe its limits; but its circumference is generally computed at eighteen hundred feet, somewhat more than one-third of a mile. Beyond the intervening island, the width of which may be equal to one thousand and fifty feet, is the second fall, about fifteen feet wide; and at the distance of ninety feet, occupied by the second island, is the third fall, the dimensions of which may be reckoned equal to those of the large island; so that the entire extent of the precipice, including the intermediate islands, is four thousand and five feet; a computation which certainly does not exceed the truth. The quantity of water precipitated from the falls is prodigious, and it has been estimated, amounts to _six hundred and seventy thousand, two hundred and fifty tuns per minute_.

From the eminence entitled the Table rock, the spectator has a fine prospect of the terrific rapids above the falls, and of the surrounding shores, embellished with lofty woods. He there sees to advantage the adjacent Horseshoe fall, and the dread abyss, into which he may look perpendicularly from the edge of the rock, if his courage be equal to his curiosity. The immensity of the various objects which here present themselves to the view, infallibly overwhelms a stranger with astonishment, and several minutes must elapse before he can possibly collect himself sufficiently to form any just conception of the awful and magnificent scene before him, which requires that all its component parts should be separately examined, and which affords so truly surprising an exhibition, that persons who have resided in its vicinity for several years, and who have been constantly habituated to its sublimity, ingenuously acknowledge, _at their last visit_, that they were never able before to discover its peculiar grandeur.

From a cliff nearly opposite to one extremity of the third fall, the falls are seen in a very interesting point of view: the scenery there, it is true, is less magnificent, but is infinitely more beautiful than from any other station. For several miles beneath the precipice the river is bounded, on either side, by steep and lofty cliffs, composed of earth and rocks, which in most parts are perpendicular. The descent to the bottom of the falls was formerly accomplished by two ladders, formed of long pine trees, with notches on their sides, on which the traveler rested his feet, and passed down amidst a variety of huge misshapen rocks and pendant trees, seeming to threaten him with instantaneous destruction. The breadth of the river in this part is about two furlongs; and toward the right, on the opposite side, the third fall appears in a very advantageous point of view. About one-half of the Horse-shoe fall is concealed by the projecting cliff, but its partial prospect is extremely fine. The bottom of the former of these falls is skirted with a beautiful white foam, which ascends from the rock in thick volumes, but does not rise into the air like a cloud of smoke, as is the case with that of the

latter fall, although its spray is so considerable, as to descend like a shower of rain, near the second ladder, on the opposite side of the river. On its brink, and along the strand, to the great fall, are to be constantly seen shattered trees and bodies of animals, which have been carried away by the extreme violence of the current.

The color of the water of the cataracts, as it descends perpendicularly on the rocks, is occasionally a dark green, and sometimes a foaming, brilliant white, displaying a thousand elegant variations, according to the state of the atmosphere, the hight of the sun, or the force of the wind. A portion of the spray, resulting from the falls, frequently towers above the hight, and literally mingles with the clouds: while the remainder, broken in its descent by fragments of rocks, is in continual agitation. The noise, irregularity, and rapid descent of the stream, continue about eight miles further; and the river is not sufficiently calm to admit of navigation, till it reaches Queenstown, on the west side of the river, and nine miles from the falls.

A late tourist has given us a more recent and fresh view of this wonderful cataract, which will aid us more fully to understand its various aspects as taken from different points of observation. “From the bank just below the ‘Clifton House,’ he says, “is perhaps the finest panoramic view of the falls. The general outline bears a resemblance to the shape of a human ear; the great Horseshoe fall [which is represented on the right hand of the cut below] constituting the upper lobe, while Goat island and the American fall [as seen on the left] represent the remaining portion. The river, whose general course has been east and west, makes a sharp turn to the right just at the point where the fall now is. Its breadth is here contracted from three-fourths of a mile to less than one-fourth. The Horseshoe fall only occupies the head of the chasm, while the American cataract falls over its side; so that this fall and a part of the Horseshoe lie directly parallel with the Canada shore, and its whole extent can be taken in at a single glance. It is this oneness of aspect which renders the prospect from this side so much the more impressive for a first view of Niagara. It gives a strong, sharp outline which may afterward be filled up at leisure.

[Illustration: NIAGARA FALLS.]

“The most complete view of the Horseshoe fall is that from the bottom of the cliff, at a point near the ferry landing. If, however, the water is unusually high, the quiet pool which is ordinarily seen in the foreground, becomes a fierce and angry rush of waters, foaming above and around the jagged rocks. If the water is very low, the bed of this pool is entirely dry. Last year [1852] there were but few days when the whole spot was not overflowed. The current nearest the Canada shore runs up-stream, as though seeking an outlet in the direction from which it came. The middle distance is marked by a line of white foam, beyond which the current runs downstream. The center of the Horse-shoe fall is directly in front, defined on the right by the verge of Table Rock, and on the left by the upper extremity of Goat island. Just below the tower which seems to rise from the midst of the waters on the American side, an immense mass of rock is dimly visible, which became detached from the precipice in February, 1852.

“A very charming glimpse of that portion of the fall directly in front of the tower, may be caught through a clump of trees which stand a little above the ferry landing. The limitation of view hightens the effect, when contrasted with the unlimited prospect of the fall presented from almost every other point on the Canada side.

“It is no very difficult task for a stout pedestrian to make his way along under the edge of the precipice from the ferry up to the foot of the fall. The path winds among huge fragments of rock which have tumbled from above, and is slippery with the falling spray. You stop to rest upon a huge rock, where a couple of rough-coated men are fishing. They tell you that it is named ‘Bass rock,’ and you recognize the propriety of the appellation, as you observe the finny spoil that has repaid their labor. The water rushes foaming and eddying around the fragments of rock, sometimes rising in great swells to the spot on which you stand. Fragments of timber, their ends rounded and worn like pebbles on a wave-beaten shore, are scattered around: some groaning and tossing in the water, others stranded high and dry upon the rocks, where they have been flung by some swell higher than usual. You are so near the foot of the fall that the descending sheet of water occupies the entire field of vision: the immense rock which interposes between Bass rock and the descending water has as yet received no distinctive name.

“The path now begins to ascend the sloping bank, winding around huge bowlders, and among gay shrubs which the perpetual spray nourishes in luxuriant greenness, wherever there is a resting-place for a patch of soil. At last you reach the dilapidated staircase which descends the perpendicular face of the cliff, and clambering around its base upon a rotten and slimy plank, you find yourself below the overhanging mass of Table Rock. You are close at the edge of the falling water, which descends in a mass apparently as solid as though carved from marble. You now begin to comprehend the hight of the fall. It makes you dizzy to look up to the upper edge of the rushing column. You stand just midway between the top and the bottom. Above you hangs the imminent mass of Table Rock; below, far down by the wet and jagged rocks, is the seething whirlpool, where the water writhes and eddies as

though frenzied with its fearful leap. Round and round it goes in solemn gyrations, bearing with it whatever floating object may have been plunged into its vortex.

“A year ago this very month of August, a young woman walked in the cool gray morning down to the brink of the cliff and flung herself into the whirlpool below. So resolute was the leap, that she shot clear of the jagged rocks at the base, and plunged sheer into the water beyond. When the visitors came sauntering down to the fall, her body was seen whirling round and round in the mad eddies, now submerged for an instant, and then leaping up, as though imploring aid. A day or two afterward, I was one of a group to whom a rough-looking man was describing the scene. He told how he and two others had descended amid the blinding spray close to the foot of the fall. A rope was then fastened to his body, which was held fast from above by the others, while he groped his misty way down to the very edge of the waters, where he waited till they whirled the corpse close inshore. He then darted a spear with a spring-barb into the body, but the force of the current tore out the hold, and it drifted away. Again it came within reach, and again the hold of the spear was too weak to overcome the force of the current. A third time the body approached, and the spear was darted. This time it caught among the strong muscles of the thigh, and held, so that the body was drawn to shore. The narrator was a rough man, roughly clad, and told his story roughly; but there was in his voice a low thrill of horror as he told how he was obliged to cut the spear-head out of the flesh with his knife, before the weapon could be extracted: ‘It was too bad,’ said he; ‘but it couldn’t be helped.’ And it was with unconscious pathos that he told how they stripped off their own rough garments, and tenderly covered the poor maimed and mutilated body before they bore it up the bank. It was a commentary, wrought out into practice, upon Hood’s immortal ‘Bridge of Sighs.’

“With the exception of the fall itself, the Canada side presents little of interest. The brink of the gorge is bare and naked, the trees which once clothed it having been cut away. The regular drive seems to be up to the Burning Spring, and thence back by way of Drummondville and Lundy’s Lane. At the Burning Spring you register your name, pay your fee, and are introduced into a small apartment, in the floor of which is a spring in constant ebullition from the escape of an inflammable gas. The flaxen-pated children of the show-woman place a receiver over the spring, and set fire to the gas, as it comes out of the jet; they then remove the receiver, and light the gas as it rises to the surface of the water; and that is all. You take your departure, looking vastly edified; while the driver thrusts his tongue into his cheek, as though he were mentally quoting a certain proverb touching ‘a fool and his money.’

[Illustration: Niagara Falls on the American side]

“In the early morning you commit yourself to the little boat in which you are to be ferried over to the American shore. Your half-felt misgivings are dissipated as you see the dexterous manner with which the brawny boatman handles his oars, and takes advantage of the ‘up-eddy’ and ‘down-eddy;’ and in a few minutes you are landed close at the foot of the American fall. Half-way up the ferry-stairs is an opening which gives access to a path along the foot of the perpendicular precipice to the verge of the falling water. From this point in the early morning, may be gained one of the most picturesque views of Niagara. Your position gives a fine view of the fall on the American side, as seen in the cut; the hight of which forms a standard by which you measure that of the Horseshoe fall, which stretches away in the distant perspective. Completing the ascent of the ferry-stairway, you reach Prospect point, at its head, from whence the same general view is gained, from a more elevated point. It is hard to say whether the view from above or below is the finer. The latter brings more into notice the hight of the falling column of water, thus gaining an additional element of grandeur, while the latter embraces a view of the wooded islands above the fall, adding greatly to the picturesque effect. The precise point from which the artist has taken this sketch is not now attainable. It was a projecting shelf of rock, a few feet below the precipice, which has been cut away to make room for the terribly unpicturesque, but most convenient stairway.

“This was apparently the point from which honest Father Hennepin, who has left us the earliest written account of Niagara, gazed upon that ‘prodigious Cadence of Waters, which falls down after a surprising and astonishing Manner, insomuch that the Universe can not afford its parallel.’ ‘The Waters,’ goes on the quaint narrative, ‘which fall from this horrible Precipice, do foam and boyle after the most hideous Manner imaginable, making an outrageous Noise more terrible than that of Thunder.’ The good Jesuit would seem to have been deeply moved by this ‘dismal Roaring;’ for in the curious picture which he gives of the falls, he represents the spectators holding their hands to their ears to shut out the din; and he hints that the Indians were forced to abandon the neighborhood of the falls, lest they should become deafened by the uproar. But the good father must have heard the ‘horrid Noise of the Falls,’ as he elsewhere calls it, with the imagination rather than with the ear. You hardly notice it as you loiter along the brink, except when some sudden atmospheric change varies its deep and solemn monotone. The sound is like the continuous and pervading murmur of the wind through a forest of somber pines. You are not forced to raise your voice in conversing with a friend by whose side you loiter along the brink of the fall, toward the bridge which gives you access to the wooded islands that beckon you on.

“Nothing can exceed the picturesque beauty of the small wooded islands which stud the rapids upon the American side. Two of rare beauty, known as Ship and Brig islands, stem the current a little above the bridge which connects Goat island with the shore. It needs but little effort of the imagination to fancy them vessels under full press of sail, endeavoring to sheer out of the current that hurries them inevitably down. The former of these islands is accessible by a bridge which connects it with Bath island, and is one of the loveliest spots imaginable. The old cedars, whose gnarled and contorted trunks overhang the waters, dipping their branches into the current, seem to cling with desperate clutch to the rocks, as though fearful of losing their hold and being swept away.

“From the bridge leading to Goat island, the rapids present that same appearance of plunging from the sky which renders their view from the Canadian shore so impressive. Goat island—so let it still be called, in spite of the foppery which has lately attempted to change its name to Iris island—presents an aspect almost as wild as it did before it had been rendered accessible to human foot. Were it not for the path which girdles its entire circumference, and the rustic seats disposed here and there, one might fancy that he was the first who had ever sauntered through its grand and stately woods. The beauty and variety of the trees on this island are wonderful. There is the maple, greeting the early spring sunshine with its fire-tipped buds; spreading out in summer its broad dome of dark green leaves in masses so thick, that beneath them you have no fear of the passing shower; and in autumn wearing its gorgeous crimson robe like an oriental monarch. The beech shows its dappled trunk and bright green foliage at every point, giving perpetual life and vivacity to the scene. The silvery trunks of the white birch gleam among the underwood. An occasional aspen, with its ever-quivering leaves, which almost shed a sense of breezy coolness in the stillest, sultriest day, contrasts finely with the dark evergreens by which it is relieved. Almost all of our northern fauna have their representatives here. Even upon the little Ship island, which can be crossed in any direction in a dozen strides, and which appears to a hasty view but a mass of twisted and gnarled cedars, there are at least seven distinct species of trees. Those trees, however, which immediately overhang the falls, have an aspect peculiar to themselves. They are bent, broken, twisted and contorted, in every direction. They seem to be starting back in horror from the abyss before them, and to wind their long finger-like roots around the rocks, in order to maintain their hold.

“One of these, an aged birch, growing upon the ridge known as the ‘Hog’s Back,’ affords a resting-place from which to gain one of the finest views of the American falls. Right in front is the small central fall, and the footbridge which leads to Luna island, with its trees dwarfed and stunted by the weight of frozen spray which loads them in the winter. Beyond is the serrated line of the American fall; while the distance is filled up with the receding lines of the banks of the river below.

“A few paces—past groups of blithe tourists, past companies of somber Indian girls in blue blankets and high-crowned hats, with their gay wares spread out at their feet—brings you to the Biddle staircase, down which you wind to the foot of the precipice. The path to the left leads along the foot of the overhanging cliff, up to the verge of the Horseshoe fall, only a portion of whose circumference is visible from any point on the American shore. You are here close upon the fragments of rock that fell from just in front of the tower, in February, 1852, the latest of those changes which are slowly and almost imperceptibly altering the form and position of the falls. This fall of rock was seen by an artist who has given us a faithful picture of its effects. He was just recovering from an illness, and while sitting in his room at the Clifton House, on the opposite Canadian shore, he was startled by a crash, almost like that of an earthquake. Tottering to the window, he beheld the immense curtain of rock in front of the tower precipitated from its ancient hold, and lying in huge masses upon the ice below; while a few streams of water trickled down the brown cliff, where but a moment before nothing had been seen but a surface of dazzling ice. The water at this extremity of the fall descends in light feathery forms, contrasting finely with the solid masses in which it seems to plunge down the center of the sweeping curve. The tower is perched upon the very brink of the precipice, so close that the next fall of rock must carry it along with it. The path to the right from the foot of the staircase, leads to the entrance to the Cave of the Winds, which lies behind the central fall. It is hard to imagine how this cavern missed being called the ‘Cave of Æolus,’ by those classicists who have exhausted ancient mythology for appellations for our American scenery. But it has escaped this infliction; and the ‘Cave of the Winds,’ it is, and will be. From the little house close by the entrance, where the requisite changes of dress are made, you look down into an abyss of cold gray mist, driven ever and anon like showers of hail into your face, as you grope your way down the rocky slope. Haste not, pause not. Here is the platform, half-seen, half-felt amid the blinding spray. Shade of Father Hennepin, this is truly a ‘dismal roaring’ of wind and water. We are across, and stand secure on the smooth, shaly bottom of the cave. Look up: what a magnificent arch is formed by the solid rock on the one side, and the descending mass of water on the other. Which is the solider and firmer you hardly know. Yet look again—for it is sunset—and see what we shall see nowhere else on earth, three rainbows one within another; not half-formed and incomplete, as is the scheme of our daily life, but filling up the complete circle, perfect and absolute.

“Upon an isolated rock at the very brink of the cataract stands a round tower. It is approached by a long, narrow bridge, resting now upon ledges of solid rock, and now upon loose bowlders. From the balcony upon its summit, you can lean far over the edge of the

precipice, and there catch the freshness of the cloud of spray that rises evermore from the unseen foot of the great fall. Or you can climb down the low rock upon which the tower stands, and gather shells and pebbles from within arm's length of the verge of the descent, so gentle, to all appearance, is the current. But be not over-bold. These waters, apparently so gentle, sweep down with a force beyond your power to stem. Not many months ago, a man fell from the bridge into their smooth flow, and was in the twinkling of an eye swept to the brink of the descent. Here he lodged against one of those rocks that lie apparently tottering upon the brow, looking over the fearful descent, with as little power to retrace his course, as he would have had to reascend the perpendicular fall. A rope was floated down to him, which he had just strength to fasten around his body, and he was drawn up from his perilous position.

"It is usual to speak of the Horseshoe fall as Canadian; and our rather slow neighbors across the river have been wont to plume themselves upon the possession of the more magnificent part of Niagara; while Young America has been heard to mutter between his teeth something about 'annexation,' on the ground that the lesser nation has no fair claim to the possession of the major part of the crowning wonder of the continent. But the portion of Niagara belonging to Canada is hardly worth contending for. The boundary line between the two countries is the deepest water, which runs far over toward the Canadian shore. The line passes through the lonely little isle in the center of the river, which has never been trodden by human foot. Right through the very center of the Horseshoe fall, where the water is greenest, cutting the thickest pillar of spray, through the inmost convolution of the whirlpool, through the calmest part of the quiet reach of water above the suspension bridge, through the maddest work of the rapids below, goes the boundary line, leaving to Canada nothing of Niagara except Table Rock, which yearly threatens to fall, and the half of the great fall: while to America it gives, together with full one-half of the Horseshoe fall, the varying beauties of the lesser cataracts, and the whole wealth of the lovely islands which gem the rapids.

"The general form of the falls is slowly changing from age to age. When Father Hennepin saw them, a century and three-quarters ago, they presented little of that curved and indented outline which now forms their most striking peculiarity. The fall on the western side extended in nearly a straight line from the head of Goat island to Table Rock, which terminated in a bluff that turned a portion of the water from its direct course, forming another cataract which fell to the east. A century later, this projecting rock had disappeared, but the spot which it had occupied was distinctly traceable. From the character of the strata through which the water has slowly worn its way back from the shores of Lake Ontario, we learn what must have been the appearances of the fall at any period of its history. Thus it can never have overcome the descent of three hundred and fifty feet at Lewiston at a single leap, but must have formed at least three cataracts separated by intervening rapids. When the falls occupied the position of the whirlpool, three miles below their present site, the descent was evidently greater than at any period before or since. But there never can have been a period when their beauty equaled that which they present at the present age. The immense breadth of the sheet of falling water, its graceful sweep of curves, and the picturesque islands that stud the brink, belong solely to our present Niagara. The falls recede at present, we are told, at the rate of something less than a foot in a year. Geology is able to predict that when a recession of a mile has taken place, some five or six thousand years hence, the hight of the fall will be reduced by a score of feet. Another five thousand years will subtract two score more of feet. Ten thousand years more, when the fall shall have worn its way four miles further back, all that constitutes Niagara will have disappeared, and the whole descent will be accomplished by a series of rapids like those near the whirlpool.

"It is strange how little of direct human interest is connected with Niagara. One would have supposed that it would have been a sacred spot with the Indians; but, with the exception of a few graves on the upper extremity of Goat island, no special memorial of the aborigines exists here. The falls have been known to the white race for too short a time to gather around them legendary associations. One or two points are associated with the memory of a young Englishman who, something like a score of years ago, set up as the 'Hermit of the Falls.' A picturesque little break in the rapids between Goat island and one of the rocky islets known as the Three Sisters, has been named from him the 'Hermit's cascade.' It is a lovely spot, by the side of which one may lie under the overarching trees, and while away the noontide hour, lulled into dreamy slumber by the deep voice of the cataract. This hermit seems hardly worthy of being made the hero of the falls. Little is told of him except that he was fond of music and of pacing by night along the margin of the river; that he was alike indisposed for human society and for clean linen. It is said, indeed, that he was accustomed to record his musings in Latin, but as no fragments of these were discovered after his death, we may set the story down as apocryphal. A deeper tragic interest is attached to a tale, now some three years old, which will be told you as you stand by the margin of the lesser fall. A party of visitors stood here, in gay discourse. Among them were a young man and his affianced bride, and with them a laughing child. The young man, catching up the child, said sportively to her, 'Now I shall throw you over;' when she, gliding from his hold in affright, half real and half feigned, slipped, and falling, plunged headlong into the stream; he sprang after, but the current was stronger than his strength, and swept them both down the smooth slope, and over the fall. Their

bodies, mangled and bruised, were recovered from the rocks below.

“The pedestrian can hardly find a pleasanter summer day’s ramble, than that along the river to Lewiston, descending on the American side, and returning by the opposite bank. For a mile below the falls, where the channel is narrowest, the current is so smooth, that one might fancy he was gazing down into some quiet tarn embosomed in the mountains, were it not that you catch the white margin of the lower rapids just where the suspension bridge stretches its slender line from the summits of the opposing cliffs.”

This bridge, a view of which is given in the cut below, is about two and a half miles below the falls, and spans the river near the head of the rapids, above the whirlpool. From pier to pier it is eight hundred feet long, and in breadth eight feet. It is suspended on eight wire cables, four on each side, which pass over towers fifty-four feet high, built of heavy timber. The present structure is only the scaffolding for constructing a larger bridge, intended for the passage of railroad cars. The towers for the large bridge will be of solid masonry, each eighty feet high. Each of the cables is eleven hundred feet long, and composed of seventy-two strong, No. 10 iron wires, closely wrapped round with small wire three times boiled in linseed oil, which anneals it, and prevents injury from rust or exposure to the weather. The cables, after passing over the piers on the banks, are fast anchored in solid masonry fifty feet back of them. The _suspenders_, which form the sides, are composed of eight wires each, and are four and a half feet apart. The bridge itself is two hundred feet above the water, and is a wonder alike of enterprise and art.

[Illustration: Suspension Bridge over Niagara River]

Our tourist proceeds as follows. “In the quiet reach of the water below this bridge, plies the little steamer, the Maid of the Mist. After passing the ugly, bustling little village growing up around the American extremity of the bridge, a path leads through quiet fields and woods along the very verge of the precipice. Here and there some tree growing upon the brink forms a safe balustrade over which you lean, and look down upon the green water dashing furiously through its confined channel far below.

“The whirlpool, three miles below the falls, is an adjunct worthy of Niagara. The stream makes a sharp bend just where the channel is narrowest and the descent of the rapids the steepest. At the angle the current has scooped out an immense basin, around whose whole circumference the water circles before it can find an outlet. All floating bodies that pass down the river are drawn into the whirlpool, where they are borne round and round for days, and weeks sometimes, it is said, before they make their escape. A practicable path winds down the bank to the water’s edge. The character of the banks gradually changes as we descend toward the outlet of the river. The hard limestone overlying the softer rock, and forming the perpendicular portion of the cliff, becomes thinner; the sloping talus at the foot grows higher, and the rocks are clothed with a luxurious forest growth. A half mile below the whirlpool is a deep cleft in the precipitous bank, which is connected with a wild Indian legend ascribing terrible convulsions of nature, and even the approach of the fatal white men, to an unauthorized violation of the privacy of a great demon who once abode here. This was the scene of a terrible tragedy in the old French wars. A convoy of British soldiers fell into an ambush of Indians at this point, and were all, with the exception of two, slain outright or driven over the edge of the chasm. The little rivulet which flows over the brink, ran red with the blood of the slaughtered, and thus gained the name, which it still bears, of the Bloody Run.

“Close by the Devil’s Hole, the railroad now in course of construction from Lewiston to the falls, gains the level of the top of the bank. From this point downward, it is excavated in the face of the cliff, forming a steep grade to its bottom. An almost continuous line of shanties, occupied by the laborers engaged in the excavation, extends along the very verge of the precipice. It was curious, as I passed along in the early April days, to see children whom we should scarcely trust out of the nurse’s arms, sprawling upon the very verge of the cliff. The laborers are apparently all Irish, and it is noteworthy to see how much more intelligent is the aspect of the younger than of the older children. I thought I could distinguish by their mere physical appearance, those who were born under the freer and happier auspices which surround them here. At the foot of the cliff the suspension bridge stretches like a slender thread across the stream, its supporting towers resting on a ledge above the level of the roadway. No line of guards watches the quiet frontiers of two great nations. The sole police is a small boy at the gate, and the only passport demanded is a shilling for toll. You climb the smooth slope to the summit, where the shattered monument to the noble Brock is the only memorial of the day when the thrice-won victory was at last wrenched from the hands of the Americans. A flock of sheep are cropping the tender herbage; a couple of lambs have found a shady resting-place in the crumbling archway of the monument. To the right the white village of Lewiston presents an aspect of bustling activity; while to the left, on the opposite Canadian shore, Queenstown rests gray and somber. At your feet, just below the dilapidated memorial of war, the bridge, symbol of union, binds the two shores: may it never be a pathway for the march of hostile armies!

“There are two or three things in the way of excursion which must sooner or later be performed. Some bright afternoon, when the west is all aglow, as you sit upon Table Rock, watching the clouds of spray momently torn from the face of the descending column, the guide with the hollow voice, whose mission is to conduct visitors behind the great sheet, presents himself. You commit yourself to his guidance, and donning the suit of yellow oil-skin, follow him down the spiral staircase, along the base of the precipice up to the verge of the cataract. You shudder, and hesitate to enter the blinding spray along that winding path, which seems in the dimness like a slender line drawn upon the face of the rock. The guide whispers a word of encouragement, deftly insinuating how boldly ‘the lady’ trod its slippery length. You take courage and advance. You can scarcely breathe, much less see; but you feel that the torrent is plunging from the immeasurable hight above into the unfathomable depth below. Somehow, how you hardly know, you have passed through the thick curtain of blinding spray, and are peering eagerly into the gray depth beyond. You are on Termination rock, and further than this mortal foot may never penetrate within the vail. Whichever way you turn, it is all cold gray mist, shrouding the overhanging rock and the overarching water above, and the profound depths below; all mist, cold gray mist above, below, around, except when you turn your eyes back along the path by which you entered, where you behold a strip of golden sky between the grim rock and the edge of the descending flood. Drenched and dripping, spent and exhausted, as a shipwrecked sailor flung by the surf upon some inhospitable shore, you follow your guide back along the misty path, and emerge gladly enough into the clear outer air, into the free sunshine, and beneath the bright sky. As you doff the heavy oil-skin integuments, a printed paper is put into your hand, certifying that you ‘have been under the great sheet of water, the distance of two hundred and forty feet from the commencement of the falls to the termination of Table Rock,’ verified by the signature of the proprietor of ‘Table Rock House.’ Your guide looks on you complacently, as though he would assure you that the great end of life was now attained, and you might take up your ‘=Nunc dimittis=.’

“Or you take your place upon the deck of the Maid of the Mist, hard by the suspension bridge, and are steamed up to the foot of the cataract. The little steamer answers but poorly to her romantic name. She swings wearily from her moorings, and goes panting and tugging up the current. Yet she manages to hold her course, unless the wind blows too strong down-stream, and slowly wins her way close up to the huge rocks on which the waters of the American fall are broken and shattered into the thickest of spray. In that spray a sharp and angry gust of wind tears a sudden rent, and through it you catch a glimpse of the green crest of the Horseshoe fall, sinking grandly into the ocean of vapor below. Or better still, if in some calm moonlight night, you glide, with the boatman, along the foot of the American fall, keeping just outside of the dark line of shadow, you will find there is nothing on earth so weird and ghost-like as the spectacle before you. The column of spray rises from the blackness below, like the specter of some gigantic tree, and spreads solemnly up into the clear air above.

“The mere summer tourist, however, sees but half the glory of Niagara. In the winter the great rocks at the foot of the fall are piled up with an accumulation of frozen spray to the depth of half a hundred feet. By creeping cautiously up the slippery ascent, you may stand face to face with the cataract, half-way up its giddy hight. Every shrub on its margin is loaded with glittering ice. The thick-branched evergreens are bowed beneath its weight, and bend to the ground like enormous plumes. The face of the cold gray rock is cased in the frozen element, and ribbed with pillars and pilasters which flash back the reflection of all the gems in the rays of the sun; and when in a clear, unclouded day, that sun shines down in its splendor, the scene is one of matchless magnificence and glory.”

Thus we have attempted a full description of Niagara; and yet words seem but feeble to set forth the magnificence and grandeur of the scene as it rises to the view of the actual beholder. There, in its vast volume and resistless power, it ever flows on with ceaseless, patient, unwearied tide. At midnight and noonday, through summer and winter, and seed-time and harvest, it is still the same. The drought of summer does not sensibly diminish, or the freshets of spring augment its mighty current. The scorching sun does not dry it up, and the chains of winter do not bind it. Emblem of God and of eternity, it rolls on, speaking in calm sublimity of Him who made it. Nor is sublimity the only characteristic of this greatest of waterfalls. There are traits of beauty, which seem even to highten the effect of its grandeur. The rainbow, ever playing in sunshine over its awful front, and seeming indifferent to the boiling whirlpool beneath; the tide of many-colored gems, into which the spray often seems converted, as it plunges over the rocks; the heaps of foam, white as wool, dancing on the billows that rush away from the foot of the fall; and more than all, an aspect of tranquillity and of repose, which settles upon the whole scene, when viewed at a little distance, are all incidents which blend in the majestic picture imprinted on the memory by this stupendous yet lovely work of nature’s God.

The falls of Niagara have been the frequent theme of poetry, but the following lines by Brainard are deemed the finest that have been produced upon the subject.

“The thoughts are strange that crowd into my brain, While I look upward to thee. It would seem As if God poured thee from his ‘hollow hand,’ And hung his bow upon thine awful front; And spoke in that loud voice, which seemed to him Who dwelt in Patmos for his Saviour’s sake, ‘The sound of many waters;’ and had bade Thy flood to chronicle the ages back, And notch His centuries in the eternal rocks!

“Deep calleth unto deep, and what are we, That hear the question of that voice sublime? Oh! what are all the notes that ever rung From war’s vain trumpet, by thy thundering side! Yea, what is all the riot man can make In his short life, to thine unceasing roar! And yet, bold babbler, what art thou to Him, Who drown’d a world, and heaped the waters far Above its loftiest mountains?—a light wave, That breaks and whispers of its Maker’s might!”

FALLS OF THE MONTMORENCI.

The Montmorenci empties itself at the distance of about eight miles northeast of Quebec, into the great river St. Lawrence, to the coast of which it gradually descends from the elevated mountain on which it has its source. At a station called La Motte, situated on the northern extremity of a sloping ground, its waters diffuse themselves into shallow currents, interrupted by rocks which break them into foam, and accompanied by murmuring sounds which enliven the solitude and solemn stillness prevailing throughout the surrounding forests and desolate hills. Further down, its channel is bounded by precipitous rocks, its breadth becoming extremely contracted, and the rapidity of its current proportionably augmented. At a place called “the natural steps,” there are several beautiful cascades of ten or twelve feet. These steps, which are extremely regular, have been gradually formed by the accession of waters the river receives in its progress, at the breaking up of winter, by the melting of the snows. From the middle of April to the end of May, its waters roll with increasing hight and rapidity. Being powerfully impelled in their course, they insinuate themselves between the strata of the horizontal rock, vast fragments of which are detached by the rushing violence of the sweeping torrent.

[Illustration: FALLS OF MONTMORENCI.]

On the eastern side, the bank, which is almost perpendicular, and fifty feet high, is surmounted by lofty trees. The south-west bank rises beyond the steps, and terminates in a precipice. On the opposite side, the bank is regular, and of a singular shape, resembling the ruin of an elevated wall. The trees by which the banks are inclosed, united with the effect produced by the foaming currents, and the scattered masses of stone, form a scene wild and picturesque. The stream now taking a southern direction, is augmented in its velocity, and forms a grand cascade interrupted by huge rocks. A quarter of a mile further down a similar effect is produced. After exhibiting an agreeable variety through its course, the river is precipitated, in an almost perpendicular direction, over a rock two hundred and fifty feet in hight. A view of this latter cascade is given in the cut. Wherever it touches the rock, it falls in white clouds of rolling foam; and, beneath, where it is propelled with uninterrupted gravitation, it forms numerous flakes, like wool or cotton, which are gradually protracted in the descent, until they are received into the boiling profound abyss beneath.

The effect from the summit of the cliff is awfully grand, and truly sublime. The prodigious depth of the descent of the waters of this surprising fall; the brightness and volubility of their course; the swiftness of their movement through the air; and the loud and hollow noise emitted from the basin, swelling with incessant agitation from the weight of the dashing waters, forcibly combine to attract the attention, and to impress the mind of the spectator with sentiments of grandeur and elevation. The clouds of rising vapor, which assume the prismatic colors, contribute to enliven the scene. They fly off from the fall in the form of a revolving sphere, emitting with velocity pointed flakes of spray, which spread in receding, until they are interrupted by the neighboring banks, or dissolved in the atmosphere.

The breadth of the fall is one hundred feet; and the basin, which is bounded by steep cliffs, forms an angle of forty-five degrees. When viewed from the beach, the cataract is seen, with resplendent beauty, to flow down the gloomy precipice, the summit of which is crowded with woods. The diffusion of the stream, to the breadth of fifteen hundred feet, and the various small cascades produced by the inequalities of its rocky bed, on its way to the river St. Lawrence, display a very singular and pleasing combination.

THE TUCCOA FALL.

This fall, in Franklin county, Georgia, is as yet scarcely known to the best informed of our geographers, and is notwithstanding one of the most beautiful that can be conceived. It is much higher than the great fall of Niagara; and the water is charmingly propelled over a perpendicular rock. When the stream is full, it passes down the steep in one expansive sheet, magnificent to behold.

FALLS OF THE MISSOURI.

The most prominent features of this great river, which is fed by so many streams, having their sources in a great variety of soils and climates, are its wonderful falls, rapids and cascades, the following connected view of which is abstracted from the very accurate draught and survey made by Captain Clarke.

This river is nine hundred feet wide at the point where it receives the waters of Medicine river, which is four hundred and one feet in width. The united current continues five thousand, four hundred and twelve feet, somewhat more than a mile, to a small rapid on the north side, from which it gradually widens to four thousand, two hundred feet, and at the distance of nine thousand and forty-two feet, (nearly a mile and three-fourths,) reaches the head of the rapids, narrowing as it approaches them. Here the hills on the north, which had withdrawn from the bank, closely border the river, which, for the space of a mile, makes its way over the rocks with a descent of thirty feet: in this course the current is contracted to sixteen hundred and forty feet, and, after throwing itself over a small pitch of five feet, forms a beautiful cascade of twenty-six feet, five inches; this does not, however, fall quite perpendicularly, being stopped by a part of the rock, which projects at about one-third of the distance. After descending this fall, and passing the Cotton-wood island, on which the eagle has fixed its nest, the river goes on for eight thousand, seven hundred and seventy-eight feet, (more than a mile and a half,) over rapids and little falls, the estimated descent of which is thirteen feet six inches, till it is joined by a large fountain boiling up underneath the rocks near the edge of the river, and falling into it with a cascade of eight feet. It is of the most perfect clearness, and rather of a bluish cast; and even after falling into the Missouri it preserves its color for half a mile. From this fountain the river descends with increased rapidity for the distance of thirty-five hundred and thirty-one feet, during which the estimated descent is five feet: from this, for a distance of twenty-two hundred and twenty-seven feet, the river descends fourteen feet seven inches, including a perpendicular fall of six feet seven inches. The river has now become pressed into a space of fourteen hundred and nineteen feet, and here forms a grand cataract, by falling over a plain rock, the whole distance across the river, to the depth of forty-seven feet, eight inches: after recovering itself, the Missouri then proceeds with an estimated descent of three feet, till at the distance of sixteen hundred and eighty-three feet it again is precipitated down the crooked falls, nineteen feet perpendicularly; below this at the mouth of a deep ravine, is a fall of five feet, after which, for the distance of sixteen thousand and five feet, (upward of three miles,) the descent is much more gradual, not being more than ten feet, and then succeeds a handsome level plain for the space of twenty-nine hundred and thirty-seven feet, (more than half a mile,) with a computed descent of three feet, making a bend toward the north. Thence it descends, during seventy-nine hundred and twenty feet, about eighteen feet and a half, when it makes a perpendicular fall of two feet, which is fourteen hundred and eighty-five feet beyond the great cataract, in approaching which it descends thirteen feet, within a distance of about six hundred feet, and gathering strength from its confined channel, which is only eight hundred and forty feet wide, rushes over the fall to the depth of eighty-seven feet and three-quarters of an inch. After raging among the rocks, and losing itself in foam, it is compressed immediately into a bed of two hundred and seventy-nine feet in width; it continues for fifty-six hundred and ten feet to the entrance of a run or deep ravine, where there is a fall of three feet, which, joined to the decline of the river during that course, makes the descent six feet. As it goes on, the descent within the next thirty-nine hundred and sixty feet is only four feet; from this, passing a run or deep ravine, the descent for sixteen hundred feet is thirteen feet: within thirty-nine hundred and sixty feet, is a second descent of eighteen feet; thence twenty-six hundred and forty feet further, is a descent of six feet; after which, to the mouth of Portage creek, a distance of forty-six hundred and twenty feet, the descent is ten feet. From this survey and estimate it results that the river experiences a descent of three hundred and fifty-two feet in the course of fifteen or sixteen miles, from the commencement of the rapids, to the mouth of Portage creek, exclusive of almost impassable rapids which extend for a mile below its entrance.

CATSKILL FALLS.

The Catskill, or Kauterskill falls, represented in the cut below, are in the south-west part of the town of Catskill, about fourteen miles from the village, and two miles west from Pine Orchard, a celebrated summer resort on the brow of the Catskill mountain. Two ponds, uniting their outlets, pour the stream thus formed, by falls and rapids in a deep ravine, to the plain below. The first fall is a hundred and eighty feet perpendicular; and the second, which is within a short distance, about eighty feet. Behind the first fall is an immense natural amphitheater, into which the visitor can go, and look through the water as it falls from above. The view from the ‘Mountain house,’ near by, is extensive and varied. The landscape, in a clear atmosphere, is visible for sixty miles.

[Illustration]

TRENTON FALLS.

Among the most beautiful and romantic cascades of the United States, may justly be reckoned Trenton falls, situated about eighteen miles north-east of Utica, in the state of New York, on West Canada creek. Here, within a course of two miles, there are

six falls, with an aggregate descent of three hundred and twelve feet. The scenery is the most wild and picturesque imaginable; the stream flowing through a narrow ravine, between perpendicular walls of limestone, which in some places are one hundred and fifty feet high. The pathway of the spectator is mostly along the very margin of the chasm which forms the channel of the rushing waters, on a ledge, or shelf, so narrow and perilous, that the head often is giddy from the sight; and sometimes it is difficult to sustain one's self. These cascades are more remarkable for the wildness and variety of scenery, than for the volume of water they present. The hight of the principal fall is estimated at one hundred feet.

WATERFALL OF SOUTH AFRICA.

The great chain of mountains which runs from north to south through the colony of the Cape of Good Hope, divides into two branches, one of which stretches south-east, and the other due south. At the extremity of the latter branch is "the waterfall mountain," in one of the clefts of which a large stream of water falls from the high rock above, and presents, in the winter season, when swollen by the rains, a glorious spectacle. To view this fall to advantage, the traveler has to climb to a considerable hight over the steep and broken rocks which form one side of the mountain, and, on reaching the top, sees it on the other side. Its hight is estimated at between eighty and ninety feet, and its breadth at between thirty and forty. Adequate terms can not be found to describe the sublimity of this scene, after abundant rains, when it is in its full beauty. In the vale beneath, the water is collected in a vast and deep basin, excavated in the stone; and by the side of the stream is a grotto, which runs within the rock to the depth of between thirty and forty feet. The arched entrance to this grotto is close to the falling water, when the stream is full. The rocks about it are thickly grown over with shrubs, which are then sprinkled by the spray. The European travelers who proceed from Cape Town to the interior of South Africa, seldom fail to make a pilgrimage to this enchanting spot.

CATARACTS OF THE NILE.

This celebrated river, through its long and fertile range of about two thousand British miles, in winding through abrupt and precipitous countries, exhibits very considerable cataracts, ten or twelve of which, having a descent of more than twenty feet, occur, before it reaches the level of Egypt. The one which, by way of eminence, is called the cataract of the Nile, was visited by Mr. Bruce, from whose relation the following particulars are extracted.

At the distance of half a mile beneath the cataract, the river is confined between two rocks, over which a strong bridge of a single arch has been thrown, and runs into a deep trough, with great roaring, and an impetuous velocity. On ascending, the cataract presents itself amid groves of beautiful trees, and exhibits a most magnificent and stupendous sight, such as, Mr. Bruce observes, ages, added to the greatest length of human life, could not efface or eradicate from his memory. It struck him with a kind of stupor, and total oblivion of where he was, as well as of every sublunary concern. At the time of his visit, the river had been considerably increased by rains, and fell in one sheet of water, above half an English mile in breadth, and to the depth of at least forty feet, with a force and noise which were truly terrific, and which, for a time, stunned him, and made him giddy. A thick fume, or haze, covered the fall in every part, and hung over the course of the stream both above and below, marking its track, although the waters were not seen. The river, although much swollen, preserved its natural clearness, and fell, partly into a deep pool, or basin, in the solid rock, and partly in twenty different eddies to the very foot of the precipice. In falling, a portion of the stream appeared to run back with great fury on the rock, as well as forward in the line of its course, raising waves, or violent ebullitions, which chafed against each other.

CATARACT OF THE MENDER.

The cataract which constitutes the source of this river, the Scamander of the ancients, is thus beautifully described by Doctor Clarke. "Our ascent, as we drew near to the source of the river, became steep and rocky. Lofty summits towered above us, in the greatest style of alpine grandeur; the torrent, in its rugged bed below, all the while foaming on our left. Presently we entered one of the sublimest natural amphitheaters the eye ever beheld; and here the guides desired us to alight. The noise of waters silenced every other sound. Huge craggy rocks rose perpendicularly, to an immense hight; whose sides and fissures, to the very clouds, concealing their tops, were covered with pines. These grew in every possible direction, among a variety of evergreen shrubs; and enormous plane-trees waved their vast branches above the torrent. As we approached its deep gulf, we beheld several cascades, all of foam, pouring impetuously from chasms in the naked face of a perpendicular rock. It is said the same magnificent cataract continues all seasons of the year, wholly unaffected by the casualties of rain or melting snow. Having reached the chasms whence the torrent issues, we found, in their front, a beautiful natural basin, six or eight feet in depth, serving as a reservoir for the water during the first moments of its emission. It was so clear that the minutest object might be discerned at the bottom. The copious

overflowing of this reservoir causes the appearance, to a spectator below, of different cascades, falling to the depth of about forty feet, but there is only one source. Behind are the chasms whence the water issues. We entered one of these, and passed into a cavern. Here the water appeared, rushing with great force, beneath the rock, toward the basin on the outside. The whole of the rock about the source was covered with moss; close to the basin grew hazel and plane trees; above were oaks and pines; and all beyond a naked and fearful precipice."

The bold and precipitous country of the Alps offers a variety of waterfalls and perpendicular torrents which are well deserving of notice; more particularly those in the vicinity of Mount Rosa, a part of the northern boundary of Piedmont. The river Oreo, fed by numerous streams from Mount St. Gothard, Mount Cenis, and several branches of the Apennines, forms, at Cerosoli, a vertical cascade, estimated at four hundred fathoms, or twenty-four hundred feet; while the torrent Evanson, descending from another part of Mount Rosa, exhibits a fall of more than two hundred fathoms, rolling down pebbles of quartz, veined with the gold which is occasionally traced in the mountains of Challand. The Cascata del Marmore, or Marble Cascade, so denominated from the mountain down which the Velcino falls being almost wholly of marble, lies about three miles from Terni. In proceeding toward it, the traveler is struck with terror on viewing the precipices, which are of a romantic hight; but is sufficiently rewarded, when, on reaching the summit of the mountain, he regards the stupendous cataract, formed by the river as it rushes from the mountain. Having reached the declivity of its channel, the waters descend with a rapid course for a short space, and then fall from a perpendicular hight of three hundred feet, breaking against lateral rocks, which cause vapors to ascend much higher than the summit of the cataract, by which the neighboring valley receives a perpetual fall of rain. After this descent, the waters rush into the cavities of the rocks, and then bursting through several openings, at length reach the bed of the river.

The grand cascade of the Anio, near Tivola, flows down the edge of a steep rock; and at its foot, the water, in a succession of ages, has hollowed grottos of various shapes and sizes, in a manner so beautifully picturesque, as to baffle all description. Of these, the grotto of Neptune is the most celebrated. Near to it are three smaller cascades, which rush murmuring through the ruins of the villa Mecænas, down the woody steep which forms the opposite bank of the river, and present the painter with one of the most picturesque views imaginable, the foreground varying beautifully at every step he takes.

In Savoy, the Arve flows many miles between high, craggy and inaccessible rocks, which appear to have been purposely cleft to give its waters a free passage. The surprising echoes and continual sounds occasioned by its streams, the trampling of the horses and mules, the hallooing of passengers, &c., are, in these places, reverberated three, four, and even in some parts six or seven times, with a noise so deep and wild, as to strike with terror the traveler who is unaccustomed to them; and the firing of a gun or pistol, is there more terrible than the loudest claps of thunder. A steep precipice, with monstrous impending rocks, which seem ready to fall, joined to the roaring of the river, add largely to the general sublimity. The cataracts of this river are more or less loud and terrible, in proportion as the waters are more or less swollen by the melting snows, with which the tops of the mountains are covered. One in particular, called the Nun of Arpena, falls from a prodigiously high rock with great noise and violence: its descent is said to exceed eleven hundred feet.

In Dalmatia, the river Cettina forms a magnificent cascade, called by the inhabitants Velica Gubavisa, to distinguish it from a less fall a little below. The waters precipitate themselves from a hight of above one hundred and fifty feet, forming a deep majestic sound, which is caused by the echo resounding between the steep and naked marble banks. Many broken fragments of rocks, which impede the course of the river after its fall, break the waves, and render them still more lofty and sonorous. By the violence of the repercussion, their froth flies off in small white particles, and is raised in successive clouds, which are scattered, by the agitation of the air, over the valley. When these clouds ascend directly upward, the inhabitants expect the noxious south-east wind called the sirocco.

The fall of the Staub-Bach, in the valley of Lauterbrannen, is estimated at nine hundred feet of perpendicular hight; and about a league from Schaffhausen, at the village of Lauffen, in Switzerland, is a tremendous cataract of the Rhine, where that river precipitates itself from a rock said to be seventy feet in hight, and not less than four hundred and fifty feet broad.

In Sweden, near Gottenburgh, the river Gotha rushes down from a prodigiously high precipice into a deep pit, with a dreadful noise, and with such amazing force, that the trees designed for the masts of ships, which are floated down the river, are usually turned upside down in their fall, and shattered in pieces. They frequently sink so far under water, as to disappear for a quarter of an hour, half an hour, and sometimes for three-quarters of an hour. The pit into which the torrent precipitates them, is of a depth not to be ascertained, having been sounded with a line of several hundred fathoms, without the bottom being found.

In addition to the other North American cataracts already described, may be noticed the Passaic falls, formed by the river Passaic, which discharges itself into the sea at the northern extremity of the state of New Jersey. About twenty miles from the mouth of this river, where it has a breadth of about a hundred and twenty feet, and runs with a very swift current, it reaches a deep chasm, or cleft, which crosses its channel, and falls about seventy feet perpendicularly in an entire sheet. One end of the cleft is closed up, and the water rushes out of the other with incredible rapidity, in an acute angle to its former direction, and is received into a large basin. It thence takes a winding course through the rocks, and spreads again into a very considerable channel. The cleft is from four to twelve feet in breadth, and is supposed to have been produced by an earthquake. The falls of St. Anthony, on the river Mississippi, descend from a perpendicular hight of thirty feet, and are nearly eight hundred feet in width, while the shore on each side is a level flat, without any intervening rock or precipice.

In England, among the cataracts which merit a brief mention, may be cited the one in Devonshire, near the spot where the Tamer receives the small river Lid. The water there falls above a hundred feet: it proceeds from a mill at some distance, and after a course on a descent of nearly one hundred feet from the level of the mill, reaches the brink of the precipice, whence it falls in a most beautiful and picturesque manner, and, striking on a part of the cliff, rushes from it in a wider cataract to the bottom; where falling again with great violence, it makes a deep and foaming basin in the ground. This fine sheet of water causes the surrounding air at the bottom to be so impregnated with aqueous particles, that those who approach it find themselves in a mist. In Cumberland there are several cataracts; but these are exceeded in beauty by a remarkable fall of the Tees, on the western side of the county of Durham, over which is a bridge suspended by chains, seldom passed unless by the adventurous miners. Asgarth force, in Yorkshire, is likewise a very interesting fall.

In Scotland, the fall of Eyers, near Loch Ness, is a vast cataract, in a darksome glen of a stupendous depth. The water rushes beneath, through a narrow gap between two rocks, and thence precipitating itself more than forty feet lower into the bottom of the chasm, the foam, like a great cloud of smoke, rises and fills the air. The sides of this glen are stupendous precipices, blended with trees overhanging the water, through which, after a short space, the waters discharge themselves into the lake. About half a mile to the south of this fall, is another which passes through a narrow chasm, whose sides it has undermined for a considerable distance. Over the gap is a true alpine bridge, formed of the trunks of trees covered with sods, from the middle of which is an awful view of the water roaring beneath. In Perthshire, the river Keith presents a very considerable cataract, the noise produced by which is so violent as to stun those who approach it. The western coast of Ross-shire is, however, peculiarly distinguished by these natural wonders, among which may be cited the grand cataract of the river Kirkag, and the cascade of Glamma, which latter being situated amid the constant obscurity of woody hills, is truly sublime.

In Ireland, the noble river Shannon has a prodigious cataract, which, at about fifty miles from its mouth, prevents it from being longer navigable for vessels of a large burden.

SPRINGS AND WELLS.

ST. WINIFRED'S WELL.

Holywell, in Flintshire, is famous for St. Winifred's well, one of the finest springs in the world. On account of the sanctity in which it was holden, it gave name to the town. This well pours out, each minute, _twenty-one tuns of water_, which, running to the middle of the town, down the side of a hill, is made use of by every house as it passes, after which it turns several mills, and is employed in various manufactures, which greatly increase the population of the place and its neighborhood. Over the spring, where a handsome bath has been erected, is a neat chapel, supported by pillars, and on the windows are painted the chief events of St. Winifred's (or, as it was anciently written, Wenefrede's) life. About the well grows moss, which the ignorant and superstitious devotees most stupidly imagine to be St. Winifred's hair. This saint is reported to have been a virgin martyr, who lived in the seventh century, and, as the legend says, was ravished and beheaded in this place by a pagan tyrant; the spring having miraculously risen from her blood. Hence this bath was much frequented by popish pilgrims, out of devotion, as well as by those who came to bathe in it for medicinal purposes. Mr. Pennant says, "The custom of visiting this well in pilgrimage, and offering up devotions there, is not yet entirely laid aside: in the summer a few are to be seen in the water, in deep devotion, up to their chins for hours, sending up their prayers, or performing a number of evolutions round the polygonal well."

It might have been supposed that the present enlightened age would have been secure against a repetition of impostures of this kind; but Doctor Milner, a Catholic bishop, of Wolverhampton, took much pains to persuade the world that an ignorant proselyte, of the name of Winefrid White, was there cured of various chronic diseases, so late as the year 1804, by a miracle. Sir Richard

Phillips, having, in the Monthly Magazine, referred this pretended miracle to the known effect of strong faith on ignorant minds, in any proposed means of cure, was attacked by the Catholic clergy for his incredulity; but in number three hundred and two, of the Monthly Magazine, he replies in the following words.

“We have no doubt whatever that Winefrid White was cured by her journey to Holywell, and by bathing in the wonderful natural spring at that place; but we are not credulous enough to believe that her cure was effected by any antagonist properties of the water to the cause of her disease; nor impious enough so to sport with eternal omnipotence, as to assert that a capricious suspension of the laws of nature took place for this purpose. On the contrary, we believe that the poor woman was cured by causes well known to every medical practitioner, and proved in hundreds of recorded instances; that is to say, by her faith in the means proposed for her cure, wrought to the highest pitch by her religion, and by the assurances of those to whom she was accustomed to defer. We think, nevertheless, that the publication of this ‘case of Winefrid White,’ savors strongly of religious empiricism, and is exactly analogous to the ‘cases of cure’ which we every day see advertised in all the newspapers. We refrain from treating the subject theologically, yet it appears to us that Matthew xxiv. 24, proves that ‘signs and wonders’ are not only no evidence of divine interposition, but may be used even by ‘false prophets, so as to deceive the very elect.’ The continuance of miraculous powers will be found, we suspect, to depend on other circumstances than the date of the year. They disappear wherever the printing-press begins to be freely used, and, by its agency, fixes all the circumstances that attend them; and they still continue to flourish wherever the history of the circumstances depends for any period on traditional evidence. Miracles are, therefore, performed in abundance, even in our days, among the negroes, the Hottentots, the Caffres, the Tartars, the South Sea islanders, and the Indians of the two Americas. The last we believe on record are to be found in the Hon. M. Elphinstone’s published embassy to Cabul in 1808: he states that the sick were carried after him many days’ journey; and, at page twenty-eight, he says: ‘Some thought we could raise the dead; and there was a story current, that we had made and animated a wooden ram at Mooltaun; that we had sold him as a ram; and that it was not till the purchaser began to eat him, that the material of which he was made was discovered.’ We forbear to press the subject further.”

WIGAN WELL.

About a mile from Wigan, in Lancashire, is a spring, the water of which burns like oil. On applying a lighted candle to the surface, a large flame is suddenly produced, and burns vigorously. A dishful of water having been taken up at the part whence the flame issues, and a lighted candle held to it, the flame goes out; notwithstanding which the water in this part boils and rises up like water in a pot on the fire, but does not feel warm on introducing the hand. What is still more extraordinary, on making a dam, and preventing the flowing of fresh water to the ignited part, that which was already there having been drained away, a burning candle being applied to the surface of the dry earth at the same point where the water before burned, the fumes take fire, and burn with a resplendent light, the cone of the flame ascending a foot and a half from the surface of the earth. It is not discolored, like that of sulphureous bodies, neither has it any manifest smell, nor do the fumes, in their ascent, betray any sensible heat. The latter unquestionably consist of inflammable air, or hydrogen gas; and it ought to be observed that the whole of the country about Wigan, for the compass of several miles, is underlaid with coal. This phenomenon may therefore be referred to the same cause which occasioned the dreadful explosion of Felling colliery; but in the present case, this destructive gas, instead of being pent up in the bowels of the earth, accompanies the water in its passage to the surface.

DROPPING WELL AT KNARESBOROUGH.

This dropping well, or petrifying spring, rises at the foot of a limestone rock, at an inconsiderable distance from the bank of the river Nidd. The spring, after running about sixty feet, divides, and spreads itself over the top of the rock, whence it trickles very fast, from thirty or forty places, into a channel hollowed for the purpose, as seen in the cut, each drop producing a musical kind of tinkling, probably owing to the concavity of the rock, which, bending in a circular projection from the bottom to the top, occasions its brow to overhang about fifteen feet. This rock, which is about thirty feet in hight, forty-eight in length, and from thirty to fifty in breadth, started, in the year 1704, from the common bank, and left a chasm, from five to nine feet wide, over which the water passes by an aqueduct formed for the purpose. It is clothed with evergreen and other shrubs, which add greatly to the beauty of this very interesting scene.

[Illustration: DROPPING WELL AT KNARESBOROUGH.]

The water is said to abound with fine particles of a nitrous earth, which it deposits, but when in a languid motion only, and leaves its incrustations on the leaves, moss, &c., which it meets with, in trickling thus slowly through the cavities of the rock. This spring is

estimated to send forth twenty gallons of water in a minute. Here are to be seen pieces of moss, bird's nests with their eggs, and a variety of other objects, some of them very curious which have been incrusted or petrified by the water.

BROSELEY SPRING.

This celebrated boiling spring, or well, at Broseley, in Shropshire, was discovered in the month of June, 1711. It was first announced by a terrible noise in the night, there having been a remarkable thunder-storm. Several persons who resided in the vicinity having been awakened in their beds by this loud and rumbling noise, arose, and proceeding to a bog under a small hill, about two hundred yards from the river Severn, perceived a surprising commotion and shaking of the earth, and a little boiling up of water through the grass. They took a spade, and digging up a portion of the earth, the water immediately flew up to a great hight, and was set on fire by a candle which was presented to it. To prevent the spring from being destroyed, an iron cistern has been placed over it, provided with a cover, and a hole in the center, through which the water may be viewed. If a lighted candle, or any burning substance, be presented to this aperture, the water instantly takes fire, and burns like spirit of wine, continuing to do so as long as the air is kept from it; but on removing the cover of the cistern, it quickly goes out. The apparent boiling and ascent of the water of this spring, are still more obviously the result of hydrogen gas, or inflammable air, than in the preceding instance of Wigan well.

HOT SPRINGS OF ST. MICHAEL.

In the eastern part of this island, (one of the Azores,) is a round, deep valley surrounded by high mountains, in which are many hot springs; but the most remarkable is that called the Caldeira, situated in the eastern part of the valley on a small eminence by the side of a river, on which is a basin about thirty feet in diameter, where the water continually boils with prodigious fury. A few yards distant from it, is a cavern in the side of a bank, in which the water boils in a dreadful manner, throwing out a thick, muddy, unctuous water, several yards from its mouth, with a hideous noise. In the middle of the river are several places where the water boils with so intense a heat, that a person can not dip his finger into it without being scalded. On its banks are several apertures, out of which the steam rises to a considerable hight, and is so hot that it can not be approached by the hand. In other parts, the spectator would be led to suppose that the bellows of a hundred forges were blowing in concert; while sulphureous streams issue out in a thousand places. The bushes even, near these spots, are covered with pure brimstone, condensed from the steam which issues from the ground. In the small caverns whence the steam issues, many of the inhabitants prepare their food.

HOT SPRINGS OF THE TROAD.

The Troad, a country of Phrygia, in Asia Minor, of which Troy was the capital, abounds with hot springs; the most interesting one of which is thus described by Doctor Clarke. It is situated near a place called Bonarbashy, signifying literally "the head of the springs," and gushes perpendicularly out of the earth, rising from the bottom of a marble and granite reservoir, and throwing up as much water as the famous fountain of Holywell, in Wales. Its surface seems vehemently boiling; and, during cold weather, the condensed vapor above it causes the appearance of a cloud of smoke over the well. While the mercury stood at forty-six degrees in the open air, it rose, when the thermometer was plunged in the water, to sixty-two degrees. Notwithstanding the warmth of this spring, fishes were seen sporting in the reservoir. In every part of the district through which the Mender flows, from Ida to the Hellespont, are many of these springs, of different degrees of temperature.

The Geysers have already been described, in treating of Mount Hecla, and its surprising volcano. In following up the details of the phenomena of this nature given above, by a brief notice of other bubbling, tepid and boiling springs, it may not be improper to premise that heat, water and vapors of various kinds, exist in prodigious quantities beneath the surface of the earth; and frequently, as has been seen in the phenomena of volcanoes and earthquakes, burst forth from enormous openings, with tremendous destruction. It often happens, however, that the openings are small and porous, and that the vapors ascending through them, are simply combined with water. Hence that almost infinite variety in the characters of these springs, fountains and lakes, the waters of which are combined with extraneous substances. In some cases the clastic gases, or vapors, ascend from specific levity alone, and are destitute of all taste and odor; insomuch that springs are found which bubble without boiling, or betraying heat or any other foreign quality. In other cases they are strongly impregnated with heat; and are then either tepid or boiling, according to the proportion of extricated caloric they contain. Occasionally, whether hot or cold, they are blended with metallic, sulphureous, saline, and other substances, and hence assume the name of mineral waters; while, if the substance thus dissolved be combustible, as naphtha, bitumen, or turpentine, the fountain will often inflame and burn on the application of a lighted torch.

The water of the noted boiling spring at Peroul, near Montpelier, is observed to heave and boil up very furiously in small bubbles, which manifestly proceed from a vapor breaking out of the earth, and rushing through the water, so as to throw it up with noise, and in many bubbles; for on digging in the vicinity of the ditch where the spring lies, and pouring fresh water on the dry spot newly dug, the same boiling is immediately observed. A similar bubbling of the water is likewise found near Peroul, on the seashore. In several dry places near the spring, are small ventiducts, passages or clefts, whence steam issues; and at the mouths of these passages, small light bodies, such as feathers, pieces of straw, leaves, &c., being placed, are soon blown away. This vapor, on the application of a lighted candle or torch, does not flame or take fire, as is the case with that of the boiling spring at Wigan; so that there are two different sorts of steam, to occasion these boilings, at the same time that neither of the fountains is medicinal, or even warm.

Other boiling waters, of a very different temperature, possess, like those of the hot springs of St. Michael, a sufficient degree of heat to boil eggs, and to serve for other culinary purposes. Among these may be instanced those of the Solfatara, near Naples; those on the summit of Mount Zebio, in the Modenese territory; and those which constitute the source of the imperial bath at Aix la Chapelle. In Japan, a hot spring is said to burst forth which constantly maintains the boiling-point, and the water of which retains its heat much longer than common water. It does not flow regularly, but during an interval of two hours each day; and the force and violence of the vapors are then so great, that large stones are ejected, and raised to the hight of ten or twelve feet, with a noise like that of the explosion of a piece of artillery.

From the phenomena which have been adduced, it appears that the exhalations constantly escaping from the vast subterraneous magazines in which they are prepared, vary greatly in their qualities and effects. Some are cold and dry, resembling air or wind, as those near Peroul, and in the cavities of mountains, especially those of Æolus and other hills of Italy, as well as in particular mines. Others are inflammable, and of a bituminous nature, though not positively warm, as those of Wigan well. Others are very hot, sulphureous and saline, more especially those of the natural stoves, sweating-vaults, grottos, baths and volcanoes near Naples, Baiæ, Cuma and Pozzuoli, as also in some of the subterraneous works at Rome. And others, again, are of an arsenical, or other noxious quality, as those of the Grotta del Cane. Now, these various streams meeting with, and running through water, must occasion in it a great variety of phenomena and effects.

It is observed by Doctor Thomson, in his history of the Royal Society, that the hot spring at Bath, has continued at a temperature higher than that of the air for a period of not less than two thousand years, although it is so far distant from any volcano, that, without a very violent and improbable extension of the agency of volcanic fires, it can not be ascribed to them. There are various decompositions of mineral bodies, which generate considerable heat; or, to speak more properly, water is itself the decomposed substance generating heat by its decomposition. The evolution of azotic gas is a proof that the heat of the Bath waters is owing to a particular decomposition which takes place within the bowels of the earth. The greatest heat of these waters is one hundred and sixteen degrees of Fahrenheit's scale; but that of the mineral waters of Carlsbad, in Bohemia, ascends to one hundred and sixty-five degrees.

There are several curious springs which are worthy of notice in this connection, though somewhat varying from the class thus far mentioned. One of these was recently discovered in California, about fifty miles east of San Felipe, in San Diego county. It was discovered by a party engaged in surveying the public lands, and consists of a collection of fountains or springs of soda water, situated in a sandy plain or depression of the surface of the desert. The spring is in a mound of symmetrical shape, tapering like a sugar-loaf, in the center of the top of which is a hole, apparently unfathomable, containing the carbonated beverage fresh from some natural laboratory below. Some of these mounds are six feet high, and clothed with a green and luxuriant coat of grass, while others are shaped like an inverted bowl, and fringed by a growth of cane. The water is described as having the same sparkling and effervescing quality as that ordinarily sold by apothecaries, and was drunk with avidity by both the men and animals belonging to the party discovering it. When impregnated with acid of any kind, it produced instant effervescence, and in that form was peculiarly refreshing as a drink.

Another singular spring has also been discovered on the way from the Great Salt lake, to Los Angelos, through the Cajon pass. The traveler who gives the account of it says: "We had crossed the great desert without any accident, and then camped on a stream of deliciously cool water, about twelve to eighteen inches wide, which distributes itself about half a mile lower down in a meadow covered with luxuriant grasses. This camp-ground is called by the Spaniards, 'Las Vegas.' Once more we had plenty of grass for our fatigued animals, and we determined to rest here for the day. During our journey we passed a number of deserted wagons, chairs, &c. An ox-train from Little Salt lake had preceded about ten days; and it was not difficult to follow their trail, for in the space of one hour I counted the putrid carcasses of nineteen oxen and horses. What a lesson to those who venture on such a journey unadvisedly and unprepared! The strong north wind which blew all day, raised a cloud of dust which almost blinded me,

although I had goggles and a green vail to protect my eyes; however, the delightful and refreshing water of this oasis soon purified me; and I felt, having crossed the desert, breakfasted and bathed, much more comfortable, both mentally and physically. The acacia was the only tree on this stream. Having remained at this camp all one day, the next morning we were on the road to Cottonwood springs, some twenty miles distant, where we would find water and grass, and then commence a journey over another desert of fifty-five miles. We followed up this little stream for about three miles, when the road turned a little to the right; but I was anxious to see the head of the stream, for, from the appearance of the surrounding country, I judged it to be very near. Several gentlemen and myself continued up the stream, and after a ride of half a mile, we came to a large spring, thirty-five feet wide and forty long, surrounded by acacias in full bloom. We approached through an opening, and found it to contain the clearest and most delicious water I ever tasted; the bottom appeared to be not more than two feet from the surface, and to consist of white sand. One of the party prepared himself for a bath, and soon his body divided the crystal waters. While I was considering whether I should go in, I heard him calling to me that it was impossible to sink, the water was so buoyant. I hardly believed it, and, to be able to speak certainly, I also undressed and jumped in. What was my delight and astonishment to find that all my efforts to sink were futile. I raised my body out of the water, and suddenly lowered myself, but I bounded upward as if I had struck a springing-board; I walked about the water up to my armpits, just the same as if I had been walking on dry land. The water instead of being about two feet deep, was over fifteen, the length of the longest tent-pole we had along. It is impossible for a man to sink over his head in it; the sand on the banks is very fine and white; the temperature is seventy-eight degrees of Fahrenheit. I can form no idea as to the cause of this singular phenomenon. Great Salt lake also possesses this quality, but this water is perfectly sweet. In the absence of any other name I have called it Buoyant spring. I have never heard of it as possessing this quality, and should like some of the savants to explain the cause of buoyancy. We lingered in the spring for fifteen minutes, when we dressed and resumed our ride, highly delighted and gratified by our exploration. I made drawings of this spot and surrounding mountains."

Still another singular spring, also in California, was discovered by a Mr. Dabney, when boring for water in San Jose. The auger penetrated through a stiff bed of clay fifty-eight feet thick, when a stream of water was struck which forced itself up the aperture with unprecedented power, and in a volume greater, it is believed, than all the other artesian streams in the neighborhood combined. From this well alone flowed a sufficiency of water to turn a mill. It boiled up with great force, and ran off in a stream four feet wide and six inches deep. At the mouth the current washed out a hole of several feet wide and very deep. Serious apprehensions were entertained, when the stream first burst forth, that it would be impossible to control it. The water was cold and delightful, and it was estimated that the spring would be sufficient to supply the whole city plentifully.

Reciprocating fountains, or springs, may be cited among the most curious phenomena of nature. An irregularity of flow is not uncommon in boiling springs; but there are other springs which evince a periodical influx and reflux, almost as regular as the tides of the ocean. These changes, it will be seen, frequently occur several times in a day, or even in an hour. They are ascribed to various causes, either subterraneous or superficial; but in general, springs and lakes of this description, have been ascertained to communicate with others beneath, through pores or apertures of various diameters, which serve equally to carry off the waters, and to supply them afresh. In such cases the flux and reflux of the upper head of water, must necessarily depend on the state of that beneath; and the causes which alternately augment and diminish the latter, must produce a similar effect on the former.

Paderborn spring, in Westphalia, disappears twice in twenty-four hours, returning constantly, after a lapse of six hours, with a great noise, and so forcibly as to drive three mills at a short distance from its source. The inhabitants call it the _bolderborn_, that is, the boisterous spring. Lay-well spring, near Torbay, is about six feet in length, five in breadth, and nearly six inches deep. The flux and reflux, which are very visible, are performed in about two minutes; when the spring remains at its lowest ebb for the space of about three minutes. In this way it ebbs and flows twenty times within the hour. As soon as the water begins to rise, many bubbles ascend from the bottom; but on its falling, the bubbling instantly ceases. Giggleswick spring, in the West Riding of Yorkshire, lies at the foot of a hill of limestone, named Giggleswick Scar. Its reciprocations are irregular, both with respect to duration and magnitude, the interval of time between any two succeeding flows being sometimes greater, and at other times less, insomuch that a just standard of comparison can not be formed. The rise of the water, in the stone trough or cistern which receives it, during the time of the well's flowing, is equally uncertain, varying from one inch to nine or ten inches, in the course of a few reciprocations. This spring, like the preceding one, discharges bubbles of air at the time of its flowing. Near the lake of Bourget, in Savoy, is a reciprocating spring which rises and falls with a great noise, but not at stated and regular times. After Easter, its ebbings and flowings are frequently perceived six times in an hour; but in dry seasons not more than once or twice. It issues from a rock, and is called =La Fontaine de Merville=, the marvelous fountain.

BITUMINOUS AND OTHER LAKES.

PITCH LAKE OF TRINIDAD.

Near Point la Braye, (Tar point,) the name assigned to it on account of its characteristic feature, in the island of Trinidad, is a lake which at the first view appears to be an expanse of still water, but which, on a nearer approach, is found to be an extensive plain of mineral pitch, with frequent crevices and chasms filled with water. On its being visited in the autumnal season, the singularity of the scene was so great, that it required some time for the spectators to recover themselves from their surprise, so as to examine it minutely. The surface of the lake was of an ash color, and not polished or smooth, so as to be slippery, but of such a consistence as to bear any weight. It was not adhesive, although it received in part the impression of the foot, and could be trodden without any tremulous motion, several head of cattle browsing on it in perfect security. In the summer season, however, the surface is much more yielding, and in a state approaching to fluidity, as is evidenced by pieces of wood and other substances, thrown upon it, having been found enveloped in it. Even large branches of trees, which were a foot above the level, had, in some way, become enveloped in the bituminous matter. The interstices, or chasms, are very numerous, ramifying and joining in every direction; and being filled with water in the wet season, present the only obstacle to walking over the surface. These cavities are in general deep in proportion to their width, and many of them unfathomable: the water they contain is uncontaminated by the pitch, and is the abode of a variety of fishes. The arrangement of the chasms is very singular, the sides invariably shelving from the surface, so as nearly to meet at the bottom, and then bulging out toward each other with a considerable degree of convexity. Several of them have been known to close up entirely, without leaving any mark or seam.

The pitch lake of Trinidad contains many islets covered with grass and shrubs, which are the haunts of birds of the most exquisite plumage. Its precise extent can not, any more than its depth, be readily ascertained, the line between it and the neighboring soil not being well defined; but its main body may be estimated at three miles in circumference. It is bounded on the north and west sides by the sea, on the south by a rocky eminence, and on the east by the usual argillaceous soil of the country.

MUD LAKE OF JAVA.

The following details relative to the volcanic springs of boiling mud in Java are extracted from the Penang Gazette.

Having received an account of a wonderful phenomenon in the plains of Grobogna, a party set off, from Solo, in September, 1814, to examine it. On approaching the place, they saw what at first appeared like the surf breaking over the rocks, with a heavy spray falling to the leeward. Alighting, they went to the “Bluddugs,” as the Javanese call them, which they found to be an elevated plain of mud, about two miles in circumference, in the center of which immense bodies of soft mud were thrown up to the hight of ten or fifteen feet, in the form of large bubbles, which bursting, emitted great volumes of dense white smoke. The largest bubbles, of which there were two, rose and burst some seven or eight times a minute, throwing up from one to three tuns of mud, the smell of the smoke from which was very offensive, like the washings of a gun-barrel. It was both difficult and dangerous to go near the large bubbles, as the surface, except where it had been hardened by the sun, was all a quagmire. They went, however, close to a small bubble, (the plain was full of them, of all sizes,) and observed it for some time. It appeared to heave and swell, and when the air within had raised it to some hight, it burst, and the mud fell down in concentric circles, and then remained quiet till again it was raised, again to burst; which was at intervals of from one to two minutes. The water drained from the mud was collected by the Javanese, and being exposed to the sun deposited crystals of salt.

Next morning the party rode to a place in the forest, to view a salt lake, a mud hillock, and various boiling pools. The lake was about half a mile in circumference, of dirty-looking water, boiling up all over in gurgling eddies; the water being cold, bitter and salt, with an offensive smell. The mud hillock, which was near, was about fifteen feet high, in the form of a cone, with a base of eighty, and a top of eight feet diameter. The top was open, and the interior, which was full of boiling and heaving mud, was found to be eleven fathoms deep. Every rise of the mud was attended by a rumbling noise from within; and the mud was more liquid than at the bluddugs, and unattended by smoke. Near the foot of this hillock was a small pool of water, like that of the lake, boiling violently; and some two hundred yards distant, two larger pools or springs of the same general description, the smell of which was very offensive, and the boiling of which could be heard at quite a distance, resembling the noise of a small waterfall. The water both of the bluddugs and of the lake, is used medicinally by the Javanese, and also, as stated above, for the making of salt, which is gathered in considerable quantities, and the government income from which adds not a little to the public revenues. The general cause of the phenomena here witnessed, is supposed, beyond all question, to be volcanic; the salt water being thrown up by this agency in a heated state, and thus mingling with the soil to produce the boiling and heaving mud above described.

SALT LAKE OF UTAH.

Before leaving the subject of lakes, springs, &c., we must not omit to mention the Great Salt lake of Utah territory, which has been gazed upon with interest by many an emigrant, passing with his family, as represented in the following cut, to his far western home. This lake lies in a region abounding with scenery of unrivaled magnificence and beauty. “Descend from the mountains,” says a late writer, “where you have the scenery and climate of Switzerland, to seek the sky of your choice among the many climates of Italy, and you may find, welling out of the same hills, the freezing springs of Mexico, and the hot springs of Iceland, both together coursing their way to the great salt sea in the plain below. The pages of Malte Brun provide me with a less truthful parallel to it, than those which describe the happy valley of Rasselas, or the continent of Balnibarbi. In the midst of this interesting region, the most remarkable object is the Great Salt lake: which, in the saltness of its waters, in the circumstance of its having no outlet, and being fed from another and smaller lake of fresh water, (with which it is connected by a stream which has appropriately been called the Jordan,) and in the rugged character of some portions of the surrounding region, bears a remarkable resemblance to the Dead sea of Palestine. Instead, however, of lying one thousand feet below, it is more than four thousand feet above the level of the sea; and its waters, being an almost pure solution of common salt, are free from the pungent and nauseous taste which characterizes those of the Dead sea. This lake is about seventy miles long, and thirty miles wide, and is so intensely salt that no living thing can exist in it; and by evaporation in hot weather, it leaves on its shores a thick incrustation of salt.

[Illustration: THE EMIGRANT FAMILY.]

Some twenty-five miles south of this, and connected with it by the river Jordan, as mentioned above, is Utah lake, a body of fresh water, some thirty-five miles in length, which abounds with trout and other fish. And some seven hundred feet higher still, is Pyramid lake, on the slope of the Sierra Nevada mountains, so named from a singular pyramidal mount rising from its transparent waters to the hight of some six hundred feet; and walled in by almost perpendicular precipices, in some places three thousand feet high. Some distance from here, too, are the _boiling springs_, described by Fremont, the largest basin of which is several hundred feet in circumference, and has a circular space at one end some fifteen feet in diameter, entirely occupied with the boiling water. A pole sixteen feet in length, was entirely submerged on thrusting it down near the center; and the temperature of the water near the edge was two hundred and six degrees. In this vicinity also, are appearances similar to the _mirages_ of the great deserts of the old world. In traveling over the salt deserts of the Fremont basin, his party saw themselves reflected in the air, probably, as Fremont himself suggests, from the saline particles floating in the atmosphere, and in some way affecting its refracting power. The entire region, is one of great wildness and grandeur.

ATMOSPHERICAL PHENOMENA.

METEORS.

From look to look, contagious through the crowd The panic runs, and into wond’rous shapes The appearance throws: armies in meet array, Thronged with aerial spears and steeds of fire; Till the long lines of full-extended war In bleeding fight commixt, the sanguine flood Rolls a broad slaughter o’er the plains of heaven. As thus they scan the visionary scene, On all sides swells the superstitious din. Incontinent; and busy frenzy talks Of blood and battle; cities overturned, And late at night in swallowing earthquake sunk, Or hideous wrapt in fierce ascending flame; Of sallow famine, inundation, storm; Of pestilence, and every great distress; Empires subversed, when ruling fate has struck The unalterable hour: even nature’s self Is deemed to totter on the brink of time. Not so the man of philosophic eye, And aspect sage; the waving brightness he Curious surveys, inquisitive to know The causes, and materials, yet unfixed, Of this appearance beautiful and new.—THOMSON.

The nature of those splendid phenomena of the heavens which are embraced under the general term meteors, can not be so well elucidated as by an extract from the travels of Messrs. Humboldt and Bonpland to the equinoctial regions of the new continent. The sublime wonders described by the former of these travelers were witnessed by them at Cumana, a city of Venezuela, in South America.

“The night of the eleventh of November, 1779, was cool and extremely beautiful. Toward the morning, from half after two, the most extraordinary luminous meteors were seen toward the east. M. Bonpland, who had risen to enjoy the freshness of the air in the gallery, perceived them first. Thousands of bolides (fire-balls) and falling stars, succeeded each other during four hours. Their direction was very regular, from north to south. They filled a space in the sky extending from the true east thirty degrees toward the north and south. In an amplitude of sixty degrees the meteors were seen to rise above the horizon at east-north-east, and at east to describe arcs more or less extended, falling toward the south, after having followed the direction of the meridian. Some of them attained a hight of forty degrees; and all exceeded twenty-five or thirty degrees. There was very little wind in the low regions of the atmosphere, and this blew from the east. No trace of clouds was to be seen. M. Bonpland relates, that from the beginning of the phenomenon, there was not a space in the firmament equal in extent to three diameters of the moon which was not filled at every instant with bolides and falling stars. The first were fewer in number, but as they were seen of different sizes, it was impossible to fix the limit between these two classes of phenomena. All these meteors left luminous traces from five to ten degrees in length, as often happens in the equinoctial regions. The phosphorescence of these traces, or luminous bands, lasted seven or eight seconds. Many of the falling stars had a very distinct nucleus, as large as the disk of Jupiter, from which darted sparks of vivid light. The bolides seemed to burst as by explosion; but the largest, those from one degree to one degree and fifteen minutes in diameter, disappeared without scintillation, leaving behind them phosphorescent bands (_trabes_) exceeding in breadth fifteen or twenty minutes, or sixtieth parts of a degree. The light of these meteors was white, and not reddish, which must be attributed, no doubt, to the absence of vapors, and the extreme transparency of the air. For the same reason, under the tropics, the stars of the first magnitude have, at their rising, a light evidently whiter than in Europe.

“Almost all the inhabitants of Cumana were witnesses of this phenomenon, and did not behold these bolides with indifference; the oldest among them remembered, that the great earthquakes of 1766 were preceded by similar phenomena. The fishermen in the suburbs asserted, that the fire-work had begun at one o’clock; and that, as they returned from fishing in the gulf, they had already perceived very small falling stars toward the east. They affirmed at the same time, that igneous meteors were extremely rare on those coasts after two in the morning.

“The phenomenon ceased by degrees after four o’clock, and the bolides and falling stars became less frequent; but we still distinguished some toward the north-east, by their whitish light, and the rapidity of their movement, a quarter of an hour after sunrise. This circumstance will appear less extraordinary, when I state that in full daylight, in 1788, the interior of the houses in the town of Popayan was highly illumined by an aerolite of immense magnitude. It passed over the town when the sun was shining clearly, about one o’clock. M. Bonpland and myself, during our second residence at Cumana, after having observed on the twenty-sixth of September, 1800, the immersion of the first satellite of Jupiter, succeeded in seeing the planet distinctly with the naked eye, eighteen minutes after the disk of the sun had appeared in the horizon. There was a very slight vapor in the east, but Jupiter appeared on an azure sky. These facts prove the extreme purity and transparency of the atmosphere under the torrid zone. The _mass_ of diffused light is so much less, as the vapors are more perfectly dissolved. The same cause that weakens the diffusion of the solar light, diminishes the extinction of that which emanates either from a bolis, Jupiter, or the moon, seen on the second day after her conjunction.

“The researches of M. Chladni having singularly fixed the attention of the scientific world upon the bolides and falling stars, at my departure from Europe, we did not neglect during the course of our journey from Caraccas to the Rio Negro, to inquire everywhere, whether the meteors of the twelfth of November had been perceived. In the savage country, where the greater number of the inhabitants sleep out in the air, so extraordinary a phenomenon could not fail to be remarked, except when concealed by clouds from the eye of observation. The Capuchin missionary at San Fernando de Apura, a village situated amid the savannas of the province of Varinas, and the Franciscan monks stationed near the cataracts of the Orinoco, and at Maroa, on the banks of the Rio Negro, had seen numberless falling stars and bolides illumine the vault of heaven. Maroa is south-west of Cumana, and one hundred and seventy-four leagues’ distance. All these observers compared the phenomenon to a beautiful fire-work, which had lasted from three till six in the morning. Some of the monks had marked the day upon their ritual; others had noted it by the nearest festivals of the church. Unfortunately, none of them could recollect the direction of the meteors, or their apparent hight. From the position of the mountains and thick forest which surround the missions of the cataracts and the little village of Maroa, I presume that the bolides were still visible at twenty degrees above the horizon. On my arrival at the southern extremity of Spanish Guiana, at the little fort of San Carlos, I found a party of Portuguese, who had gone up the Rio Negro from the mission of St. Joseph of the Maravitains, and who assured me, that in that part of Brazil, the phenomenon had been perceived, at least as far as San Gabriel das Cachoeiras, consequently as far as the equator itself.

“I was powerfully struck at the immense hight which these bolides must have attained, to have been visible at the same time at Cumana, and on the frontiers of Brazil, in a line of two hundred and thirty leagues in length. But what was my astonishment, when at my return to Europe, I learned that the same phenomenon had been perceived, on an extent of the globe of sixty-four degrees of latitude, and ninety-one degrees of longitude; at the equator, in South America, at Labrador, and in Germany! I found accidentally, during my passage from Philadelphia to Bordeaux, in the memoirs of the Pennsylvanian society, the corresponding observations of Mr. Ellicott (latitude thirty degrees, forty-two minutes;) and, upon my return from Naples to Berlin, I read the account of the Moravian missionaries among the Esquimaux, in the library of Göttingen. Several philosophers had already discussed at this period the coincidence of the observation in the north with those at Cumana, which M. Bonpland and I had published in 1800.

“The following is a succinct enumeration of facts. First, the fiery meteors were seen in the east, and the east-north-east, to forty degrees of elevation, from two to six hours at Cumana, (latitude ten degrees, twenty-seven minutes, fifty-two seconds, longitude sixty-six degrees, thirty minutes;) at Porto Cabello, (latitude ten degrees, six minutes, fifty-two seconds, longitude sixty-seven degrees, five minutes;) and on the frontiers of Brazil, near the equator, in the longitude of seventy degrees west of the meridian of Paris. Secondly, in French Guiana, (latitude four degrees, fifty-six minutes, longitude fifty-four degrees, thirty-five minutes,) the northern part of the sky was seen all on fire. Innumerable falling stars traversed the heavens during an hour and a half, and diffused so vivid a light, that those meteors might be compared to the blazing sheaves shot out from fire-works. Thirdly, Mr. Ellicott, an astronomer in the United States, having terminated his trigonometric operations for the rectification of the limits on the Ohio, being, on the twelfth of November, in the gulf of Florida, in the latitude of twenty-five degrees, and longitude eighty-one degrees, fifty minutes, saw, in all parts of the sky, ‘as many meteors as stars, moving in all directions: some appeared to fall perpendicularly; and it was expected every minute that they would drop into the vessel.’ The same phenomenon was perceived upon the American continent as far as the latitude of thirty degrees, forty-two minutes. Fourthly, in Labrador, at Nain (latitude fifty-six degrees, fifty-five minutes) and Hoffenthal (latitude fifty-eight degrees, four minutes,) and in Greenland, at Lichtenau (latitude sixty-one degrees, five minutes) and New Herrnhutt, (latitude sixty-four degrees, fourteen minutes, longitude fifty-two degrees, twenty minutes,) the Esquimaux were frightened at the enormous quantity of bolides which fell during twilight toward all points of the firmament, some of them being a foot broad. Fifthly, in Germany, M. Zeissing, vicar of Itterstadt, near Weimar, (latitude fifty degrees, fifty-nine minutes, longitude nine degrees, one minute east,) perceived, on the twelfth of November, between the hours of six and seven in the morning, when it was half after two at Cumana, some falling stars, which shed a very white light. Soon after, toward the south and south-west, luminous rays appeared from four to six feet long: they were reddish, and resembled the luminous track of a sky-rocket. During the morning twilight, between the hours of seven and eight, the south-west part of the sky was seen, from time to time, strongly illuminated by white lightning, which ran in serpentine lines along the horizon. At night the cold increased, and the barometer rose.

“The distance from Weimar to the Rio Negro, is eighteen hundred sea leagues; and from Rio Negro to Herrnhutt, in Greenland, thirteen hundred leagues. Admitting that the same fiery meteors were seen at points so distant from each other, we must also admit, that their hight was at least four hundred and eleven leagues. Near Weimar, the appearance like sky-rockets was seen in the south and south-east; at Cumana, in the east and in the east-north-east. We may therefore conclude, that numberless aerolites must have fallen into the sea, between Africa and South America, to the west of the Cape Verde islands. But, since the direction of the bolides was not the same at Labrador and at Cumana, why were they not perceived in the latter place toward the north, as at Cayenne? I am inclined to think, that the Chayma Indians of Cumana did not see the same bolides as the Portuguese in Brazil, and the missionaries in Labrador; but, at the same time, it can not be doubted, and this fact appears to me very remarkable, that in the new world, between the meridians of forty-six degrees and eighty-two degrees, between the equator and sixty-four degrees north, at the same hour, an immense number of bolides and falling stars were perceived; and that those meteors had everywhere the same brilliancy, throughout a space of nine hundred and twenty-one thousand square leagues.

“The scientific men who have lately made such laborious researches on falling stars and their parallaxes, consider them as meteors belonging to the furthest limits of our atmosphere, between the region of the =aurora borealis= and that of the lightest clouds. Some have been seen, which had not more than fourteen thousand toises, or about five leagues of elevation. The highest do not appear to exceed thirty leagues. They are often more than a hundred feet in diameter; and their swiftness is such, that they dart, in a few seconds, over a space of two leagues. Some of these have been measured, the direction of which was almost perpendicularly upward, or forming an angle of fifty degrees with the vertical line. This extremely remarkable circumstance has led to the conclusion, that falling stars are aerolites, which, after having hovered about a long time in space, take fire on entering accidentally into our atmosphere, and fall toward the earth.

“Whatever may be the origin of these luminous meteors, it is difficult to conceive any instantaneous inflammation taking place in a region where there is less air than in the vacuum of our air-pumps; and where (twenty-five thousand toises high) the mercury in the barometer would not rise to twelve-thousandths of a line. We have ascertained the uniform mixture of atmospheric air to three-thousandths nearly, only to an elevation of three thousand toises: consequently, not beyond the last stratum of fleecy clouds. It might be admitted, that, in the first revolutions of the globe, gaseous substances which yet remain unknown to us, may have risen toward that region, through which the falling stars pass: but accurate experiments, made upon mixtures of gases which have not the same specific gravity, prove that we can not admit a superior stratum of the atmosphere entirely different from the inferior strata. Gaseous substances mix and penetrate each other with the least motion; and a uniformity of their mixture would have taken place in the lapse of ages, unless we suppose in them the effects of a repulsive action unexampled in those substances which we can subject to our observations. Further, if we admit the existence of a particular aerial fluid in the inaccessible region of luminous meteors, falling stars, bolides, and the =aurora borealis=, how can we conceive why the whole stratum of those fluids does not at once take fire, but that the gaseous emanations, like the clouds, occupy only limited spaces? How can we suppose an electrical explosion without some vapors collected together, capable of containing unequal charges of electricity, in air, the mean temperature of which is, perhaps, twenty-five degrees below the freezing-point of the centigrade thermometer, and the rarefaction of which is so considerable, that the compression of the electrical shock could scarcely disengage any heat? These difficulties would in great part, be removed, if the direction of the motion of falling stars allowed us to consider them as bodies with a solid nucleus, as cosmic phenomena (belonging to space beyond the limits of our atmosphere) and not as telluric phenomena (belonging to our planet only.)

“Supposing that the meteors of Cumana were only at the usual hight at which falling stars in general move, the same meteors were seen above the horizon in places more than three hundred and ten leagues distant from each other. Now, what an extraordinary disposition to incandescence must have reigned on the twelfth of November, in the higher regions of the atmosphere, to have furnished, during four hours, myriads of bolides and falling stars, visible at the equator, in Greenland, and in Germany.

“Mr. Benzenberg judiciously observes, that the same cause, which renders the phenomenon more frequent, has also an influence on the largeness of the meteors, and the intensity of their light. In Europe, the nights when there are the greatest number of falling stars, are those in which very bright ones are mixed with very small ones. The periodicalness of the phenomenon augments the interest which it excites. There are months, in which M. Brandes has reckoned in our temperate zone, only sixty or eighty falling stars in one night; and in other months their number has risen to two thousand. Whenever one is observed, which has the diameter of Sirius or of Jupiter, we are sure of seeing so brilliant a meteor succeeded by a great number of smaller meteors. If the falling stars be very frequent during one night, it is very probable that this frequency will continue during several weeks. It would seem that, in the higher regions of the atmosphere, near that extreme limit where the centrifugal force is balanced by gravity, there exists, at regular periods, a particular disposition for the production of bolides, falling stars, and the =aurora borealis=. Does the periodicalness of this great phenomenon depend upon the state of the atmosphere? or upon something which the atmosphere receives from without, while the earth advances in the ecliptic? Of all this we are still as ignorant as men were in the days of Anaxagoras.

“With respect to the falling stars themselves, it appears to me, from my own experience, that they are more frequent in the equinoctial regions than in the temperate zone; more frequent over the continents, and near certain coasts, than in the middle of the ocean. Do the radiation of the surface of the globe, and the electrical charge of the lower regions of the atmosphere, which varies according to the nature of the soil, and the positions of the continents and seas, exert their influence as far as those hights, where eternal winter reigns? The total absence even of the smallest clouds, at certain seasons, or above some barren plains destitute of vegetation, seems to prove, that this influence can be felt at least as far as five or six thousand toises high. A phenomenon analogous to that of the twelfth of November, was observed thirty years before, on the table-land of the Andes, in a country studded with volcanoes. At the city of Quito, there was seen, in one part of the sky, above the volcano of Gayambo, so great a number of falling stars, that the mountain was thought to be in flames. This singular sight lasted more than an hour. The people assembled in the plain of Exico, where a magnificent view presents itself of the highest summit of the Cordilleras. A procession was already on the point of setting out from the convent of St. Francis, when it was perceived that the blaze of the horizon was caused by fiery meteors, which ran along the skies in all directions, at the altitude of twelve or thirteen degrees.”

The bolides, or fire-balls, and falling stars, so striking an example of which is given above, are of all sizes, from a small shooting-star of the fifth magnitude, to a cone or cylinder of two or three miles in diameter. They differ in consistency as much as in dimensions, and in color as much as in either. Occasionally, they are a subtile, luminous and pellucid vapor; and sometimes a

compact ball, or globe, as though the materials of which they are formed, were more condensed and concentrated. Not unfrequently they have been found to consist of both, and consequently to assume a comet-like appearance, with a nucleus or compact substance in the center, or toward the center, and a long, thin, pellucid or luminous main, or tail, sweeping on each side. They are sometimes of a pale white light; at others, of a deep igneous crimson; and, occasionally iridescent and vibratory. The rarer meteors appear frequently to vanish on a sudden, as though abruptly dissolved or extinguished in the atmospheric medium, their flight being accompanied by a hissing sound, and their disappearance by an explosion. The most compact of them, or the nuclei of those which are rarer, have often descended to the surface of the earth, and with a force sufficient to bury them many feet under the soil; generally exhibiting marks of imperfect fusion and considerable heat. The substance is, in these cases, for the greater part metallic; but the ore of which they consist is not anywhere to be found, in the same constituent proportions, in the bowels of the earth. Under this form the projected masses are denominated aerolites, or meteoric stones.

It may not be uninteresting to preface a succinct account of the most surprising of these meteors, by a notice of the hypotheses which have been imagined concerning them; however justly the learned Humboldt may have concluded, in the words of the extracts given above, that we are still “as ignorant on this subject as men were in the days of Anaxagoras.” Sir J. Pringle contended, with other philo

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X-ray, violet ray, and other rays

Maynard Shipley

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X-Ray, Violet Ray and Other Rays

With Their Use in Modern Medicine

Maynard Shipley

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INTRODUCTION

Highly important as are the phenomena of Radioactivity from the physical, chemical, medical, and philosophic points of view, they are hardly comparable in their relations to the affairs of our everyday life to the Roentgen or X-rays, and to the invisible violet or ultra-violet rays. The X-rays are utilized today in hundreds of practical ways, and are vastly important also in surgery, medicine, dentistry, and in biological investigations. It is perhaps not too much to say that the discovery of the so-called X-rays should be numbered among the two or three most important revelations of modern science. This will be clearly demonstrated in the course of the chapters to follow.

X-RAY, VIOLET RAY AND OTHER RAYS

CHAPTER I

EVERYDAY USES OF X-RAYS

To enumerate and describe all the practical uses of X-rays, apart from medicine and scientific research in general, would require a good many more pages than can be devoted to the subject here. To take a few cases at random, without describing the instruments and methods employed: radiography reveals flaws in the structure of iron and steel building and bridge materials, and in the cylinders of airplane engines, and so avoids accidents. In England a gasoline or petrol tank was shown to have rivet heads

on the outside and none on the inside.

Serious defects in the steel axles of railway and automobile “under carriages” have been discovered by radiography. In one case, at least, the axles had been drilled in the wrong position and the holes had been simply filled with metal and covered over. An entire lot was rejected in consequence and probably serious accidents were forestalled.

“Cracks in castings, bad welds and weak places which do not show on the surface of metal are perfectly clear to the searching rays. How much would you give to _know_ that that welded part in your automobile is really solid and perfect, that it contains no flaw to break down some day when you are twenty miles from a machine shop? A well-known mechanical engineer said recently that in ten years a metallurgical X-ray machine will be as vital a part of the equipment in an automobile repair shop, a foundry, or machine shop as it is now in a dentist’s office.”

We are assured by _The Iron Trade_ (73:26) that “the practice of analyzing metals by means of X-rays is only in its infancy. There is every reason to believe that soon great advances will be made in determining the crystallization and therefore the properties of metals. Students of metallurgy are well aware that the properties of metals and other bodies depend on the nature of their crystallization. The microscope has rendered valuable service largely because it enables the form and arrangement of the crystalline grains to be studied. The X-ray carries the same form of inquiry into a region 10,000 times more minute, thereby furnishing new evidence as to crystalline structures, so that it is now possible to see the atoms and the molecules, and the way they form crystals. Every crystal has its characteristic X-ray spectrum and can be identified thereby even when the individual crystals are beyond the resolving power of the microscope and the substance is in danger of being called amorphous. If a specimen contains a mixture of crystalline substances, the spectrum shows the combined effect of all the substances, and provided each individual spectrum is known, the specimen can be analyzed.”

The X-rays are also used to determine the quality of the fabric in automobile tires, and even to detect irregularities in the centers of golf balls, and to reveal why some of them fly straighter and farther than others.

“The professional detective, too,” says Mr. Wilfred S. Ogden (_Popular Science Monthly_, August, 1923), “will find X-rays useful in his business. Consider the detection of infernal machines, for example. Two or three X-ray plates will tell an investigator just what is in a suspicious-looking box. If it is a bomb the X-ray will show him how to get it apart and render it harmless. Immediate detection of false bottoms in trunks is child’s play with the X-ray. When the government provided its customs inspectors with X-ray machines the gems which smugglers try to hide in the linings of clothes or in hollow-handled hairbrushes might as well be worn openly.

“The X-rays give us one of the easiest ways to detect the alteration of checks and other documents. It is seldom that such an alteration is made with exactly the same ink used on the original. Inks even of the same color, differ in the way they affect the rays. In most cases all that is necessary to detect an alteration is to place the suspected document for a moment under the X-rays and make a photograph of it. The new ink used in the alteration will stand out clearly as different from the old.

“The industrial detective will find X-rays just as useful. The adulteration of foods by sawdust, sand or clay; the adding of too much filler to paper; the presence of grit in lubricating oil, all will be revealed.

“Another use of the rays comes home to every cook and housewife. X-rays constitute the only sure way to tell good eggs from bad. Pass each egg in turn through the X-rays and let its shadow fall on a chemical screen. You will see exactly what is inside each egg. The ones containing hopeful chicks may be rejected.”

One of the most remarkable economic or biological uses of the X-ray so far developed is the study of silk-worms and their diseases. The Silk Association of America has established a laboratory—Department of Sericulture—in the Canton Christian College, presided over by a staff of Chinese and foreign entomologists. Here the silk-worm is X-rayed by powerful microscopes, and all his disorders diagnosed and corrected, says Mr. Philip A. Yountz (_Scientific American_, September, 1925).

“Numerous autopsies on deceased members of the silk-worm tribe revealed that from 50 to 100 percent of the worms raised in South China were infected with diseases that made the infant mortality rate excessively high and destroyed the value of the silk from those hardy enough to survive. The elimination of these diseases would enable South China to produce four or five times as much silk.”

In Great Britain, X-rays are used in the analysis of coal, the method being an adaptation of the X-ray stereoscope.

In Berlin, S. Nalken, a noted criminologist, has devised an important improvement in finger-print identification. X-ray pictures are obtained of the finger, with the muscles and bones. This is done without the use of any chemicals that could obstruct the delicate furrows of the finger lines. Moreover, the finger bone is shaped so characteristically as to aid identification. Whenever a certain likeness of finger-lines is discovered, the bones are examined to see if further research is necessary.

Picture fakers have been dethroned by application of the X-ray to paintings. Recently painted “old masters” are now easily detected. Modern artists use white-lead, which is more opaque than the “priming” or “sizing” used by the older artists; and the X-ray device “made in Germany” in 1914 by Dr. Faber, and further developed by the French expert, Dr. André Chéron, at once distinguishes the old from the new. One picture by Van Ostade, of men drinking at a table, proved to be a fraud when submitted to the X-ray; it had been painted over a study of dead birds. Another, called “The Royal Child,” a supposed 16th century work, now in the Louvre, was proved to have been painted during the 19th century over a picture of very much earlier date.

During a popular lecture on the X-ray in London, before the Royal Institution, the distinguished physicist, Prof. G. W. C. Kaye, showed a number of radiograph slides, among which were two pictures by Dutch painters, one representing the Madonna and the other the Crucifixion. In the former, the Madonna appeared to be looking at something which was non-existent in the canvas, and a radiograph proved the missing object was a child which some former owner of the picture had painted out. In the second picture, a woman in the attitude of prayer was found to have been painted over what was in the original the figure of a man in monk’s garb.

The first X-ray pictures ever taken of a mummy were completed by scientists at the American Museum of Natural History, New York City. The pictures showing the skeleton in detail are expected to be a great aid in studying the development of bone formations in the evolution of man. This first subject of the scientists’ X-ray was a South American Indian mummy. Fake mummies, like false gems, are instantly detected by X-ray methods.

One of the methods used for detecting the theft of diamonds at the mines is to examine the workmen with X-rays. Of course, a fluoroscope is used to make the X-ray image visible, and this is the type used in any regular X-ray work.

The X-rays are now being used in shoe-stores—“foot-o-scope” instruments—to enable shoe salesmen to see the bones of a customer’s foot and thus make correct fittings of shoes.

A few years ago there arrived from Germany a new kind of mechanical doll. “A secret mechanism inside enabled it to walk, sit down or stand up, and to do other unusual things. The importer in possession of the sample doll would not allow it to be opened. But one of the competitors borrowed the doll. He had promised not to open it. But he made some X-ray photographs of it. Now he is manufacturing these dolls himself.”

During the World War every effort was made to introduce contraband materials into Germany and if it had not been for the all-seeing eye of the Roentgen ray, it would have been impossible to prevent materials of the utmost importance to the enemy from reaching him by way of neutral countries. Efforts were made repeatedly to smuggle rubber and copper by burying them in bales or bundles of other materials. It would have been impossible to have made a minute investigation of every bale that was shipped, but by means of X-rays it was possible to see through these bundles and packages and locate any substances that were more or less opaque to the rays.

The X-ray has been found useful for examining timber up to 18 inches thick for internal knots, resin pockets, cracks and other defects.

“When submarines were active and the supply of the best kinds of wood was uncertain, it was necessary to make some of the wooden parts out of small pieces of ordinary wood fitted and glued together. The way these pieces were joined and fastened was extremely important. A bit of weak glue inside some little strut might mean a disastrous collapse in the air. But real inspection seemed impossible, for the places where important faults might exist were hidden from view. Finally scientists solved the problem by building an X-ray apparatus with which they could look into the inside of each built-up airplane part and tell whether it held some little imperfection which might prove dangerous.

“This ‘internal inspection’ of wooden articles by X-ray has been applied, since the war, to many other articles. Hidden joints inside high-class furniture and cabinet work, invisible knots and flaws inside the wood itself, can be determined easily by X-ray examination.” (W. S. Ogden).

The Scientific American (September, 1924) published an abstract of a paper read before the _Deutschen Bunsen-Gesellschaft_, in which Dr. D. Coster showed that “the relations between the X-ray spectra of the different elements are so simple that, in some respects, they are more useful for purposes of chemical analysis than ordinary luminous spectra. An important advantage is the fact that the X-ray spectrum of an element is quite independent of the nature of the compound containing it. It is easy to detect the presence in a mixture of which not more than one milligram is available. Certain precautions are necessary in examining the X-ray spectra; although the number of lines for each element is comparatively limited, recent observations have shown the existence of a number of weaker lines; in addition to this, with the high voltages now generally used, not only the spectrum of the first order, but also those of higher orders appear. Slight impurities in the material of the anticathode, and in the subject under examination, also give their lines, so that there are often various possibilities to be considered before a given line can be explained. Not only the wave length, but also the typical appearance of the suspected lines must be considered, as well as their relative intensity. By measuring photometrically the intensity of the spectral lines it is possible, in some cases, to obtain a quantitative estimate of the amount of an element present in a mixture.”

Another method of rapid analysis of material in the laboratory by the use of X-rays in a much shorter time than that required by the older chemical methods is that devised by Professor Urbain, of the Minero-Chemical Laboratory at the Sorbonne, with the assistance of Eugene Delaunay. Mr. Delaunay, who did the actual work of testing the new X-ray method, says there is no risk of error.

By employment of X-rays the scientist is now able to ascertain the arrangement of the atoms and molecules within the crystal “network” (structure—or “space lattice” of the crystal).[1] The results are obtained from the study of the reflection and refraction of the rays by the crystals, or, more precisely, the successive rows of molecules in the crystal. These act toward the extremely short X-rays in the same way as a grating spectroscope does to ordinary light-rays.

Man’s ability to lengthen the ultra-violet end of the spectrum is limited by his capacity to provide a diffraction grating, or a mineral prism, which can split up light-waves of increasingly greater frequency (or shortness). The width of a grating space (a fine line on speculum metal, which acts as a minute mirror) must be comparable to the wave length of the light. Previous to the discoveries of Prof. Max von Laue in Munich (now in Zurich), and Prof. William Henry Bragg, of the University of London, no grating or other material was known whose spaces were as small as the wave length of X-rays. Laue conceived the brilliant idea that the regular arrangement of the atoms in a crystal might serve the purpose. They did. Bragg, and later his son, Prof. W. L. Bragg, of the University of Manchester, followed up the work of Laue with results of immeasurable value to science.

A very important relation between the atomic number of an element and its X-ray spectrum was discovered by the brilliant young English physicist, H. G. T. Moseley (1888-1915), in his 26th year, a year before his death by a Turkish bullet at the Dardanelles. While analyzing the characteristic X-rays which are given off when any kind of substance is bombarded with cathode rays, Moseley found that the atoms of all the different substances emit radiations or groups of radiations which are extraordinarily similar, but which differ in their wave lengths as we proceed from substance to substance; the frequencies (wave lengths) change by definite steps as one progresses from elements of lower to elements of higher atomic weights. Through Moseley’s epoch-making discovery we now know that each of the 92 elements, from hydrogen to uranium, is built up by successive additions of one positive charge (proton) and one negative electron, and that the atomic numbers—from 1 to 92—correspond to the number of protons and electrons in each successively heavier (and more complex) atom.

FOOTNOTES:

[1] This phase of our subject can only be alluded to in this little book. For an authoritative yet easily understood exposition of the subject, see Bragg, W. H. and W. L., “X-Rays and Crystal Structure”; also Kaye, G. W. C., “X-Rays”; and, for more advanced reading, deBroglie, Maurice, “X-Rays”.

CHAPTER II

CURATIVE VALUE OF X-RAYS

In my Little Blue Book on Radium (No. 1000), it is shown that the “emanation” and the “gamma rays” of radioactive substances are being used to great advantage in our hospitals, but that certain dangers to the patient’s normal cells attended employment of these radiations.

It is gratifying to note that successful X-ray treatments are now being given in cases of cancer, rays being produced—under high-tension currents—that are almost identical with the gamma rays of radium.

Moreover, the X-rays have a double value in medicine. In the first place, they are used as an aid to diagnosis, forming those branches of radiotherapy known as radioscopy and radiography. Then they are also used to great advantage in the alleviation or cure of certain maladies. By means of radioscopic or radiographic examination it may be found that there is a tumor in the chest, and as a result of that diagnosis it may be decided to institute treatment (radiotherapy) by means of X-rays or radium rays or the two combined.

The method of employing extremely penetrating X-rays—under high voltage and amperage—seems to have been first used in Germany, during the World War, but was soon developed to a high degree of efficiency in France, England, and the United States, especially by Dr. William Duane, professor of biophysics at Harvard.

As early as 1919, Professor Dessauer, in Germany, produced the penetrating X-rays by means of a high-tension current ranging from 170,000 to 240,000 volts. It was later found, that rays at 200,000 volts became homogeneous, so that a further increase was considered as of no therapeutic value.

In March, 1923, Dr. I. Seth Hirsch, head of the X-ray department of the Bellevue Hospital in New York, gave a drastic treatment—for cancer—of four periods of 16 hours each with the X-rays at 250,000 volts, apparently with satisfactory results. The patient suffered no pain or inconvenience during the treatment with the exception of occasional nausea. A year later an experiment was made in a Philadelphia laboratory where an X-ray treatment of 300,000 volts was used. It seems that alleviation rather than cure has been the result of nearly all cases where cancer had been well advanced.

Other important improvements, meanwhile, were being introduced by the German specialists, during the World War and later, among which was the just mentioned method of giving large tissue-destroying doses, requiring from ten to 15 hours; to this was added careful filtration of the rays, and the invention of the _ionto_—a quantimeter for exact measurements. A number of malignant diseases is reported to have yielded to this new system of massive doses under higher voltage. But Professor Duane has stated that neither X-rays nor the gamma rays of radium should be considered as a permanent cure for cancer.

Until recently the tubes in which X-rays are produced have always been made of glass. The latest discovery is a tube made of fused silica, or vitreosil. Vitreosil permits the passage of the short rays, will stand a much higher temperature than glass, and is much stronger. This means more continuous service from X-rays.

According to Dr. Francis C. Wood, director of the Crocker Institute of Cancer Research of Columbia University, a marked advance in the treatment of cancer has been made possible by a new type of X-ray tube, the invention of Dr. C. T. Ulrey, of the Westinghouse Company. The new tube has a higher emissive power—in other words, it is as if the candle-power of an ordinary lamp were increased six-fold. It is besides designed for use with higher voltages than have previously been practical in Roentgenology. The result is to reduce the necessary exposure from two or three hours per patient to 20 minutes, and to increase the life of the tubes. Incidentally, the new tube gives a greater proportion of the type of rays that cure certain forms of cancer, and less of the sort that attack healthy tissue.

A revolutionary discovery by Dr. Jacques Forestier, of Aix-les-Bains, France, for which a gold medal was awarded him in 1925 by the French Academy, has made possible a method of exact diagnosis by X-rays heretofore deemed by many workers impossible of attainment.

As is well known, it is not difficult to make an X-ray picture of the bones of the body. They are so much denser than the soft parts of the body that, even with the ordinary photographic plate, it has been possible to photograph them fairly well. By pumping the stomach full of gas or air—which are highly transparent to the X-rays—and then applying the X-ray, it has sometimes been possible to locate the beginnings of cancer of the stomach, and the place of malignant growth.

Another method in common use is to give the patient about a pint of some substance opaque to X-rays, such as bismuth carbonate, thus making it possible to record the passage of the mixture, the outline of the stomach and the intestines thus being made visible. In this way ulcers of the stomach have been frequently located.

Bismuth and similar substances could not be injected into the brain or spinal cord, on account of their poisonous effect on the highly sensitive cells of these regions. Now, thanks to the method discovered by Dr. Forestier, the cavities of the brain and spine can be

safely explored, as well as the network of bronchial tubes in the lung—the so-called “bronchial tree.”

In an interview with Mr. David Dietz, Dr. Forestier said (in part):

“I make use of a French oil called lipiodol. It is a chemical compound composed of poppyseed oil and iodine. The chemical previously had been used as a treatment for certain diseases, such as goiter. But no one had ever thought of using it in X-ray work.

“I noticed that where patients had been treated with lipiodol opaque spots appeared when X-ray pictures were made of the treated parts. It occurred to me, therefore, that lipiodol could be used as a means of making photographs.

“Accordingly, in company with Dr. Sicard of Paris, I began to experiment. We worked with animals until we were convinced of the correctness of our method. When we were sure that it was safe we tried it on human beings. I have used it in more than 5,000 cases in Europe without having a single adverse result.

“The lipiodol is injected into the brain cavity or the canal of the spinal cord or the bronchial tubes and then a regular X-ray photograph is made. The oil renders the injected part opaque to X-rays and they show up as sharp black images in the photographs.

“The method is of particular value when a patient is suffering from paralysis which has been caused by a pressure of a tumor or growth somewhere along the spinal cord. In this case a drop of the oil is injected into the spinal canal at the base of the brain. In a healthy patient it would immediately travel to the base of the spine. But in the paralyzed patient it only travels as far as the point of compression. The X-ray picture therefore reveals the drop of oil as a black spot. The surgeon then knows the exact spot at which to operate in order to find the growth causing the pressure, which in turn results in paralysis.

“In diagnosing the lungs with the use of lipiodol the injection in the bronchial tree enables the X-ray worker to tell at once whether the patient is suffering from diseases of the bronchial tubes themselves, or from diseases of the lung tissue, such as tuberculosis.”

It is gratifying to be able to relate that along with the improvements already described, progress has also been made in the preparation of photographic plates required by the radiographer. Until recently no photographic plate had been made which fully met the requirements of X-ray work, and there was little contrast in X-ray photographs. They were all much too sensitive to the longer (visible) wave lengths, and produced blurring effects.

Early in 1921 an excellent photographic plate, 25 times more rapid than anything previously known, was invented by Dr. Leonard A. Levey, a prominent member of the Roentgen Society. It makes an X-ray photograph of the vital organs of the living body whose movements have hitherto blurred the images on the ordinary photographic plate. Distinct pictures of the heart, lungs and stomach can now be made. Dr. Levey has made snapshot photographs of the heart, lungs and kidneys. All were taken in a flash with the X-rays on the new plate.

Dr. H. Becher has called the attention of Americans to the achievement of Dr. Schleussner, an eminent German authority in photochemical matters, who has succeeded, after years of investigation, in sensitizing photographic plates for X-ray use by an addition of certain organic salts which are absorbed by the grains of silver bromide on the photographic plate. The plate thus formed is very responsive to the soft rays of an X-ray tube. The soft rays are relatively longer than the hard Roentgen rays. One could compare the soft rays to blue-violet light, if their effects on this new photographic plate are used for the comparison. Photographs taken with such plates give very contrasting effects.

On the “Neo-Roentgen plate” the effect of the yellow light was almost nil. For this reason, developing the plate is considerably facilitated, as the plate can be exposed to yellow light and the attendant, who need not be a skilled operator, can examine the plate in a rather brilliant light without necessarily guessing at possible results. The examination of the plate under a ruby light is, therefore, completely done away with. It follows that if the new X-ray plate should come into general use, much clearer X-ray photographs would be possible; the time of exposure could be decreased; an unskilled operator could develop the plate in a room flooded with yellow light. Such improved plates are now being extensively used.

While not attempting to enumerate all the special affections to which X-ray therapy is now being successfully applied, a few uses may be mentioned.

X-RAYS CURE WHOOPING COUGH

In a preliminary report published in the _Medical and Surgical Journal_ (Boston), Dr. Henry I. Bowditch and Dr. Ralph D. Leonard express the belief that a valuable cure for whooping cough has been found in X-ray treatment of this disease, which has stubbornly resisted most, if not all, of the other remedies applied.

Definite improvement was noted in most of 26 cases of active pertussis (whooping cough) treated with the X-ray, the subjects of which ranged in age from three months to 40 years, with disease stages from one to ten weeks. The physicians added that they could not give any rational explanation of the action through which the X-ray appeared to produce beneficial results. The report said:

“Each patient received three or four applications of the X-ray at intervals of two or three days.”

Many of these cases have not been observed sufficiently long to determine the final result. Nevertheless, “it is evident to us that there resulted a definite improvement in these patients which cannot be explained by mere accident.... It does not seem likely that [the beneficial result] is due to any direct bactericidal property of the X-ray.

“We feel warranted in classifying a small percentage of these 26 cases under the heading of “prompt cures.” By this we mean that after two or three applications of X-rays, covering a period of six days, the spasms and whoops entirely disappeared and the patients were clinically well, except for, possibly, a very slight cough.

“The bulk of the cases, however, we have classified as relieved. This group consists of perhaps 70 percent of the total. By relieved we mean that there has been a gradual diminution in the number of spasms.

“There is a small percentage of cases, perhaps 10 to 15 percent, which apparently were not relieved. In this group are included one moribund case and one rather difficult feeding case.

“While our evidence so far is not sufficient to warrant any definite conclusions, we have the feeling that the X-ray at the present time may be of more value in the treatment of pertussis than any other form of treatment, including serum.”

X-RAYS FOR MALARIA

An Italian physician, Dr. Antonio Pais, of Venice, has since 1916 been successfully treating malaria by means of X-rays. This treatment is, however, not employed as a substitute for quinine, but merely to reinforce its action. The X-rays are directed toward the region of the spleen, and the effect is to reduce its enlargement. At the same time the composition of the blood is modified. The success obtained by Dr. Pais has, according to the _Bibliothèque Universelle et Révue Suisse_ (Lausanne), been so great that the Italian Government decided to introduce his method of treatment into the military hospitals.

Since the war the treatment has been studied by Prof. B. Grassi, who made a report, at an Italian scientific meeting, in which he declared the action of X-rays upon chronic malaria to be “truly marvelous.” The _Bibliothèque Universelle_ says, regarding earlier treatments:

“The attempt was made by them to destroy the parasite contained in the spleen. But it is now known that the X-rays employed for therapeutic action have no effect upon micro-organisms, although they may be injurious to the elements of the blood. In the method devised by Dr. Pais, the X-rays are employed to stimulate the functioning of the spleen, of the marrow, and of the lymphatic elements by means of slight but prolonged excitation; they are employed in infinitesimal doses—homeopathically, so to speak. Thus the result is absolutely different as well as the method.”

Dr. James B. Murphy demonstrated that accompanying cancer grafts on immune animals there occurs a general increase in the circulating lymphocytes and hyperplasia of the lymphoid tissue. When the lymphoid tissue of immune animals was destroyed, the immunibility was annulled. Two methods of increasing the lymphocytes have been found, namely, diffuse small doses of X-rays, and dry heat. Mice with lymphocytosis induced by these agents show Increased resistance to replants of their own tumors. The results afford ground for hope of human application. (Reported in _Scientific American Monthly_, January, 1920, page 96.)

It has been found that actively growing tissue, whether normal or pathological, is the most susceptible to X-rays, and it is comparatively easy to sterilize a number of species of animals without otherwise injuring them. (Prof. James W. Mayor, _Science_, September 23, 1921.) C. R. Bardeen found that X-rays prevent worms from regenerating lost parts. Observations of the effect of exposure to X-rays on the fertility of animals were described in a paper by Prof. L. H. Snyder of the North Carolina College of Agriculture. Exposure of male rats to X-rays, he said, had rendered them sterile at the end of two months, the animals regaining

fertility when no longer subjected to the rays.

If not handled with due caution and skill, X-rays may do more harm than good, provoking malignant growths as well as retarding their development. As early as 1911, Otto Heese published a record of 54 cases of cancer caused by means of improper handling of these powerful rays.

In the early days of X-ray therapy the nature and effects of these radiations were wholly unknown. Operators did not hesitate to test and adjust their tubes by throwing the shadow of their hands on the flouroscope. X-rays do not make objects visible to the human eye, and to see the effects of them it is necessary to interpose a special screen between the eyes and object through which the X-rays are to penetrate. The cardboard screen is coated with a fluorescent substance, such as barium-platinum-cyanide, or calcium tungstate. This screen is best placed in one end of a black wooden or pasteboard box, against the other end of which the eyes are placed when in use.

This screen under the influence of X-rays becomes luminous and enables one to see shadows or silhouettes of objects of denser material interposed between the eyes and the X-ray tube, when the tube is in operation.

CHAPTER III

MARTYRS TO RADIOLOGY

It was not until several years after the discovery of X-rays by Roentgen, in December, 1895—after operators had been severely burned in laboratories and hospitals all over the world, and surgeons and physicians began to compare notes, that the pathological effects of X-rays were discovered and understood.

Says John Macy (in his memorial volume on Walter James Dodd, heroic victim of 50 separate operations due to X-ray burn):

“It is easy now to understand what was happening to Dodd and his contemporaries. In a modern X-ray machine the strength of the current, the quality of the spark, all the conditions, are determined by metrical instruments. In the early days the operator tested his tube and adjusted it by throwing the shadow of his hand on the fluoroscope; by the look of the shadow he judged how the machine was behaving. First he used the left hand until that became too sore, then the right. And until devices were found to focus and confine the rays, the face of the operator was exposed, and sometimes the neck and chest were burned. A limited exposure to the X-ray is as harmless as a walk in the sunlight. It is the repeated, continuous bombardment of the ray that is calamitous. Dodd and the other pioneers lived in the X-ray.”

John L. Bauer was the first victim of the X-ray, in 1906. He was followed in 1914 by Henry Green, who, although he knew he was doomed, and in spite of the fact that he had become almost helpless physically because so much flesh had been cut away in amputating cancerous growths, persisted in his work to the end.

Major Eugene Wilson Caldwell of the Medical Reserve Corps of the United States Army, the inventor of the Caldwell liquid interrupter and other devices for therapeutic use, lost his life in 1918. Dr. Charles Infroit of the Salpetrière Hospital, Paris, died on November 29, 1920. One of Dr. Infroit’s hands became infected in 1898 as a result of his continuous use of the X-ray, and an operation was performed. After that he had 24 other operations, 22 of them performed in the last ten years of his life, the last on August 1, 1920, when his right arm and left wrist were amputated.

Dr. Charles Vaillant, whose heroic services to humanity have made necessary 13 amputations until now he is armless, on February 19, 1923, received from United States Ambassador Herrick the Carnegie plaque, while the cravat of the Paris Gold Medal of the French Legion of Honor was conferred upon the martyr. Physicians say further amputations are inevitable, and that these will result in Vaillant’s death.

In 1921, the eminent English radiologists, Dr. Cecil Lyster and Dr. Ironside Bruce, and Dr. Adolphe Leroy of the St. Antonie Hospital in Paris, died martyrs to their noble profession. “All of these men went knowingly to death. Perhaps they did not take their sacrifices in the spirit of the saint, possessed by a vision of suffering humanity. Theirs may have been the ardor of the scientist, the endurance of a worker who hears the challenge of nature’s silence and goes to battle. But in themselves they express the powerful urge of a spirit that longs to see, to feel, to know, and to possess all the mysteries of the universe. It is the same spirit that makes men rebel and agonize for a better order of humanity. These men seem better than the world that produces them. But each of them, when he dies, may pull the rest of humanity a little closer to his level.”

Dr. Frederick Henry Baetjer of Johns Hopkins Hospital has only two of his ten fingers left. He lost the other eight as the result of burns received in X-ray experimentation.

Dr. Francis Carter Wood, X-Ray and radium expert of the Crocker Special Fund Cancer Laboratory of New York, calls particular attention to the fact that “the deaths which are occurring now are the results of repeated exposures ten or more years ago, when no one knew what the effect of the rays might be. The burns suffered then were the result of continuous exposure without protection against the rays. One exposure, or a moderate number of them, would do no harm; but before the present perfection of the apparatus it was necessary to adjust the focus for each picture, and the operator would do this by looking at his bare hands through the fluoroscope. This resulted in chronic burns, and the burned flesh formed a fertile soil for cancer. Lead one-quarter of an inch thick will stop both radium and X-rays.”

In Dr. Wood’s opinion, workers in X-rays today “need not suffer any ill effects except through their own carelessness.”

A discovery which promises to put an end to the dangers to life and limb risked by those who engage in working with X-rays was communicated to the Academy of Sciences of Paris as early as May, 1920. It is the result of experiments by Dr. Pesch of the Faculty of Montpelier, who himself is one of the sufferers from X-rays, and who has long been seeking the means of protecting his young confrères.

He found that deep red rays are antagonistic to the ultra-violet rays which produce irritation and burning of the skin, and certain oxidations. Thus, by the simultaneous application of both rays he secures immunity for X-ray workers. He has already proved that erythema can be prevented by the application of red rays. Daniel Berthelot, who announced the discovery to the Academy, recalled that as long ago as 1872 the antagonism of extreme rays of the spectrum had been foreseen by Becquerel in his study of phosphorescence.

Dr. Pesch employs a filter composed of a plastic material that allows only the red and yellow rays to pass. It is claimed that by means of this filter not only are the X-rays made harmless, but its employment effects a cure for radio-dermatitis, the affection which has maimed or killed so many of the early workers in X-ray therapy.

According to Dr. G. Contremoulins, Chief of the principal laboratory of the Paris hospitals, whose researches and experiments were begun in February, 1896, the usual methods of protection even today are not always adequate. Says he (in _La Démocratie Nouvelle_, Paris, April, 1921):

“Young radiologists, especially those born of the war, take no heed of the experience acquired by their elders, being quite convinced that the glasses, gloves and aprons containing lead offer a perfect protection—they even imagine that strictly speaking they might get along without them.

“Like a child which hides behind a wooden door to shield itself from the bullets of a machine gun, our young radiologists believe they are safe when they have donned their gloves and examine their patients behind a sheet of lead glass. But, unfortunately, these enable them only to avoid those superficial skin affections caused by the most absorbable rays of the spectrum.

“But they receive, alas, those other radiations which are more penetrating, and these slowly produce lesions of all the ductless glands in the body, whose internal secretions we now know to be of such vital importance in the bodily economy.”

The modern employment of 200,000 volts under three milliamperes gives rise to the need of great caution in the use of X-rays. Even the health of persons in adjoining rooms or buildings, Dr. Contremoulins believes may be imperiled. In the _Popular Science Monthly_ for October, 1921, this veteran radiologist makes some startling revelations. To quote a few passages:

“In April, 1896, five months after the discovery of X-rays—or Roentgen rays, as they are also named in honor of their discoverer—a pose of eight hours was required for a correct radiograph of a profile head, the tube being placed ten inches from the sensitive plate.

“In April, 1921, a similar image was obtained in four hours at a distance of 90 yards from the apparatus. This means that the radiation with modern apparatus is more than 20,000 times stronger than was possible in 1896.

“With the very weak radiation that I have used for my experiments, corresponding to the ordinary radiographic and radioscopic work, it has been easy for me to obtain images of metallic objects and human bones placed on a sensitive plate 15 feet from the radiating source, although the rays pass directly through a slab of marble an inch thick, a sheet of lead one-tenth of an inch thick,

and a flooring eight inches deep, built of oak boards and rough plaster.

“Fifty feet from this same source I have been able in four hours to fog a photographic plate placed behind a wall of brick and stone 20 inches thick. Also in the same time I have obtained a correct radiograph of a skull and a crab, 262 feet from the X-ray machine. All these experiments were made with a 17-centimeter spark and two milliamperes of current.

“If photographic plates are so readily affected by these rays, we must admit that animal cells also are affected to an appreciable degree. The X-rays that are being used to cure a patient may at the same time inflict radio-dermatitis on other persons exposed to their influence in adjoining rooms or buildings. Nothing will suffice for safety but to cover the walls and floors of X-ray rooms with sheets of lead from a quarter to half an inch thick, according to the power of the source and its distance from the lining....

“Biologic reactions from X-rays take two forms. The first is a skin lesion known as radio-dermatitis, caused by the skin’s absorbing a large quantity of radiations. The second results from the improvements in X-ray tubes and the use of filters absorbing the radiations of long wave length, currently named ‘soft radiation.’ This reaction takes place deep beneath the skin upon the active cells that are the most vulnerable. It is principally the internal secretion glands that are affected. Among those who continually receive even weak doses, a gradual lessening of vitality takes place, leading slowly to a physiological impoverishment that inevitably carries them off sooner or later.”

Dr. Contremoulins was able to escape serious injury up to the outbreak of the World War, but is now a victim of his services to wounded soldiers. As a result of his efforts—and due also, partly, to suits brought against a Paris physician by neighbors who alleged that their health had been impaired, resulting (perhaps) in two cases of cancer—a thorough-going investigation was undertaken by the French Ministry of Hygiene.

Dr. Declere of the Academy of Medicine presided over a committee which included Mme. Curie, M. Becquerel, a radiologist; Dr. Vaillant and a number of specialists. A leading member of the Academy said he did not believe that X-rays menaced persons who did not come into direct contact with them.

“I intend to study the question by three methods,” he said. “First, we shall make a purely physical examination, studying the action of the rays and in what measure they exert themselves at certain distances. Second, we shall experiment with the living tissues of rabbits, trying various distances several hours a day and noting the effect on the red and white corpuscles and glands of the animals. Then, since it is impossible to make such experiments on human bodies, we shall collect data based on 25 years’ experience with X-rays to see whether physicians in close contact have been burned.”

While X-ray treatment cannot be said to _cure_ a deep-seated cancer, it is undoubtedly being given with highly beneficial results in many cases, alleviating much suffering and retarding the growth of malignant tissues.

As is well known, tuberculosis can advance to a dangerous stage before it exhibits physical symptoms recognizable by physicians. The X-ray not only brings to light incipient consumption, but reveals the exact place and extent of the lesion. Any abnormalities of the alimentary tract, also, may readily be brought to view, as well as certain effects produced on certain arteries, due to arterio-sclerosis or to angina pectoris (a very painful form of heart disease).

It has been well said that “the list of diseases, the presence and extent of which are betrayed or confirmed by the X-ray, would fill pages and would include most of the enemies to human health. Among them may be mentioned many forms of tuberculosis, occult abscesses whose ramifying consequences physicians were once unable to refer to their source, tumors, cancers, kidney stones, gastric ulcers, diseases of the heart.”

The martyrdom of radiologists has not been in vain.

In cases of emergency, X-ray diagnosis may now be given patients in their own homes. A surgical X-ray outfit that can be carried in an ambulance and taken to the bedside of a patient too ill for removal to a hospital passed a successful trial in England, thus adapting an emergency war-time arrangement to civilian use. A generator in the ambulance operates the tube, which has a special mounting that enables it to be placed over the patient’s bed, and adjusted for height and position by hand-wheels. The control apparatus is mounted on a separate stand, and connected with the ambulance outside by a cable wound on a reel. Provision is made for developing the exposed plates at once, so that a diagnosis can be made in a few minutes.

CHAPTER IV

DISCOVERY AND NATURE OF X-RAYS

In March, 1923, there passed from this world one of the most beautiful exemplars of the true scientific spirit that earth has ever seen—Dr. William Conrad Roentgen, F.R.S., Professor of Experimental Physics in the University of Munich, the discoverer of X- or Roentgen Rays.

Born at Lennep, on March 27, 1845, Professor Roentgen filled a number of important posts before his death in 1923, in which year he was awarded the Nobel Prize in Physics—an award which brought with it a gift of $40,000. Although suffering from the poverty which resulted in Germany as an aftermath of the World War, Professor Roentgen refused to utilize the Nobel Prize award for his own personal uses. He gave the entire sum to a research society to enable other students to carry on their investigations.

While occupying the chair of Professor of Physics and Director of the Physical Institute at Würzburg, Dr. Roentgen made the discovery—in 1895—for which his name is chiefly known—though his researches led to important advances in several other departments of physics.

While experimenting with a highly exhausted vacuum tube on the conductivity of electricity through gases, Dr. Roentgen noticed that a paper screen covered with potassium platinocyanide—a phosphorescent substance—which chanced to be lying nearby, became fluorescent under action of some radiation emitted from the tube, which at the time was enclosed in a box of black cardboard. Professor Roentgen then found, by experiment, that this heretofore unknown radiation had the power to pass through various substances which are impenetrable to ordinary light-rays. He found that if a thick piece of metal—a coin, for example,—were placed between the tube and a plate covered with the phosphorescent substances, a sharp shadow was cast upon the plate. On the other hand, thin plates of aluminum and pieces of wood cast only partial shadows.

Thus was it demonstrated that the rays which produced the phosphorescence on the glass of the vacuum tube could penetrate bodies quite opaque to ordinary light-rays. Like ordinary light, these rays affected a photographic plate; but owing to their peculiar behavior in regard to reflection and refraction, Roentgen was led to put forward the hypothesis that the rays were due to longitudinal, rather than to transverse waves in the “ether.” They will ionize gases, but they cannot be reflected, polarized or deflected by a magnetic or electric field, as are ordinary light-rays. (It has been shown that the _scattered_ secondary rays show polarization.)

Being in doubt as to the real nature of these penetrating rays, Roentgen called them “X-rays.”

In 1896 Professor Roentgen was the recipient of the Rumford Medal of the Royal Society. This honor was shared by his compatriot Philipp Lenard. Lenard was the discoverer of the rays emanating from the outer surface of a plate composed of (any) material permeable by cathode rays. By impinging on solids, the cathode rays (negative electrons) generate X-rays. “Lenard rays,” which are similar in all their known properties to cathode rays projected from the cathode of a vacuum tube, do not emanate from the cathode. (Unlike the X-rays, cathode rays may be deflected from their natural course along “straight lines” by the application of a magnetic or electric field.) Professor Lenard, as also Hertz, discoverer of the now well-known “wireless waves,” had already demonstrated that a portion of the cathode rays could pass through a thin film of a metal such as aluminum.

When Roentgen rays (X-rays) are allowed to fall upon any substance, the matter emits cathodic (or secondary Roentgen) rays. “The characteristic secondary radiation may be compared with the phosphorescence produced by ultra-violet light, and the cathodic secondary rays with the photoelectric effect” (Sir J. J. Thomson).[2]

The penetrating power (“hardness”) of these rays appears to be determined solely by the nature of the elements in the emitting substance. The velocity of the cathodic (or secondary Roentgen) rays seems to be quite independent of the matter exposed to the primary rays, but increases as the hardness (penetrating power) of the primary Roentgen rays increases.

The _character_ of the emitted rays, in brief, appears to be quite unaffected by the chemical or physical condition of the element. Red-hot iron, for example, exhibits the same characteristic Roentgen radiation as iron at room temperature. But the _penetrating power_ (hardness) of this characteristic (emitting) radiation increases gradually and continuously with increasing atomic weight of the emitting elements. The complete independence of the penetrating power of the characteristic Roentgen radiation from external surroundings indicates strongly that it is closely connected with the nature of the nuclei (“cores”) of the atoms giving rise to it.

FOOTNOTES:

[2] When ultra-violet light is allowed to fall upon a metal it causes the metal to emit electrons and thus to acquire a positive charge, the velocity of the emitted electrons being exactly proportional to the frequency of the incident light. Or when light of X-ray type falls upon the surface of almost any substance, it takes hold of an electron in the atoms of that surface and hurls it out into space with a speed exactly proportional to the wave length of the light. This phenomenon is known as the photoelectric effect.

CHAPTER V

ULTRA-VIOLET LIGHT IN HEALTH AND DISEASE

That both the compound rays of ordinary sunlight and ultra-violet rays ("artificial sunlight") are highly effective in the treatment of a number of complaints is now well known. They are both in general use for the external treatment of rickets, tuberculosis, and a number of other diseases. Light-rays are also applied to hasten the healing of wounds.

The use of the sun as a healing agent seems first to have been developed in a scientific way by Dr. Neils R. Finsen, a young Danish physician who was later awarded the Nobel Prize in Medicine. His original researches were undertaken toward the end of the 19th century. Then Dr. Rollier opened the first sunlight clinic in 1903, and in 1910 established his school at Leysin, in the Alps. Dr. Rollier is now treating about 1,000 patients, mostly afflicted with various forms of tuberculosis of the bone. The sun cure is also used to some extent for pulmonary tuberculosis, and with considerable success. (See my _Man's Debt to the Sun_, Little Blue Book No. 808, Chapter IV.)

According to Dr. Rollier, exposure of the diseased to the sun's rays is efficacious in the treatment of anemia, malnutrition, bone and gland infections and various types of tuberculosis, and is a body builder for convalescents. On the outskirts of San Rafael, California, is a novel sun sanitarium, Helios Sanitarium, modeled after the Alpine sanitaria of Dr. Rollier.

Two investigators have recently studied the comparative germ-destroying power of the blood in healthy and ill persons, before and after exposure to sunlight. It was found that the germ-killing power of the blood was increased when the sun bath lasted for a certain length of time. It was shown that too long or too short an exposure decreased the blood's power. It was decreased also in patients who had fever. Several other conditions were found to influence the results. Physicians believe that several points of practical value may emerge from these experiments. One important and useful result is that they offer a new method to guide and gauge the effects of treatment in tuberculosis and other diseases.

The practice of X-ray treatment (since 1910 included under the more general term _radiotherapy_) includes treatment not only by X-rays, but also by all kinds of rays—treatment by heat, by the sun's rays, by ultra-violet rays, and even by violet rays. The rays of radioactive substances used in medicine come under the etymological term of radiotherapy. But in general practice, amongst radiologists, the term is applied to treatment by X-rays alone. Nevertheless, it is now well established that the ultra-violet rays are not only bactericidal, but that they also play an important role in the treatment of certain diseases, and in the maintenance of good health. On the other hand, these rays produce a certain irritability among persons of the white race in the tropics, which cannot be regarded as healthful in their general effects.

Since the amount of ultra-violet light coming from the sun has been shown by Abbott to be variable, it may be that some of the irritability which seems to be general among the inmates of our public institutions on certain days is due to this change in the sun's outpour of ultra-violet radiation. As Dr. E. E. Free remarked not long ago:

"Put these facts together. Ultra-violet rays affect life. The amount of ultra-violet coming from the sun is variable. Does this mean that some of the obscure, day by day variations of health can be due to this? Some days everybody seems happy and cheerful. Other days everybody is depressed. Still other days are breeders of 'nerves.' Maybe the ultra-violet does it. Maybe not. Doubtless the investigators will find out presently."

Recent experiments at the Maine Agricultural Experiment Station, conducted under the direction of Dr. John W. Gowen, have led to the important discovery that milk from cows that have been treated with ultra-violet light, from mercury-vapor quartz lamps, contains a much larger amount of the substance—presumably a vitamine, or vitamines—that prevents rickets in children and young animals. At any rate, it was found that the milk from cows deprived of sunlight and ultra-violet light was quite deficient in the anti-rachitic factor. Animals and birds fed on the sunless milk uniformly developed rickets.

The Holstein-Friesian cows used in the experiments were of nearly the same age and calving date and all received like treatment as to feed, temperature, etc., and stood side by side in the same barn. "Throughout the treatment," says Dr. Gowen, "these cows

did not leave the barn. For one month none of the cows received ultra-violet light. For the second month two cows received ultra-violet light 15 minutes a day, generated from a Cooper-Hewitt alternating current light at three feet above their backs. For the third month these cows received ultra-violet light for 30 minutes a day under the same conditions. In the meantime Rhode Island Red chickens were allowed to develop rickets, shown both clinically and by X-ray photographs. They were divided into two lots, one lot of these chickens receiving milk from the ultra-violet cows, the other of two lots of chickens, milk from the control cows. Both lots received all the milk they wished.

The chickens have now been under treatment 50 days. The lot receiving milk from cows exposed to ultra-violet light are in good condition with no appearance of rickets in X-ray plates. The lot receiving normal milk has moved progressively toward more extreme clinical and X-ray rickets. The experiment was repeated, using the milk from these same cows on White Leghorn chickens showing clinical and X-ray rickets. Five chickens were in each lot. After 38 days' treatment four of the lot receiving milk from the ultra-violet cows are almost cured of rickets, showing only a very slight stiffness. The fifth chicken shows some stiffness. Four of the lot receiving the normal milk show constantly increasing symptoms of the more advanced stages of clinical rickets.

These results point to the conclusion that more of the substance necessary to cure rickets is absorbed by the cow exposed to ultra-violet light and secreted by her in her milk. The cows prevented from receiving ultra-violet light are not able to secrete this anti-rachitic substance in sufficient quantities to cure or allay the process of clinical rickets. The results thus point to an environmental factor transmitted by the cow to her offspring through the medium of her milk. They further suggest that the high incidence of rickets in children during the late winter months is due to their mothers not receiving ultra-violet light either during pregnancy or while in lactation. Furthermore, it would appear that cows' milk produced especially for baby-feeding should be from cows which have access to ultra-violet light either from the sun or from some other source.

Dr. C. C. Little of the University of Maine, and his associates, fully demonstrated the value of sunlight to animal life through experiments on a flock of 233 chicks. The chicks were divided into three groups and all were given the same diet. One group was kept in natural sunlight, the second was kept in sunlight that went through window glass, and the third was given both natural sunlight and extra ultra-violet rays produced artificially. The last class grew the best. The class that got only natural sunlight grew normally. The class kept behind window glass all developed bone disease. The glass of the greenhouse allowed the light of the sun and the heat of infra-red rays to get through. But it screened out the ultra-violet waves.

The beneficent effects of invisible ultra-violet rays are seen in both the organism exposed to them and the food consumed. This is true whether the rays come direct from the sun or by means of a quartz lamp. Ordinary glass lamps prevent the ultra-violet rays from passing out. But not all kinds of foodstuffs by any means are favorably affected by the rays. Only those foods which contain fat seem to be materially improved. The value of milk and of cod liver oil is greatly enhanced by exposure to the rays. Dr. Benjamin Kramer has been highly successful in treating babies affected with rickets by subjecting milk itself to the action of ultra-violet light.[3]

As early as 1923, it had been shown by feeding experiments with various types of animals at the University of Wisconsin that sunlight was acting either directly upon the animal or upon its food. The same dietary was found to produce contradictory results. It was established—especially by H. Steenbock and E. B. Hart—that sunlight is indispensable to man and beast, in that it is the determinant of the efficiency with which calcium can be assimilated and retained. (See their report, _Journal of Biological Chemistry_, Vol. 62, page 577, 1925.) Calcium, it is pointed out, needs to be conserved because in proportion to the body needs it is not found abundantly in foods and feeds. Steenbock and Hart tell us that sunlight plays the particular rôle of conservator "by virtue of its content of ultra-violet radiations of approximately 250 to 302 millimicrons in wave-length, but unfortunately these are not present in sufficient degree to provide a wide margin of safety for the animal. As a result we have rickets in the young and poor dentition, restricted lactation, abortion and impoverishment of the skeleton in lime to a dangerous extent in the adult.... The ultra-violet rays bring their effect through the medium of certain compounds widely distributed in plant and animal tissue, so that practically any foodstuff can be 'anti-rachitically' activated. 'Make hay while the sun shines' is more than a mere poetic slogan, for hay made in the dark is devoid of rickets-preventing properties" (_Science_, December 4, 1925).

The careful experiments of J. S. Hughes showed that chickens receiving a standard scratch feed and mash, supplemented with sprouted oats and buttermilk, developed rickets (weak legs) when deprived of direct sunlight. Chicks receiving the same feed but given sun baths developed normally, although they were confined in a very small pen, with little opportunity to exercise. Light from ordinary electric bulbs had very little, if any, beneficial action. Light from the Hereus mercury arc lamp was very beneficial. Cod liver oil also proved to be effective in preventing rickets in chickens as in mammals.[4]

That such fats as olive oil and lard may be activated by exposure to ultra-violet rays and used as a substitute for cod liver oil in the treatment of rickets is evidenced by experiments reported by the Department of Agricultural Chemistry of the University of Wisconsin. In the series of experiments now published, olive oil and lard were exposed to the action of the ultra-violet rays from a powerful mercury-vapor quartz lamp, for periods of time ranging from half an hour to 17 hours.

After exposure to the rays these fats were fed to a group of experimental rats in which rickets had been produced, and the activated olive oil and lard were found to have the same beneficial results that follow the administration of cod liver oil. The weight of the rats increased and an analysis of the bones showed an increase in the calcium content.

Some of the activated olive oil, which had been stored in a stoppered bottle, showed no change in potency ten months later. It was found also that the fats might be activated by the rays from the open carbon arc, the iron arc, and sunlight; but that exposure for such prolonged periods as 17 hours destroyed their potency. This destruction took place even on cod liver oil.[5]

It has long been known that human tissue is more actively changed by light when it has been “sensitized.” Quinine, esculin, fluoresceine, etc., are examples of tissue sensitizers, in addition to their other effects. The most powerful of all known sensitizers is haemato-porphyrin—or simply “porphyrin.” This sensitizer is a purple substance closely allied to the haemoglobin that gives blood its red color. Subtracting its iron and albumin from haemoglobin by appropriate chemical processes leaves porphyrin. This substance reacts strongly to the ultra-violet rays, in rare cases causing a disease which turns the teeth to a deep purple hue. Victims of this uncommon ailment have to wear gloves constantly, and when going out of doors during the day time must put on heavy veils.[6] Porphyrin is capable of dissolving the red corpuscles of the most dissimilar animals in the presence of sunlight. But neither the haemato-porphyrin nor the light alone is capable of injuring the animals. Only the combined effect of the two can harm them. A physician experimentally injected an exceedingly minute quantity into himself and then exposed himself to a moderate light, and became very ill.

Hausmann found that even the diffused sunlight of an early spring day in Vienna was sufficient to cause the death of white mice which had been subjected to small quantities of this strange substance. Dr. E. C. Van Leersum, of Holland, proved by experiments with rats that the utilization of lime by our bodies can be controlled almost at will by this “sensitization” process. Rickets, or a condition indistinguishable from rickets, can be produced or cured by proper control of the sensitization.

SUNLIGHT AND INFANTILE PARALYSIS

An article by Science Service, quoted in _Science_, September 11, 1925, says:

Another of the dreaded diseases of childhood, infantile paralysis, which, like rickets, graduates large quotas of cripples, has responded to the good influence of the sun’s rays. Dr. G. Murray Levick, medical director of the Heritage Craft Schools at Chailey, Sussex (England), who originated the treatment, said that no other method has ever had as good results as this in the treatment of infantile paralysis.

Dr. Levick first deduced that neurasthenia in grown-ups and rickets in the young are due to the same cause. Both these diseases, he claims, are nutritional disturbances of the nerve centers affecting the bones in the young, and the nervous systems in the old. The action of sunlight on the skin forms a substance which is carried into the blood and feeds the nerve centers as well as the bones. His success in treating neurasthenia with sun’s rays led him to apply it to cases of infantile paralysis, a disease which is a severe shock to the nervous system and which results in muscular atrophy. Under the action of sunlight a renutrition of nerve centers takes place.

Synthetic sunlight produced by him with an electric arc light of his own invention proved as good as natural sunlight, and could be better regulated to the patient’s endurance. He used two distinct kinds of light-rays, the short ultra-violet rays for nerve nutrition, and the long red and infra-red rays for muscle treatment. Red rays, as can be seen when the hand is held up against the sunlight, penetrate the flesh to a considerable extent, and can therefore stimulate the sleeping muscle.

Dr. Levick warns that immediate success must not be expected. He has found constant improvement where short daily treatments were continued over a period of several years. While the method may not be effective in extreme cases, it is nevertheless a test which will soon show after a few treatments whether any rejuvenation of the nerve fiber is taking place.

It is now admitted that the (red) heat-waves may play some part in heliotherapy—exposure to direct sunlight for medical purposes. Dr. Lazarus-Barlow, Professor of Experimental Pathology in the University of London, concludes that even though heat-rays may

also play some part in curative processes, “experience of the treatment of wounds by sunlight in France during the World War indicated that a degree of benefit arises from exposure to sunlight which cannot be attributable to warmth and ultra-violet rays. On the other hand, in the Finsen light treatment of lupus (a tubercular affection of the skin of the face, occurring in several forms) and in the treatment of tuberculosis at high altitudes, ultra-violet rays play a predominant part.”

As the ultra-violet rays penetrate but a fraction of a millimeter into the epithelium, “it is uncertain how the rays act.” The suggestion is here ventured that since the recently discovered Millikan Rays are particularly powerful under the same conditions that make application of the ultra-violet rays practicable as a therapeutic agency, it may later be found that these highly penetrating rays, of exceedingly short wave length, aid greatly in effecting some of the cures now attributed wholly to the longer (and less penetrating) ultra-violet rays or the much shorter X-rays.[7]

Professor Lazarus-Barlow calls attention to the fact that it is precisely those tubercular persons who tan easily who are said to derive the greatest benefit from a sojourn at high altitude.

Very remarkable is a recently adopted machine which “pours ultra-violet light through a funnel down the throat of a patient.” The new apparatus, first used in London, is employed for treatment of various mouth and throat diseases, “thus making it possible for patients to take internal baths of artificial sunlight” (_Science_, February 26, 1926).

In England, where the sky is so often overclouded, it is natural that much attention has been given to ultra-violet ray therapy. A recent press dispatch tells us:

“London recently had 23 consecutive days on which no beam of the sun could force its way through the mantle of cloud and fog which spread over that section of England. Now the Britons are making artificial suns that may be available for both indoor and outdoor illumination. Arc lights throwing powerful ultra-violet rays are being installed in beauty shops and hotels, and patrons are given opportunity to bathe their bodies in this brilliance. These rays are being billed as more potent than sun baths, and citizens who have small chance to see the orb of day get their sunshine and their medicine at one swoop.”

Two Indian scientists, S. S. Bhatnagar and R. B. Lal, of the University of the Punjab, Lahore, discovered in 1925 that germs grow faster when exposed to “polarized” light than to ordinary light. (Ordinary light—according to the undulatory theory—is due to vibrations transverse to the direction of the ray, but varying so rapidly as to show no particular direction of their own, the fronts of the light-waves crisscrossing at all angles. When, by any means, these vibrations are given a definite direction, the light is said to be _polarized_, the fronts of the waves being all arranged in the same direction, though the path of the rays may be plane, elliptical, circular, or rotary, according to the method of polarization employed.)

The Indian experimenters took cultures of the germs of typhoid fever and cholera, and exposed one set to ordinary light, and another to a beam of polarized light. The latter multiplied much faster than did the germs under ordinary light.

It was demonstrated in 1925 by Dr. Elizabeth S. Semmens, of Bedford College, London, that the digestion of starch takes place more readily under polarized light than in ordinary light.

Prolonged exposure to the ultra-violet rays will destroy any germs known to science. (Cathode rays—which are shorter than ultra-violet rays—will kill not only germs, but insects as well, by means of a device developed by Prof. W. D. Coolidge.)

“Bacteria,” says Dr. Coolidge, “have been rayed, and an exposure of a tenth of a second has been found sufficient to kill even highly resistant bacterial spores. Fruit flies, upon being rayed for a small fraction of a second, instantly showed almost complete collapse, and in a few hours were dead.”

This may lead to the application of cathode rays as a germicide, but their effect on higher forms of life shows that their unskilled use would be most dangerous. For example, Dr. Coolidge relates:

“The ear of a rabbit was rayed over a circular area one centimeter in diameter for one second. After several days a scab formed which fell off a few days later, taking the hair with it. Two weeks later a profuse growth of snow-white hair started which soon became much longer than the original gray hair. Another area was rayed for 50 seconds. In this case, scabs developed on both sides of the ear, which scabs later fell out, leaving a hole. The edge of this hole is now covered with snow-white hair.”

A very interesting problem to scientists relates to the question as to whether or not insects are color-blind. It may be that we now have at least a partial answer to this vexed question, and in terms of ultra-violet radiations.

Dr. Frank E. E. Germann, of Cornell University, calls attention to some recent experiments which show conclusively that at least one kind of insects (flies) have a range of vision in the ultra-violet, just as we have in the visible spectrum. It was also made “perfectly evident that flowers do have their characteristic ultra-violet radiations” (_Science_, March 26, 1926, page 325). It is due “to our own egotism that we call the insect color-blind.”

A given type of insect might in reality be visiting flowers of the same color as far as it was concerned, while to us it appeared to be visiting flowers of all colors. “Might not two flowers, one red and one blue, both give out the same group of wave lengths in the ultra-violet, and thus be identical in color to an insect seeing only the ultra-violet? Moreover, what is to prevent two different kinds of red flowers from giving out two entirely different sets of wave lengths in the ultra-violet, and thus appearing to have entirely different colors to an insect?”

In a very real sense, science is only at the beginning of the discoveries it will yet make in its investigations of the nature and action of ultra-violet, cathode and X-rays.

FOOTNOTES:

[3] It is interesting to note in this connection that Kuzelmass and McQuarrie have suggested that oxidation of cod liver oil gives rise to ultra-violet radiation. (See _Science_, September 19, 1924.)

[4] Paper read before the 66th meeting of the American Chemical Society, held in Milwaukee, Wis., September 10th to 14th, 1923.

[5] Dr. Harriette Chick and her co-workers of the Vienna University Child Clinic discovered, first, that the action of cod liver oil on the bone-lesions of rickets has an exact parallel in that of the ultra-violet rays of sunlight, or of the rays from a mercury-vapor quartz lamp; and, second, that the oil and the rays were effective substitutes the one for the other. See my _Man’s Debt to the Sun_, Little Blue Book No. 808, page 49.

[6] The only creature that has porphyrin as part of its normal body-covering is a tropical bird called the touraco, parts of whose feathers are dyed a brilliant red by a porphyrin-copper compound known as turacin. This pigment is remarkable also because it seems to be the only normal occurrence of copper as a coloring compound in feathers or skin. Turacin is soluble in weak alkali, so that when it rains and the bird comes into contact with such alkaline solutes as frequently occur in nature, the turacin bleaches out! Although porphyrin is rare as a normal coloring in adult animals, it is the commonest pigment found in the shells of birds’ eggs. Almost all eggs, from the hen’s brown to the robin’s blue, contain it.

[7] The length of the very short X-rays was accurately determined by a new method developed by Compton and Doan in 1925, and was found to be about three billionths of an inch.

Transcriber’s Notes

pg 19 Changed: In March, 1923, Dr. I. Seth Hirsh to: In March, 1923, Dr. I. Seth Hirsch

pg 42 Changed: unable to refer to their soure to: unable to refer to their source

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Untitled

British Medical Association

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Transcriber's Notes:

Underscores "_" before and after a word or phrase indicate _italics_ in the original text. Small capitals have been converted to SOLID capitals. Old spellings have been preserved. Typographical and punctuation errors have been silently corrected.

SECRET REMEDIES,

WHAT THEY COST AND WHAT THEY CONTAIN.

BASED ON ANALYSES MADE FOR THE

BRITISH MEDICAL ASSOCIATION.

LONDON: BRITISH MEDICAL ASSOCIATION, 429, STRAND, W.C. 1909.

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PREFACE.

One of the reasons for the popularity of secret remedies is their secrecy. It is a case in which the old saying _Omne ignotum pro magnifico_ applies. To begin with, there is for the average man or woman a certain fascination in secrecy. The quack takes advantage of this common foible of human nature to impress his customers. But secrecy has other uses in his trade; it enables him to make use of cheap new or old-fashioned drugs, and to proclaim that his product possesses virtues beyond the ken of the mere doctor; his herbs have been culled in some remote prairie in America or among the mountains of Central Africa, the secret of their virtues having been confided to him by some venerable chief; or again he would have us believe that his drug has been discovered by chemical research of alchemical profundity, and is produced by processes so costly and elaborate that it can only be sold at a very high price.

The British Medical Association considered, therefore, that it would be useful if not instructive to make analyses of some of the secret remedies, the virtues of which are so boldly advertised, especially in popular monthly magazines and weekly newspapers, and in diaries and almanacks pushed under the front door or dropped over the area railings. The results are given in the following pages; they have been classified under various heads, according to the particular kind of disorder for the cure of which the preparation is more particularly vaunted. The claims in some instances are so comprehensive that it has not always been easy to assign the nostrum its proper place, and for a few it has been necessary to institute a chapter on Cure Alls.

An inquiry of the kind is, from the analytical point of view, tedious and often difficult; for though the analytical chemist can easily and quickly identify the nature of inorganic salts in a mixture or powder, and estimate their amount, most vegetable drugs which exert any appreciable effect on the body owe their power to the presence of an alkaloid or glucoside. The active principle of opium, for instance, is morphine; that of cinchona bark, quinine; that of belladonna, atropine, and so on, and the chemist can recognise any alkaloids present in a mixture or pill. It is otherwise, however, with vegetable extracts and colouring matters, for which

pharmaceutical science has not yet been able in all cases to supply easily applicable and conclusive tests, because for the most part they contain no active principle and are used in pharmacy for their agreeable odour or bitter taste, as vanilla or sorrel are used in cookery. Of the accuracy of the analytical data published there can be no question; the investigation has been carried out with great care by a skilled analytical chemist, who has controlled his results in various ways, one being that in every doubtful case the formula obtained by analysis has been tested by making it up and comparing the appearance, taste, and physical properties of the imitative mixture with those of the secret preparation sold to the public.

The articles in this volume have not been confined to a mere dry statement of the results of analysis. Care has been taken to reproduce the claims and exuberant boasts of the vendors, and the contrast between them and the list of banal ingredients which follow must strike every reader. This juxtaposition of analytical facts and advertising fancies is instructive and sometimes entertaining, the fancy is so free and the fact so simple.

It must not be assumed that the concoctors of these mixtures and powders and ointments show any particular skill in the compounding of drugs. On the contrary, they appear curiously indifferent to taste and appearance, and perhaps count on the belief, common among the poorer classes at least, that the nastier a drug the more effective it is. There is, at any rate, the excuse for this belief that the effort to subdue the repugnance to the draught produces a glow of virtue which may perhaps have a certain stimulating effect on the mind; the patient having not only spent his money but suffered some discomfort, is anxious to justify his faith by assuming himself to be the better for the double sacrifice.

It is not, however, only the poorer classes of the community who have a weakness for secret remedies and the ministration of quacks; the well-to-do and the highly-placed will often, when not very ill, take a curious pleasure in experimenting with mysterious compounds. In them it is perhaps to be traced to a hankering to break safely with orthodoxy; they scrupulously obey the law and the Church and Mrs. Grundy, but will have their fling against medicine. Usually, however, people of these classes take to some system. It used to be electricity or hypnotism or some eccentricity of diet; nowadays it is more often Christian Science.

Judging from the relative number of secret remedies advertised for different complaints, it would seem that the most attractive fields for exploitation by the “patent” medicine man are afforded by those diseases which are widely prevalent, and sufficiently serious to cause considerable suffering and incapacity, inasmuch as such disorders lend themselves to sensational descriptions of the dire consequences which will follow if the one and only real and certain cure is not purchased.

The estimates of cost given throughout the volume refer only to the ingredients, the prices of the various drugs being those quoted in an ordinary wholesale drug list, and take no account of the cost of bottles, boxes, wrappings and packages, very often a much more serious source of expenditure. The stamp duty levied by the Inland Revenue under an old Act of Parliament must also be taken into consideration, but, ostensibly at least, it is paid by the purchaser, for the full price of a nostrum is usually 1s. 1½d. or 2s. 9d. and so on, the extra 1½d. or 3d. representing the value of the stamp. “Store prices” have, however, invaded this, like most other fields of enterprise.

CHAPTER I.

CATARRH AND COLD CURES.

The analyses here given of some of the proprietary articles which the public are induced to buy for the cure of ordinary colds and catarrh furnish a good example of the absurdity of the barefaced pretensions in which nostrum mongers indulge, for minor ailments are by no means neglected by the makers of nostrums; if the price to be obtained is somewhat lower than in the case of more serious disorders the cost price can be reduced in an equal or greater proportion. Alarming accounts, too, of the evils to be expected if resort be not had to the advertised articles are not wanting. Thus, in the advertisement of one of the articles described below, it is stated that catarrh “invariably creates biliousness, constipation, pleurisy, asthma, bronchitis, catarrhal fever, and consumption”; also that “it is estimated that over 20,000 people died in the United Kingdom last year of consumption caused by catarrh.” The remedy put forward for this malignant disease is shown by analysis to consist of a solution of a pinch of common salt with a trace of carbolic acid, the actual cost of the quantity sold for a shilling being one-thirtieth part of a farthing. The probability that many people would regard a slight cold in the head as not requiring a resort to a “specialist in chronic disease in every form” such as the proprietor of this preparation, is turned to account by a disparaging reference to the medical profession. “Catarrh,” we are told, “in its chronic form (and the complaints arising from it) is a malady which has not, up to the present time, received that attention and research from the medical faculty which it deserves. Most practitioners have given it merely a passing thought, or

poohed at it as a mere cold which would soon pass off, and perhaps give some light tonic to tone up the stomach." Another of the "remedies" described well illustrates the way in which the public is deluded by such "specialists"; camphor, quinine and ipecacuanha are frequently employed as domestic remedies in the early stages of a cold in the head, and persons who believe in their usefulness can no doubt be induced to buy a "cold cure" which professes to contain them in combination with other drugs, presented in a form convenient and agreeable to be taken; but in the tablets which are represented as consisting of cascara, bromide, quinine, ipecacuanha, camphor and bryonia, analysis did not reveal any appreciable traces of cascara, bromide, quinine, ipecacuanha, or camphor. The principal ingredients actually present were cinchonine, an alkaloid found in the bark from which quinine is prepared but cheaper than quinine, and acetanilide, a chemical better known under the name antifebrin, both in very small doses.

Many proprietary medicines of varied kinds are recommended for colds among a host of other complaints for which they are stated to possess curative powers. Apart, however, from such inclusive recommendations, a considerable number are put forward expressly and primarily for cold and catarrh, and it is a selection of these which is here described.

DR. LANE'S CATARRH CURE.

This is prepared and sold by a Company giving an address in London. The price is 1s. a bottle, containing 2½ fluid ounces.

Much printed matter is supplied with this preparation, and a few extracts are here given:

Catarrh, in its chronic form (and the complaints arising from it), is a malady which has not, up to the present time, received that attention and research from the medical faculty which it deserves. Most practitioners have given it merely a passing thought, or poohed at it as a mere cold which would soon pass off, and perhaps give some light tonic to tone up the stomach. And therein lies the fatal error, for Catarrh is a disease that cannot be trifled with, as millions can only too surely testify.

... to let any part or organ of the system become diseased breeds the seeds of a host of other complaints, as all the organs of the body are in sympathy with each other. The cause of this is easily explained in a case of Catarrh.... It invariably creates Biliousness, Constipation, Pleurisy, Asthma, Bronchitis, Catarrhal Fever, and Consumption.

It is estimated that over 20,000 people died in the United Kingdom last year of Consumption caused by Catarrh.

The speciality of myself and Associate Physicians is chronic disease in every form. Our library was selected to this end, and the Herbal World explored for this purpose—the successful treatment of chronic disease.

We have never seen one out of five hundred of the patients whom we have cured. Most cases can be treated just as well at a distance as if we saw them in person; as our experience enables us to judge correctly from a written description the nature and extent of the disease under which the patient is labouring.

The preparation is described on the wrapper as:

The _Only Reliable_ and Effective Preparation for the Permanent and _Radical Cure_ of this most dangerous disease.

The directions on the label are:

For Catarrh.—Pour one-half teaspoonful in the palm of the hand, close one nostril with the finger, and inhale the liquid through the open nostril with sufficient force to carry the spray down into the throat. Inhale another half teaspoonful through the other nostril in the same way; it is not advisable to swallow the Catarrh Cure—however, it is perfectly harmless if you chance to do so. Use night and morning and in extreme cases three times a day.

Analysis showed the composition of the liquid to be:

Phenol (carbolic acid) 0·4 part. Sodium chloride (common salt) 3.3 parts. Water to 100 fluid parts.

The traces of impurities usually present in common salt were also found.

The estimated cost of the ingredients in 2½ fluid ounces is one-thirtieth of a farthing.

VAN VLECK'S CATARRH BALM.

This balm is supplied by an American Company having an address in London. The price charged is 4s. 6d. for a package containing 1■ oz.

In an accompanying circular it is stated that:

This preparation is perfectly harmless, readily absorbed, and through its healing, soothing action affords immediate relief and quickly cures Catarrh of the Nose and Head, Catarrhal Deafness, Hay Fever, Cold in the Head, La Grippe, Tonsillitis, Sore Throat and all inflamed, irritated conditions of the nose and throat.

The “Balm” was an ointment, contained in a collapsible tube. The directions on the label are:

First clear your head out thoroughly by blowing your nose, then squeeze out from the tube a piece of Dr. Van Vleck’s Catarrh Balm about the size of a pea, on the end of the finger, and rub it well up into each nostril, hold the other nostril and snuff it up until you can feel it all the way up through the air passages in your head. For severe Catarrh in the Head and Cold in the Head also rub thoroughly over the outside of the nose and across the forehead and on the sides of the head just below the temples. For Catarrhal Sore Throat and Tonsillitis rub thoroughly on the outside of the throat and swallow at bedtime a small piece about the size of a pea. Do not get it into the eyes. This preparation is perfectly harmless, readily absorbed, and through its healing, antiseptic, soothing action affords immediate relief.

The substance consisted of soft paraffin containing a small quantity of phenol and about 2 per cent. of a mixture of volatile oils. Oils of eucalyptus, pumilio pine, and yellow sandal-wood were recognized, and the respective proportions of these were estimated by comparing mixtures of known composition with the original. The results obtained gave the following formula

Phenol 0·6 part. Sandal-wood oil 0·5 ” Oil of pumilio pine 0·7 ” ” eucalyptus 1.2 parts. Soft paraffin to 100

The estimated cost of the ingredients for 1■ oz. is ½d.

DR. MACKENZIE’S “ONE DAY” COLD CURE.

This is supplied by a Company described as of London and New York. The price charged for a box containing 30 tablets is 1s. 1½d.

This preparation is described on the package as:

The Best Cure! For the Worst Cold! A Speedy Cure in all Cases of Cold, Influenza, Headache, and all Neuralgic Affections. Nature’s Remedy.

Dose.—One tablet to be swallowed with a little water every two hours until relieved.

As a preventive, one every four hours.

Not for Children.

The tablets were coated with sugar coloured with ferric oxide (so-called chocolate coating); after removal of the coating they had an average weight of 2 grains. Analysis showed them to have the following composition:

Cinchonidine sulphate 0·83 grain. Acetanilide 0·71 ” Camphor 0·10 ” Talc 0·21 ” Water 0·15 ”

The estimated cost of the ingredients for 30 tablets is 1¼d.

KEENE’S “ONE NIGHT” COLD CURE.

This also is supplied by a Company giving its address as New York and London. The price charged is 1s. 1½d. a box, containing 30 tablets.

This is recommended in the circular enclosed in the box in the following terms:

Keene’s One Night Cold Cure will break up any cold overnight; or money refunded! Influenza cured in three days. Guarantee Label around every Box. If Keene’s One Night Cold Cure fails to Cure your Cold, your money will be cheerfully returned on presentation of Guarantee Label.

Keene’s One Night Cold Cure is in Tablet form and contains nothing injurious, being chiefly composed of Quinine, Cascara, Camphor, and other Ingredients adopted by the Leading Medical Authorities for Colds in the Head, Throat, and Lungs.

The “guarantee label” is worded as follows:

GUARANTEE.

If Keene’s “One Night” Cold Cure fails to effectually break up any ordinary cold, return this Guarantee with box to your Chemist and he will refund price paid.

Cascara—Bromide—Quinine—Ipecac— Camphor—Bryonia—tablets. 7½d. per box. The Keene Co. Irving A. Keene, Treasurer.

The tablets were coated with sugar, coloured with ferric oxide (so-called chocolate coating). After removal of the coating they had an average weight of 2·07 grains. Analysis showed that they contained no bromide, no quinine, except the minute trace occurring as an impurity in the cinchonine found, and no camphor in sufficient quantity to be detected; there was no evidence of any extract or other preparation of cascara, and if any were present, the quantity did not exceed a small trace; the alkaloid found did not give the slightest indication of ipecacuanha alkaloid; extract of bryonia may have been present, as it has no distinctive characters serving for identification. The ingredients found were:

Cinchonine sulphate 0·21 grain. (approx.). Acetanilide 0·32 ” ” Calcium carbonate 0·25 ” ” Starch 0·34 ” ” Extractive and excipient 0·87 ” ” In one tablet.

The extractive and excipient possessed no characters indicating the substance from which it was derived; it contained a small proportion of alkali in organic combination, equivalent to 1·2 per cent. of dried sodium carbonate in the tablet, and the mineral constituents usually present in vegetable extracts. The estimated cost of the ingredients for 30 tablets is ¼d.

MUNYON’S CATARRH TABLETS AND SPECIAL CATARRH CURE.

These two preparations, which have been at one time or another very extensively advertised, are supplied by a Homœopathic Company. They are stated to be manufactured in U.S. of America. The price charged for the tablets is 1s. a package, containing 17 tablets.

This preparation is recommended in the circular which accompanies it in the following terms:

CATARRH POSITIVELY CURED.—Are you a sufferer with catarrh? Have you taken all sorts of drugs and patent nostrums? Are you tired of paying big doctor bills without being cured? Are you willing to spend two shillings for a cure that permanently cures catarrh by removing the cause of the disease? If so, ask your chemist for a shilling bottle of Munyon’s Catarrh Cure and a shilling bottle of Catarrh Tablets. The Catarrh Cure will eradicate the disease from the system and the Tablets will cleanse and heal the afflicted parts and restore them to a natural and healthful condition.

On the package it is stated that:

When used in conjunction with the CATARRH CURE, they cure discharges from the head and throat, dryness, soreness and scabs in the nose, pains in the head, and all symptoms of Catarrh.

The directions are:

Dissolve one Tablet in 20 teaspoonfuls of warm water and use this solution for thorough cleansing of the nose and throat, night and morning. Inject through the nostrils with Munyon’s Atomizer or by snuffing.

The tablets had an average weight of 6 grains. Analysis showed the composition to be:

Sodium bicarbonate 1·87 grains. ” chloride 1·81 ” Borax, partly dehydrated 2·20 ” Phenol (carbolic acid) trace. Gum 0·12 grain.

in one tablet. The amount of borax was equivalent to 2·58 grains of the fully hydrated salt.

The estimated cost of the ingredients for 17 tablets is one-twentieth of a penny.

Besides the “Catarrh Cure” referred to in the above as intended for use with the tablets, there is a “Special Catarrh Cure” which costs 4s. a package containing 460 pilules.

On the package it is stated that:

It cures the most aggravated cases of hawking and spitting of mucus, stuffy or oppressed feeling in the head, dryness or scabs in the nose, gloomy, dull spirits, difficulty of breathing, dropping of mucus from the head into the throat, and liability to take cold easily.

The directions are:

Take four pellets every hour. Half quantity for children.

The average weight of the pilules was ½ grain. On first opening the bottle containing them a slight smell of alcohol was noticeable, but the loss of weight on drying was only 0·08 per cent. No medicament of any kind could be detected, nor any substance but sugar; determination of the amount of the latter showed 100 per cent. to be present.

From the odour of alcohol observed it is not unlikely that the pilules had been “medicated” by treatment with some dilute tincture, but if so, the amount of medicament so imparted was infinitesimal.

The estimated cost of 460 pilules is one-tenth of a penny.

BIRLEY’S ANTI-CATARRH.

The price charged for this fluid, sold by a London Company, is 1s. 1½d. a bottle, containing nearly 3 fluid ounces.

The bottle was accompanied by four pages of printed matter headed “The Birley Monthly Report,” in which the “Anti-Catarrh” was included in a “List and Prices of Dr. Birley’s Compounds of Free (or Unoxidised) Phosphorus,” and described as “Special Remedy for Catarrh and Influenza.” The following extracts are from the same circular, under the heading “The Wonders of Phosphorus.”

Free (or unoxidised) Phosphorus, whose chief seat or situation is in the brain, is one of the most important elements contained in our bodies. Without Free Phosphorus there can be no thought, and very probably no life....

One thing is proved beyond doubt, that the degree of intellectual thought depends upon the amount of Free Phosphorus in the brain, and just as the Phosphorus is unduly wasted, so does the brain power weaken....

Free Phosphorus, it is thus shown, must be the saving agent—no other means is possible. This one element must be replaced.

The directions are:

For an ordinary cold take one teaspoonful every two hours until better, then every third and fourth hour, and finally night and morning.

For severe attacks, commence by taking a dose every hour until better, then gradually increase the period between each dose as attack abates. For Children, give half doses.

Analysis showed the presence of:

Sugar (partly as “invert sugar”) 74 parts. Tartaric acid 1·15 parts. Phosphoric acid 0·07 part. Alcohol trace. Water to 100 fluid parts.

No free phosphorus could be detected, but the odour when the bottle was first opened suggested the presence of a trace. From the presence of a trace of alcohol it appears probable that an alcoholic solution of phosphorus had been added, and that the phosphoric acid had been formed by its oxidation. If the phosphorus found were in the free state each fluid drachm would contain about ¹/■■ grain. The liquid was of a light straw colour, probably produced by addition of a trace of colouring matter.

The estimated cost of the ingredients for 3 fluid ounces is ½d.

CHAPTER II.

COUGH MEDICINES

There are probably few, if any, ailments more frequently treated by the sufferer or his friends, without recourse to medical advice, than coughs and colds. The remedies employed in such domestic practice include preparations like “linseed tea” and others made at home, but these no doubt are supplemented in very many instances by some proprietary preparation, either one of those so

largely advertised, or the speciality of some local compounder. It might be contended that here, if anywhere, is a legitimate field for the maker of nostrums, and it is therefore of some interest to ascertain what is being supplied in such nostrums. The particulars as to composition and claims made which are given below show that they well illustrate the evils which inevitably creep into the dealing in secret remedies, and the downward steps which lead to purely swindling nostrums. One of the articles now described bears on the label the unusual recommendation, “For serious cases seek medical aid”; this preparation is recommended as a “valuable aid” in various complaints, and the fact that it contains morphine is stated clearly on the label, but information is not given as to the amount of morphine present. Less modest claims are made for competing articles, until we eventually reach such statements as “all that is necessary is to take one dose of the lung tonic in warm water on retiring to rest, and the cold will have disappeared in the morning ... cure is quite certain,” and “If it fails no other medicine will ever succeed.” Again, while the presence of morphine in one of the medicines is plainly declared, as we have stated, this is not so in other instances. In one of those in which on analysis morphine was found to be present the advertisement begins with a “guarantee” that the medicinal remedies contained in the lozenges cannot injure the most delicate constitution, and includes the statement that they may be safely administered to very young children; in another case the specific declaration is made that “the cough pills do not contain opium,” which would certainly be regarded by most people as meaning that they do not contain the active principle of opium—morphine; and yet this was found to be present. The uncertainty as to what the composition of a secret medicine may be at any particular time is illustrated by another of the articles described, which has in past years been the subject of legal proceedings in the course of which the presence of morphine was proved, but which is now found not to contain any.

The number of advertised proprietary medicines for the cure of coughs is very large, and the number of those but little advertised and having principally a local sale is still larger; the latter, as a rule, have a good deal of resemblance to the advertised preparations. A selected few of the most widely advertised of this class have been examined.

The information which chemical analysis can give as to the composition of proprietary medicines is necessarily limited to the recognition of those ingredients which possess more or less definite chemical properties. The makers, of course, can make use of any one or more of a long series of vegetable extracts which very much resemble each other, and of various sweetening and flavouring materials sold for the purpose. In the case of many secret preparations analysis can afford complete and positive information as to their composition; but this is not so in every case, owing to many preparations commonly used in pharmacy being devoid of definite active principles that can be identified, and possessing no characters distinguishing them from others of the same class. Many such preparations are likely to be employed in cough mixtures; and, as these medicines usually contain a large proportion of treacle, honey, extract of liquorice, decoction of linseed, or some other old-fashioned complex preparations as basis, the identification of small proportions of many substances which are likely to be present becomes practically impossible. Many of the drugs in recognised use for coughs, such as senega, Virginian prune, etc., as well as domestic remedies like horehound and coltsfoot, are practically safe from certain identification by chemical analysis for such reasons, and in some of the preparations described below such substances may perhaps be present in addition to the ingredients named. The receipts given are not put forward as necessarily representing the whole of the ingredients in the articles in question, but they probably include all those which are of any importance or possess any known curative action.

The chief interest in the composition of such medicines, however, centres in the presence or absence of more potent remedies, such as preparations of opium, ipecacuanha, etc.; and here the analyst is on surer ground. The extraction of minute quantities of alkaloids from complex mixtures containing large quantities of saccharine and “extractive” matters is, however, a matter of much difficulty, and their identification is complicated by the great similarity in the behaviour of morphine and the alkaloids of ipecacuanha towards the various reagents used in their recognition. In this connection it may be pointed out that one or two of the nostrums here dealt with have been the subject of fairly frequent legal proceedings in consequence of their having been sold without proper observance of the poisons regulations, and the evidence given in such cases has shown wide differences in the results obtained by different analysts of high standing, both as to the quantity of morphine present, and even as to the fact of its presence or absence. In making the analyses here recorded, great pains have been taken to obtain accurate results, and they have been confirmed by the employment of alternative methods, etc.; but the results can only be given subject to the caution just expressed.

KAY’S LINSEED COMPOUND.

This compound is sold by an English provincial company in bottles, price, 9½d., 1s. 1½d., 2s. 9d., 4s. 6d., and 11s. per bottle; the 2s. 9d. size contained a little over 5½ fluid ounces.

This preparation is described on the label, wrapper, and in circulars, both as “Linseed Compound,” which is given as the registered trade mark, and as “Kay’s Compound Essence of Linseed, Aniseed, Senega, Squill, Tolu, etc.” On the label it is also stated that it

contains a preparation of chloroform and morphine, and it is, therefore, labelled Poison. It is Demulcent, Expectorant, Tonic, and Soothing for Colds, Coughs, Asthma, Hoarseness, Difficulty of Breathing, Consumption, and Simple Ailments of the Chest, Throat, and Lungs.

In a pamphlet enclosed in the package, this preparation is recommended to be taken for Cold, Influenza, Sore Throat and Quinsey, Pulmonary Catarrh, Bronchitis, Asthma, Consumption of the Lungs, Whooping Cough and Croup. In most of these, however, it is recommended as a “valuable aid” rather than a positive cure; other articles, such as ipecacuanha wine, muriate of ammonia, cod liver oil, and chemical food, as well as “Kay’s Linum Catharticum Pills,” are also recommended; while under Bronchitis we read:

In an acute attack, _i.e._, when the symptoms are inflammatory with much fever, etc., _the family doctor should at once be called in_.

The directions on the label are as follows:

Scale of Doses { To be modified according to the { age or debility of the Patient.

For over 21 years, a teaspoonful in water, at bedtime. ” 12 ” half a teaspoonful ” ” ” 6 ” 15 drops ” ” ” 4 ” 10 ” ” ” ” 2 ” 5 ” ” ”

Half Doses may be taken three or four times a day. It is not intended for Infants. For serious cases seek medical aid.

Analysis showed that 100 parts by measure contained 1·07 parts of chloroform and 4·3 parts of alcohol, both by measure, and 67 parts of solids; about 48 parts of the latter consisted of sugar, partly in the form of invert sugar, and the remaining 19 parts consisted principally of the mucilage of decoction of linseed; oil of aniseed was present, and evidence was obtained of small quantities of preparations of tolu and squill. Tho ipecacuanha alkaloids extracted amounted to 0·007 per cent., and the morphine to 0·021 per cent. If the ipecacuanha were present in the form of wine of the official strength, this represents:

Ipecacuanha wine 42 minims. Morphine ¹/■ grain. Chloroform 5 minims.

in each fluid ounce.

OWBRIDGE’S LUNG TONIC.

This is sold by another English provincial company, price, 1s. 1½d., 2s. 9d., 4s. 6d., and 11s. a bottle; the 2s. 9d. size contained a little over 6½ fluid ounces.

It is stated on the wrapper that this:

Cures Coughs, Colds, Asthma, Bronchitis, Influenza, and all Affections of the Chest, Throat, and Lungs.

Also,

This Preparation does not contain any Opium, Laudanum, or Morphine, therefore does not require a Poison Label.

A pamphlet was enclosed in the package, from which the following is an extract:

Having once contracted a cold, however slight, it is of the first importance to have it thoroughly and radically removed. To do this it is worse than useless to rely upon a few lozenges, or any of the simple expedients to which many have recourse. Avoid linseed poultices, which are excessively weakening, and highly calculated to make the patient liable to a second, and, perhaps, more severe cold than the first. All that is necessary is to take one dose of the lung tonic in warm water on retiring to rest, and the cold will have disappeared in the morning. The lungs and bronchial tubes will be fortified and invigorated to an extraordinary degree. Should the cough not be quite removed by the first dose, continue according to directions. Cure is quite certain.

The directions on the label were:

Scale of Doses.

Above 14 years one teaspoonful. 6 to 14 years half a teaspoonful. 3 ” 6 ” fifteen drops. 1 ” 3 ” five to seven drops. 6 months to 1 year three to five drops.

Not to be given to a child under Six Months old.

To be repeated 3 or 4 times a day, if necessary. The doses given during the day should be mixed with a little cold water, the one at bedtime in a tablespoonful of warm water.

Analysis showed that 100 parts by measure contained 0·3 part of chloroform and 2 parts of alcohol, both by measure, and 89 parts of solids; about 73 parts of the latter consisted of sugar, rather more than half of which was in the form of invert sugar; it is probable that this had been added in the form of honey, and that the remainder of the solids consisted largely of the non-saccharine portion of the honey. Oils of aniseed and peppermint were present, and evidence was obtained of a very small quantity of a preparation of capsicum. The alkaloids of ipecacuanha were found to the amount of 0·002 per cent.; if these were present in the form of wine of the official strength, this represents:

Ipecacuanha wine 15 minims. Chloroform 2 ”

in each fluid ounce.

POWELL’S BALSAM OF ANISEED.

This fluid, prepared by a London maker, is sold in bottles, price, 1s. 1½d., 2s. 3d., 4s. 6d., and 11s. per bottle; the 2s. 3d. size contained a little over 3 fluid ounces.

In a circular enclosed with the bottle it was stated that:

This old and invaluable Medicine has the extraordinary property of immediately relieving Coughs, Colds, Bronchitis, Hoarseness, Difficulty of Breathing, and Huskiness in the Throat. It operates by dissolving the congealed Phlegm, and thus promotes free expectoration....

In Asthma, Chronic Cough, Influenza, Difficulty of Breathing, etc., no pen can describe the wonders that have been wrought by this deservedly popular preparation.

The directions for use were:

For a Grown Person a teaspoonful two or three times a day. For a child about 8 years old, 20 drops; and 12 years, 40 drops.

N.B.—Grown persons as well as children should take it in a little gruel or warm water; or saturate a lump of sugar with the above quantities is a pleasant way of taking it.

Analysis showed that 100 parts by measure contained 1·8 parts of benzoic acid, about 4·2 parts of extract of liquorice, and 2 parts of sugar, 40 parts by volume of alcohol, and enough oil of aniseed to give a strong aniseed flavour; a very small quantity of an aromatic resin, apparently benzoin, was also found, and 0·012 per cent. of alkaloid. This alkaloid resembled morphine in its behaviour to solvents, by which all the commoner alkaloids were excluded; but other tests showed that it was not morphine, and it is possible that it was a morphine derivative, such as dionine or peronine, but it was not found practicable to establish its exact identity owing to the smallness of the amount. Powell’s Balsam of Aniseed has, in the past, been the subject of legal proceedings on several occasions, and evidence has been brought in those proceedings proving that it contained morphine; so that it would seem that its composition has been changed since then.

DR. KILMER’S INDIAN COUGH CURE.

This preparation, stated to be made in U.S.A., is advertised from an address in London. The price is 1s. 1½d. a bottle, containing 3 fluid ounces.

It was stated on the outside of the package that:

This wonderful preparation contains no opium, morphine, chloral, or other hurtful drugs, and therefore does not dry up a cough. Every ingredient is from Vegetable products which grow within sight of almost every sufferer. It will not only help but cure the most Chronic and Complicated cases.

The directions were:

Dose: ½, 1, or 2 teaspoonfuls every ½, 1, 2, 3, or 4 hours as the case may require. Children—less according to age.

Analysis showed that 100 parts contained 63 parts of solids, of which practically the whole was sugar; there was also present about 2 per cent. of alcohol and about 0·5 per cent. of oil of pumilio pine, with rather less than 0·1 per cent. of a resinous substance agreeing well with the resins from compound tincture of benzoin; a small resinous deposit also remained adhering to the inside of the bottle. A trace of a bitter yellowish substance was present, which may have been the aloes contained in the compound tincture, but did not agree perfectly with it in character; the quantity was too minute for exact identification. No alkaloid was present.

CROSBY'S BALSAMIC COUGH ELIXIR.

This elixir, sold from a provincial English town, and wholesale through a company in London, costs 1s. 1½d., 2s. 9d., and 4s. 6d. per bottle; the 2s. 9d. size contained nearly 4¾ ounces.

It was described on the label as:

A safe, speedy, and effectual remedy for Coughs, Colds, Hoarseness, Difficulty of Breathing, Wheezing and Irritation of the Throat, Hooping Cough, Asthma, and Incipient Consumption.

In circulars enclosed with the bottle, its use in these various complaints was more fully described; and it was stated further that:—

It contains no opiates, and is absolutely non-poisonous, and may therefore be taken with safety by the young and aged alike.

The directions given on the label were:

For Children, one month to one year, 5 to 10 drops in a little water. From one to five years, 10 to 20 drops. From five to ten years, 20 to 30 drops. From ten to fifteen years, 30 drops to one teaspoonful. From fifteen years and upwards, one teaspoonful, gradually increased to three teaspoonfuls, in a wineglassful of water.

Analysis showed that 100 parts by measure contained 65 parts of solid matter, about 58 parts of which consisted of invert sugar, 10·6 parts by volume of alcohol, a trace of chloroform, 1·35 parts of sulphuric acid, and 0·3 part of acetic acid; a trace of an aromatic substance probably derived from tolu was present, and a minute trace of alkaloid (much less than 0·001 per cent.); the remainder appeared to consist of extractive and colouring matter, and may have contained the non-saccharine portion of honey if the invert sugar were added in that form. A trace of acetic ether could be detected, and it is probable that the acetic acid found represented acetic ether originally added, which had undergone hydrolysis; in that case the amount of acetic ether originally present would be 2¼ minims in 1 fluid ounce. The sulphuric acid found corresponds to 44 minims of the official dilute sulphuric acid in 1 fluid ounce.

VENO'S LIGHTNING COUGH CURE.

This is prepared by a company in an English manufacturing town. The price charged is 1s. 1½d. a bottle, containing 2¾ fluid ounces.

On the label it was stated that:

If it fails no other medicine will ever succeed. It should be used in all cases of Coughs, Colds, Bronchitis, Pleurisy, Sore Throat, Hoarseness, Asthma, Croup, Whooping Cough, Influenza, and Catarrh.

In most cases it should be used with Veno's Lightning Fluid.

Dose.—For an Adult, one teaspoonful; for a Child under ten, half teaspoonful; for an Infant, five or ten drops every two or three hours, during the day only.

Analysis showed that 100 parts by measure contained 7·6 parts of glycerine, 1·6 parts by volume of alcohol, a trace of chloroform, 0·23 part of a resin, 0·2 part of alkaline ash, and 1·1 parts of extractive and colouring matter. No alkaloid was present. The resin was not aromatic, and possessed no well-marked characters, but showed some resemblance to the resin of _Grindelia robusta_; the fluid extract of this drug is prepared with the aid of alkali, and the strongly alkaline nature of the ash found would agree with the presence of fluid extract of grindelia, but positive proof of the presence of the latter could not be obtained; the amount of resin found corresponds to about 7 minims of the fluid extract in 1 fluid ounce.

KEATING’S COUGH LOZENGES.

These lozenges are sold from an address in London in boxes, price, 1s. 1½d., 2s. 9d., 4s. 6d., and 11s. per box; the 1s. 1½d. size contained 50 lozenges.

A circular enclosed in the package was headed:

Notice—Guarantee.

The medicinal remedies contained in these lozenges cannot injure the most delicate constitution.

Another extract from the circular stated:

Very many also of the Nobility and Clergy, and of the public generally use them _under the recommendation of some of the most eminent of the Faculty_. Such medical testimony must be convincing of their efficacy as well as conveying the satisfactory assurance of their freedom from any medicine in the slightest degree injurious to the constitution, Medical Men being well aware of the deleterious effects of many preparations, which in Pulmonary Affections do but mask the symptoms for a time, and afford only temporary relief, while perhaps the constitutional disease is aggravated, or at least unsubdued. They may be safely administered to females of the most delicate frame, and to very young children, for they not only allay Cough and Nervous Irritation, but they sustain the constitution, by promoting a healthy state of the Digestive Organs. They have immediate influence over the following cases:—_Asthmatic and Consumptive Complaints, Coughs, Shortness of Breath, Hoarseness, etc., etc._

Directions for Use. One or two, taken at bedtime, will allay the irritation in the Throat, and prevent the Cough from disturbing the patient during the night, _and one also eight or ten times in the day_, when the Cough is troublesome, will afford great relief.

The average weight of the lozenges was 16½ grains; analysis showed that they contained morphine, alkaloids of ipecacuanha, extract of liquorice, sugar (partly as invert sugar), and gum; some evidence was also obtained of the presence of extract of squill and tolu, but positive proof of the identity of these was not obtainable. The proportions of the various ingredients found corresponded to:

Morphine 0·007 grain. Ipecacuanha 0·07 ” Extract of liquorice 2·1 grains. Sugars 13 ”

in one lozenge.

BEECHAM’S COUGH PILLS.

These cough pills, sold from a town in Lancashire, cost 1s. 1½d. per box, containing 56 pills.

The following extracts are from a circular enclosed with the box:

Persons suffering from Cough and kindred troubles should relieve their minds of the idea that nothing will benefit them unless it be in the form of a lozenge, or taken as liquid. Let them try _Beecham’s Cough Pills_, and they will never regret it.

The _Cough Pills_ do not contain opium; they do not constipate; they do not upset the stomach. On the first symptoms of a Cold or Chill, a timely dose of Beecham’s Cough Pills will invariably ward off all dangerous features. For years many families have used no other Winter Medicine. Householders and travellers should avail themselves of this good, safe, and simple remedy for Coughs in general, Asthma, Bronchial Affections, Hoarseness, Shortness of Breath, Tightness and Oppression of the Chest, Wheezing, etc.

The doses may be from three to six pills morning, noon, and night.

The pills had an average weight of 1·4 grains. In spite of the statement that they “do not contain opium,” analysis showed morphine to be present, together with powdered squill, powdered aniseed, extract of liquorice, and a resinous substance agreeing in character with the resin of ammoniacum. Approximate determination of the proportions of the ingredients is alone possible in such a mixture; the results obtained pointed to the following formula:

Morphine 0·0035 grain. Powdered squill 0·1 ” Powdered aniseed 0·3 ” Ammoniacum 0·3 ” Extract of liquorice 0·4 ”

in one pill.

SOME GERMAN NOSTRUMS.

Dr. F. Zernik, assistant in the Pharmaceutical Institute of the University of Berlin, undertook a short time ago, at the invitation of the Editor of the _Deutsche Medicinische Wochenschrift_, to report on some of the secret remedies which are thrown on the market in such numbers in Germany as well as England. It would appear that for the most part the remedies advertised in Germany are not the same as those most advertised in this country, but it is proposed in this and subsequent chapters to give some abstracts from the articles in which Dr. Zernik has from time to time reported the results of his examinations.

DR. LAUSER'S COUGH DROPS.

Dr. Zernik found on analysis that these Cough Drops did not contain the ingredients alleged; there was for instance only 3·35 per cent. of alcohol, although the advertiser speaks of tinctures of 50 per cent. In addition to this small proportion of alcohol the mixture appeared to consist of a watery solution of liquorice, an infusion of senna root, some ammoniated solution of aniseed and small quantities of ammonium chloride.

REICHEL'S COUGH DROPS.

Reichel's Cough Drops cost 1 mark for a bottle containing 65 ccm., about 2¼ fluid ounces. The purchaser is supposed to take 15 or 20 drops on sugar or in water four or five times a day. It is an alcoholic fluid, smelling and tasting of arnica, pimpinella, and anise.

TUSSOTHYM.

Tussothym, in spite of the wonderful qualities claimed for it by the firm producing it, proved to be a weak alcoholic distillate of thyme, diluted with water but probably containing another indifferent drug. It is advertised as good for all diseases of the respiratory organs, and especially for whooping cough.

DR. B. ASSMANN'S WHOOPING COUGH REMEDY.

This Whooping Cough Remedy is, according to the vendor, so complicated that it is only made by himself, and cannot be obtained elsewhere. The packet contains forty powders, twenty of which are marked No. 1, and twenty No. 2. The chemical analysis showed that each powder, weighing 2 grams, consisted of milk sugar (lactose). No other constituent was detected.

CHAPTER III.

CONSUMPTION CURES.

Nostrums and quack medicines vary greatly in the extent to which they constitute deliberate fraud. In the case of some of them, it is easy to believe that the makers themselves have a certain faith in their preparations, and recommend them in cases for which they are unsuited with that bona fides which arises from ignorance, assisted, unconsciously perhaps, by an appreciation of the profitable nature of the business. Such preparations frequently contain some one or more of the drugs in common use for the complaints for which the nostrum is offered, and are even, occasionally, combinations compounded in the first place from a medical prescription which may have been found useful in certain appropriate cases. The injury to the public in such instances arises from the excessive nature of the claims made, the excessive price usually charged, and the probability of the advertised medicine being taken in cases for which it is quite unsuitable, when it may do harm positively by its effects or negatively by preventing the sufferer from seeking proper advice.

But with other proprietary medicines it is quite clear that the makers cannot in the slightest degree believe in the claims they make; the "remedy" in these cases is some substance or mixture devoid of medicinal activity, or possessing some slight therapeutic property having no relation to the disease for which the nostrum is put forward as a cure. It is often, indeed, for inert preparations that the most extravagant and emphatic claims are made; the makers, and the advertisement-writers whom they employ, are untrammelled by any necessity of squaring their statements with the real properties of the thing to be recommended, and having set out consciously and deliberately to deceive, they are able to give their whole attention to telling the most effective stories in the most plausible manner, and reaping the maximum of payment for the minimum of expenditure. People who are ill or suffering are to be frightened with impressive pictures of the aggravated suffering and premature death that await them unless they take the "only cure" in question, therefore let them be frightened thoroughly. Careful suggestion will induce people who are not ill to believe that they or some of those dear to them are in the early stages of some disease; therefore let everything possible in the way of striking advertisements, personal letters, and repeated assertions be utilised to produce the result. It is the victim's money that is wanted;

therefore let the price be fixed high, and the advertisements be written up to it. If it should be discovered by correspondence that so much cannot be cajoled or frightened out of an individual sufferer, the price can be reduced gradually as “special concessions,” in return for which testimonials may be extracted.

Of quack medicines the sale of which is conducted more or less on these fines, two examples are described in this chapter, and other examples will be enumerated later.

One of the two now dealt with is “Tuberculozyne,” largely advertised in Great Britain but apparently of American origin; it affords an instructive example of the methods of the Transatlantic nostrum monger. The two liquids sold under this name consist of little more than coloured, flavoured water, but the modest price demanded is £2 10s. for a month’s, supply. No effort is spared to induce the victim to continue the “treatment” month by month, in spite of the evident absence of any benefit, which is unblushingly accounted for by the seriousness of the particular case, while the necessity of getting the system thoroughly permeated with the remedy is insisted on. The sale of another preparation advertised as a cure for consumption, Stevens’ Consumption Cure, is conducted in a very similar way, but this time the herbs are said to be African, and the odd names they bear certainly have a Kaffir flavour. The vendor considerately warns the public against American quacks and impostors and against the preposterous and wicked swindles of Polish or German Jews. Although Stevens is so engagingly candid about his rivals he follows the plan of sending one letter after another to any sufferer whose name he may have obtained, a system which seems to have been invented in America; it is certainly cheaper than bold advertisement in newspapers, and is apparently found even more satisfactory, as it enables the vendor to give individual attention to the depth of his correspondent’s pocket if not to the severity of his disease. But Stevens has somewhat bettered his instruction, and his letters and circulars have a character of their own due to the effrontery of his attitude toward the medical profession. Persons who respond to the advertisement receive a list of questions to be answered by the doctor who has attended them, and are advised to continue under the observation of their medical man in order that the latter may be impressed by the marvellous effects of the remedy. Not long ago a circular letter was sent out to medical practitioners, asking them to treat consumptive cases “which defy all the ordinary remedies” with this secret preparation. The circular continues: “The great drawback to my cure, so far as the medical profession is concerned, has always been the fact that I would not reveal its formula. This is now done away with; its formula is 80 grains of umckaloabo root and 13■ grains of chijitse to every ounce, prepared according to _British Pharmacopœia_ methods.” The farce of revealing a formula by the employment of such fancy names as these is one of the oldest dodges of the quack medicine man, and no such names as “umckaloabo” and “chijitse” appear in any available work of reference on pharmacy. Enquiries made in various parts of South Africa have been negative, experts in native matters being unable to ascertain that the names were known. Further, the Native Affairs Department of Cape Colony has caused enquiries to be made in the Transkeian territories into the question whether the native tribes there resident had any knowledge of “umckaloabo” and “chijitse,” or of their reputed medicinal properties. The result of the inquiry was entirely negative. Nothing was known of any such plants, nor was it even possible to identify their names. Smith’s _South African Materia Medica_ contains no record of any such names as “umckaloabo” and “chijitse.”

A similar system of repeated letters sent in series to the sufferer or his friends appears to be followed by the Weidhaas Hygienic Institute, Ltd., which carries on a home in the south of England but also treats patients by correspondence. The proprietors, who would seem to hail from Germany, issue a pamphlet with the title _Dum spiro spero_, which is made up mainly of the usual testimonials, but contains also a sort of outline of the physiology of various organs, taken from medical works. The pamphlet does not differ from the ordinary productions of advertising quacks; the terms are said to be very moderate, the more so as it is the rule to make one charge only for the whole treatment, the proprietors taking the risk of its being of long duration. It would seem, however, that this arrangement is not always followed, for in a “Diet Table” headed “Direction for Weidhaas Home Treatment” we find the following:

It is absolutely necessary that all patients, while under my treatment, shall take the “Star Tonic” regularly.

On Rising.—Take one cup of “Star Tonic.” (This must be always taken in sips only.)

For Breakfast.—Take the delicately flavoured Nutritive Salts Cocoa, boiled in milk (which, being specially prepared for invalids, on account of the great percentage of nutritive salts which no other cocoa contains, is most suitable in your case....)

Between Breakfast and Lunch take one or two tumblers of milk. If possible this should always be taken in the form of Kefyr, one of the easiest digestible nourishing and strengthening tonics. (Full particulars of this are enclosed herewith.)...

Half an hour before mid-day meal.—(From 1 to 2 o’clock.) Sip one cup of Star Tonic.

For Mid-day Meal.—_Make it a strict rule to take regularly green vegetables of some kind, such as spinach, cabbage, lettuce, etc. A fair amount of these should be taken daily._ To these may be added a few potatoes, very little meat or fish, and now and then, in the place of the latter, some pulses, such as lentils (German are best)....

At Tea Time.—If absolutely necessary, take a cup of weak ordinary tea or health coffee; better still, take a cup of Star Tonic, some _cold_ toast....

For Supper.—(Let this meal be not later than two-and-a-half, or, better still, three hours before going to bed.) Take either Cocoa or Kefyr....

Before going to bed.—Always make a point of taking one glass of Kefyr or cup of Star Tonic.

When in bed always have some cold “Star Tonic” near at hand, and sip some when troubled with cough or acute symptoms.

At the bottom of the diet table is a notice to the following effect:

“The above specially recommended articles can be had from the Sales’ Department of the Weidhaas Hygienic Institute, Ltd.”

In the circular, referred to above as enclosed, Kefyr ferment is offered for sale.

In one case which was enquired into of a young man who had been induced to obtain the treatment, his mother wrote to the institute complaining that the treatment appeared to have done her son more harm than good. The reply, after insisting that the remedy supplied was the very best cure for his complaint, continued: “As to it lowering his vitality, let me say that it is not unusual for patients to feel apparently worse in the beginning, but it only shows that the treatment is disturbing the cause of the trouble. Now, this is just what I want it to do. I want to disturb it and thus drive it out of the system. I hope then you will allow your son to proceed under my directions. Give the treatment a fair trial and it will do all that is claimed for it.” The patient was at the time in an advanced stage of pulmonary phthisis, and died of hæmoptysis, of which he had had two previous attacks, seven weeks after the letter quoted above was written. A month after his death a letter was addressed to him by the director of the institute in the course of which it was stated that: “Many patients do not gain immediate relief, or even partial improvement during the early stages of the treatment, but Perseverance and a faithful adherence to all my instructions will invariably bring about the desired result.”

Among the papers sent to an enquirer was a printed form which seems worthy of reproduction, since it illustrates a method of getting into touch with possible patients, which appears to be followed with variations by other companies that appeal to the sick:

R. B.

HAVE YOU FRIENDS WHO NEED OUR TREATMENT?

If you know of anyone whom you think might derive benefit from the use of our Home Treatment, you will do them and us a great favour by noting hereon their names, addresses, and the trouble you believe them to be afflicted with. Upon receipt of the names we will send them information concerning our method of treatment, _but will not mention your name unless you desire it_.

----------+----------+---------- Name. | Address. | Ailment.
----------+----------+---------- | | | | | | | | | | ----------+----------+---------- Please return to The Weidhaas Hygienic Institute.

Some time ago a firm of pharmaceutical chemists in a provincial town received a postcard from a company which offered 5s. for the name of any patient suffering from diabetes, pointing out that “it is money easily earned.” The pharmaceutical chemists expressed indignation at the attempt to bribe them to commit a breach of confidence, but such a request might not be so regarded by a patient, more especially if the advertiser lays great stress upon his benevolent motives, and his anxiety to benefit as many persons as possible.

But although this letter-writing system with its paraphernalia of biographies of the discoverer, typewritten personal letters, free coupons and guarantee bonds is much in vogue, there are other nostrums advertised in the old-fashioned way and sold at the familiar price of 1s. 1½d. for a small bottle. Among these are some old preparations for coughs, for which more emphatic claims as remedies for consumption have been made of late years. The result of the analysis of two of these will first be given.

CONGREVE’S BALSAMIC ELIXIR.

This preparation, advertised from an address in London, is sold in bottles, price 1s. 1½d., 2s. 9d., 4s. 6d., 11s., and 22s. The 2s. 9d. bottle contained 1■ fluid ounces, the 4s. 6d. bottle contained 4 fluid ounces.

On the outer package was to be read:

Congreve's Balsamic Elixir. Has had a World-wide Reputation for 80 years as the Best Remedy for Consumption, also for Asthma, Chronic Bronchitis, Coughs, Colds, and Whooping cough. Safe and Effective. Free from any poison.

The following extracts are from a circular enclosed with the bottle:

In the most obstinate attacks of Asthma, which have threatened speedy suffocation, when the sufferer, harassed by excessive coughing, has laboured dreadfully for breath, with an acuteness of agony not to be described, this Balsam has restored the patient to health, after the medical practitioner had abandoned the usual means in despair.

In Pulmonary Consumption, the best remedy is this Balsamic Elixir, as most unquestionable Testimonials prove. It has been successfully prescribed in Consumptive cases regarded as hopeless by the first physicians.

Correspondence. Advice by letter from time to time will be given to any patient whilst continuing Mr. Congreve's Treatment, provided that the 22s. or 11s. bottles of Elixir are _obtained direct from_ [the address given by the vendor in his advertisements] during the period of correspondence.

The directions were:

For adults.—Take a teaspoonful, alone or mixed with honey or lump sugar, three or four times a day, as the urgency of the case requires. Children from 8 to 15 years may take two-thirds of a teaspoonful; from 5 to 8 years, half a teaspoonful; from 2 to 5 years, twenty drops; at six months, ten drops; younger infants from four to six drops.

The "elixir" was a bright red liquid; analysis showed it to contain 28·5 per cent. by volume of alcohol, and 2·6 per cent. of total solids; the latter consisted of resinous constituents (about 0·5 per cent.), sugar (about 1 per cent.), a little tannin, colouring matter (apparently cochineal), and extractive. Alkaloid was present only to the extent of a trace, under 0·001 per cent.; the extractive showed no characters by which its source could be determined; the resinous material was of an aromatic nature similar to the resins of benzoin, storax, tolu, or balsam of Peru, and appeared to be derived from a mixture of two or more of these. No other active ingredients were found to be present.

THE BROMPTON CONSUMPTION AND COUGH SPECIFIC.

The "Sole proprietor" gives an address in a part of London remote from Brompton, but it is perhaps hoped that the name may suggest some connection with the well-known Brompton Consumption Hospital. The price charged is 1s. 1½d., 2s. 9d., 4s. 6d., and 11s. per bottle; the 2s. 9d. bottle contained 3■ fluid ounces.

The origin of the preparation is thus described:

This Specific is prepared from the Prescription of an eminent Physician, who practised nearly forty years in Madeira, he was celebrated for his success in the treatment of Consumption and diseases of the Chest. Upon a visit to this country some years since, he gave the Prescription to a late Physician, who tried it upon five hundred out-patients; its effect was wonderful; it acted like magic upon their Coughs, and prevented that great waste of strength and flesh peculiar to this disease. It will save the lives of thousands and prevent Consumption, by administering it upon the first symptoms of Cough, which will be immediately cured by a few doses.

In a circular enclosed with the bottle it was stated:

A Cough is the forerunner of Consumption. In England alone 50,000 people die of it thus constituting one-fourth of the nation's death rate annually. It has destroyed more human beings than War, Pestilence, and Famine combined; it neither spares the old nor young, "and there is no family in which this rapacious destroyer of the human race has not had its victim." It is a well-known fact that people with diseased lungs can live for years, and follow their usual avocations in life, provided they are relieved of the principal feature of the disease—the Cough—which shakes and destroys the very elements of the blood, upon which life is supported. How very valuable and important to all, then, must a medicine be which will arrest and cure so fearful a malady!

The directions were:

Dose.—One teaspoonful three times a day and at bedtime. It may be repeated at night, or at any time when the Cough is troublesome.—Children over five years of age, one-third of a teaspoonful.

The following appeared on the outside wrapper:

In conformity with the Sale of Poisons Act, 1868, this preparation, containing a minute quantity of Laudanum and Chloroform, must be labelled Poison, but its composition remains unaltered.

The preparation was a syrupy liquid of pleasant odour and taste, resembling diluted treacle. Analysis showed it to contain in 100 fluid parts, 61·4 parts of total solids; of this, 35·5 parts were glucose and 9·9 parts cane sugar, and 2·6 parts ash, consisting principally of calcium sulphate. Chloroform, referred to on the wrapper, was not present in sufficient traces to be detected; alkaloid was present to the extent of 0·025 part in 100 fluid parts, of which 0·015 part appeared to consist of the alkaloids of ipecacuanha, and approximately 0·01 part was morphine. The difference between the sugars found and the total solids would be fully accounted for by the non-saccharine portion of treacle; extractive contained in the preparations of ipecacuanha and opium used would also be included in this. Small proportions of other drugs having no well-marked characters might possibly also be present; there was no evidence of any further ingredients, but in the presence of so large a proportion of treacle small quantities of indifferent substances it would not be possible to detect.

About 1 per cent. by volume of alcohol was present; assuming liquid extract of ipecacuanha and tincture of opium to have been the preparations of these drugs used, the formula is approximately:

Liquid extract of ipecacuanha 0·75 part. Tincture of opium 1·3 parts. Treacle 75 parts. Water to 100 fluid parts.

Estimated cost of ingredients for 3■ fluid ounces, ¾d.

STEVENS' CONSUMPTION CURE.

This is advertised as manufactured only by C. H. Stevens. The price is 5s. per bottle, containing 2¼ fluid ounces.

This preparation does not appear now to go under any other name than that of "Stevens' Consumption Cure"; as regards its past history, the following extract from _Truth_ Cautionary List for 1908 is of interest:

Stevens, C. H.—The proprietor of a remedy for consumption which has been put on the market in South Africa and England under the name of Sacco, and later in South Africa as Lungsava, the recipe for which is stated to have been long in use amongst the Kaffirs and Zulus. In connection with the advertising of Sacco in England, an article which appeared in _Truth_ was circulated in a mutilated form, omitting a condemnation of its sale as an absolute remedy for consumption. Stevens has acquired a number of testimonials from medical men, who must now regret their precipitate action. He is now in England on a new campaign.

The claims made for this preparation were put forward in printed circulars, and in letters, apparently printed in imitation of typewriting, sent at intervals to an applicant for particulars of the cure. Extracts from these are here given:

It has been admitted the world over that there is no remedy known to the Medical Fraternity to really cure Consumption, so it is preposterous to claim the ordinary drugs that are known to every Chemist even, to cure this disease, just because they are given a fancy name, and advertised by a Polish or a German Jew; it is not only preposterous but a wicked swindle.

There is no other treatment, drug, or medicine advertised in Great Britain to-day to cure Consumption, the ingredients of which are not known to every doctor and chemist in the world, and if you cannot obtain relief from these under the care of your own Medical Adviser, how can you be cured by using them on the advice of an American Quack.

Your own doctor will bear out what I say. Most of these American Impostors come to England after the U.S.A. Post Office Authorities have refused to convey their letters.

I do not say in my advertisements "Consumption can be cured," "Consumption is curable," or any such evasive remarks, but I say "_I will guarantee to cure you_ if you are consumptive, or _return your money_ in full," and that my terms are "No Cure, No Pay."

The African herbs which my Cure is prepared from have never been used by any white Doctor or Chemist before I introduced same to civilization a few years ago. These herbs are original and have defied our cleverest Analysts to discover the active principals they

contain....

I only returned to England a few weeks ago to prove my Cure to the satisfaction of the British Government, having been absent for many years....

It does not matter whether a Doctor is attending patients or not whilst they are under my treatment, although I always prefer a Doctor to be in attendance to see the cure being effected because I particularly wish to convince the Medical fraternity of the genuineness of my cure.

From the first letter:

Usually two or three weeks' treatment is quite sufficient to make a substantial improvement, and a three months' course, in most cases, is sufficient to effect a cure.

From the second letter:

Let me send you a two weeks' treatment, which is more than sufficient to completely stop the progress of the disease.

From a later letter:

In spite of the mountains of prejudice to be overcome, I intend to prove that at last something has been discovered that will destroy the Tubercle Bacillus without being detrimental in any way to the human system; in fact, besides destroying this germ, it is a strong tonic, and will invigorate a healthy body as well as bring back to its normal condition a Consumptive one....

Now you must know that throughout the world our clever Scientists and most Prominent Specialists on Consumption have for ages past spent their lives trying to find something which will destroy the Tubercle Bacillus without injuring the human system. They have had everything at their command; the most up-to-date Sanatoria, the cleverest Nurses, and the pick of climates, yet they have failed, though every drug and remedy known, including every ingredient contained in any proprietary medicine or cough mixture ever heard of has been exhaustively tested in every shape and form. My treatment differs in this one great respect, that none of the ingredients have ever been used before by any Chemist or Doctor, and are an entirely original discovery....

I will give any Doctor its formula who requests it, and will supply him free of charge with all the treatment he needs for experimental purposes, and you must see that I can gain nothing by doing all this unless my treatment positively cures Consumption, as I claim it to do.

On the back of the printed letter quoted above appeared the following:

GUARANTEE BONDS.

The following are specimens of my guarantee Bonds. No. 1, I give to any sufferer who is considered by his Doctor to have at least six months to live in the ordinary course of matters. Terms of No. 2 Bond have to be mutually arranged. I do not accept any money under this Bond until all the conditions are fulfilled.

NO. 1 GUARANTEE BOND.

To Mr. In consideration of you having paid me £2 12s. 6d. for a three months' course of my treatment for consumption, I hereby guarantee that your health has, at the end of the three months, considerably improved to the satisfaction of yourself and also of your Doctor (who must be a practitioner registered in the British Isles) under a penalty of refunding the whole of the amount paid, viz., £2 12s. 6d. (Signed) C. H. STEVENS.

Broadway, Wimbledon.

NO. 2 GUARANTEE BOND.

I hereby guarantee that it will be impossible to find any trace of the Tubercle Bacillus in your system and that you will be completely cured of Tuberculosis (consumption) to the satisfaction of your own Doctor and the Government Laboratory on or before, _____ 19___.

The only condition being that the sum of £_____, is paid to me when this guarantee is fulfilled. (Signed) C. H. STEVENS.

Broadway, Wimbledon.

These are “specimens” of guarantee Bonds. Another document, however, which appeared to be the guarantee bond actually given, differed in containing a clause by which the patient:

hereby agrees to take same [_i.e._, Stevens’ Consumption Cure] according to the directions sent out with the medicine, for three calendar months from date hereof, and to follow as far as possible the advice given regarding habits of life, diet, etc., and to fill in the form on counterfoil attached, correctly.

The “form on counterfoil attached” contained a number of questions to be answered by the patient, and also a portion “to be filled in by a Medical Practitioner after the above has been filled in by the Patient,” including such questions as:

How long have you attended to this Patient?

Do you consider this a mild, severe, or hopeless case?

Do you consider this Patient has a fair chance of recovery providing Stevens’ Consumption Cure is all it is claimed to be?

and on the back the following appeared:

This Guarantee must not be given by a chemist or any one else until it is signed by a registered Medical Practitioner to the effect that he considers the Patient to have at least six calendar months to live.

Thus the appearance was maintained of guaranteeing benefit or cure, and refunding the money if the undertaking were not fulfilled; but the conditions to be complied with were such that it appears unlikely that Mr. Stevens is ever troubled with applications for return of money under one of his “Bonds.”

A “detailed direction sheet” was supplied, from which the following is taken:

One teaspoonful in a wineglass of water (as hot as can be conveniently taken for preference) one hour before breakfast and two hours after the last meal in the evening, unless the patient be in the habit of waking between 12 midnight and 3 a.m., in which case an extra dose may be taken then. After the first week’s treatment half-an-hour before breakfast is quite sufficient.

It appears that the use of this wonderful substance is not limited to consumption cases.

Stevens’ Consumption Cure is a vegetable germicide, fatal to all disease germ growths, but acts as a strong tonic; is a blood purifier, stomach cleanser, and a nerve stimulator; one will readily understand that it must be all these to cure Consumption and build up a broken-down system entirely by itself. Stevens’ Consumption Cure can safely be advantageously given wherever a germ disease exists or is suspected.

One of the most recent circulars sent out by Mr. Stevens is addressed to medical practitioners, asking them to use his remedy in severe cases of pulmonary tuberculosis which defy all the ordinary remedies, and professing to give the formula of the preparation as follows:

Its formula is 80 grains of Umckaloabo root and 13 and one-third grains of Chijitse to every ounce, prepared according to British Pharmacopœia methods.

The medicine was a clear red liquid, and analysis showed it to contain in 100 fluid parts, 21·3 fluid parts of alcohol, 1·8 parts of glycerine, and 4 parts of solid substance; this solid substance contained about 1 part of a tannin and 0·2 part of ash, the remainder being extractive. No alkaloid was present and no other active substance could be detected. The solid substance agreed in all respects with the solids of decoction of krameria, or a mixture of this decoction with a little tincture of kino. The formula thus appears to be approximately:

Rectified spirit of wine 23·7 parts by measure. Glycerine 1·8 parts. Decoction of krameria (1 in 3) to 100 parts by measure.

or it may be made with tincture of krameria.

Estimated cost of ingredients for 2¼ fluid ounces, 1½d.

TUBERCULOZYNE.

The Derk P. Yonkerman Company, Ltd., an American company with an agency in London, charges £2 10s. 0d. for a month's treatment and supplies two bottles, labelled respectively No. 1 and No. 2 Tuberculozyne, and containing in each between 11 and 12 fluid ounces of liquid.

The advertisement offered a book on "Consumption and how it may be quickly cured," and a trial of the cure itself, to be sent free. Application for the book and sample brought bottles of "No. 1 Tuberculozyne" and "No. 2 Tuberculozyne," holding about ½ ounce each, and a book of 48 pages dealing with the remedy. A few extracts from the book will sufficiently indicate the nature of its contents.

There have been found cures for small-pox, and safe precautions, such as vaccination, prevent the spread of the disease; the horror of yellow fever has been dispelled by a remedy that amounts practically to a cure, and one could always flee to a northern clime and escape it. The dread diphtheria also has yielded up its dark secret, and now is no more a stalking spectre; while yet dangerous it can be handled.

But through all these discoveries, consumption remained as mysterious and deadly as ever. It invaded the homes of the rich and the poor. It hunted out its victims among the inhabitants of the far northland of ice and snow, and it was just as persistent in the temperate zone and at the equator.

Climate, temper, condition of health or purse made no difference. One day the health and strength of the athlete, and the next day the fever of the consumptive; in a short time the frail skeleton would be laid away—another victim. That was the oft-repeated story of the "great white plague."

But this horrible, awful consumption, that has gone stalking through the land, should never again strike the same terror to the souls of brave men and women, and fill our hearts with such a helpless despair—for consumption can now be cured. Tuberculozyne (Yonkerman), the most wonderful and marvellous medical discovery of the age, cures consumption....

After researches lasting for nearly twenty years, the persistent efforts of Dr. Derk P. Yonkerman have been crowned with success, for his Tuberculozyne treatment has already been proved in hundreds of cases to be a specific of almost miraculous curative power. Its healing virtues have been demonstrated in not only the early stages of consumption, but in far advanced and seemingly hopeless cases as well....

Tuberculozyne (Yonkerman) was such a marvellous remedy that when its discoverer first announced he could cure consumption there were few ready to believe. He had, however, discovered certain salts of copper of remarkable therapeutic value, and his production was immediately subjected to the most elaborate and rigid demonstrative tests....

The consumption germs (tubercle bacilli) cannot live in the presence of copper, and as the Tuberculozyne treatment introduces copper into the blood, the consumption germs cannot live....

Intra-Venous Injection, after thorough tests under the most favourable conditions, proved absolutely ineffective. Trachael (_sic_) Injection has also been tried with equally unsatisfactory results. Inoculation with lymph from tuberculous animals not only utterly failed, but frequently hastened the patient's death. Antimony, prussic acid, emetics, blisters, mercury, iron, digitalis, clover, and numerous other drugs, have all proved useless, for they failed to have any action upon the cause of the disease, and only gave the patient temporary relief, if they produced any beneficial effects at all.

In treating consumption in the past, physicians making Tuberculosis a speciality have been accustomed to recommend creosote and its product guaiacol, while later arsenic has found a certain amount of favour. These physicians have undoubtedly been honest and conscientious in prescribing such treatment, for they were upheld by the practice of years, and the indorsement of the greatest specialists in each generation for a hundred years. Yet they were wrong; just as wrong and just as ignorant of the true remedy for consumption as the ancients were of geography before the new world was discovered.

Against the use of creosote or guaiacol, Dr. Yonkerman speaks positively and emphatically, and his opinions have now the support of all present-day physicians making Tuberculosis their special study.

A "Life History of Dr. Derk P. Yonkerman" was also given, from which it appeared that the home of Tuberculozyne is in Michigan, U.S.A.

The book was accompanied by a long letter, and this was followed at intervals by others; these were all printed to appear as typewritten, and dealt chiefly with the terrors of consumption if neglected, the importance of taking Tuberculozyne at once, and, after a supply had been sent, with the necessity of continuing its use even if no apparent benefit results. A few extracts are here given:

You need not be discouraged or believe your case incurable, even if you have tried all the usual remedies and found no relief, for hundreds of our cured patients have had the same experience; after all other remedies had failed to even stop the progress of their disease, they tried Tuberculozyne and were quickly cured.

From the third letter:

We realize that since you were taken ill your expenses must have been burdensome, and if you feel that at the moment the cost of a complete treatment of Tuberculozyne is more than you can readily meet, we will send you the full month's supply upon receipt of but 40s.; the remaining 10s. you may pay at your own convenience when you are fully satisfied that your cure is complete and permanent.

From the fifth:

It is therefore with a genuine desire to help you that we write enclosing a Special Voucher Coupon issued in your name, which will help you materially if the cost of our remarkable specific has been more than you could really meet.... This Special Voucher Coupon which we have issued to you is good for £1 Sterling when sent with your order for Tuberculozyne. You have only to post the coupon together with 30s., and immediately we will forward to you the complete treatment and full instructions for its use.

From later letters:

Even if her improvement is not at once pronounced, do not be discouraged; for in some cases the patients at first even seemed to be losing ground, but they persevered and finally were cured. It would be much better to take the treatment a few weeks too long than to stop too soon....

Just at this time, when the patient has been taking our treatment for some weeks and it is beginning to permeate her system through and through, courage is needed, for great improvement may not yet be apparent though her cure be assured.

Every letter was accompanied with one lithographed copy, or more, of testimonials.

The directions were:

After each meal, put thirty drops of the medicine from each bottle into a tumbler of milk; stir well and drink immediately.

If milk is distasteful, the medicine may be taken in water which has been boiled.

For patients between the ages of seven and fifteen years, give one-half of the above dose; for those under seven years, give five (5) drops only, from each bottle.

No. 1 was a bright red liquid; analysis showed it to contain in 100 fluid parts, 3·4 parts of potassium bromide, 12 parts of glycerine, a trace of a pungent substance, sufficient oil of cinnamon (or oil of cassia) to give a flavour, a very small quantity of alcohol, and cochineal colouring matter darkened with a trace of alkali; no copper was present. The following formula gave an exactly similar liquid:

Potassium bromide 3·4 parts. Glycerine 12·0 " Oil of cassia 0·1 part. Tincture of capsicum 0·17 " Cochineal colouring q.s. Caustic soda 0·06 part. Water to 100 fluid parts.

No. 2 was a brown liquid, one specimen being bright and another containing a little sediment. Analysis showed it to contain in 100 fluid parts, 18 parts of glycerine, sufficient essential oil of almonds to give a flavour, and a colouring matter which appeared to be burnt sugar. No copper was found in the small free sample, but the larger bottle of No. 2 contained 0·01 per cent. of copper, and a trace of sulphate: this quantity of copper is equivalent to ¹/■■ grain of crystallised copper sulphate in each fluid drachm. As regards the other ingredients the following formula gave an exactly similar liquid:

Glycerine 18 parts. Essential oil of almond 0·1 part. Burnt sugar q.s. Water to 100 fluid parts.

The estimated cost of ingredients for No. 1 and No. 2 together is 2½d.

The following notes on some German nostrums for Consumption are derived from Dr. Zernik's articles in the _Deutsche Medicinische Wochenschrift_.

KÖRBER'S CURE FOR CONSUMPTION.

The advertisements of this preparation are described as particularly flagrant. Treatment for a fortnight costs about 12s., and the medicine contains butter fat, honey, catechu and tar-water.

BACILLENTOD.

Bacillentod or "death to bacilli" also described as a "family tea," is advertised as a miraculous preparation which cures all diseases of the respiratory tract. In the prospectus the word "phthisis" is misspelt. One packet costs 1s., and consists of 85 grams of galeopsidis, the dog, flowering, or hemp nettle, a herb which is now quite obsolete but was an ingredient of "Lieber's tea for consumption," which used to have an extended sale.

HONEY COD LIVER OIL.

Pastor Felke's Honey Cod Liver Oil is recommended in preference to the ordinary forms of cod liver oil, on account of its pleasant taste and of the absence of any disturbing effect on the digestion. It is said to contain "fat extracted cod liver oil," whatever that may mean, but proved on examination to be nothing more than a mixture of 0·05 per cent. of cod liver oil with oil of peppermint and raspberry syrup.

CHAPTER IV.

HEADACHE POWDERS.

Headache is so common a disorder that it was to be expected that secret remedies asserted to be certain and safe cures would be extensively advertised, and the sale, especially to women, of headache powders, in most cases as proprietary articles, is at the present day undoubtedly enormous. Persons who may be disposed to resort to their use should, however, bear two facts in mind; the first is that headache is not a disease but a symptom, and that the only rational treatment is to ascertain and remove the cause, whether it be error in diet, want of exercise, local irritation of some nerve as by an unhealthy tooth, eyestrain, or some serious chronic nervous disease. The second is that fatal results have been known to follow self-treatment with antifebrin (acetanilide), which figures largely in most of them.

The powders analysed were in all cases obtained from ordinary dealers in unopened packages; the composition of each is given in such a way as to show the dose of each article in one powder of average weight. Since the separation of the ingredients depends largely on their different solubilities in various liquids, it is not possible to obtain quantitative results having quite the same degree of accuracy as in some other kinds of analytical work; but the results of analysis have been checked by preparing mixtures of the composition calculated and submitting them to the same analytical process; the possible error in the proportions given below does not in any instance exceed a very small fraction.

DAISY POWDERS.

The English Company which sells this remedy charges 7½d. for 10 powders; the average weight of one powder was 6 grains, but the weight of individual powders in a packet was found to vary from 5·7 to 6·4 grains.

The medicament consisted of acetanilide alone. Being an unmixed drug it was not liable to stamp duty, and the package was accordingly unstamped. The dose was stated to be one powder, repeated in two hours if necessary; half a powder for children of 12 years; not adapted for children under 12 years.

Two "certificates" were printed on each wrapper from individuals who are notorious for giving testimonials in the guise of certificates of analysis. The only fact certified was that the powders were "free from any injurious substance," in which medical opinion will scarcely support the writers.

The estimated cost of the drug (60 grains) in a packet is one-eighth of a penny.

The same Company also supplies “Head powders prepared by Daisy, Ltd.,” the wrappers being printed in such a way that careful inspection was required to distinguish these from the powders sold as “Daisy powders.” The “head powders” were found to consist of phenacetin only.

CURIC WAFERS.

These so-called wafers, also put up by an English Company, are recommended as a “safe and certain cure for headache, toothache, and neuralgia”; stated to be prepared “from the Prescription of an Eminent West-End Physician.”

The “wafers” consisted of ordinary cachets, with the name of the article embossed on one face. They contained the medicaments in the form of powder. The package contained 12 wafers for 1s. 1½d. The average weight of the contents of one wafer was 8·2 grains, but that of the contents of individual wafers in a package varied from 7·3 to 9·3 grains. Analysis showed the composition of the powder to be:

Acetanilide 3·28 grains Phenacetin 3·28 ” Caffeine citrate 1·64 ”

Directions for taking the wafers were given, but it was not stated whether the dose is one or more.

The estimated cost of the drugs (98·4 grains) in a packet is nine-tenths of a penny.

STEARNS’S HEADACHE CURE.

This remedy, advertised by an American Company with agents in London, is recommended as “A Speedy, Certain, and Safe Cure for Headaches of all Origins, whether Sick, Bilious, Nervous, or Hysterical.”

Like the foregoing it was put up in cachets described as wafers. The package contained 12 wafers for 1s. The average weight of the powder contained in one wafer was 9·8 grains; but the weight of individual wafers in a package varied from 9·3 to 10·2 grains.

Analysis showed the composition of the powder to be:

Acetanilide 3·92 grains. Caffeine 0·98 grain. Sugar of milk 4·90 grains.

The dose was one wafer. “If relief is not obtained, repeat in an hour, but more than two wafers should not be taken.”

The estimated cost of the drugs (118 grains) in a packet is a little under ½d.

BELL’S FAIRY CURE.

This Fairy Cure, which is put up by an English Company, is stated to give relief instantly in all cases of neuralgia, headache, etc. A handbill enclosed in the package made further claims, from which the following extracts are taken, “guaranteed to be an instant and absolute cure” for “neuralgia, headache, brain fag, nerve pains.” “Nothing else is like it. Nothing else is so good. Don’t compare it with ordinary ‘cures’ or ‘powders.’ Fairy Cure stands absolutely alone.”

Ten powders were sold for 7d. The average weight of a powder was 2·7 grains, but individual powders in a package varied from 2·0 to 3·7 grains.

Analysis showed the composition of the powder to be:

Acetanilide 1·16 grains. Phenacetin 1·16 ” Caffeine 0·38 grain.

The directions were to take one powder, “repeat in an hour if necessary, then every two or three hours until a cure is effected.” Yet it is guaranteed to be an instant cure! There was a notice that it was not to be given to children below 12 years of age.

In this case also an “analyst’s report” was given on the wrapper; it stated that the powder “is composed of several organo-therapeutic agents well-known in medicine”; probably the “analyst” did not mean quite what he said in the following: “In my opinion, the preparation is well calculated to fulfil the purpose for which it is intended, namely—neurotic affections.”

The estimated cost of the drugs (27 grains) in a package is ¼d.

KAPUTINE.

This preparation, put up by an English Company, is stated to cure in ten minutes headache, neuralgia, and all nerve pains. In view of the similarity in composition of these articles, the claims to uniqueness are amusing. In this case the wrapper bore the words “Nothing as good. Nothing similar,” while on the circular enclosed in the package it was stated that “Kaputine is composed of several approved ingredients. That is, unlike the white headache powders, which consist solely of one crude drug, and which have frequently been condemned as dangerous by the Medical Press—Kaputine is most carefully prepared from several ingredients which have the absolute confidence of the Medical Profession.”

The price of 18 powders is 1s. 1½d. The average weight of one powder was 6·6 grains; the weight of individual powders in a package varied from 5·7 to 7·5 grains.

Analysis showed the composition of the powder to be:

Acetanilide 6·30 grains. Ferric oxide 0·05 ” Sugar 0·21 ”

That is, the acetanilide was tinted pink with what is practically the saccharated carbonate of iron of the _British Pharmacopœia_.

The dose was given as one powder: “If not completely cured in two hours, the dose may be repeated. Half a powder for children under 12.”

The estimated cost of the drugs (119 grains) in a packet is just over ¼d.

HOFFMAN’S HARMLESS HEADACHE POWDERS.

These powders are prepared by a New York Drug Company, but the package also bears the name of another company, presumably the English agents. The powders are described as “a simple and effective cure for all headaches.”

Ten powders were sold for 1s. 1½d. The average weight of one powder was 10·5 grains; nine out of ten weighed from 9·3 to 10·5 grains, the tenth weighing 15·3 grains.

Analysis showed the composition of the powder to be:

Acetanilide 5·02 grains. Cocoa 4·02 ” Sodium bicarbonate 1·01 ”

The dose was given as one powder, to be repeated in half an hour if not relieved.

Estimated cost of drugs (105 grains), one-third of a penny.

WHOLESALE AND RETAIL SPECIALITIES.

In addition to the above proprietary articles, large numbers of headache powders are supplied singly by retailers, and are commonly bought for this purpose ready packed from a wholesale house. It was, therefore, thought worth while to examine a sample of such powders; the one taken for the purpose is known as the “Good as Gold” headache powder; three dozen were attached to a card for exhibition, and the powders are retailed at 1d. each. The average weight was found to be 2·8 grains, six individual powders ranging from 2·7 to 2·9 grains. The powders consisted of acetanilide only.

The estimated cost of the drug for three dozen powders is ¼d.

There is reason to believe that practically all the others sold in this way are of the same composition.

CHAPTER V.

BLOOD PURIFIERS.

Although, as a rule, the makers of any kind of quack medicine find no difficulty in showing that almost any disease that can be named takes its rise in the organs or part of the system which their own particular nostrum professes to benefit, it is, of course, particularly easy to connect a great variety of diseases with the condition of the blood. The claims made for some of the following “blood purifiers” do not fail in comprehensiveness, for ringworm and itch, among other complaints, appear to be regarded as disorders of the blood.

CLARKE’S WORLD-FAMED BLOOD MIXTURE.

This is advertised and sold by an English Drug Company, price 2s. 9d. a bottle, containing 8¼ fluid ounces.

The following passages are quoted from a pamphlet enclosed with the bottle:

No matter what the symptoms may be, the real cause of a large proportion of all diseases is bad blood. Clarke's World-famed Blood Mixture is not recommended to cure every disease; on the contrary, there are many that it will not cure; but it is a guaranteed cure for all blood diseases.... It never fails to cure Scrofula, Scurvy, Scrofulous Sores, Glandular Swellings and Sores, Cancerous Ulcers, Bad Legs, Secondary Symptoms, Syphilis, Piles, Rheumatism, Gout, Dropsy, Blackheads or Pimples on the Face, Sore Eyes, Eruptions of the Skin and Blood, and Skin Diseases of every description.

On the label it was stated:

The Mixture is pleasant to the taste, and warranted free from anything injurious to the most delicate constitution of either sex, which all Pills and most Medicines sold for the above diseases contain.

Directions: The mixture must be taken about half-an-hour after meals, in the following doses:—

For Adult Males.—One tablespoonful four times a day. " _Adult Females._—One tablespoonful three times a day. " _Children under 12 years of age._—Two teaspoonfuls three times a day. " _Under 12 years._—From half to one teaspoonful, according to age, mixed with a little water and sugar.

Analysis showed the mixture to contain 1·5 per cent. of potassium iodide, 1·2 per cent. of sugar (partly inverted), 1·6 per cent. by volume of alcohol, and traces of chloroform and ammonia, a brown colour being given by a small quantity of what was evidently burnt sugar. The composition of 8 ounces is thus:

Potassium iodide 52·5 grains. Spirit of sal volatile 10 minims. Spirit of chloroform 67 " Simple syrup 50 " Burnt sugar q.s. Water to 8 fluid ounces.

The estimated cost of the ingredients is 1■d.

OLD DR. JACOB TOWNSEND'S AMERICAN SARSAPARILLA.

This is sold by a Company having offices in London. A bottle, holding a little under 9 fluid ounces, costs 2s. 6d.

On the wrapper it was stated:

This Sarsaparilla is the great purifier of the blood and general juices of the system, it effects the most salutary changes in disease; cures scrofula, salt rheum, all scorbutic disorders, chronic sore eyes, rheumatism, piles, liver complaints, erysipelas, all blotches and eruptions of the skin; in short, it removes every impurity of the blood, and all humours and morbid collections of the body.

The directions given on the label were:

Take half a wineglassful three or four times a day, an hour before or after meals. Persons very weak and debilitated may begin with a tablespoonful and increase the dose as the patient recovers health and strength. It is better to take it without the addition of water.

Analysis showed 100 fluid parts of the liquid to contain 18·2 parts of solids, of which 5·5 parts were sugar (partly inverted) and 2·5 ash, the remainder being of the nature of a vegetable extract. The mineral constituents were only those common to the ash of most drugs, and no metallic salts were found in medicinal doses; nothing of alkaloidal nature was present. The mixture contained 8·1 per cent. by volume of alcohol. In the case of a vegetable preparation of this kind, containing no definite active principle that can be identified chemically, it is not possible to state with certainty the various drugs from which it may have been prepared; a study of its general properties, and a series of careful comparisons, pointed to the present mixture being of similar nature to the compound concentrated solution of sarsaparilla (liquor sarsae compositus concentratus) of the _British Pharmacopœia_, with the omission of the liquorice, and with the addition of sugar: the drugs in the official preparation (besides liquorice) are sarsaparilla, sassafras, guaiacum wood, and mezereon. A liquor prepared in this manner, with the alcohol reduced to the amount found in the mixture under examination and the aroma slightly increased by adding a little additional oil of sassafras, agreed fairly well both in general properties and the results of chemical examination with the medicine under consideration.

MUNYON'S BLOOD CURE.

Munyon's Homœopathic Home Remedy Company has an office in London, but the label on the bottle bears the words "Manufactured in U.S. of America." On the outer package it was stated:

It eradicates all Impurities from the Blood, and cures Scrofulitic Eruptions, Rash on the Scalp, Scald Head, Itching and Burning, and any form of Unhealthy, Blotchy, Pimply, or Scaly Skin;

and similar claims were put forward on the label and in a circular enclosed with the bottle.

The bottle cost 1s. and contained about 200 pellets or pilules, of the average weight of ½ grain. They consisted of sugar; careful search was made for small quantities of medicament, but no other ingredient could be detected. Quantitative determination of the sugar showed just 100 per cent.

The estimated cost of the pilules is one-thirtieth of a penny.

HARVEY'S BLOOD PILLS.

These pills are sold by a Company giving an address in Wales. A bottle, containing 20 pills, costs 1s. 1½d.

The label and the enclosed circular bear the picture of a man's head, with the words, "Harvey. Discoverer of the circulation of the blood," with the possible implication that the Harvey who discovered the circulation of the blood also discovered or invented these blood pills.

The modest claims made in the circular included the following:

Harvey's Blood Pills for Skin Diseases. An Unfailing Remedy for Scurvy Sores! Harvey's Blood Pills for Scrofulous Sores. A Certain Remedy for Ulcerated Legs! Harvey's Blood Pills for Sluggish Liver. The Surest Remedy for Ringworm! Harvey's Blood Pills for Erysipelas. The Quickest Remedy for Itch! Harvey's Blood Pills for Boils. An Effective Remedy for Eruptions! Harvey's Blood Pills for Rheumatism. The Safest Remedy for Piles!

Harvey's Blood Pills are purely Vegetable, and contain the best properties of Sarsaparilla, Dandelion, Burdock, and Quinine. They are Warranted Free from Mercury.

Harvey's Blood Pills fortify the feeble, restore the invalid to health, and do good in all cases. All sufferers should immediately have recourse to these celebrated Pills.

Harvey's Blood Pills are "specially" suitable for Females. They remove all impurities.

Somewhat lengthy directions were given for diet, etc., as well as for taking the pills, in various cases; from which it appeared that the usual dose is:

For a male adult, one Pill three times a day; a female adult, one Pill twice a day; children one Pill at bedtime.

The pills were coated with French chalk, coloured red externally; when deprived of their coating, the average weight was 2·76 grains. Analysis showed them to contain quinine equivalent to 17·3 per cent. of the crystalline sulphate, 21·7 per cent. of potassium iodide, small proportions of powdered rhubarb and liquorice, and vegetable extract or extracts. A mass prepared from the following formula agreed closely with the pills in general properties and in results on analysis in various ways:

Quinine sulphate 17 grains. Potassium iodide 22 " Powdered rhubarb 16 " " liquorice 8 " Extract of sarsaparilla 12 " " burdock 12 " " taraxacum 12 " Divided into 36 pills.

The estimated cost of the ingredients for 20 pills is ¾d.

PROFESSOR O. PHELPS BROWN'S BLOOD PURIFIER.

Professor O. Phelps Brown advertises in this country from an address in London; the bottle sold for 2s. 9d. contained 6 fluid ounces.

The following paragraph appeared on the label:

This medicine is a concentrated preparation of Rock Rose and Stillingia, combined with other plants, well-known for their specified action on the blood, which makes a compound medicine, that has never been equalled, and will be hard to surpass in the scientific future. It is impossible to give a full account of its virtues and cleansing capacities on this label, and the Prof. must, therefore, be content with briefly stating that it is an infallible remedy for All Diseases of the Blood, be they Constitutional, Hereditary, or of Recent Contraction. Nearly every ailment known to the medical faculty is in a greater or lessor degree dependent for its appearance and its virulence upon a _Disease of the Blood_. Ulcers, Tumours, Scrofula Bunches, Fistula, Piles, Painful Eruptions, indeed all afflictions manifested upon the outer surface of the body are the consequences of diseased blood. Many terrible maladies, which take the shape of Internal Inflammation, Sores, etc., and appear in the form of Fevers, Aches, Swellings, Glandular Disturbances, Mental Derangement, and General Debility, also proceed from the same cause. It is an admitted fact that, with Pure Blood and Regular Bowels, no individual ever can be permanently, seriously, or dangerously ill, if ill at all.

Dose.—For Adults, one tablespoonful three times a day before eating. For Children, the dose must be reduced to a teaspoonful.

Analysis showed 100 fluid parts of the liquid to contain 19·7 parts of solids, of which 15·5 parts were sugar (partly inverted); a good deal of mucilage was present, but no alkaloid and no mineral substance except the small quantity of ash always present in vegetable extracts; alcohol was present to the extent of 23 per cent. by volume. Evidence was obtained of the _probable_ presence of a preparation of stillingia, but this drug does not contain any active principle by which it can be certainly identified. Rock rose (_Cistus canadensis_) has been used to some slight extent medicinally, but no particular virtues appear to have been assigned to it; it is, however, described as bitter and astringent. The 3 or 4 per cent. of extractive matter present in the mixture under consideration showed neither bitterness nor astringency, nor any property by which it could be identified, or which would indicate any medicinal properties.

HOOD’S COMPOUND EXTRACT OF SARSAPARILLA.

This is an American preparation, but the Company which makes it has offices in London. A bottle, costing 1s. 1½d., contains 2¼ fluid ounces.

The following paragraph appeared on the covering of the bottle:

A trial bottle will convince the most skeptical of the real merit of Hood’s Sarsaparilla, and will enable everybody to test its wonderful power in restoring and invigorating the whole system, in renovating and enriching the blood, in giving an appetite and a tone to the stomach, in eradicating and curing Scrofula, Scrofulous Humors, Scald Head, Syphilitic Affections, Cancerous Humors, Ringworms, Salt Rheum, Boils, Pimples and Humors on the Face, Catarrh, Headache, Dizziness, Faintness at the Stomach, Constipation, Pains in the Back, Female Weakness, General Debility, Costiveness, Biliousness, and all diseases arising from an impure state or low condition of the blood. Hood’s Sarsaparilla is designed to act upon the blood, and through that upon all the organs and tissues of the body. It has a specific action also upon the _secretions_ and _excretions_, and assists nature to expel from the system all humors, _impure particles and effete matter_ through the lungs, the liver, the kidneys, and the skin. It effectually aids _weak, impaired, and debilitated organs_, invigorates the _nervous system_, tones and strengthens the _digestive organs_, and imparts new life and energy to all the functions of the body. The peculiar point of this medicine is that it strengthens and builds up the system while it eradicates disease.

In a pamphlet enclosed with the bottle it was stated:

It is carefully prepared from Sarsaparilla, Dandelion, Mandrake, Dock, Pipsissewa, Juniper Berries, and other valuable vegetable remedies, in such a peculiar manner as to retain the full curative value of each ingredient used.

The dose was given as:

Adult, ½ to 2 teaspoonfuls; usual dose 1 teaspoonful three times a day; children, less, according to age.

Analysis showed it to contain, in 100 parts by measure, potassium iodide 1·7 parts (7½ grains in 1 fluid ounce), and sugars (partly inverted) 9·1 parts; the total solids amounted to 12·8 parts, thus leaving 2·0 parts of vegetable extract per 100 fluid parts. The concentrated compound solution of sarsaparilla in the _British Pharmacopœia_ contains about 21 parts of solids in 100 fluid parts, so that it may be concluded that the amounts of extracts of “Sarsaparilla, Dandelion, Mandrake, Dock, Pipsissewa, Juniper Berries, and other valuable vegetable remedies” in this mixture were not large. The liquid had a somewhat aromatic odour and taste, in which oil of juniper could not be detected, nor was it recognizable on distillation; none of the other ingredients mentioned is capable

of being identified in such a mixture. No alkaloid was present, and careful search for other likely ingredients gave only negative results. The mixture contained 19·6 per cent. by volume of alcohol.

HUGHES'S BLOOD PILLS.

These pills, made in Wales, are sold in boxes, price 1s. 1½d., containing 30 pills.

They were described on the label as "For all Blood, Skin, and Nerve Diseases." In a circular enclosed with the box there was a dissertation on the functions and composition of the blood, from which the following extracts, with all their capital letters, are taken:

The Blood being therefore the Life of the living Body, it stands to reason that if it is poisoned, you poison the whole system, and eventually destroy the life of the man. When the blood is chilled, or distempered through breathing impure air, unhealthy food, etc., it at once gets disturbed, and breeds disease in some form or other. This is the cause of Blast, Scurvy, Piles, Boils, King's Evil, Swollen Glands, Inflammation of the Eyes and Lids, Pains in the Sides, Back, and Kidneys, Cough, Bronchitis, Pleurisy, Rheumatism, Wounds in the Legs and Different Parts of the Body, all Scorbutic Affections, Cancer, Pimples on the Face, Neck, etc., and all Skin Eruptions, Chilliness, Headache, Indigestion, Fullness after Meals, Dyspepsia, Vomiting, Loss of Appetite, Consumption, Toothache, Neuralgia, Fits, St. Vitus's Dance, all Liver Complaints, Costiveness, Yellow Jaundice, Depression of Spirits, Stitches in the Sides, Fevers, Epidemics, Plagues, Gout, Nerve Diseases, Lumbago, Erysipelas, all kinds of Inflammation, and most Chest Diseases.

The noted Pills, "Hughes's Blood Pills," act directly upon the Blood and Juices of all parts of the system, which they Strengthen and Purify. By so doing the Liver, Kidneys, Heart, Lungs, Stomach, Bowels, Brain and Nerves are renewed and toned to such a degree that their functions are perfectly performed, securing to the man healthy days.

Very lengthy directions were given for taking the pills for a variety of complaints, from which it appeared that the usual dose was one or two pills at night, or one three times a day.

The pills had a thin loose coating of French chalk; after removing this the average weight was 2 grains. Analysis showed the presence of no inorganic salts, except the usual small quantities of phosphate, sulphate, etc., found in the ash of most vegetable drugs. The pill contained a trace of oil of cloves and consisted of powdered drugs to the extent of about half its weight; ginger and cinchona were identified in this portion; a trace of alkaloid was extracted, showing the properties of the alkaloids of cinchona. A portion of the tissue, which appeared to be derived chiefly from a seed, could not be recognized, and a lengthy series of comparisons failed to identify it. The remainder of the pill was separated into two substances, which appeared to be aloes and jalap resin, but in each a mixture as this pill presented, the identity of these substances cannot be established with complete certainty. The proportions of the ingredients, also, can only be ascertained approximately; the following formula was indicated:

Aloes 0·7 grain. Jalap resin 0·2 " Powdered cinchona bark 0·3 " " ginger 0·2 " Oil of cloves Trace. In one pill.

CHAPTER VI.

REMEDIES FOR GOUT, RHEUMATISM, AND NEURALGIA.

The medicines here described vary considerably in their nature, and to some extent in the complaints for which they are recommended, but no definite line can be drawn between them. Some are primarily for gout, but are recommended also for rheumatism; others are mainly for rheumatism, but are also recommended for gout and neuralgia; while others, again, are chiefly advertised for neuralgia and headache.

BLAIR'S GOUT AND RHEUMATIC PILLS.

These pills, which are a British product, are sold in boxes, price 1s. 1½d., and containing 14 pills.

They were described in a circular accompanying the box as:

The great and universal remedy for the immediate relief and cure of Acute and Chronic Gout, Rheumatism, Suppressed Gout, Rheumatic Gout, Gouty Skin Diseases, Bronchitis and Asthma, Sciatica, Lumbago, and Neuralgia, and as a preventive or prophylactic where the disease has a tendency to recur, or attacking any vital part, as the Stomach, Brain, or Heart.

Other extracts from this circular are:

In all cases of Gout, no matter of what length of standing, they not only give relief from the almost intolerable pain, but where the patient has kept his bed for months, _One Box will frequently carry off the attack_ in two or three days—in many cases of extreme torture relief has been obtained in two or three hours ... in those gouty skin affections, Psoriasis and Eczema, these Pills have no equal.

Blair's Gout and Rheumatic Pills are not only efficacious in curing Gout, but in all those diseases allied to it.

They never fail. They always cure.

Directions and Doses.

For Gout and Rheumatic Gout.—Take two Pills three times a day, just after meals, and when it is very severe, take two during the night, and they should be persisted in until the swelling and stiffness have disappeared.

In cases of long standing, where the tendency of the disease is to recur, it is advisable to take a short course of the Pills as a preventive. Dose.—Two twice a day for a fortnight.

For Suppressed Gout, including Gouty Asthma, Bronchitis, Dyspepsia Rheumatism, Rheumatic Headaches, Lumbago, Sciatica, Tic Doloreux, Pains in the Head, Face, etc., they must also be taken, two Pills three times a day, just after meals, that quantity being generally sufficient, but in some cases a longer continuance of them is necessary, particularly in Rheumatism of long standing, but that will also be eradicated by perseverance in the use of these Pills. _They should be taken from time to time also as a preventive._

Spring and Autumn. In these treacherous Gout and Rheumatic Seasons, to prevent a recurrence, sufferers are earnestly advised to take a short alterative course of this famous medicine.

It is requested, in case this medicine should considerably open the bowels, that it may be laid aside until that effect has ceased, when it may be resumed, beginning with a smaller dose. Patients are also informed that it is unnecessary for any aperient medicine to be taken during its use, unless they have been costive for some days.

The pills had an average weight of 2·9 grains. Analysis showed them to contain powdered colchicum corm, exsiccated alum, and an excipient. The quantities found indicated the following formula:

Powdered colchicum corm 2·1 grains. Burnt alum 0·35 grain.

in one pill.

The estimated cost of the ingredients for 14 pills is one-seventh of a penny.

HAMM'S RHEUMATIC, GOUT, AND SCIATICA CURE.

The Originator and Proprietor of this cure, who hails from the north of England, charges 2s. 9d. for a bottle containing 8 fluid ounces. It was described on the outside package as "The Greatest Remedy in the World. It has no equal for the cure of Rheumatism, Gout, and Sciatica." In a circular enclosed with the bottle it was stated that:

It never fails to Cure those distressing and torturing Complaints, and in most cases has given relief from the excruciating pains by taking a few doses. This Standard Remedy has time and again succeeded after all other internal remedies have failed. Purify the Blood by driving the Uric Acid from the system and you will remove the cause of all Rheumatism, etc. Hamm's Famous Rheumatism Cure has Never Failed to do it.

The dose was given on the label as "One Tablespoonful three times a day, after meals."

The preparation was a brown, slightly turbid liquid. Analysis showed it to contain potassium iodide, sodium salicylate, a little vegetable extractive, and a trace of alcohol. The extractive was moderately bitter, but possessed no characters indicating the drug from which it was derived; it contained no alkaloid. Quantitative determination of the ingredients showed the formula to be:

Potassium iodide 15 grains. Sodium salicylate 66 " Extractive 28 " Alcohol Trace. Water to 8 fluid ounces.

Assuming the extractive to be of the same price as extract of gentian, the estimated cost of the ingredients of 8 fluid ounces is ½d.

GLORIA TREATMENT FOR RHEUMATISM.

This “treatment” is advertised as follows:

Cure yourself of Rheumatism. I will tell you how and send you the remedy Free. My combination treatment cures, not merely relieves but actually cures, cases of Rheumatism, Gout, and Sciatica.... The numerous so-called remedies offered to the public, through the medium of the newspapers, have absolutely killed all confidence; therefore, in order to make my genuine remedy more generally known, I have decided to give away a large quantity so that everybody can test for themselves the truth of my statements. My combination treatment consists of: 1. Gloria Balm, which Instantly Relieves Pain. 2. Gloria Pills which Purify the Blood and Invigorate the Whole System. 3. Gloria Tonic Tablets which Effect a Complete and Permanent Cure.... I earnestly ask every Rheumatic Sufferer to obtain a free supply of this medicine at once. Simply send a postcard request, and a supply will reach you in less than 24 hours.

Application to the address given brought sample boxes of the pills and tablets only, accompanied by a booklet entitled “Rheumatism and Gout, Causes and Cure,” and a letter of the usual type, as indicated by the following extracts:

I was very pleased to receive your communication this morning, as having suffered from the terrible disease with which you are afflicted myself it naturally affords me a great deal of gratification to be able to place in the hands of every sufferer a genuine remedy for it—a remedy which cured me and has cured many thousands of others besides....

It is, as I have often heard it described by persons bubbling over with gratitude for their relief from the above distressing ailments, Nature’s very own cure for Rheumatism and Gout. The danger of allowing the poisonous acids which cause these diseases to continue their work day by day in the body cannot be exaggerated....

Before closing this letter I once more beg to impress upon you the danger of delay in commencing the treatment, especially as applied to your particular case.

Since “Gloria Balsam” was apparently not thought sufficiently important for a sample to be sent, supplies were obtained of the tablets and pills only for examination.

Gloria Tonic, price 4s. 6d. a box, containing 50 tablets, was described on the box as “a scientific preparation for the cure of all uric acid ailments, including Rheumatism and Gout, Lumbago, Sciatica, Scrofula, and all other diseases resulting from Impurities of the Blood.” This rather wide claim was somewhat at variance with statements made in the booklet, from which a few extracts may be given:

It was with the object of curing all rheumatism that I introduced “Gloria Tonic” to the public, and I believe that it is a task worthy of the cause. I do not propose to make the attempt with a remedy similar to the many thousands of cure-alls with which the market is overloaded, but with a true and reliable rheumatism specific—“Gloria Tonic.”

I am not offering you a remedy of that kind, but one which is solely compounded for the cure of rheumatism, one that has been tested in Hospitals and Sanatoriums, one that has the endorsement of physicians and University professors, and, above all, one which has already enabled many hundreds of persons to abandon crutch and cane. Do not wonder if this can be true. The foregoing statement is an absolute fact....

I could easily get many times 4s. 6d. for a box of “Gloria Tonic,” but it is my purpose not so much to accumulate wealth as to benefit suffering mankind....

“Gloria Tonic” is to-day the only remedy on the market that cures all forms of rheumatism effectively, and without destroying the delicate tissues of the Heart, Stomach, Liver, and Kidneys....

The merit of this remedy is unapproachable. I have no object in telling you this aside from having your interests at heart, and wish to protect you against the many harmful drugs. You need not have any fear in taking “Gloria Tonic” as directed, while the smallest dose of other rheumatic remedies might harm you.

The directions were:

For adults: From one-half to one tablet is a dose, and four doses should be taken daily as follows: Half to one tablet before the morning, noon, and evening meal, and on retiring.... Dose for children from 10 to 15 years, one half-tablet. From 5 to 10 years, one-quarter of a tablet. Below these years, the medicine should not be given.

The average weight of the tablets was 11·2 grains; among 12 weighed separately the weights varied from 10·5 to 12·5 grains. Analysis showed the presence of potassium iodide, guaiacum resin, extract of liquorice, powdered liquorice, starch, mineral matter—apparently a mixture of talc and kaolin—a resinoid substance, and a trace of alkaloid. The alkaloid amounted to 0·016 per cent.; it did not agree in properties with any of the common alkaloids, but agreed, so far as it was practicable to examine it, with the alkaloid of phytolacca (the American weed, poke-root, or pokeberry); the resinoid also agreed in its properties with the resinoid phytolaccin, but there are no distinctive tests by which its identity could be certainly established. The quantities of the various ingredients were estimated as accurately as possible, and the following formula was indicated:

Potassium iodide 1·8 grains. Guaiacum resin 0·8 grain. Extract of liquorice 1·0 ” Resinoid (phytolaccin?) 0·9 ” Powdered liquorice 1·7 grains. Rice starch 2·0 ” Talc and kaolin 2·1 ” In one tablet.

In the formula the most expensive ingredient is the phytolaccin, which is also the least certain, both as to identity and quantity. Taking the formula here given, the estimated cost of the ingredients for 50 tablets is 8d.

Gloria Pills, price 1s. 1½d. per box, containing 40 pills, in addition to being supplied as part of the “treatment” for rheumatism, were recommended as a general laxative. It was stated in the circular enclosed with them that “Gloria Laxative Pills will cure Constipation, Torpid Liver, Piles, Headache, Dizziness, Sour Eructation, Heartburn, Bloating, Flatulence, Nausea, Sleeplessness, Mental Depression, Palpitation of the Heart, Nervousness, Kidney Trouble, and all other conditions resulting from Dyspepsia and Indigestion.”

The pills were coated with talc, coloured to a chocolate colour with oxide of iron. After removal of the coating, the average weight was 1·1 grains. Analysis showed the constituents to be chiefly extracts and resins. The two samples of pills examined—namely, the gratis sample of eight pills first supplied, and the full box afterwards obtained—differed materially in composition; the former contained about 25 per cent. of powdered liquorice, 6 or 8 per cent. of powdered rhubarb, and 6 or 8 per cent. of wheat flour, while the latter contained neither liquorice nor rhubarb, and proportionately more of the soluble constituents, which appeared to consist in both cases of extracts of aloes and cascara sagrada with jalap resin. The various constituents were estimated quantitatively, but in such a mixture exact results are of course unattainable, and even the qualitative results must be given with a certain reservation. The formula indicated for the pills in the 1s. 1½d. box was:

Extract of cascara sagrada 0·3 grain. ” Socotrine aloes 0·5 ” Jalap resin 0·07 ” Flour } q.s. Excipient }

in one pill.

Estimated cost of ingredients for 40 pills, ½d.

BARING GOULD’S ANTI-RHEUMATIC PEARLS.

This article is introduced to the public by an advertisement headed:

“Rheumatism speedily cured.” The advertisement states that Mr. Baring Gould, of an address at a provincial watering place, “very strongly recommends Marvellous Cheap Remedy for Chronic Rheumatism, Gout, etc. Free Information for addressed envelope.”

Application for information with regard to the remedy brought a box of the “Pearls” with an intimation that the price was 5s., or 3s. 9d. for prompt cash. In the enclosed circulars the proprietor was described as “W. Baring Gould, Rheumatic Specialist and Scientist in Chemistry,” and the “Pearls” were referred to in the following terms:

Baring Gould’s Anti-Rheumatic “Pearls” (Patent and Trade Mark Registered). The Most Wonderful and Most Effectual “Anti-Rheumatic” Ever Known....

Mr. Baring Gould desires to say that from a recent careful examination of his records, he finds that he relieves or cures (mostly by his wonderful “Pearls”) at least eighty people in every hundred who come under his care.

There is nothing to approach the “Pearls” in Curative value for all kinds of Rheumatism, Sciatica, and Gout. They are entirely free from every kind of injurious substance, and may be taken with absolute safety and benefit by the most delicate bedridden sufferers.

DOSE.—Take 2 Pearls twice a day. Being flexible and tasteless they are easily swallowed, or the gelatine casing may be removed and the contents placed in half a wineglass of water (hot or cold) and taken in that way. The flavour of the medicaments is agreeable to the palate and to the stomach also.

The “Pearls” consisted of gelatine capsules, of the flattened form known commercially as “perles,” containing a white powder. The average weight of the contents was 5·9 grains, the contents of single capsules varying from 5·0 to 6·5 grains. It should be said that aspirin, a drug in very common use for rheumatism, is acetyl-salicylic acid. Analysis showed the powder to consist of:

Acetyl-salicylic acid 85 per cent. Sugar of milk 15 ”

The estimated cost of ingredients for 40 capsules is 1½d.

GOWER’S GREEN PILLS.

These pills, which cost 1s. 1½d. per box, containing 44 pills, were described in the advertisement as:

A real remedy for rheumatism, backache, muscular rheumatism, sciatica, gout, lumbago, cramps, stiffness of joints, kidney disorders, dropsical swellings, etc. These Pills act directly on the organic and muscular parts of the body, and bring instant relief to tired, aching, and painful muscles and joints.

In the circular enclosed with the pills it was stated that:

The ingredients ... are known only to the proprietors. They are not to be found either in the _British Pharmacopœia_ or in any surgery in the land. It was not your doctor’s fault that he did not cure you, it was his misfortune—he did not know how. He had not these remedies in his possession. We offer you the opportunity of using them and recovering your health.

Gower’s Green Pills, though an eminently scientific pill, do not act like magic. The days of miracles have gone by. They act surely, but sometimes slowly in cases of Rheumatism of long standing.

In taking these pills we would like it to be thoroughly known that if your disease is one of long standing you cannot be completely cured with one or two boxes. A rheumatic sufferer who has tried most remedies and has been tortured with pain for five years cannot expect to be a new man in five weeks. If it takes as many as a dozen 2s. 9d. boxes to cure a case like this, the sufferer cannot but consider it the best investment that he ever made in his life.

The directions were:

One dose to be taken three times a day, before or after meals. Three Pills are one dose.

The pills were coated with talc, with a small quantity of a green colouring matter. After removal of the coating the pills had an average weight of 1·2 grains. Analysis showed them to contain soap (about 36 per cent.), an alkaline salicylate (about 37 per cent.), extractive, and vegetable tissue. No alkaloid was present; the extractive was dark in colour, without bitterness or other characteristic taste, and showed no properties by which its source could be identified; microscopic examination of the tissue showed the presence of two powders, one of which agreed well in its characters with powdered cimicifuga root, while the other bore much resemblance to jalap, but not enough to warrant the statement that it was jalap. The total amount of vegetable powder was about 20 per cent., of which about one-third appeared to be cimicifuga; 11 per cent. of silicious ash was also present.

DR. COLLIE’S OINTMENT.

This ointment, supplied by a Scottish Company at the price of 1s. 9d. for a box containing 1¾ ounces, is advertised in the following terms:

Try Dr. Collie for Rheumatism. His ointment positively cures while you sleep. You don’t rub it in, but apply just like a poultice. It draws out the cause of your trouble, and a speedy cure ensues. Try Dr. Collie’s Ointment—Instant relief for Sciatica, Lumbago, and swollen joints.

It appeared, however, from a booklet sent with the ointment that rheumatism was only one among a large number of complaints for which the ointment was recommended; it was described on the label as:

A certain cure for Sprains, Bruises, Cuts, Burns, Chapped Hands, Eczema, Blood Poisoning, Whitlows, Sea Water Boils, Abscesses, Piles, Rheumatism, Sciatica, Lumbago, Pains in the Back and Loins, and all Sores and Ulcers of every description.

The directions for its use in rheumatism were:

First wash the part to be treated with warm water and soda, then thoroughly dry—(a quantity of the ointment may then be well rubbed in). Now get a piece of thick cotton cloth (old sheeting answers very well) or better still, chamois leather, spread the ointment thickly and apply like a poultice. When the dressing begins to get dry, take it off, and after scraping the cloth replace it with fresh ointment. The part may, after a dressing or two, begin to itch, and the skin, being stimulated, may come out in a humour. If so, do not be alarmed but persevere. This is a sure sign that the Ointment is doing its work, drawing out the deleterious matter, viz., Uric Acid Poison, from the body through the most natural of all channels, the pores of the skin.

Analysis showed the presence of colophony resin, petroleum jelly, a little beeswax, and a fatty base. The colophony was accompanied by a small proportion of another substance of resinous nature, which appeared to be the altered resin to be found in the variety of colophony known commercially as “black resin”; a dark substance was also present which appeared to consist of the natural impurities of crude petroleum; the fatty basis showed generally the properties of a mixture of lard and tallow. A similar ointment was obtained by using the following formula:

Black resin 12 per cent. Beeswax 2 ” Crude petroleum jelly 26 ” Tallow 20 ” Lard 40 ”

Estimated cost of ingredients for 1¾ ounces, 1d.

ZOX.

Zox is a powder made by a Company with an address in London and the price charged is 1s. for a box containing eight powders. It was described on the wrapper as:

The most marvellous pain reliever. Instantly cures Toothache, Neuralgia, Headache, Sciatica, and all Nerve Pains. Pure, Harmless, not Aperient.

In a circular enclosed with the box directions were given for taking the powders for neuralgia, toothache, headache, sciatica, rheumatic and gouty pains, and influenza. For neuralgia the directions were:

Ono Powder should be taken when in pain, and should the enemy return, continue the Powders every four hours, for a few days. If very weak from continual pain, take a few doses of Zox Tonic; this will give you speedy relief.

For rheumatic and gout pains:

Take one Zox Powder two or three times a day while pain is acute; avoid beer and spirits of all kinds.

The average weight of the powders was 4½ grains, single powders in a box varying in weight from 4 to 6 grains. Analysis showed the powder to consist of acetanilide only.

The estimated cost of the drug for eight powders is one-tenth of a penny.

OQUIT.

The vendors, a Company with a London address, sell tubes of 20 tablets for 1s. 1½d.

This is advertised as follows:

Neuralgia. Within 10 minutes of taking “Oquit” that frightful nerve-racking pain will be cured. One dose will convince you. Try it.

A pamphlet was enclosed with the package, headed “Oquit for Headaches and Nerve Pains, Headache, Neuralgia, Gout, Sciatica, Rheumatism, Lumbago, Influenza, Feverish Colds, Sea Sickness.” A few extracts are here given:

Oquit ... is made in strict accordance with a medical prescription from drugs which are daily prescribed by the most eminent physicians for the relief of nerve pains. There is nothing experimental about “Oquit.” The drugs of which “Oquit” is composed are perfectly well known, and their claim to be regarded as unrivalled for the purpose has been rigidly tested and endorsed by the leading exponents of modern medicine. What is really unique about “Oquit” is the scientific proportion in which the constituent drugs

are combined. It is a remarkable fact, and one which is attested by every medical man, that the action of a drug may be made effective or ineffective according to the manner in which it is prescribed. There are certain subordinate drugs which prepare the way, as it were, for the action of a principal drug, and the proportion between the ingredients of a prescription is of vital importance in relation to the effect produced. It is to this scientifically adjusted proportion that the remarkably beneficial results of “Oquit” are due....

In the cure of Neuralgia, “Oquit” has proved eminently successful when taken in the same way as recommended for headache, with the addition that a third and further doses should be repeated, if found necessary, at intervals of three hours....

In Rheumatism, whether the acute or chronic forms, “Oquit” is extremely beneficial, expelling from the system the inflammatory agents which give rise to the frequently excruciating pains in the joints and muscles involved, and confers a most welcome relief....

In Gout, Sciatica, and Lumbago the eliminating power of “Oquit” is of the greatest possible value. In all these cases, adults should take three “Oquits” every three hours at the commencement of an attack, reducing the dose to two, and then to one, as the pain decreases.

The average weight of the tablet was 5·1 grains. Analysis showed them to contain:

Acetyl-salicylic acid 66·2 per cent. Starch, chiefly maize 20·0 ” Talc 4·2 ” Gum 1·5 ” Extractive 3·1 ” Moisture 5·0 ” Alkaloid a trace.

As stated above aspirin is acetyl-salicylic acid, and so it may be added is xaxa.

The alkaloid did not show well-marked characters by which it could be identified, but agreed fairly well in its reactions with the total alkaloid of gelsemium; the general nature of the extractive was consistent with its being a preparation of this drug.

The estimated cost of ingredients for 20 tablets is ¾d.

GENOFORM TABLETS.

A substance was described under the name Genoform in the _Pharmaceutische Post_ in 1905, as being the methylene-glycol ester of salicylic acid; but as the present preparation is advertised to the public, and supplied under a patent medicine stamp, it must be regarded as a secret remedy. The proprietor, it is stated, resides in Leipzig but there is a London agency, and the remedy is sold in tubes price 1s. 1½d., containing 10 tablets.

An advertisement of this preparation was headed: “Gout, Rheumatism, Sciatica, and Neuralgia Cured. A Miracle in Rheumatism.” Then followed a testimonial describing the “miracle.” On the package of the tablets it was stated that:

Genoform cures gout, rheumatism, sciatica, neuralgia, etc. Genoform gives instant relief and effects a permanent cure.

A circular enclosed in the package stated:

Genoform is a certain cure, and you need not suffer another day. No matter where the pain is, or how severe it is, or how long you have had it, Genoform Tablets will rid you of it. They give relief in many cases immediately, and produce a permanent cure.

Take them to-day and feel well. Genoform eases pain with a rapidity which is remarkable, at the same time doing away with the cause. Remember that.

It is no mere relief. It stamps out the cause of Gout, Rheumatism, Sciatica, and Neuralgia. It is absolutely harmless. No remedy equals it in its quick and certain effects.

Patients afflicted for years and unable to walk or use their limbs have been made sound and free from pain in a very little time....

Absolutely crippled rheumatic persons, unable to dress or undress themselves, have entirely recovered with only a few doses of this preparation.

The directions were as follows:

The Tablets must never be taken on an empty stomach, but either during or after meals (from 3 to 9 tablets daily). Taking the Tablet is facilitated by letting it soak first in a spoonful of water and drinking a little water afterwards. Any oppression of the stomach is soon relieved by 5 or 6 drops of dilute Hydrochloric acid taken in half a glassful of water.

As Genoform contains Salicylic Acid and that well-known drug for Rheumatism sometimes causes a little buzzing in the ears, if such buzzing ever occurs it is well to discontinue Genoform for 24 hours and afterwards take only a small dose for a day or so. It must be clearly understood that there is no possible harm or danger in such buzzing and few persons are so affected, but we think it wise to advise you lest you should think Genoform does not agree with you and discontinue its use.

The tablets had an average weight of 7·7 grains. They contained no free salicylic acid, but on hydrolysis with alkali they yielded 91·0 per cent. of that substance. Starch was present to the extent of 4·1 per cent., so that the material other than starch yielded 94·9 per cent. of its weight of salicylic acid. Salicyl-methylene-glycol ester CH■(C■H■O■)■ would yield 95·6 per cent.; investigation of the other products of hydrolysis showed that this ester was the substance present; no other ingredient was found. On examination the substance proved to be hydrolyzed at once by alkali in the cold, but not by cold dilute acid; hot water caused slight decomposition, and on boiling it in water it readily yielded salicylic acid. The formula of the tablets is thus:

Salicyl-methylene-glycol ester 95 per cent. Starch (and moisture) 5 ”

POST’S C. B. Q. TABLETS FOR RHEUMATISM.

Two specimens of the proprietary article sold under the name of C. B. Q. have been examined at an interval of nine years. The earlier analysis showed that the tablets contained potassium iodide, quinine and colchicine in small quantities, a salicylate and extract of liquorice, used no doubt to bind the powder together. The analysis made in 1908 showed that of the tablets then examined each contained about 1½ grains of potassium iodide, a small quantity of salicylate, a vegetable extract, and magnesia. The extract was hygroscopic and the magnesia was no doubt employed to bring the mixture into a form suitable for tablet making. The extract was slightly bitter and the tablets contained a small amount of alkaloid, which was not certainly identified.

GOUT VARALETTES.

Analysis of Bishop’s Gout Varalettes showed the presence of lithium citrate and a small quantity of what appeared to be piperazine, together with the usual effervescing basis consisting of sodium bicarbonate and tartaric acid.

PISTOIA GOUT POWDERS.

There was a powder for gout known to an earlier generation under the name of the “Portland Gout Powder;” according to the prescription given by Jourdan in the _Pharmacopée Universelle_ (1828); it consisted of: Gentian root, round birthwort root (_Aristolochia rotunda_), ground pine root (_Teucrium chamaepitys_), the tops of germander (_Teucrium chamaedrys_), and of the lesser centaury (_Erithroea centaurium_), of each equal parts to be ground separately to a fine powder and mixed; dose, half a teaspoonful. He gives of this three variants, in one of which the gentian is replaced by guaiacum.

For some years past a good deal has been heard about the Pistoia gout powders. A pamphlet entitled _The antigouty powders of the R.R. Benedictine Mothers of Pistoia for the treatment of a gouty source_ (Rome, 1904) presents a curious resemblance to the advertising pamphlets issued by ordinary nostrum dealers. There is a short disquisition on gout written in very odd English, this is followed by a translation of a large number of testimonials to the virtues of the powder, and this again by the following “Warning to our Customers”:

Having known that in some towns of Italy, and even in Pistoia, some antigouty drug circulates under the name of “Vegetal Antigouty Powders of the Cloister” or under other names alike, making every body trust that they come from our Monastery, we think ourselves, in duty bound, to remember to our Customers that no deposit of our Antigouty Powders is to be found neither in Pistoia nor in other towns or places in Italy or abroad, and that we have accorded to nobody the faculty of preparing or selling them.

Consequently every antigouty remedy which in any way should be made known as coming from this Monastery, must be considered as a product of vulgar falsification and adulteration.

The label on some boxes of the powder states that it is based on gentian, and on Indian wood, which is one of the synonyms of guaiacum. The pamphlet, which has already been quoted, states that the powders do not contain colchicum, belladonna, or any other poisonous substance, but

are a composition of medicinal grasses, none of which can ever have a pernicious effect upon the health, whatever may be the state of the person who uses it.

It is asserted that “often many miraculous cures are obtained,” but it appears that the treatment must be a prolonged one, for the pamphlet further states that:

When it is question of a first affection or of a light gouty attack, the treatment of a whole year without interruption can in general be sufficient; because it is necessary for the blood to stay under the action essentially depurative of the drug during four seasons.

But when the illness is old, a year of treatment cannot of course be enough to extirpate entirely the distemper, and the use of the drug must be protracted till necessary.

The sample of Pistoia gout powder examined was of a greenish ginger colour and had a bitter taste. MM. Guignard, Collin, Chastaing, and Barillot give the following formula for the Pistoia gout powder:

Colchicum corm 10 parts Bryony root 10 ” Betony (root, stem, and leaves) 50 ” Gentian root 10 ” Camomile (chiefly stem, leaves, a little root, and flowers) 10 ”

M. Collin is one of the leading authorities on the microscopic characters of powdered vegetable drugs, and a microscopical examination of the specimen revealed characters consistent with this formula; such small differences as were observed were only such as might be expected between specimens grown under different conditions of soil, climate, etc.

Another formula which has been published for the powders is as follows, but the sample examined agreed more nearly with No. 1:

II.

Colchicum corm 20 parts. Bryony root 10 ” Betony root 40 ” Gentian root 10 ” Camomile 10 ”

LAVILLE’S ANTIGOUT REMEDIES.

According to Zernik, the chief constituents of the Liqueur du Dr. Laville, an antigout remedy, very popular in France, in spite of its high price and secret composition, are colchicin (about 0·08 per cent.) and quinine in alcoholic solution. The pilules du Dr. Laville are sold as preventive remedies against gout. They were found to contain extract of winter cherry, Physalis alkekengi, one of the Solanaceae (? capsicum), guaiacum resin, powdered leaves and root of the marsh mallow, and sodium silicate. Each bottle contains 75 grams, about 2½ fluid ounces, and costs 8s.

SOME GERMAN NOSTRUMS.

The following notes upon a few German remedies are quoted from Dr. Zernik’s reports in the _Deutsche Medicinische Wochenschrift_.

URICEDIN.

This is a Berlin product vaunted as a remedy for the gouty diathesis, but its composition is very simple; it contains 2½ per cent. sodium chlorate, and 66·5 per cent. dry sodium sulphate, the remainder being sodium citrate and sodium tartrate.

RHEUMACID.

The prospectus asserts that this material, the result of years of careful and earnest study, revolutionizes all medical knowledge, and cures rheumatism, colds, neuralgia, sciatica, gout, bladder, kidney, and skin affections, etc. The price demanded for 50 grams (about 1½ ounces) is 17s. 6d., while a sample costs 1s. The sample is supposed to contain ten doses of 1 gram each, but was actually found to contain only half that quantity. There appeared to be three sorts of rheumacid, marked A, B, and C respectively, but the analysis revealed that the constituents were practically the same and included aspirin, salol, and at times salpyrin, with a little citric acid. This seems rather like making a revolution with rosewater.

ANTIGOUT SOAP.

Lazarus Gout and Rheumatic Soap is prepared in Dresden. It is a piece of medium-quality sodium soap, containing a very small quantity of an ethereal oil. The cake weighs 70 grams (about 2 oz.), and costs 1 mark.

PINE PREPARATIONS.

Electricum, described as “aethereal Tyrolese fir and pine wood oil,” and recommended by the vendors as an external remedy for rheumatism, gout, pains in the limbs, paralysis, sciatica, lumbago, and backache, neuralgia, tumours, etc., seems to consist merely of pine oil.

Weigand’s Rheumatic and Gout Spirit which it is stated relieves the pain within a few hours and cures after a short time, consists of 55 parts of turpentine oil, 55 parts of spirits of camphor, and 5 grams of Venice soap. A bottle containing 115 grams, less than 4 ounces, costs 2s. 6d.

RHEUMA TABAKOLIN.

This is a Berlin preparation; a box containing about 100 grams (about 3½ oz.) costs 5s., but the quantity for neglected and obstinate cases cost 15s. It is asserted to be a newly discovered remedy for rheumatism and gout obtained from tobacco. The directions are to extract the material with about 24 ounces of 50 per cent. alcohol, and to use this extract as a liquid application to the painful areas. Analysis showed that the substance consisted of waste and powdered tobacco perfumed with lemon oil. In Germany waste broken tobacco can be bought at about 5d. or 6d. a pound.

CHAPTER VII.

KIDNEY MEDICINES.

This group of nostrums consists of those which are put forward for the cure of kidney troubles, or conditions of ill-health commonly, but as a rule erroneously, attributed by the public to kidney disease. Several of these are in the form of pills, while others are liquids. The two principal drugs employed are oil of juniper and potassium nitrate (nitre or saltpetre), separately or together; in some cases aperients are added. Altogether extravagant claims are made for some of the articles, as is usual, of course, with proprietary medicines; this point is dealt with more fully in the descriptions of individual preparations.

In analysing complex mixtures, such as some of these nostrums are, it is, of course, not possible to attain the same precision as when dealing with medicines which consist chiefly of inorganic salts, as in the case of nostrums for epilepsy, dealt with in another chapter. A vegetable extract containing no definite active principle, such as, for instance, extract of taraxacum (dandelion), cannot be identified by any direct test; if such an extract is mixed with another, with a powdered drug, or an essential oil, its identification with perfect certainty may become almost impossible. The large variations, again, which may occur in the proportion of solid matter in a tincture or infusion, as well as the variations in the relative proportion of the different constituents of drugs, prevent the results of analysis being translated with certainty into the formula from which the mixture was compounded. These considerations apply to several of the articles described in this chapter. While the principal ingredient or ingredients in each case can be ascertained with little or no possibility of error, the subsidiary ingredients in some cases cannot be determined with the same confidence; we have endeavoured to indicate in each case the possibility of such minor errors. Full use has been made of check methods, by compounding mixtures according to the formulæ obtained by analysis and comparing them with the originals.

DOAN’S BACKACHE KIDNEY PILLS.

These pills, of American origin, which have been very extensively advertised for some years, are sold in boxes price 2s. 9d., containing 40 “kidney pills” and 4 “dinner pills.”

They were described on the wrapper of the package as a

Specific for kidney complaints and all diseases arising from disorder of the kidneys and bladder. Cure Backache, Weak Back, Rheumatism, Diabetes, Congestion of the Kidneys, Inflammation of the bladder, Gravel, Bright’s Disease, Scalding Urine, and all Urinary troubles.

A circular was enclosed with the box, in which a dissertation on “Diseases of the Kidneys and Bladder” was given, together with directions for taking the pills for various complaints. The following extracts are taken from the circular:

Doan’s Backache Kidney Pills are composed of rare and valuable medicinal agents in a combination best adapted to the speedy relief and cure of Kidney Disease, urinary and bladder affections, and all diseases resulting therefrom. They are purely vegetable, containing no ingredients of a deleterious nature, and may be taken by the most delicate person, with every confidence of their giving quick and permanent relief, without any after ill effects ... they are the only medicine known that quickly relieves and

permanently cures.

This medicine has restored to health thousands of women. As a means of healing the kidneys, and as a tonic to the whole female constitution it is unequalled.

The last sentence of the next extract shows some ingenuity:

Chronic cases of long standing. These frequently come under our notice and we hear that the patient, after trying every known remedy and failed (_sic_) has despaired of ever getting relief. Now in all stages of Kidney Disease this is where Doan's Backache Kidney Pills are the most needed, and, indeed, are the only remedy possible to give permanent relief. But it takes time. One cannot expect to be cured in a few weeks.... In some cases three or four boxes of Doan's Backache Kidney Pills are sufficient; but in these cases of long standing, 8, 10, and even 20 or 30, are required to effect a cure. But they will cure in the end if the patient perseveres. We are emphatic on this point, because in kidney disease patients are so easily discouraged. It is one of the symptoms of the disease.

The directions were to take from two to four of the dinner pills at night before commencing to take the kidney pills; then to begin with one kidney pill after each meal and one at bedtime, increasing the dose to two or three, after a short time. For children under 8, the dose was given as half a pill after each meal and at bedtime.

The "kidney pills" were ovoid in shape, and of a brown-grey colour externally, with sugar-coating beneath the thin, coloured layer; after removing the coating, the average weight of the pills was about 2 grains. Analysis showed them to contain oil of juniper and (in spite of their "purely vegetable" nature) potassium nitrate, together with a considerable proportion of a resinous substance, and of powdered fenugreek seeds and wheat and maize starches. Examination of the resin showed it to be derived from a coniferous source, and on comparison with various coniferous resins it agreed in characters with that of _Abies canadensis_ (_Pinus canadensis_), known as hemlock pitch. The proportions of the different ingredients were determined by analysis; but oil of juniper, in such small quantity, can only be approximately determined, and the amount found was confirmed by comparison of a pill containing this quantity with the pill under examination. The following formula gives a similar pill:

Oil of juniper 1 drop. Hemlock pitch 10 grains. Potassium nitrate 5 " Powdered fenugreek 17 " Wheat flour 4 " Maize starch 2 " In twenty pills.

The estimated cost of the materials of the 40 kidney pills and 4 dinner pills, ½d.

The dinner pills, of which four were included in the box of kidney pills, are also supplied separately in boxes of 50 for 1s. 1½d. The label stated that:

Doan's Dinner Pills Cure Constipation, Sick Headache, Biliousness, Dizziness, and all deranged conditions of Stomach, Liver, and Bowels.

The directions were:

For adults, 1 to 3 Pills; for children, ½ to 1 Pill.

These statements and directions were amplified in a handbill enclosed in the package.

The pills were ovoid and enclosed in white sugar-coating; the average weight of one, without coating, was about ¾ gr. Analysis showed the presence of podophyllin, aloin, oil of peppermint, a resin that appeared to be jalap resin, cayenne, liquorice, gum, maize starch, and a small quantity of an extract that resembled extract of henbane; as the extract last named had no sufficiently well-marked characters to enable a small quantity of it to be distinguished perfectly when mixed with larger quantities of the other drugs named, the identity of this ingredient could not be completely established. The following formula gives a similar pill:

Oil of peppermint 1 drop. Podophyllin 3·8 grains. Aloin 6·9 " Jalap resin 0·8 grain. Powdered capsicum 0·5 " " liquorice 0·6 " Maize starch 0·5 " Acacia gum 1·5 grains. Extract of henbane 1·5 " In twenty pills.

Estimated cost of materials of 50 pills, 1d.

DODD'S KIDNEY PILLS.

These pills, made by an American Company advertising from a London address, are sold in boxes containing 35, price 2s. 9d.

The label round the box stated:

A positive cure for all kidney diseases: cures rheumatism, Bright's disease, diabetes, backache; cures female weakness, purifies the blood, cleanses the system.

The following extracts are from a circular enclosed with the pills:

Experience has proved that Dodd's Kidney Pills are the only cure for kidney diseases.

Dodd's Kidney Pills is the only remedy that has cured Bright's Disease.

Diabetes—Dodd's Kidney Pills will cure this disease.

Dropsy—The first object in treating dropsy is to restore the kidneys to their normal condition. This is what Dodd's Kidney Pills do and hence their peculiar efficacy for this disease.

Dodd's Kidney Pills will cure any form of heart disease.

What is known as the "change of life," is a period of great importance to woman. At such a time, no remedy could be more effective than Dodd's Kidney Pills.

These pills ... consist of the active principles of vegetable substances, which have been carefully studied by the discoverer of the remedy, both as to their nature and effect, and finally given to the world in the form of a sugar-coated pill, which to-day is universally acknowledged to be the best kidney remedy obtainable.

The directions are:

Take one to three pills morning, noon, and night, before or after meals. In the majority of cases one pill is a dose.

The pills were ovoid in shape, coated and coloured red on the outside. The colouring matter formed a strongly fluorescent yellow solution, showing it to be fluorescein or an allied substance; the coating was of sugar on the outside, with an inner layer consisting of chalk. In spite of the statement quoted above, that the pills consist of the active principles of vegetable substances, it was no surprise to find that the principal ingredient was potassium nitrate, of which each contained about 1 gr.; the other constituents were sodium bicarbonate, soap, hard paraffin, wheat flour, powdered turmeric, two resins respectively soluble and insoluble in ether, a small quantity of a bitter substance, and a little extractive. Examination of the resins showed that they agreed in their characters with the two constituents of jalap resin; the bitter substance was not alkaloidal, and after careful comparison with a large number of bitter principles was found to agree with that of cascarilla. The following formula gives a pill which is practically identical with the one under examination:

Extract of cascarilla (alcoholic) 0·15 grain. Jalap resin 0·3 " Hard soap 1·0 " Potassium nitrate 1·0 " Sodium bicarbonate 0·85 " Hard paraffin 0·5 " Turmeric 0·3 " Wheat flour 0·8 " In one pill.

The estimated cost of the materials of 35 pills is 1d.

DR. VAR'S AMERICAN KIDNEY PILLS.

On the outside of the package these pills, which are advertised from an address in a town in the south of England, and sold in boxes of 14 costing 1s. 1½d., are stated to "correct the stomach and stimulate the liver and kidneys." In a circular enclosed with the box they are referred to as "Certain Corrective! Positive Cure!" while the obscurity of the following is perhaps intended to make the warning conveyed more effective:

Do not let slight or severe Kidney Disorders develop into Cancerous Decay, Twin Complaints—Kidney Liver Diseases. Cure them! Put both in strong active order. There is not a safer, surer, speedier remedy in existence. Myriads of people thank Providence for Dr. Var's Kidney Pills. _Should be taken for Natural Weak Kidneys._

The directions are:

One to be taken three times a day after meals.

The “pills” were in reality flexible capsules, each containing about 5½ grains of a soft mass in which oils of juniper and peppermint could be recognized in small quantity; examination also showed the presence of potassium nitrate, of small quantities of iron and magnesium compounds, and of lycopodium,[1] together with powdered squill, wheat starch, and a “green” extract, containing a trace of alkaloid, which appeared from its characters to be a mixture of extracts of henbane and taraxacum. The iron was perhaps an accidental impurity, and the magnesia and lycopodium were probably added to assist in making up the mass and not for therapeutic effect. The following formula gives a similar mass:

Oil of peppermint 1 drop. ” juniper 8 drops. Potassium nitrate 8 grains. Powdered squill 3 ” Wheat flour 6 ” Extract of henbane 7 ” ” taraxacum 21 ” In 10 capsules.

The estimated cost of the materials of 14 capsules is under ¾d.

[1] Lycopodium is a fine powder consisting of plant-spores sometimes used by pharmacists for enveloping pills which easily take up moisture.

FITCH’S KIDNEY AND LIVER COOLER.

A bottle of this preparation containing rather less than 4 fluid ounces is sold for 2s. The directions are:

Take two teaspoonfuls mixed in water every morning.

The label and package appear to have been devised for the purpose of suggesting, without explicitly stating, that it is a cure for the complaints named. On one side appears the following (divided into sections by use of different type):

Oh my back, how it aches! Why? Fitch’s Kidney and Liver Cooler. Trade Mark. Sluggish liver. Inactive kidneys. Over-heated blood. Bad urine. Acts chemically by absorption.

and on the other:

Oh my back, how it aches! Why? Because your Kidneys and Liver are Sluggish, and a deposit has formed in the urine which will contaminate the whole system unless dissolved chemically. Try this; you won’t regret. It’s a grand conception.

Analysis showed the liquid to consist simply of a solution of potassium nitrate in water, the strength being 56 grains in a fluid ounce—that is, 14 grains in a dose.

The estimated cost of the contents of the bottle is one-eighth of a penny.

WARNER’S “SAFE” CURE.

Warner’s Safe Cure is a liquid sold in a bottle holding about 8 fluid ounces at the price of 2s. 9d.

The label bore the words, “For Kidney and Liver and Bright’s disease and jaundice, gravel, stone”—and a long list of other complaints. “Dose for adults, one tablespoonful 5 or 6 times a day.”

A “medical pamphlet” of 34 pages accompanied the bottle, from which the following extracts are taken:

Warner’s “Safe” Cure is a purely vegetable compound, and contains no narcotic or harmful drugs; it is free from sediment and is pleasant to take; it is a most valuable and effective tonic; it stimulates digestion, awakens the torpid liver, and puts the entire system in the very best receptive state for the work of restoring the kidneys. It does its work with absolute method, preparing the tissues, soothing and stimulating the enfeebled organs, healing at the same time. It builds up the body, gives it strength, and restores the energy which is or has been wasting under the baneful suffering of kidney disease. Warner’s “Safe” Cure was discovered about thirty years ago by one of the most eminent specialists in diseases of the kidneys, who had made a life-study of kidney and kindred diseases.

How to test your kidneys. Put some morning urine in a glass or bottle; let it stand for twenty-four hours; if there is a reddish sediment in the bottom of the glass, or if the urine is cloudy or milky, or if you see particles or germs floating about in it, your kidneys are diseased and you should lose no time but get a bottle of Warner’s “Safe” Cure, as it is dangerous to neglect your kidneys for even one day. Bright’s disease, gravel, liver complaint, pains in the back, rheumatism, rheumatic gout, inflammation of bladder, stone in the bladder, uric acid poison, dropsy, eczema, scrofula, blood disease, offensive odour from sweating, so-called

‘female weakness,’ painful periods, too frequent desire to urinate, and painful passing of urine are all caused by diseased kidneys, and can be speedily cured by Warner’s “Safe” Cure, which has been prescribed for twenty-five years.”

Of Bright’s disease it is remarked:

It is one of the harassing complaints which physicians in family practice seldom have the patience to investigate and manage with sufficient care.

The assumed predilection of the public for vegetable remedies is no doubt answerable for potassium nitrate being classed as “purely vegetable” in so many of these medicines. In the present case analysis showed the presence of potassium nitrate, alcohol, glycerine, a trace of oil of wintergreen, and vegetable extractive; there was no alkaloid or similar active principle, and the extract had little distinctive taste or character; all its properties pointed to its consisting largely of extract of taraxacum, with some other extract containing a small quantity of tannin; a careful series of comparisons with all the drugs in ordinary use which were not excluded by various tests did not identify it with any of them, and it is probable that it is obtained from some non-medicinal plant.

The following formula gives an almost identical mixture:

Potassium nitrate 50 grains. Oil of gaultheria ■ minim. Rectified spirit 5 fluid drams. Liquid extract of taraxacum 10 ” Glycerine 4 ” Water to 8 fluid ounces.

This contains about 10 per cent. of pure alcohol, which is the proportion found in Warner’s Cure; in a mixture of which a tablespoonful was to be taken five or six—or, according to the handbill with it, six to eight—times a day, this proportion of alcohol is by no means negligible.

In such a mixture there is no means of determining exactly the amount of liquid extract of taraxacum, especially as it is liable to vary considerably in colour and in amount of solid residue; this is by far the most expensive ingredient in the above formula, and it is probable that the amount is here over-estimated. Taking the quantity here given, the estimated cost of the drugs for one bottle of the mixture is 5¼d.

VENO’S SEAWEED TONIC.

The Company in Manchester which advertises Veno’s Seaweed Tonic sells it at the price of 1s. 1½d. a bottle, holding 2¾ to 3 fluid ounces.

The label states:

Contains in a pleasant and agreeable form the active principles of seaweed. First introduced into the medical world by Mr. Veno, and now admitted to be a most efficient and valuable medicine. Veno’s seaweed tonic is prepared on an entirely new principle, and is free from poisonous or mineral drugs. It cures all ailments arising from a diseased condition of the Stomach, Liver, Kidneys, and Blood, which, when diseased, cause nearly all sickness. Dose.—For an adult, one teaspoonful twice or three times daily.

The following extracts are taken from a pamphlet enclosed with the bottle:

Veno’s Seaweed Tonic is a specific remedy; money cannot make it better. If it fails, no other medicine will ever succeed; but sufferers must have patience.

Kidney Diseases, Weak Back, Backache or Lumbago, Incipient Bright’s Disease. If you suffer from a weak back, with pain, soreness, or stiffness; if there is a dragging weakness in the limbs and lack of muscular energy; or if your urine is very clear or high coloured, showing a sediment of white flakes through it, it indicates a weakness or disease of the kidneys. Veno’s Seaweed Tonic should be taken for at least two or three months, in teaspoonful doses twice or three times daily, after meals.

The mixture contained a small proportion of undissolved sediment, which, when collected and examined, agreed in all respects with the insoluble portion of leptandrin. Glycerine, a little phosphate, alcohol, and a trace of chloroform were present, and vegetable extractive. Careful examination of the latter gave evidence of the presence of the constituents of cascara sagrada, senna, and rhubarb. Such a mixture as this could not, of course, be quantitatively resolved into its components, and the proportions given below were arrived at by comparisons of the properties of various trial mixtures with the properties of the original; no indication was obtained of any substance derived from seaweed. The following formula gives a practically identical mixture:

Leptandrin 10 grains. Sodium phosphate, crystals 33 ” Liquid extract of cascara sagrada 45 minims. Concentrated infusion of rhubarb (1-7) 1 fluid dram. ” ” senna (1-7) 2½ fluid drams. Glycerine 2 ” Chloroform water 1 fluid ounce. Water to 3 fluid ounces.

The estimated cost of the ingredients is 1½d.

MUNYON’S KIDNEY CURE.

This is sold by Munyon’s Homœopathic Home Remedy Company from an address in London, but is stated to be “Manufactured in U.S. of America.” The price is 1s. a bottle, containing 132 pilules.

The directions are: “Four pellets every hour,” which must at least keep the patient amused.

The label bears the words:

Cures Bright’s disease, gravel, all urinary troubles, and pain in the back or groins from kidney diseases.

The following extracts are from a circular enclosed with the bottle:

Munyon’s Improved Homœopathic Remedies are radically different from those used by the regular school of homœopathy or any other system of medicine. We have the true cure for the most obstinate as well as the most intricate of diseases. The whole secret of Munyon’s Remedies is the science of combining and harmonizing all drugs that are known to cure certain diseases, so that by our special combinations we cover every phase of the case, no matter what the complaint. There is no experimenting, no guesswork, but an absolutely fixed law of cure.

Munyon’s Kidney Cure has no equal. It cures pain in the back, loins, or groins, from kidney disease, puffy and flabby face, dropsy of the feet and limbs, frequent desire to pass water, scanty urine, dark-coloured and turbid urine sediment in the urine, gravel in the bladder, and too-great a flow of urine.

The pilules were found to vary much in size, the average weight being 0·6 grain. Analysis showed them to consist of ordinary white sugar; no trace could be detected of any alkaloid or other active principle, or of any medication. The sugar was determined quantitatively, and found to be just 100·0 per cent. of the weight of the pilules.

Estimated cost of contents of bottle, one thirty-fifth of a penny.

CHAPTER VIII.

DIABETES.

Diabetes, being a disease which runs on the whole a steady course unaffected by anything but diet, does not afford a promising field for the use of drugs; but as drowning men catch at straws, patients who have been told that they are incurable are naturally disposed to try any remedy that holds out a prospect of cure or relief. Although there are a good many proprietary remedies for diabetes, few seem to have a large sale, but such as exist are pushed by the usual pretensions set forth in advertisements and circulars. Every one must admit that few things can be more cruel than to trade upon the hopes and fears of sick people or to sell them worthless remedies with the positive assurance of cure. Yet this is what is done by the sellers of quack remedies, and the Inland Revenue pockets the patent medicine duty without a blush. Some account is here given of two much advertised preparations—Vin Urané Pesqui and Dill’s Diabetic Mixture. It may be objected that Pesqui’s Uranium Wine is not a secret remedy because it is said to contain uranium nitrate, pepsin, and “other appropriate elements” added to “old Bordeaux wine”; but uranium nitrate is a drug well-known to the medical profession, and whatever may be its properties it is not a cure for diabetes. There is no trustworthy evidence that it has ever cured a single case, and the most that can be honestly said of it is that patients have improved in general health while taking it, although it has not influenced the amount of sugar. Yet we are told in this advertisement that Pesqui’s Uranium Wine “positively cures sugared diabetes provided it is resorted to at an early stage and used during a sufficient length of time.” Dill’s Diabetic Mixture appears to consist mainly of extract of hydrastis, a well-known drug, which amongst the many virtues claimed for it has never been shown to possess any influence over diabetes; yet the advertisement says that Dill’s Diabetic Mixture is the “only known remedy for this deadly disease”! There is another triple nostrum for diabetes which, on examination, was found to consist of tablets of aspirin, unsweetened lime-juice, and a pink powder composed of sodium sulphate flavoured with oil of peppermint and tinted with phenolphthalein. These simple remedies were solemnly vouched for by the vendors in the following words: “We have satisfied ourselves that the treatment is an absolute and permanent cure”! Apparently the law cannot reach those

who publish deliberately untruthful statements with the object of selling their goods. The words of the judgment of the Lord Justice Clerk in a case with reference to Bile Beans, heard on appeal in the Court of Session at Edinburgh, should have aroused the Government to a sense of its duty to provide protection to the public. The Lord Justice Clerk exposed in plain language the procedure by which the vendors of this nostrum had worked up their business and palmed off their medicine on the public, yet the number of their advertisements does not appear to have diminished.

VIN URANÉ PESQUI.

This medicated wine is made in Bordeaux but is sold in this country from a depôt in London. The price charged for a bottle holding 24 fluid ounces is 8s.

A small booklet, entitled _Diabetes and its Cure by the Vin Urané Pesqui_, was enclosed with the bottle; a few extracts from this are here given:

It has been shown by medical statistics that there are in France every year 10,000 deaths or more, due to diabetes through a deficient treatment, whilst they could have been cured by taking the Vin Urané Pesqui....

Organic sugar enters the blood together with the alimentary sugar, the former being destroyed by the molecular changes that it undergoes for the nutrition of the different organs. If not sufficiently destroyed, it is productive of glycohemia, and as it passes into the urine it brings forth glycosuria; this pathological state determines, in course of time, particularly among persons suffering from obesity, some of the following diseases: polydipsy (excessive thirst), oedema in the legs, the enfeeblement of the physical and intellectual faculties, visionary troubles, amblyopia, cataract or gutta-opaca, headaches and anaemia, followed by dryness of the skin, successive furuncles, gatherings or boils, eczemas, itching on the skin provoking an irresistible desire to scratch one self, anthrax, urinary gravel, lumbago, sciatica, albuminuria, polyuria (insipid diabetes, without sugar, excessive emission of urine), rheumatism, dropsy, bulimia (insatiable appetite) or polyphagia, azoturia (large quantity of urine with a heavy percentage of uric acid), then fearful complications; pneumonia, prurience, either vulvar or prepucial; diabetic phimosis, gangrene in different parts of the body, particularly in the toes, the nails of which become black; consumption, etc. Great mental worries are also productive of glycosuria....

Pesqui’s Urané Wine positively cures sugared diabetes, provided it is resorted to at an early stage and used during a sufficient length of time.

As soon as the patient has made use of this wine, his thirst is allayed almost instantaneously; his strength reappears; all his functions are gradually restored; his breathing, which the absence of feculents had rendered difficult, becomes easier; he is no longer put out of breath, nor does he feel any lassitude; he can now walk about without undergoing any fatigue; his look improves and his temper assumes a more pleasant character....

The Vin Urané (Uranated Wine) prepared by Mr. Pesqui, of Bordeaux, has been qualitatively analysed at the Barral chemistry laboratory. The result of this analysis points to this medicine being a compound of old Bordeaux wine, in accordance with Bouchardat’s prescriptions, to which the following elements have been added: azotate of uranium, pepsine, and other appropriate elements.

The dose was given on the label as:

Three small sherry-glassfuls per day, with or without water, 5 minutes before, or immediately after meals, and at night before bedtime.

Analysis of the wine showed it to contain, in 100 parts by measure

Alcohol 8·75 parts. Glycerine 3·55 ” Total solids 2·92 ” Fixed acid, reckoned as tartaric 0·43 part. Volatile acid, reckoned as acetic 0·21 ” Reducing sugar 0·28 ” Cane sugar doubtful trace. Ash 0·30 part. Uranium, equivalent to crystalline uranium nitrate 0·02 ”

No digestive power whatever on egg-albumen could be detected, indicating the absence of unchanged pepsin. The amount of uranium found corresponds to one-twelfth of a grain of the nitrate in 1 fluid ounce, or half a grain in the daily dose, a sherry glass usually holding about 2 ounces.

The cost of the preparation depends, of course, on the cost of the original wine, and is scarcely affected by the added ingredients.

DILL'S DIABETIC MIXTURE.

This mixture is sold by a firm in Manchester at the price of 8s. 3d. for three bottles (not supplied singly), holding 2 fluid ounces each.

It was advertised in the following terms:

DIABETES.

Dill's Diabetic Mixture is the only known remedy for this deadly disease. No dieting necessary. It also cures Yellow Jaundice, Gall Stones, Hepatic Asthma, and all Liver Complaints. It is also the very best remedy we know for Kidney Diseases.

In a leaflet enclosed in the package it is stated:

In Diabetes the Government returns of health show that 100 per cent. die of the disease—that is, all of them—66 out of every 100 die of Coma, and 34 of Pneumonia, so that in ordinary medicine there is no cure. But after 15 years' experiment I discovered this remedy, by means of which hundreds have been restored to health and strength, the world and their families. It is the only known remedy for this deadly disease....

... all Liver complaints and Kidney complaints are cured by this remedy. And it is natural that it should be so, for when we know that the Liver is the workshop of the body; that it makes the Blood, and the Bile, and the Urine, and the Sugar which the kidneys only filter out, I say, when we know this, we may be quite sure that any remedy that cures the liver benefits the whole body. The nerves, the flesh, the skin, the blood, and tissues; even the special senses such as sight, hearing, and smell, with the sense of touch are all improved and benefited by it.

The Remedy, it is needless to say, will have to be persevered with. These are deadly diseases and must have time.

The dose was given on the label as:

One teaspoonful every four hours in a tablespoonful of water.

The mixture contained a considerable amount of sediment, partly of a heavy nature and partly very light; this caused some difficulty in dividing the contents of a bottle without altering the relative proportions of the ingredients, and increased the possible error in the quantitative results. Alcohol was present to the extent of 35 per cent.; the heavier sediment consisted of sodium bicarbonate, which is very little soluble in such a liquid; this constituent formed 7·4 per cent. of the mixture. Two alkaloids were present in approximately equal proportions, the total amounting to 0·25 per cent.; these proved to be hydrastine and berberine, and the general nature of the extractive, etc., present showed that they had been added in the form of extract, fluid extract, or tincture of hydrastis; there is no official standard for the alkaloidal strength of these, but, taking the usual proportion, the alkaloid found would represent 1·5 per cent. of extract of hydrastis. This left a portion of the total solids to be accounted for; a small amount of a resin was found which resembled scammony resin in its properties, and a larger proportion of a resinoid having general resemblance to caulophyllin (obtained from the blue cohosh or squaw-root), but the identity of the resin and resinoid could not be established owing to the absence of characteristic properties. The formula was thus found to be:

Sodium bicarbonate 7·4 parts. Extract of hydrastis 1·5 " Resin, resinoid, and other extractive 2·2 " Alcohol 35 " Water to 100 "

On the rather liberal assumption that the whole of the unidentified portion costs as much as caulophyllin, the estimated cost of the ingredients for 6 fluid ounces is 11d.

LANCASHIRE NOSTRUM

A treatment for diabetes was, and perhaps is still advertised by a firm of manufacturing chemists in Manchester. In a letter addressed to an enquirer the manufacturers wrote:

The treatment was recently discovered by a Lancashire doctor who had himself suffered from diabetes for a great number of years, and used all the recognized medical treatments without effect. His own discovery cured him entirely. The formulas have been entrusted to us, and we are manufacturing and offering the preparation to the suffering public. We have satisfied ourselves that the treatment is an absolute and permanent cure.... We have, therefore, every confidence in recommending it to you.

These statements are supported by a batch of testimonials which are not so strong as is usual in such cases. For example, one is headed in black type, "Completely cured a gentleman and his two friends," and runs as follows:

Dear Sir,—I received the treatment yesterday. A friend of mine, a London gentleman, has told me your treatment and the Gluten Bread has (_sic_) completely cured him and two friends of his of sugar diabetes.

The medicines supplied consisted of (1) tablets, of which four were to be taken each morning, and (2) a mixture. A month's supply was forwarded for 10s. 6d., from two to four months' treatment being said to be sufficient. A booklet was also sent giving the usual directions for a diet free from carbohydrates, and enjoining the use of warm clothing, with occasional hot or Turkish baths. The tablets (1) contained 5 grains of aspirin; the mixture (2) was composed of unsweetened lime-juice containing 6 per cent. of free citric acid. A pink powder, described as an aperient, consisted of dried sodium sulphate, flavoured with oil of peppermint, and tinted with phenolphthalein. These remedies are not new, nor has their use been attended with any particular success in the treatment of diabetes. It is difficult to see why they should give better results when supplied as a nostrum than when ordered in the usual way by medical men, unless we attribute something to the suggestive power of bold assertions and public advertisement.

NOTE ON DIABETIC FOODS.

In the treatment of diabetes it is the rule, in order to diminish the amount of sugar passed, to decrease or altogether exclude starchy foods from the dietary, and to replace them by various substitutes, of which the most important are gluten bread and biscuits. Some of the so-called gluten flour and special foods sold as suitable for diabetic patients are impositions, inasmuch as they are found to contain either as much or nearly as much starch as ordinary flour. In one instance brought to notice at the end of 1905, a so-called gluten flour and special diabetic foods obtained from Messrs. H. H. Warner and Co., Ltd., who are also the vendors of Warner's Safe Cure, but who in this instance acted as agents, it was found that the flour was practically ordinary wheaten flour. This is indicated in the following table, in which the result of the analysis of the special articles is placed side by side with the figures of the official analysis of wheaten flour published by the United States Department of Agriculture:

---------- | Department of | The Special |Agriculture, U.S.A.| Materials.
+---------+---------+---------+---------- | Spring | Winter | Gluten | Special | Wheat. | Wheat. | Flour. | Diabetic | | | | Food.
+---------+---------+---------+---------- Water | 10·4 | 10·5 | 12·65 | 11·06 Proteid | 12·5 | 11·8 | 10·60 | 12·40 Fat | 2·2 | 2·1 | — | 3·00 Convertible carbohydrates | 71·2 | 72·0 | 70·30 | 71·06 Mineral matter | 1·9 | 1·8 | 0·44 | 1·52 Fibre | 1·8 | 1·8 | — | —
----------+---------+---------+---------+----------

It will be seen that the amount of starch and other convertible carbohydrates in spring wheat is 71·2, and in the so-called gluten flour 70·30.

CHAPTER IX.

OBESITY CURES.

The claims made for nostrums advertised for the reduction of corpulence are, as a rule, rather less extravagant than usual. A reason for this is not far to seek; it is important that the consumer of the medicine shall be encouraged to persist in its use for a considerable time, and statements as to rapid cure might very soon be found to be at variance with the facts and would probably only lead to discontinuance of the medicine, and therefore defeat the maker's object. Nevertheless, the emphatic and confident statements, backed by testimonials, so important a weapon of the nostrum vendor, are by no means abandoned, as some of the quotations below will show. The prices named for the various articles described refer, as a rule, to the smallest size of package; in most cases larger packages, containing sufficient for several weeks' or months' consumption, are supplied at proportionally lower rates, and purchasers are urged to obtain these larger packages.

While certain of these preparations present no particular difficulty to the analyst, the majority not only contain vegetable preparations devoid of well-marked characters, but since the most important of these, extract and fluid extract of _Fucus vesiculosus_, are not prepared according to any official formula, and are naturally therefore liable to great variation, it is not possible to arrive with perfect certainty at the precise composition of such articles by analysis; and when, as in the case of any nostrum, the maker can draw on all unofficial and even non-medicinal substances for his ingredients, it is inevitable that some shall remain not certainly identified. It may fairly be assumed, however, that such unknown substances, possessing no well-defined chemical characters, will not be likely to have much, if any, therapeutic importance.

The belief that sucking lemons will make one thin is widespread, and gave origin a few years ago to a passing fashion, so that it was impossible to go anywhere, in private house or club, without meeting some gouty man or too stout lady who asserted that a

sure cure and preventive for either condition was some drink made with a fresh lemon. It was not surprising, therefore, to find that the chief ingredient in two of the secret remedies first analysed was citric acid.

Bladderwrack (_Fucus vesiculosus_) is a common seaweed which has earned, it is not quite easy to understand on what grounds, a reputation for reducing corpulency. It contains sodium salts in rather large quantities, and a small proportion of iodine, much less than many other sea-weeds. In Ireland it was once thought to be good for pigs, making them fat, and if it has an opposite effect on human beings, that effect must be very slight and uncertain.

Still, if people like to pay an absurdly high price for citric acid or extract of bladderwrack under other names, it would, perhaps, be churlish to object, but the case is rather different with the extract or other preparation of the thyroid gland found to be present in two of the nostrums most recently analysed. Medical men are not infrequently asked by patients for information or for their opinion with regard to some substance that has been praised in a family newspaper or other easily inspired or corrupted medium to which some authority is ascribed, and the detection of thyroid gland in two of the preparations analysed justifies a note of warning. The administration of thyroid requires to be carefully regulated, and its employment in self-medication cannot be regarded as a safe proceeding. Under these circumstances it can hardly be necessary to say that postal communication with the vendors of the medicines in question, even when accompanied by the patient's answers to printed questions and description of his symptoms, is not only of no value, but may be a source of danger by giving a false sense of security.

It is curious indeed to note that one of these secret preparations, Marmola, does not appear to be advertised to the public as a proprietary article at all, but is named as one ingredient among others in a prescription which is recommended in a paragraph apparently dictated solely by pity for suffering fat people; the chemist to whom the prescription will be taken to be compounded, however, is the recipient of advertising matter urging him to lay in a stock of the article to be in readiness for the demand. It is to be hoped that no chemist would dispense such a "prescription" without making it clear to his customer that what is supplied is a proprietary article, about the usefulness or innocuousness of which he knows nothing; otherwise the customer, who finds it named along with preparations bearing the letters "B.P.," is likely to suppose that it is a known substance, and that the dispensing of the prescription by a chemist indicates that the mixture is a proper and safe one to take. Two of the other preparations described are evidently usually or always supplied to the public without the agency of any retailer, the vendor thus securing the whole profit, which, it will be seen, is considerable. In both these cases the attempt is clearly made to get the customer to pay at once for as large a quantity as possible, presumably because he will be less likely to do so after giving the medicines a trial. The most alluring prospects are, of course, held out in the advertisements, but when the customer has been drawn into correspondence, and especially after he has begun to send his money, a process of "hedging" begins, as will be seen from the extracts quoted from letters sent by the vendors.

Phenolphthalein—a chemical body sold sometimes under the trade names purgen, laxoin, laxatol, laxen, etc.—appears as an ingredient in two of the nostrums, and formamine (hexamethylene-tetramine)—which goes also by many names, urotropine, cystamin, cystogen, metramine, and vesalvine among others—in one, the preparation containing the latter is said to have been devised as the result of an accident in the laboratory, in which a piece of fat became changed into oil without the rupture of the fat cells, a statement which suggests that the advertiser thinks that fat in the human body is solid like tallow or lard.

ANTIPON.

This preparation is sold by a Company with offices in London. The bottle in which it is sent out holds a little over 6½ fluid ounces and costs 2s. 6d. It bears no label, but has the word "Antipon" blown in the glass. A circular enclosed with the bottle gives a number of rules on the subject of dietary, together with statements as to the merits of the article, from which the following extracts are taken:

As a really permanent cure for corpulence, combining remarkable fat-reducing properties with tonic principles of the highest quality, "Antipon" is justly regarded by the most competent authorities as one of the most valuable discoveries in modern therapeutics, solving once and for all the vexed question of the radical cure of obesity without harmful after-effects. "Antipon" absolutely and definitely replaces all the weakening and frequently dangerous processes, systems and medicines which have hitherto done duty as remedies for the disease of obesity. It provides the medical practitioner and the public with a powerful and entirely harmless specific not hitherto within their reach.

Within a day and a night of taking the first dose there will be a reduction of weight varying from 8 oz. to 3lb., in extreme cases even more. The subsequent daily decrease will be persistent until normal weight and dimensions are attained, when the doses may be discontinued.

Directions for Use.—Take two dessertspoonfuls in half a wineglassful of water, immediately after meals. N.B.—After taking dose, cork the bottle securely.

Analysis showed the liquid to be a solution of citric acid in water, of the strength of 39·3 grains in a fluid ounce; a red colouring substance was also present, and O·4 per cent. of alcohol, the latter being doubtless introduced with the colouring. The red colour could be perfectly matched with cochineal, but the behaviour towards alkalies and other reagents showed differences; cochineal, with the addition of a little methyl orange, however, showed in most respects a similar behaviour.

The estimated cost of ingredients for 6½ fluid ounces is 1■d.

RUSSELL'S ANTI-CORPULENT PREPARATION.

This preparation is sold from an address in London and like the previous one, was in a bottle bearing no label; the letters "F.C.R." were blown in the glass, and the bottle, which held 12½ fluid ounces and cost 6s., was enclosed in a perfectly plain case, with no printed matter accompanying it. A pamphlet on the subject of the medicine was posted separately to the person ordering it; in this it was explained that:

Acting upon the many suggestions received, principally from ladies, the bottles are packed quite plainly, and without the ordinary trade labels usually found upon medicines, etc. The box is quite devoid of advertisements or anything whatever likely to denote its contents. The servants and others attached to the household may therefore be safely entrusted to open the box; inquisitiveness, if present, will not be rewarded.

In this pamphlet very detailed directions were also given for taking the medicine, and for diet and exercise. It was stated that:

In a very short space of time, say twenty-four hours, a considerable quantity of the most unhealthy fat will have been removed from that part of the system most in need of relief from the adipose matter oppressing it (the quantity varies from 8 oz. to 2 lb., or even more).

The dose is one tablespoonful in a half-wineglassful of water, within, say, ten minutes after each meal.

Analysis showed the liquid to consist of a solution of citric acid in water, containing 37 grains in a fluid ounce. The orange colour was found to be due to iron, which was present to the extent of 0·012 per cent.; and 0·4 per cent. of alcohol was also found. Addition of this proportion of iron in the form of the ammonio-citrate was found to give a practically identical colour, and the formula is approximately:

Citric acid 37 grains. Iron and ammonium citrate ¼ grain. Rectified spirit 2 minims. Water To 1 fluid ounce.

The estimated cost of the ingredients for 12½ fluid ounces is 2·1d.

ABSORBIT REDUCING PASTE AND J. Z. OBESITY TABLETS.

These two preparations are sold by a "Hygienic Skin Specialist." The paste, or, perhaps, both preparations, appear to be also known under the name of "Zobeide," as the paste was supplied in response to an order for "Zobeida," and the jar bore a label giving a so-called "analysis" (which it is needless to say was no analysis) beginning, "We have carefully examined the Zobeide Tissue Absorbers and Paste." The price of the paste was 3s. 6d., and the jar contained just over 2 ounces. The directions on the label were:

Rub in a circular direction, at night, where needed, for five minutes or more; firm, even movements, and only use as much as the skin will absorb.

The paste was a pink ointment, containing 93 per cent. of a fatty basis, 4·8 per cent. of a substance which agreed in its characters with dried bile, and was evidently ordinary "purified ox-bile," and a little carmine, the remainder being moisture. Further examination of the fatty basis showed a considerable proportion of beeswax, and the analytical results obtained agreed with a mixture of:

Beeswax 23 parts. Lard 46 " Rapeseed (colza) oil 31 "

It is not possible, however, to assign an exact formula to a mixture of fatty substances like this. The composition of the paste was approximately:

Purified ox-bile 5 per cent. Beeswax 22 ” Lard 44 ” Oil 29 ” Carmine q.s. A trace of perfume was also present.

The estimated cost of ingredients (2 ounces) is 3d.

The tablets are sold in boxes, containing 25, price, 2s.

The directions were:

Two at night dissolved in the mouth as an ordinary lozenge.

The tablets were flat oval lozenges weighing 19 grains each. Analysis showed their composition to be as follows:—

Sulphur 24 per cent. Ginger, about 4 ” Sugar 61 ” Acacia gum 8 ” Moisture 3 ”

The estimated cost of the ingredients for 25 lozenges is ½d.

XL REDUCING PILLS AND REDUCING LOTION.

Hughes & Hughes’s XL Reducing Pills and Ointment are advertised from an address in a seaside town. The pills are sold in boxes containing 28, price 2s. 9d. a box. The preparation was described, in a circular enclosed with the box, as:

A remedy at once safe, speedy, and efficacious, and of marked value from the health point of view, as it combats the special ills to which the corpulent have a liability. It is very easy to take, the pills being tasteless, and does not necessarily oblige any special course of diet.

The directions were:

2 pills, twice a day, after principal meals.

The pills were coated with French chalk, and coloured pink on the outside. After removal of the coating they had an average weight of 3 grains. Analysis showed them to contain a vegetable extract, powdered ginger, powdered liquorice, iron, potassium, phosphate, and iodide; in addition to the mineral constituents just named, the ash showed all the constituents of the ash of extract of bladderwrack; various other tests applied to the pills indicated this extract to be present, and failed to show any other ingredients. The quantities of the respective substances were determined as accurately as possible, and the formula found to be approximately:

Potassium iodide 0·15 grain. Iron phosphate 0·35 ” Powdered ginger 0·2 ” ” liquorice 0·1 ” Extract of _Fucus vesiculosus_ 2·2 grains. In one pill.

The estimated cost of the ingredients for 28 pills is 1¼d.

The Reducing Lotion for external use only with the XL reducing Pills is sold at 4s. 6d. a bottle, containing 2¼ fluid ounces.

Directions for Use.—To a little of the lotion add three or four times the amount of water (to a spoonful, three or four spoonfuls of water). The lotion is in a highly concentrated form, and equals a bottle four times the size. The lotion should be applied night and morning, gently, without rubbing, by means of the hand, or a piece of rag, to the part desired. Any part that is abnormally enlarged can be so treated, except the face, to which it should not be applied. The XL lotion will not irritate the most delicate skin, but it should not be used when there is any scratch or abrasion.

Analysis showed the presence of chloride, bromide, and iodide of potassium, glycerine, and a small quantity of a resinous substance in combination with alkali. The amount of the last constituent was very small, the resinous substance only amounting to 0·08 per cent.; it was somewhat bitter, with little colour, and showed no characteristic reactions or properties by which it could be identified. The proportions of the other ingredients were found to be:

Potassium iodide 9·7 grains. ” bromide 13·5 ” ” chloride 6·9 ” Glycerine 105 minims. Water To 1 fluid ounce.

The estimated cost of the ingredients (2¼ fluid ounces) is about ¾d.

TRILENE TABLETS.

These tablets are advertised from an address in London, in boxes price 2s. 6d., containing 66 tablets.

Enclosed with the package was a little book containing testimonials, directions, etc., and also a small circular giving instructions as to diet, with the addition:

We desire to say that such precautions are not indispensable by any means, but we formulate the above for the guidance of those in whom any peculiarity of Constitution may render such care salutary, and to promote rapidity of cure.

The directions were:

Three of the tablets three times a day 10 minutes before meals, either dissolved on the tongue or taken as pills. (_No change of diet being essential._)

It was also added:

The present supply lasts one week, in which time the weight begins to lessen, but a marked change in appearance naturally occupies _several weeks_ to effect.

Two separate packages of the tablets were obtained for analysis at an interval of several weeks; in the first supply the tablets were of a dirty white colour and contained no dye, but in the second they were bright yellow, and contained a yellow dye, which appeared to be one of the coal-tar colours; the other ingredients were the same as those found on the first occasion. The average weight of one tablet was 0·9 grain, and they were found to contain 87 per cent. of sugar, 2·4 per cent. of moisture, and O·5 per cent. of ash; about three-quarters of the remainder was starch, principally potato starch, but with a little maize. The residual 2 or 3 per cent. was a gelatinous substance which showed no marked reactions or characters, and exhibited only traces of cell tissue when examined microscopically. Analysis of the ash showed it to contain sodium, potassium, calcium and magnesium chloride, sulphate, and phosphate; these are the constant constituents of the ash of extract of _Fucus vesiculosus_; an aqueous extract of the tablets contained a small quantity of mucilage similar to that yielded by the same drug. By taking some _Fucus vesiculosus_ in the wet state, pounding it to a pulp and boiling it, a material was obtained agreeing with the gelatinous substance from the tablets, and there appeared no ground for doubting the identity of the two. Careful search was made for alkaloids and other substances in small quantity, but without any being found. The formula thus became:

Fucus vesiculosus, in pulp 3 per cent. (dry weight). Starch 7 ” Sugar 87 ” Water 3 ” Yellow dye q.s.

The estimated cost of the ingredients (66 tablets) is one-fortieth of a penny.

HARGREAVE’S REDUCING WAFERS.

This preparation is supplied from an address in London in boxes price 1s. 1½d., containing 21.

The following extracts are taken from a circular enclosed with the box; the circular contained also a number of testimonials, with directions, etc.

Purely vegetable. Contain nothing harmful. Can be taken at any time with perfect safety. Dose: Three wafers daily. One after Breakfast, Dinner and Supper. If Supper is not taken, one after Tea instead. May be dissolved on the tongue or taken as pills. No change in diet necessary.

The supply sent herewith lasts one week, in which time the Fat commences to get less. In most cases, however, to complete a cure takes about seven weeks, therefore clients should now send for the further six weeks’ treatment.

The “wafers” were really compressed tablets of the ordinary shape, coated with French chalk, and coloured pink externally with eosin. After removing the coating the average weight of the tablets was 2·4 grains; they consisted of substances of “extract” nature, with about 10 per cent. of powdered liquorice. Analysis of the ash showed all the constituents of the ash of extract of _Fucus vesiculosus_ (bladderwrack), and other tests indicated that this extract formed about one-half of the tablet; the other constituent (or constituents) also of “extract” nature, showed no reactions or properties by which it could be identified, and it was probably present merely as excipient.

ALLAN’S ANTI-FAT.

This substance is supplied by an American “Botanic Medicine Company” from a London office, in bottles containing 6½ fluid ounces, price 6s. 6d.

On the wrapper appeared the words:

Purely vegetable. Perfectly harmless. Always efficacious.

We call special attention to the efficacy of our Anti-Fat in the cure of that distressing complaint—indigestion or dyspepsia. It acts solely upon the food in the stomach, regulating and putting the liver and discharging organs in good working order.

A circular was enclosed with the bottle, entitled, “How to get lean without starvation,” from which the following extracts are taken:

A very extensive observation has convinced us, since our first circular treatise was issued, that in the majority of cases the Anti-Fat must be taken for from two to three, and, in rare cases, even four weeks before the patient will begin to notice much reduction of flesh, after which the loss goes on rapidly—generally from three to five pounds a week. In some cases the diminution in weight commences from the first two or three days’ use of it.

The treatment of obesity has hitherto rested on no sure basis.

Through the study of physiological chemistry, a _specific_ has at length been discovered, which, from the name of the discoverer, has been called Allan’s Anti-Fat.

Directions: Take two teaspoonfuls of the Anti-Fat in a wineglass full of water or sweet milk before each meal.

A small slip was also enclosed headed “CAUTION!!” which stated:

The color, as well as the flavor, of the Anti-Fat, varies somewhat with age and exposure to light, but neither in the least impairs its virtues. The temperature of the weather at the time of the manufacture of this remedy has also much to do with its clearness, or transparency, but does not affect its properties.

Analysis showed the presence of alcohol, glycerine, potassium iodide, salicylic acid, and a vegetable extract which from its properties and the analysis of the ash was evidently a purified extract of _Fucus vesiculosus_. The proportion of the latter drug represented could not, of course, be determined with certainty for the reasons already given, but the amounts of the other ingredients were ascertained by analysis, and the formula was approximately as follows:

Potassium iodide 0·3 grain. Salicylic acid 1·0 ” Glycerine 40 minims. Fluid extract of _Fucus vesiculosus_ 70 ” Water To 1 fluid ounce.

The estimated cost of the ingredients (6½ fluid ounces) is 3d.

MARMOLA.

This preparation is supplied by another American Company, which also has a depôt in London. It is sold in packages, containing ½ ounce, price 2s. 6d.

This preparation, which has been largely advertised in daily and weekly newspapers, is not represented as a proprietary article, but is mentioned as one ingredient of a prescription to be made up at a chemist’s. The following advertisement is a sample:

Is Fatness a Social Offence?

“The female form, being capable of expressing a supreme degree of grace, should be an inspiration in our daily lives and lead up to higher ideals of beauty,” said an art lecturer lately. Therefore the fat woman is an enemy to the artistic uplift, for she is entirely too heavy for any wings of fancy to raise.

Why should any woman remain fat when it is so easy to reduce one’s flesh? A woman may take but little exercise and enjoy the best of food, and still preserve a beautiful figure. She has at hand a simple fat-reducer that takes the place of starving and gymnastics. It consists of a dessertspoonful after meals and at bedtime of this simple mixture: One half-ounce of Marmola, one ounce of fluid extract of Glycyrrhiza B.P., one ounce of pure Glycerine B.P., and Peppermint Water to make six ounces in all. Every over-fat person should try it. It’s quite harmless, and will take off as much as a pound of fat a day. With a chemist’s handy, anyone can have a good figure at a reasonable cost.

A dessertspoonful of the mixture prescribed would contain about 9 or 10 grains of Marmola. The prescription and directions were reproduced on the label of the package, and it was added:

If faithfully taken as directed for 60 or 90 days, satisfactory results should be obtained.

which is a decidedly milder statement than that in the advertisement that it “will take off as much as a pound of fat a day.”

The box contained a light brown powder, and analysis showed the presence of (1) a large proportion of a powdered seaweed, agreeing well in characters with the powder of _Fucus vesiculosus_, its identity being further indicated by the composition of the ash; (2) a substance of proteid nature, agreeing well in characters with the powder of dried thyroid gland, its identity being further indicated by the presence of iodine in organic combination; (3) phenolphthalein; (4) sodium chloride (common salt); and (5) extractive. The last showed no well-marked characters by which it could be identified, and differed both in quantity and some minor properties from the extracts obtained from a specimen of powdered fucus which was used for comparison. This difference might quite well be due to differences in the drug or in the treatment it had received, or the extract may represent some other ingredient possessed of no distinctive characters; a trace of oil of peppermint was also present.

Although it was easy to ascertain the nature of the ingredients the determination of the proportions in which they were present in such a mixture offered no little difficulty. It is not necessary to detail here the methods employed, but it will suffice to say that while every care was taken to make the results as accurate as possible, they cannot in the nature of the case be more than approximate. The formula arrived at was:

In one Dose. Dried thyroid gland 14 per cent. 1·4 grain. Phenolphthalein 4 ” 0·4 ” Sodium chloride 7 ” 0·7 ” Powdered _Fucus vesiculosus_ 50 ” 5·0 grains. Extractive 25 ” 2·5 ” Oil of peppermint trace trace.

Taking the “extractive” at the price of some of the commoner medicinal extracts, the estimated cost of the ingredients for half an ounce is about 4d.

FIGUROIDS.

The tablets sold under the name of Figuroids are or were recently supplied by a London Company, price 2s. 9d. per bottle, containing 12 large and 12 small tablets.

They were described in a pamphlet enclosed in the package as

A Scientific Obesity Cure discovered through an accident while making Scientific Investigations in the Laboratory.

Other extracts from the pamphlet are as follows:

In looking through quantities of anti-fat literature one finds all kinds of crude, ignorant explanations, such as, for example, that the remedy absorbs the fat. Now, a sponge absorbs water, or any dry thing will absorb a liquid, but common sense will tell you that a liquid taken into the body will not absorb fat; you can clearly understand that point without further explanation. Another remedy, it is claimed, simply destroys the fat. This explanation is, as you can see, equally preposterous. In Nature nothing is destroyed. When a piece of coal is burned it is not destroyed, it is only changed into gases and smoke, and fat is not destroyed by any remedy.

Now here is the true and scientific explanation. When Figuroids are taken, and the fat passes out of those cells into the circulation, it is oxidized. This produces chiefly water and carbonic acid gas. This oxidation takes place while it is being carried along in the circulating blood. This carbonic acid gas and water vapour are eliminated from the system as already explained.

When you take Figuroids, therefore, your extra fat simply passes from the adipose cells through their unbroken walls into the blood, and is there changed to water and Carbon Dioxide, and thus leaves the body.

This is the scientific, simple, natural explanation, and Figuroids is the only remedy which has the effect....

If then you are exceedingly stout and suffering from all the unpleasant symptoms resulting from that condition, if you find your weight excessive, if you suffer from heart palpitation, if you have redness of the face with annoying perspiration and shiny appearance of the nose and face, if the throat and bosom are altogether too stout, and if the lines of the figure have been lost, or if the abdomen has become too prominent, if Gout and Rheumatism make themselves manifest occasionally, and all the disagreeable and often dangerous symptoms of Obesity are apparent, you will know that in Figuroids you have a perfectly safe remedy, while if you suffer but slightly from Obesity and all the symptoms are less marked, you will also know that Figuroids furnish you with an effective, agreeable, and perfectly Safe cure....

When taking Figuroids it is not necessary to unduly restrict yourself in the matter of diet. You may eat and drink what you desire in reason. It would of course, be foolish to drink or eat excessively of fat or fattening foods.

In another enclosed circular the Company stated that:

They have decided to originate a No Cure No Payment system, and will refund the purchase money to any patient whose weight is not reduced by from two to six pounds per month whilst taking Figuroids.... This offer to refund purchase money is made on the understanding that the Figuroid Company's instructions are faithfully observed and the conditions of their offer complied with.

The directions on the label were as follows:

Each bottle contains an equal number of full doses (large tablet) and half doses (small tablet).

Take regularly one full dose (large tablet) dissolved in plain or soda water within 30 minutes after each of the first three meals on the first day. Next day take one half dose (small tablet) dissolved in plain or soda water within 30 minutes after each of the three meals. Third day take full doses again; and so continue alternating.

Although it is here clearly conveyed, without directly making the statement, that the large and small tablets only differ in being full doses and half doses respectively, examination showed their composition to be different, and it was necessary to analyse them separately.

Large Tablets.

The large tablets had an average weight of 58 grains; analysis showed them to contain an effervescing mixture of sodium bicarbonate and tartaric acid, in which the former was in excess, so that the resulting product was alkaline, together with sodium chloride (common salt), phenolphthalein, formamine (hexamethylene-tetramine), talc, and gum. The quantity of each of the ingredients was determined as accurately as possible, with the results given below; it will be noted that these quantities add up to 101·4 instead of 100, the reason being that the whole of the soda is for convenience represented as bicarbonate, whereas a portion of it had become converted to carbonate by loss of carbon dioxide.

In One Tablet. Sodium bicarbonate 62·0 per cent. 38·9 grains. Tartaric acid 22·6 " 13·1 " Sodium chloride 6·5 " 3·8 " Phenolphthalein 2·0 " 1·2 " Formamine 3·5 " 2·0 " Talc 2·8 " Gum about 2·0 "

Hexamethylene-tetramine or formamine, is perhaps better known by its trade names—urotropine, cystamin, urisol, etc.; it does not appear to have been described as of value for obesity.

Small Tablets.

The small tablets had an average weight of 34·3 grains. Analysis showed them to contain sodium bicarbonate and tartaric acid, but in this case the latter was in excess and the product acid; the other ingredients were sodium chloride, phenolphthalein, and talc. The results of quantitative determinations indicated the following formula (more carbon dioxide had been lost in this case; the figures add up to 108·5, the reason being that given above):

In One Tablet. Sodium bicarbonate 34·8 per cent. 11·9 grains. Tartaric acid 46·3 " 15·9 " Sodium chloride 22·8 " 7·6 " Phenolphthalein 1·6 " 0·5 grain. Talc 3·0 "

The estimated cost of the ingredients of the contents of a 2s. 9d. bottle is 1¾d.

FELL REDUCING TREATMENT.

In pushing this "treatment," advertised by an Association giving an address in London, the system of letters in series is resorted to, but a small package, containing 112 tablets, can be purchased for 6s. 6d.

An advertisement ran as follows:

FAT PEOPLE GIVEN FREE TREATMENT.

We have such marvellous records of reductions effected in hundreds of cases with the Fell Reducing Treatment, that we have decided, for a limited period only, to give free trial treatments.

7 LB. PER WEEK REDUCTION IS GUARANTEED, without dieting. Perfectly harmless, pleasant; easy and quick results. Send no money. Simply address the Fell Formula Association, 340, Century House, 205, Regent Street, London, W., enclosing stamp to pay postage, when a free supply in plain wrapper will be immediately forwarded.

A free supply was sent on application, accompanied by a letter and sundry circulars; other letters followed at intervals, and extracts from some of these will be given. They were printed in imitation of typewriting, with the name and address typed in, so as to give the appearance of being personal letters. It will be noted that when a customer has been attracted by the advertisement that "7 lb. per week reduction is guaranteed, without dieting," very much smaller claims are gradually substituted.

Esteemed Friend,

Your favour of recent date has received our careful attention, and we take pleasure in sending you a three days' trial of the Fell Reducing Treatment. Before taking it, weigh yourself, and then again in three days, on the same scales and in the same clothes, you will find you have lost some 3 lb. in weight.

An abnormal condition like corpulency requires that the antidote directly reaches the seat of the complaint, and by these Reducers the blood will be purified, and all the organs of the body restored to natural healthy action, while the germs of the disease will be entirely eradicated from the system, so that the superfluous fat, which will be removed will not return....

At the present stage of the disease in your case, we can positively assure you that under our treatment a marked improvement will begin at once, and continue steadily until a complete reduction in weight, with all the benefits to general health, is effected. Unlike most other methods of treatment, the action begins immediately and the sufferer feels better almost from the beginning, and it is with confidence that we advise you to begin a course of treatment with our Reducing Preparation at once.

Our regular terms and prices are 26s. for a case containing three 11s. boxes, whereby a saving of 7s. is effected.

If you take up the treatment in this manner you can be sure of having sufficient of the Tablets to take you through to a quick reduction. Single boxes of Tablets, however, are supplied at 11s. and smaller sizes at 6s. 6d. The 6s. 6d. box covers a ten days' treatment, while the 11s. boxes contain three times the quantity of the 6s. 6d.

This letter was not answered, but before long another was received which contained the following passages:

In sending you the sample of the "Fell" Preparation, we did so more to show the thorough nature of our treatment than from the expectation that material benefit would be realized from same. As you require to bring about a certain reduction you must necessarily undergo a certain course of treatment. A pound a day reduction results in many cases, and there is every reason to expect that such reduction can be effected in yours. A serious affliction such as obesity is not to be removed by any temporary remedy or with a few days' treatment....

Remember, a 26s. case contains sufficient treatment to reduce materially the most stubborn and long standing case, while an 11s. box contains three times the quantity of the 6s. 6d. box....

A supply was sent for and was accompanied by the following letter:

Dear Sir,

I have despatched to you the Tablets together with directions and instructions. I ask you to carefully observe same, and am confident if you do so, you will very soon see most beneficial results....

I am confident that you will be highly delighted with the splendid effects of the Tablets at the end of a few weeks if you follow carefully my instructions and are prompt and regular in taking the Tablets. I am sending you herewith printed instructions and rules for diet. You will note that our suggestion as to what you should eat, if strictly followed, will not work any hardship, and that you will never go hungry....

This letter, signed "_____ 'Adviser, Fell Formula Association,'" was accompanied by a printed circular giving rules as to diet, etc., and by a "symptom blank," to be filled up by the patient in order to obtain particulars of "the Fell System of Simple Muscular Movements for Reducing the Weight and Increasing the Strength, in combination with the 'Fell' Reducing Treatment"; it appears from the latter that particulars of these exercises are only supplied when the 26s. case is sent for.

A fourth letter dealt with generalities and recommended taking the reducing treatment in increased quantities, but after an interval a fifth was received, enclosing a booklet advocating the use of “the Century Thermal Bath Cabinet,” from which the following are extracts:

... We have strongly recommended the Home Turkish Bath that it may be used at least once a week as an adjunct to the Reducing Treatment; hence our affiliation to the “Century Thermal” Bath Cabinet, Ltd., whose home cabinet is built on such lines as to render it the best device extant for taking Hot Air or Vapour Baths.

... in any event, it were better to spend the required amount, for were the cost as much as £10 in all (it has but rarely exceeded that) the expense is out of all proportion to the ultimate benefit.

... with the Fell treatment no case of obesity, in either sex, can fail to be reduced if assisted with the regular use of the Hot Air Bath.

Booklets entitled _Corpulence or Obesity. Its causes, results, and successful treatment: The Treatment of Obesity by the “Fell” Reducing Treatment_: and _Make Muscle of your Fat_, were also sent at different times. The following extracts from two of these scarcely appear consistent:

A Guarantee to Reduce Weight.

It is not our purpose to indulge in empty talk only, or in unconsequential boasts. We are prepared to, and do, give a positive guarantee that the Fell Treatment, used in conjunction with the Muscular System, will reduce the fat of any person—provided our instructions are adhered to—in the space of a very few weeks.

Do We Guarantee?

We are frequently asked this question personally and by letter, and reply emphatically—No, we do not. To say Yes—would be illogical and certainly demoralising.

A guarantee that any medical remedy or curative will absolutely effect its stated purpose is misleading, deceptive, delusive, and is a trap to ensnare, not intelligent individuals, but the unwary, the unsophisticated, and those utterly unable to discriminate as to the merits or demerits of any so-called specific.

The dose was stated to be:

Nine tablets daily. Three taken three times a day before meals. They may be taken as pills or dissolved on the tongue.

The tablets had an average weight of 1 grain. Analysis showed them to contain 90·8 per cent. of milk sugar, 2·4 per cent. of greasy matter, which appeared to be a mixture of stearic acid and paraffin, evidently employed as a lubricant in making the tablets, and 6·8 per cent. of an extract which agreed well in its characters with extract of _Fucus vesiculosus_; its identity was further indicated by analysis of the ash. Each tablet would thus contain:

Extract of bladderwrack 0·07 grain. Milk sugar 0·91 ”

The estimated cost of the ingredients for 112 tablets is ¼d.

NELSON LLOYD SAFE REDUCING TREATMENT.

In this instance the bait of free trial for a fortnight is held out in the advertisements issued from an address in London; the following are extracts from one advertisement:

I myself am a member of a family many of whom died prematurely after much mental and physical suffering, arising from corpulence. While studying medicine for my degree, I saw the signs of the family complaint in myself. I naturally sought to avert what I for some time feared as being my hereditary fate. It was when I had almost given up hope that I discovered a cure for my condition, which all the time grew worse, in spite of my hopeful trials of all advertised and unadvertised remedies for stoutness. I at last gave up expecting a cure from other people. I experimented with my own thought-out remedies, and, happily, at last my perseverance—or, rather, my desperation—succeeded....

The result of several years’ study and experience has only served to make my treatment more and more successful....

I specially invite those who have tried other remedies for reducing weight without success to write me for:

I. A copy of my book, “The Scientific Treatment of Obesity” (just published, price 6d.), thoroughly deals with the subject in a popular, readable style....

II. Two photos of the lady referred to above, with her letter giving full particulars of her cure.

III. Everything required for a complete fourteen days’ free trial treatment.

I make no charge for all the above, but ask you to enclose sixpence (by postal order), just to cover the expenses of carriage, packing, and dispatch of parcel.

Application for the “Treatment” brought a box containing 42 tablets, a copy of the booklet mentioned above, and a letter and form for particulars. A few extracts will suffice to show what was claimed and the methods adopted.

From the booklet:

Different cases vary so much that the same treatment is never exactly suited to any two cases. Moreover, the treatment has to be modified as the patient progresses, the condition of the individual being periodically allowed for.... I wish to make it perfectly clear that not only do I offer every client the full benefit of practically a life-study of the whole subject of corpulence, but that I _guarantee_ to effect a cure of every case I take up.

There are no “ifs” and “buts” about my promises to my patients. I undertake to reduce corpulence by rational individual treatment in each and every case entrusted to me, and I undertake to promise (_sic_) that my treatment is in no way weakening, that it is permanent, and also that it has absolutely no ill effects.

From the first letter:

One of the Tablets should be taken after each of the three chief meals of the day for the next fortnight. I suggest that if convenient you weigh yourself before beginning the course, and again in fourteen days’ time, with the same scales and in the same clothes. You will find you have lost weight, while improving in your general condition.... My course of Treatment lasts a month except in unusual cases. The tablets I have sent you for the first fortnight will at once put a stop to the fat-forming habit of the body; these tablets are taken during the first fortnight in all cases, and while excellent results follow even in this brief period, they need to be followed up from the fifteenth day by additional and different remedies, adapted to each individual case.

In order to prepare this part of your Treatment I shall need to have before me full particulars of your case, which you can easily give me by filling up the Consultation Form enclosed herewith....

My fee for a month’s course of Treatment is one guinea, but you will see that I have given you credit for the first fortnight’s Treatment sent you herewith, because this is free in accordance with my offer through the Press. This means that by sending at once you can have one month’s complete treatment for half cost. To secure this concession you must, however, send me the Consultation Form filled up, and remittance for 10s. 6d. in time to continue your Treatment on the fifteenth day, and I must have at least three clear days in which to consider your case and prepare and post your Treatment to reach you in time.

The “Consultation Form” contained questions as to age, height, weight, chest and abdomen measurements, details of bodily condition, habits, and diet; this was filled up so as to represent an ordinary case of moderate obesity, and returned with 10s. 6d. In the next letter it was stated:

I am preparing your second fortnight’s treatment, and it will be forwarded in due course, but I feel I should like to take this opportunity of pointing out to you that there are special features about your case which, while not preventing the accomplishment of the improvement you desire, will, however, entail a little longer course of treatment than one month.

In my opinion your case requires a two months’ course of my treatment, at the end of which time the results will be all that you can desire. I thought it only right you should know this, and I would like you to tell me if you will take the full course my experience leads me to advise you.

My fee for the two months’ course is two guineas, but you have already standing to your credit the sum of one guinea, being one half-guinea allowed for first fortnight’s free trial, and the other half-guinea you have just sent me.

I should like you to take the full course my experience tells me is necessary for you, and if you now send me the one guinea balance, I will at once arrange for the supply of all the necessary remedies to you at the proper intervals.

The second fortnight's treatment consisted of "special tablets" and a liquid; these were accompanied by a further letter, a diet table, and a report form, to be filled in and returned after 10 days.

The three kinds of medicine were examined with results as follows:

The preliminary tablets.—There were 42 in the box, and the directions were to take one three times a day after meals.

They were sugar-coated and coloured red externally; after removal of the coating, they had an average weight of 4·7 grains. Analysis showed them to consist principally of substances of extract nature, together with an amount of liquorice fibre representing about 20 per cent. of powdered liquorice; iodine was present in organic combination, and a nitrogenous substance; the amount of nitrogen was 0·51 per cent., representing 3·2 per cent. of proteid; no tissue of thyroid gland was present, and the nitrogenous material was probably contained in an extract of this substance. The remainder possessed the general characters of extract of _Fucus vesiculosus_, and its identity was also indicated by analysis of the ash; some gum was also present, and some indication was obtained of another substance also, which, however, possessed no important characters, and was probably also of the nature of excipient. The formula indicated by the results was thus:

Extract of bladderwrack 2·5 grains. Proteid of thyroid gland 0·15 grain. Powdered liquorice 0·9 " Excipient and moisture, etc. q.s. In one tablet.

The "special" tablets.—There were 33 of these in a box; the directions were to take one after the mid-day and one after the evening meal. They were sugar-coated but not coloured. After removal of the coating, they had an average weight of 4·6 grains. Analysis showed their composition to agree qualitatively with that of the preliminary tablets, but the nitrogenous material and the liquorice were present in somewhat larger amounts. The following formula was indicated by the results:

Extract of bladderwrack 2·5 grains. Proteid of thyroid gland 0·19 grain. Powdered liquorice 1·4 " Excipient and moisture, etc. q.s. In one tablet.

The liquid.—Two fluid ounces were supplied, the directions being to take 30 drops in a wineglassful of cold water the last thing at night before retiring and on rising in the morning. Analysis showed this to contain alcohol, glycerine, nitrogenous matter, a little iodine in organic combination, and substances of extract nature; the character of the extract and the composition of the ash again pointed to its being derived from _Fucus vesiculosus_; the amount of nitrogen was determined and the equivalent amount of proteid matter calculated; the alcohol and glycerine were also determined quantitatively: the amount of extract of bladderwrack could only be arrived at by difference, supported by the probability that the alcohol was all, or nearly all, added in the form of the fluid extract of this drug, and the figure can therefore only be given with reservation; there were also indications of some small amount of flavouring and colouring matter having been added. The approximate formula appeared to be:

Proteid of thyroid gland 0·3 part. Liquid extract of bladderwrack 32 fluid parts. Glycerine 12 " In 100 fluid parts.

The amount of thyroid actually represented by the nitrogenous matter found in these three preparations was too uncertain for an estimate of the cost price to be of value.

CORPULIN, AND DALLOFF'S TEA "CONTRE L'OBESITÉ" GRAZIANA ZEHRKUR.

Of the German preparations examined by Dr. Zernik two contain bladderwrack. One called Corpulin contains also tamarind and cascara sagrada. The other, Dalloff's Tea "Contre l'Obesité," as to which the advertisers assert that "regular use leads to the removal of superfluous adipose tissue and the person becomes healthy and attains old age" was found to consist of a mixture of the leaves of senna, bearberry (_Uvœ ursi_) and lavender, and anthylla flowers. Any action it may have depends probably on the senna leaves. It is sold in boxes costing 7s. 6d. or 4s. 6d.; the smaller box contains 80 grammes, or nearly 3 ounces of the powder.

Graziana Reducing Treatment (Zehrkur) is sent out in parcels costing 3s. Each contains a packet of a greyish-brown powder, a box of 40 starch capsules, each containing 0·2 gramme of a light brown finely-divided powder, and a box of 86 pills, each weighing 0·22 gramme. The chief ingredient of each of the preparations is powdered _Fucus_. The pills contain some substance yielding emodin, the purgative principle, or one of the purgative principles, of aloes, rhubarb, buckthorn, and senna, and also some sulphates and chlorides.

CHAPTER X.

SKIN DISEASES.

Proprietary articles for the cure of eczema and other skin affections include several which are as widely advertised as any nostrums of any kind. Some of them are at first offered at the comparatively low price of 1s. 1½d.; but in almost every case the further information supplied on application shows that what is really recommended is a “treatment,” including an ointment or other application, a special soap, and a medicine to be taken internally, and often also a dusting powder, and occasionally other articles. The importance of persisting in the treatment is strongly emphasised, with the result that anyone who once lays out 1s. 1½d. is likely to be drawn into spending quite a considerable sum. Only a few out of the long list which might be made of these articles have been analysed, but the results throw sufficient light on the general nature of the whole class. The most striking point about them is perhaps the extremely commonplace nature of the drugs selected, although the vendors in some instances would have the buyer believe that the preparation sold is the result of years of patient experiment.

ANTEXEMA.

A Company with an address in London advertises for sale a bottle, price 1s. 1½d., containing a little less than 1½ ounces, but the “Antexema Treatment” includes Antexema, Antexema Soap, and Antexema Granules (to be taken internally). On a handbill enclosed with the bottle it was stated that:

In most cases “Antexema” will by itself effect a cure, but the permanence of this is assured by the continued use of a suitable soap, and the cleansing and purifying action of “Antexema Granules” on the blood.

A booklet on “Skin Troubles” was also enclosed, containing some “before” and “after” illustrations, but they could hardly be expected to convince anyone; directions were given in this for the course to be pursued in a variety of disorders, including such “skin troubles” as in-growing toenails, lupus, piles, ulcers, etc. Incidentally, twelve other preparations made by the same Company, in addition to the three named above, were recommended.

On the outer package it was stated that:

“Antexema” is the most efficacious remedy known for the relief of all inflamed conditions of the skin. Its beneficial effects are not confined to the curing of Eczema, Psoriasis, Nettlerash, Erysipelas, Boils, and other serious troubles, but it is also by far the best remedy for Cuts, Burns, Sores, Bruises, Chilblains, Blisters, Insect bites, and every variety of trouble to which the skin is liable.

Only “Antexema” itself was analysed. It consisted of an emulsion, with more or less of a watery layer below it. The directions for use were:

Shake the bottle well, and, if necessary, stir up the contents until a milky substance is formed. Then gently rub “Antexema” into the parts affected until dry, and if the case is a severe one it should be applied as often as possible. “Antexema” is odourless, non-poisonous, and invisible when rubbed on the skin, and it instantly allays irritation. Do not wash any weeping or inflamed surface until healed, and, if possible, avoid dressings and coverings.

Analysis showed it to consist of:

Soft paraffin 35·4 per cent. Boric acid 1·5 ” Gummy matter 12·4 ” Water 50·7 ”

The gum resembled in some respects a mixture of acacia and tragacanth, but could not be exactly identified.

The estimated cost of the ingredients of 1½ ounces is two-thirds of a penny.

PACIDERMA PREPARATIONS.

These preparations are advertised as follows from an address in London:

New Cure for Eczema.—A victim who was cured after 5 years’ intense suffering will gladly send to all readers of the _Christian Herald_ full particulars (free) of an inexpensive guaranteed cure for Eczema, Bad Legs, Sore Hands and all Skin Eruptions, on receipt of stamped addressed envelope.—Write to A. Paciderma.

An application to the address given brought a typed letter apparently produced on a multiple copy machine, from “Paciderma. Manageress, Mrs. E. Avice,” from which the following extracts are taken:

“Paciderma” ... consists of three preparations (in one package), one for internal use and two for external use. Both internal and external Remedies are absolutely necessary to eradicate the disease.... The price is most moderate, namely 6s. and postage 3d. for the package containing the three preparations for thirty days’ full treatment. In conclusion I would point out to you that these Remedies have met with a world-wide success, even in the worst forms of these terrible complaints, and are in fact so wonderfully successful that they are

GUARANTEED EFFICACIOUS IN EVERY CASE

no matter what has previously been tried and failed.... Be sure to fill up the Order Form which I am enclosing you as carefully and accurately as you can so that I may be able to give your case my fullest attention and consideration.

This letter was accompanied by a booklet entitled “Eczema and how to Cure it,” and by an order form with spaces for name, address, date, and the following further particulars:

Age; sex; occupation; how long been suffering? where the complaint is located; are the spots or wounds dry? is there any sticky discharge? are your bowels constipated? do you suffer from piles? do you suffer from indigestion? do you suffer from rheumatism or gout? Do you suffer from any other complaint?

This form, filled up with the details of an imaginary case, was sent with a postal order for the requisite amount. A case of “Paciderma” preparations was at once received, and needless to say there was no evidence of their having been modified in any way in consequence of the “fullest attention and consideration” given to the particulars supplied. The preparations were accompanied by a further letter, typed like the first, from which the following is extracted:

One case of the remedies is generally sufficient to effect a cure, and I trust that it may be so in your case, but if the disease has been in the system for years it has got a firm hold, and naturally takes longer to eradicate; therefore, if this case of remedies should not cure you, you must lose no time in writing for a further supply so that no time may be lost between. You must avoid anything likely to irritate the skin, and be especially careful as to the soap you use, as many soaps are most injurious, being quite sufficient in themselves to cause an eruption. I should recommend you to use “Paciderma Skin Soap” to wash yourself with, as it is absolutely pure, and will keep your skin smooth and healthy.

After an interval a further letter was received, which ran as follows:

Dear Sir,—I have been expecting to hear from you as to how the treatment I sent you some time ago has affected you. I sincerely trust that you have derived benefit from it. As I think I told you before, some cases are naturally much more difficult to cure than others, and take longer time, as in most cases the disease has been for years getting a firm hold on the system, and cannot, therefore, be eradicated in a few days.

I assure you I should be the last to induce you to spend money, unless I honestly thought and believed that the treatment would benefit you. I have been a fellow sufferer myself, and know what it did for me by persevering after everything else had failed. If, therefore, you are not yet cured, I think it is only my duty to strongly urge you to persevere with the treatment, and if you hesitate to do so owing to the money being a consideration to you, I am willing to meet you as far as I possibly can, and will send you the complete 6s. 3d. case for 4s. 6d. post free, which is just cost price, or I will send you the Blood Wafers for 2s. 2d. per box post free instead of 2s. 10d., or the Crème for 2s. 2d. post free instead of 2s. 10d., or the Powder for 7d. instead of 9d. post free.

I am offering you this very great reduction in price as I am most anxious that you should be cured, as I am quite certain that you will be if you persevere steadily.

Do not be afraid of troubling me by writing me fully as to how the treatment has affected you, as I can assure you that I am quite as anxious to cure you as you yourself are to be cured, and I take a special interest in your case.

Trusting soon to hear from you.

Yours truly, E. AVICE.

The booklet already referred to contained a sworn statement by Mrs. Avice detailing her own sufferings and cure, the latter being due to “a dear old friend, an M.D.” Further paragraphs, not in the sworn statement, were as follows:

It remained for my old friend, the Doctor, to whose discoveries I owe my cure, to find the only certain remedy for this dread complaint. For years he studied and searched to find a cure for that curse of hot climates, the “prickly heat,” a very distressing form of Eczema which is very prevalent in warm countries, and which few Europeans escape. At last his perseverance was rewarded, and the long sought for Remedy found and used with the greatest success both abroad and after his return to England. Since his death I have still further improved on and perfected his ideas, and have evolved my now well-known “Paciderma,” which has met with the most startling success in every case in which it has been tried....

Paciderma cures all skin troubles without exception, all pimples, blotches, sores and eruptions of every kind, in sufferers of every age, from the infant at the breast to the old and infirm man or woman who has reached or passed the allotted span of three score years and ten.

It is absolutely the only cure for Eczema.

The following are the results of the examination of the remedies evolved after so much study and research and perfected and improved:

Paciderma Crème.—Price 2s. 9d. per box, holding nearly 4 ounces. Directions for use:

Apply the Crème to the parts affected with the finger, or spread on lint or soft linen, and bandage.

The Crème consisted of a fairly stiff ointment, which on analysis gave results corresponding to the following formula:

Zinc oxide 25·6 per cent. Calcium carbonate 2·7 ” ” sulphate 15·8 ” Boric acid 15·9 ” Basis 58·7 ”

The basis consisted of soft paraffin, apparently with a small proportion of a saponifiable oil, such as olive oil.

The estimated cost of the ingredients for 4 ounces is 1½d.

Paciderma Powder.—Price 9d. per box, containing about 3 ounces. The directions ran:

Allays all itching and irritation, and should be applied freely and frequently to the affected parts, in fact whenever they itch or irritate.

Analysis showed the composition to be:

Maize starch 54 per cent. Boric acid 14 ” Insoluble mineral matter 19 ” Moisture 13 ”

The insoluble mineral matter contained alumina, magnesia, and silica, corresponding to a mixture of talc and kaolin; this composition also agreed with all its other properties.

The estimated cost of ingredients for 3 ounces is ¾d.

Paciderma Blood Wafers.—Price 2s. 9d. per box of thirty.

Directions. One to be taken every night at bedtime.

The “wafers” consisted of cachets, each containing about 8½ grains of a powder, the composition of which was indicated by analysis to be:

Sodium bicarbonate 59 per cent. Precipitated sulphur 37 ” Powdered ginger 3 ” Aloin 1 ”

The ginger and aloin could only be estimated approximately.

The estimated cost of the ingredients for 30 wafers is one-fifth of a penny.

CUTICURA REMEDIES.

The remedies are stated to be prepared by a Drug and Chemical Corporation in the U.S.A.

The “system,” which has been very widely advertised, consists of Cuticura (Ointment), Cuticura Soap, and Cuticura Resolvent (liquid or pills); the ointment and the resolvent liquid were taken for analysis.

A booklet was enclosed in each package, containing, with other matter, directions for the use of the remedies in fourteen languages; from it the following extracts are taken:

In the treatment of torturing, disfiguring, itching, scaly, crusted, pimply, blotchy, and scrofulous humours of the skin, scalp, and blood, with loss of hair, the Cuticura Remedies have been wonderfully successful. Even the most obstinate of constitutional humours, such as bad blood, scrofula, inherited and contagious humours, with loss of hair, glandular swellings, ulcerous patches in the throat and mouth, sore eyes, copper-coloured blotches, as well as boils, carbuncles, sties, ulcers, scrofulous rheumatism, and most humours arising from an impure or impoverished condition of the blood, yield to the CUTICURA SYSTEM OF TREATMENT in the majority of cases, when the usual remedies fail.... Parents are assured that these Remedies are composed of the purest and sweetest ingredients known to modern pharmacy, and may be used on the youngest infants with complete satisfaction.

Cuticura Ointment.—Price 2s. 6d. per box, containing 1¾ ounces.

Directions.... Cuticura Ointment may be applied to any part of the surface of the body by direct application with the finger, the palm of the hand, or spread on cotton, linen, or absorbent cotton, and covered with a light bandage, or by any means by which a remedy of this consistence would be used.

... in rare instances of individual tendency to acute eczema, acne, acne rosacea, erysipelas, and other highly inflammatory conditions, especially those affecting the face, it may act as an irritant, and hence those using it must observe what has been said in the foregoing directions in order that they may exercise judgment as to whether to continue it or not, should any unfavourable symptom present itself.

Examination of the ointment showed the absence of all metallic compounds, also of alkaloids or other active principles, and of saponifiable fat. It consisted of a mixture of hard and soft paraffins, slightly perfumed with rose, and coloured green. The chief green colouring matter present appeared to be an aniline dye, and a mixture of paraffins, coloured with a trace of malachite green and a little chlorophyll, agreed very closely with it in its properties. No other ingredient could be discovered.

The estimated cost of the ingredients of 1¾ ounces is ¾d.

Cuticura Resolvent.—Price 2s. 6d. per bottle, containing 6½ fluid ounces.

In the pamphlet quoted above it is stated:

Cuticura Resolvent is alterative, antiseptic, tonic, digestive, and aperient, and is confidently believed to be superior to other preparations for purifying the system of humours of the skin, scalp, and blood, with loss of hair. CUTICURA RESOLVENT is prepared in accordance with the most advanced pharmaceutical and therapeutical knowledge from medicinal agents of ascertained purity and potency, and while in the highest degree effective, commends itself to delicate, sensitive, and refined people, especially women, because of its pure, sweet, and gentle action.... It is believed to be one of the most successful of blood-purifying and strengthening medicines for children in all conditions which point to inherited impurities and weaknesses, and may be taken on the first appearance of glandular swellings, ulcers, sores, especially on the neck, pallor, weakness, and delicate, frail conditions, with every hope of success.

DIRECTIONS.—Adult dose, two teaspoonfuls three times a day; for children over ten years of age and delicate females, one teaspoonful; for children from five to ten years of age, one half of a teaspoonful; for children two to five years of age, 15 drops; from one to two years, 10 drops. To be taken three times a day, immediately after each meal.

Analysis showed the composition of the mixture to be:

Potassium iodide 17 grains. Sugar and glucose 486 ” Extractive 8 ” Alcohol 10 fluid drachms. Water to 6½ fluid ounces.

No alkaloidal substance was present; the extractive gave a slight indication of the presence of a preparation of rhubarb; all other drugs with well-marked characters were absent.

ZAM-BUK.

This ointment is sold by a London Company in a box, containing three-fifths of an ounce, price 1s. 1½d.; a Zam-Buk soap is also recommended for use as part of the treatment. In a circular enclosed in the package it was related how:

Certain medicinal plants were taken, and from them were extracted gums and juices possessing considerable healing and curative power. Costly experiments at last secured the right blending of these juices; and to the final product, a preparation virtually capable of growing new and healthy skin, the name of Zam-Buk was given....

Zam-Buk practically contains those substances which Nature has intended for the use of man ever since she bequeathed to him the instinct to rub a place that hurts....

Zam-Buk has proved itself to be unequalled for Cuts, Bruises, Burns, Scalds, Abrasions, Festering Sores, Poisoned Wounds, Lacerated Wounds, Old Wounds, Sprains, Strains, Swellings, Dog Bites, Cat Scratches, Obstinate Sores, Chafings, Itch (Scabies), Stings from Hornets, Bees, Wasps, Centipedes, and Spiders; Running Sores, Ulcers, Ringworm, Eczema (acute or chronic form), Psoriasis (tetter), Pimples, Acne, Abscesses, Boils, Carbuncles, Scrofula, Cramp, Barber's Itch, Heat Rashes, Sunburn, Freckles, Blotches, Blackheads, Scalp Irritations Scurf or Dandruff, and other Scalp Sores; Colds, Chills, Raw Chapped Hands, Sore Lips, Raw Chin after Shaving; Inflamed Patches, Sore Nipples, Glandular Swellings, Swollen Knees, Bad Legs, Blind and Bleeding Piles, Cold-Sores, Sore Backs, Diseased or Weak Ankles, Sore and Aching Feet, Perspiring Feet, Chilblains, Soft Corns, Saltwater Sores. Rubbed well into the part affected, Zam-Buk gives great relief from Rheumatism, Lumbago, Neuralgia, Sciatica, Toothache, and allays all kinds of Inflammation, Itching, and Irritation.

The directions on the box were:

For Bruises, Cuts, Sores, Sprains, Open Wounds, Sore Breasts, Inflamed Patches, Ulcers, Eczema and Piles; first cleanse the parts with pure water and then apply Zam-Buk direct or on a piece of clean lint. For Burns, Scalds, etc., rub Zam-Buk lightly over the injured part and cover same as soon as possible in order to exclude the air. To use Zam-Buk as an Embrocation rub it in well, both into the muscles and tendons, when the healing, stimulating and strengthening ingredients in Zam-Buk will be absorbed into the system.

Analysis showed its composition to be:

Oil of eucalyptus 14 per cent. (approximately). Pale resin (colophony) 20 " " Soft paraffin 55 " " Hard paraffin 11 " " Green colouring matter a trace.

An ointment prepared in accordance with this formula and tinted with chlorophyll agreed in all respects with the original.

The estimated cost of the ingredients for three-fifths of an ounce is ¼d.

ZIP OINTMENT.

This is supplied by a Company giving an address in a London suburb in box containing rather less than an ounce (0·85 ounce) at the price of 1s. 1½d.

On a circular enclosed with the box this ointment was described as a "cure for Eczema, Ringworm, Psoriasis." It was also stated that:

Zip is the product of many years' experience and trials, and will be found the best and most reliable remedy for the above troublesome complaints.

The directions given on the box were:

Wash well the parts with the Zip Skin Soap, and apply Zip night and morning.

Analysis showed the composition of the ointment to be:

Calomel 2·1 parts. Lead acetate 1·0 part. " oleate 2·5 parts. Oil (probably olive) 2 " Glycerine 5 " Creosote A trace. Oil of lemon grass Sufficient to perfume. Paraffin ointment To 100 parts.

The estimated cost of the ingredients for 0·85 ounce is ½d.

The following are quoted from Dr. Zernik's notes on some of the skin remedies most advertised in Germany.

CRÈME EKZEMIN.

Crème Ekzemin, advertised as a cure for almost all diseases of the skin, including psoriasis, is a mixture of precipitated sulphur and a semi-fluid fatty mass, coloured red. The tube contains 75 grammes, and costs 5s. 2½d.

PHEUN SKIN PASTE.

Pheun Skin Paste, according to the vendors, possesses marvellous properties, and when applied to the skin it not only removes all the dirt but kills all the bacteria, even when situated in the deeper layers, and it is recommended as a cure for all forms of skin diseases. Zernik, on analysis, found it to contain 31 per cent. of soft paraffin, 5 per cent. of water, 2 per cent. of soap, and 10 per cent. of a dry substance yielding slimy material.

JUNIPER BEAUTY CREAM AND JUNIPER BEAUTY SOAP.

It may be worth while to add that Zernik says of a certain “Juniper Beauty Cream,” sold in Berlin, that it is a water-containing ointment, perfumed with oil of bergamot, containing 5 per cent. of white precipitate (ammoniated mercury) and 11 per cent. of salicylic acid. It seems to be intended for the face, but looking to the large proportion of salicylic acid it contains, it might, perhaps, be more appropriate for use as a corn plaster.

RINO CURATIVE OINTMENT.

Rino Curative Ointment, advertised as containing naphthalan, Peru balsam, chrysarobin, etc., was found by Zernik to consist of turpentine, oil of cade, 1 per cent. of boric acid, 6 or 7 per cent. of yolk of egg and an indifferent vehicle,

CHAPTER XI.

MEDICINES FOR BALDNESS.

During recent years the number of preparations put forward for the cure of baldness has been increased by a new class, those, namely, which are not applied locally but taken internally. The principal ingredient in all seems to be the dried colouring matter of the blood of warm-blooded animals—haemoglobin. The most widely advertised of them is sold under the name of “Capsuloids.”

CAPSULOIDS.

The price was 2s. 3d. for a box containing 36 capsuloids.

On the outer package it was stated that:

Our special process used in making Capsuloids is never used and never has been used outside our Laboratory. It is known only to the Capsuloid Company, Ltd., and has never at any time been communicated to any other person or firm. This material is then enclosed in little pear-shaped gelatine capsules which are made of the finest and purest gelatine. As a result of our special process, Capsuloids have that particular and remarkable effect upon the hair through the medium of the blood which is so well and widely known. There is no other preparation which possesses anything like the same effect.

Capsuloids not only cause the death of those harmful germs which we have proved to be the cause of falling out and prematurely grey hair, but they also restore the injured growing cells of the hair roots, and nourish them, and cause them to multiply so that the roots become firm and grow rapidly, producing thick and luxuriant hair, and where there has been premature greyness, it is also cured. Recent scientific investigation has definitely proved this, and has demonstrated that hair cannot be made to grow by using external preparations.

Directions. To stop falling out of the hair and to restore the colour to prematurely grey hair, adults should take two, or in very severe cases three, capsuloids before eating or with the first part of each meal, three times daily. The doses for younger persons is one or two with each meal. Capsuloids never cause constipation or indigestion, nor do they in any way upset the stomach, or any part of the system.

A booklet of 20 pages was enclosed in the package, in which the above statements were repeated and further elaborated with the aid of a diagram of the root of a hair, with blood-vessels, oil gland, “growing cells containing harmful germs,” etc.

The capsuloids were elongated gelatine capsules containing a dark material, the average contents of one weighing 3·4 grains. The material yielded 32 per cent. to a solvent suitable for extracting fats, and this portion proved to be a mixture of about equal parts of a neutral oil and a fatty acid, agreeing in their characters with olive oil and oleic acid, respectively. Extraction of the residue with alcohol then removed 10 per cent. of an aromatic balsamic substance, generally resembling Peruvian balsam, but lighter in colour; a mixture of equal parts of Peruvian balsam and purified storax gave a substance practically identical. The residue, insoluble in both solvents, was a red-brown powder, which was found by its characters to be dried haemoglobin. Careful search was made for arsenic, alkaloids, and other ingredients, but nothing else was detected. The results indicated the following formula for the contents of the capsules:

Haemoglobin 1·97 grain. Olive oil } Oleic acid } of each 0·54 ”

Balsam of Peru } Purified storax } of each 0·17 ” In one capsule.

The estimated cost of materials for the contents of 36 capsules is 1d.

Other dealers have paid the company the sincere compliment of imitation, and various similar articles appear to be largely sold. The following particulars are taken from price lists and advertisements intended for retail chemists; as haemoglobin is referred to as the principal constituent in each case, they were not submitted to analysis.

CAPSULATED HAEMOGLOBIN OVALS FOR THE HAIR.

“Capsulated Haemoglobin Ovals for the Hair. Contain 2½ grains of Pure Haemoglobin.”

They were supplied by a firm in a south country seaside town, labelled with name and address of the retailer. The wholesale price quoted was for tubes of 25, 4s. per dozen.

HAEMOGLOBIN HAIR CAPSULES.

“Capsules for the Hair. When falling out or turning prematurely grey, these capsules by enriching the blood make the hair glossy, luxuriant, and full of vitality.”

These were not described on the package as containing haemoglobin, but were quoted in the price list as “Haemoglobin Hair Capsules.” They were supplied by a company in a seaside town. “Store price, 1s. 6d.” Wholesale price, 7s. per dozen packages.

SOLUBLE CAPSULES OF HAEMOGLOBIN.

“Soluble Capsules of Haemoglobin. A natural hair food. Produces Healthy, Strong, and Luxuriant Hair.”

The wholesale price of these, supplied by a London firm, was for boxes of 36, 5s. 9d. per dozen.

CHAPTER XII.

CANCER REMEDIES.

A very slight acquaintance with the advertisements of quack medicines is enough to show that a knowledge of the causes of the disease for which a cure is promised is in no wise necessary for the composition of either the medicine or the advertisement, in fact, it is impossible to believe that the extravagant claims and absurd statements made could be put forward by persons having any knowledge of disease. It is no matter for surprise, therefore, that in the case of the least understood and least successfully combated of diseases many proprietary “remedies” are put forward. A considerable number of these articles have been received and the alleged claims tested at the laboratories of the Imperial Cancer Research Fund; specimens of a few of these were obtained and submitted to analysis, and some notes on their composition cannot fail to be of interest to members of the medical profession, who will probably from time to time have to treat sufferers from cancer who have been induced to buy one or other of these preparations.

As was to be expected, the articles examined have little or nothing in common. In the case of diseases for which the ordinary treatment involves the use of certain specific drugs, proprietary medicines are usually merely varying compounds of those drugs; thus, of the advertised cures for epilepsy, analyses of which are given in the next chapter, the essential ingredient in all but one is an alkaline bromide. But in cancer the would-be maker of a proprietary “cure” has no such accepted treatment to guide him, or to

restrict the free range of his fancy in selection of ingredients; it is probable that some of the “remedies” here described were inspired by the fact that some apparent improvement followed their fortuitous use in some cases, _post hoc_ having been assumed to mean _propter hoc_; the first to be described, however, can hardly rest even on this basis.

It is a colourless liquid, containing a trace of sediment; the odour is that of alcohol, though very slightly vinous. Fractional distillation showed the presence of about 40 per cent. of alcohol; on complete evaporation, a trace (0·02 per cent.) of dry residue was left. This residue was free from any alkaloid, and its behaviour with reagents gave no indication of any other active principle; it agreed in character with the “extractive” found in spirit that has been kept in a wine-cask. After removing the alcohol, the liquid was perfectly tasteless. This “remedy” is thus very simple in nature, consisting merely of diluted and slightly impure alcohol. Its composition brings to mind the analysis published some years ago of a so-called electric fluid, or “electricity,” for the cure of cancer, which was taken up by a certain well-known journalist and boomed by him in the pages of the review which he edited; many marvellous cures were ascribed to it, but examination showed that although it was sold at several shillings per fluid ounce, it consisted of plain water. Notwithstanding the exposure, the article is at present quoted in wholesale lists, and is therefore presumably still in demand. The cost of the “medicine” we are now dealing with is of course considerably greater than the cost of plain water, but this fact will be but small consolation to the victim who derives as little benefit from the one as from the other.

The next article analysed was a blue fluid containing a considerable blue sediment, and smelling fairly strongly of terebene. The chief ingredient was found to be a blue dye stuff of the oxazine or thiazine group, much resembling methylene blue (which is the only member of these groups ordinarily used in medicine), but differing from it in solubility and in its behaviour with certain reagents. This constituted the greater part of the sediment, and a portion of the dye was also in solution. The liquid further contained a dissolved gum and a trace of terebene; these, with a little magnesium carbonate, were all the ingredients present. No trace of any alkaloid was found, and the solvent was water. The gum showed no difference from ordinary acacia gum, and was probably added to suspend the undissolved dye stuff. Water dissolves very little terebene, and no more of the latter was present than could be dissolved by the water; it was probably employed to give an aromatic taste and smell, and the magnesia was doubtless used to subdivide the terebene in the manner commonly followed by pharmacists when dissolving essential oils in water. It thus appears that the essential ingredient of this medicine is the blue dye stuff; it is possible that this has been used as methylene blue, since the articles sent out under the same name by different dye manufacturers often differ in composition; but, as already stated, it is not identical with the methylene blue usually met with. The total solids in the mixture, after shaking up the sediment, amounted to 13·2 per cent., of which the dye stuff constituted something like one-half.

A third preparation was a brown liquid of syrupy consistence found to consist of wood tar. It was a much purer product than ordinary Stockholm tar, and its peculiar odour indicated that it was derived, at least in great part, from the birch; no other ingredient could be found. This article came from Sphakia, Crete; the label bore no directions for its use, leaving it uncertain whether it was intended for internal or external use, but the latter appears the more probable.

The remaining articles are clearly intended for external application; the first of these consisted of a plaster mass, in the half-pound sticks in which such masses are usually supplied. Analysis showed the principal ingredient to be lead oleate, with a little stearate, and small quantities of resin and soap. These are the ingredients of the resin and the soap plasters of the _British Pharmacopœia_, and the proportion of soap present showed the specimen under examination to be emplastrum resinae.

The next preparation was an ointment of Dutch origin. It contained large quantities of ammonium alum and zinc sulphate, with a little sodium sulphate, made up into a stiff ointment with a basis consisting of beeswax, soft paraffin, oil, and resin. The quantities of the salts were approximately:

Alum 27 per cent. Zinc sulphate 37 ” Sodium sulphate 8 ”

The presence of so large a proportion of mineral salts, of course, leaves very little tenacity in the ointment; particles of the white salts were easily visible to the eye, and the effect of applying the preparation must be practically the same as if the dry salts were rubbed on the skin except that the basis would, of course, act as a lubricant in the rubbing.

The last of these preparations was another ointment; the mineral ingredients in this case, however, were in organic combination. This ointment contained copper oleate and aluminium oleate with a basis of lard and a little resin. The proportions of the active ingredients were approximately:

Copper oleate 15 per cent. Aluminium oleate 35 ”

No alkaloid or other active principle was found.

A bottle of lotion for cancer and other affections, obtained in the ordinary way through a dealer, was examined. The label commences with the statement that the lotion “cures cancerous or malignant sores”; then follows a list of other diseases, with the addition, “even cases that have been under the treatment of doctors and at infirmaries for years.” Analysis showed the composition of the lotion to be substantially as follows:—

Zinc sulphate 92 grains Carbolic acid (pure phenol) 1·2 oz. Glycerine 1·8 fl. oz. Cochineal solution sufficient to give a deep red colour. Water to 3·3 fl. oz.

This quantity is contained in a bottle costing 4s. 6d.; the directions are to add the whole contents to 1½ pints of water, which is to be applied to the diseased parts for about five minutes two or three times a day.

Another pretended “cure” for this disease was supplied from an address in Croydon, by a person who described himself as a retired Government analytical chemist. The bottle did not bear an Inland Revenue stamp. The vendor seems to prefer to see and examine the patients. In one such case he was paid 3 guineas, and asked for more, as it was, he said, a complicated case. The directions given were “two tablespoonfuls should be taken three times a day.” Analysis of this liquid showed the presence of ferric chloride, and traces of hydrochloric acid and alcohol, and nothing else except water; the alcohol indicates that the tincture of perchloride of iron, and not the liquor, was employed; determination of the amounts of iron and chlorine present showed that 6 fluid ounces of the mixture contained 5·7 fluid drachms of the tincture.

A few years ago a good deal was heard of the wonderful cures said to be achieved by two persons who resided at Cardigan. A great deal of secrecy was observed, but it was known that a fluid was applied to the surface of the cancerous tumour. The treatment, it was stated, began with prayer, and exhortations to the patient to trust in the Almighty; the lotion or oil, which was said to be made entirely from herbs and to contain no mineral caustic, was then painted on with a brush. Unlike other empirics who profess to remove the “roots” which the knife leaves behind, these Welsh practitioners asserted that their remedy made the “roots” shrink into the original growth which then fell off like a ripe apple from a tree. The practice seemed to be to require the patient to attend daily to have the local application made for periods extending over several months. Eventually, in some cases, a mass of dried, heaped-up crusts formed, and when this became detached it was put into a bottle and given to the patient who was told that it was the cancer extracted by the treatment. In one case which was enquired into, this bottle cancer was submitted to microscopical examination; it was found to consist of crusts formed of sloughing parts of the skin and inflammatory exudation, the whole being such a mass as might be produced by the use of an escharotic. The crusts when submitted to chemical analysis were found to contain zinc chloride in considerable amount, together with a very appreciable quantity of an insoluble compound of lead. A healing oil was also supplied to help the cancer falling off, and this when chemically examined was found to contain 27 per cent. of oil of turpentine, the remainder consisting principally of an ordinary saponifiable oil, probably cotton-seed or olive oil. In addition there was a considerable amount of deposit which proved to consist almost wholly of barium sulphate, a very insoluble salt, used, under the name of permanent white, by watercolour artists. It would seem, therefore, that the statement that the applications contained no mineral caustic was inaccurate. In other patients the effect of this Cardigan treatment was more destructive. In the case of one woman who had been informed that the cancer had been cured and that she only required some tonic medicine to complete the cure, the surgeon who was called to her when she was _in extremis_ has said that he never beheld anything like it in his life; the whole breast was a necrosing mass, black and stinking, the ulcers extending up to the collar-bone and down to the margin of the ribs and across the middle line; the hand could have been inserted under the margin of the dead part all round. Some unfortunate patients persevered with the treatment although suffering pain described as excruciating.

Caustics are, in fact, the weapon of the quack, and although they may have a legitimate sphere in surgery, it is very limited; zinc chloride, for instance, has occasionally been used in a strong solution or paste as a caustic under special circumstances. Although portions of a tumour may be removed by caustic application, it is impossible to eradicate the whole in this way, as the cancerous process is extending into adjacent parts. The formula of the quack—“cancer treated without the knife”—appeals with great force to the public who do not know the terrible long-drawn-out agony which those treated with caustics have to undergo. Of this a vivid description was given by a well-known naturalist, the father of a distinguished man of letters, in a little book in which he related the suffering of his own wife; she was treated by an American cancer-curer by caustics. The process of “cure” lasted several months, and the result may be summed up in the statement that “suffering never ceased from the beginning of the operation till her spirit was freed from the worn-out body.”

CHAPTER XIII.

REMEDIES FOR EPILEPSY.

The nostrums which appear to be most advertised at the present time for the treatment of epilepsy afford a good example of the fact which has been previously pointed out that in some instances the vendors of secret preparations make use of drugs in common use by the medical profession for the treatment of some particular disorder; this is, of course, only possible when the symptoms are well-marked and easily recognised. As will be seen from the analyses given below of a number of nostrums advertised as remedies for epilepsy it was found that all, with one exception, contained bromide salts, that is to say, a drug the effect of which is described and discussed in every medical work dealing with the disease; nevertheless, the advertisers endeavour to lead the purchaser to believe that the preparations possess peculiar virtues unknown to the medical profession. The exceptional preparation contains vervain (_Verbena officinalis_) which held a place in the old pharmacopœias and herbals, chiefly as an astringent application to wounds or as a lotion for sore mouth. Dodoens (1572) says it is good for headache applied as a plaster, while Gerarde (1633) mentions its use as a garland round the head for the same condition, but he disapproves of the many old wives' tales told regarding it which tend to sorcery, and are such as honest ears abhor to hear; indeed, he hints that some assert that the "divell did reveal it as a secret and divine medicine." According to Pliny, vervain was gathered by the Druids of Gaul and Britain at the rising of the Dog Star, when neither sun nor moon shone, with the left hand only, and after libations of honey. When thus obtained it was said to vanquish fevers and other distempers, to be an antidote to the bite of serpents, and a charm to conciliate friendship. Paris speaks of it as in his own time the subject of a work on scrofula by a Mr. Morley, which was written for the sole purpose of restoring the much injured character and use of vervain, so that it is evidently a herb which has suffered much from detraction. Mr. Morley directed the root of the plant to be tied, with a yard of white satin ribbon, round the neck where it was to remain until the patient was cured. The modern vendor does not indulge in these refinements.

In submitting the following analyses it should be stated that a mixture or powder, dispensed according to the prescription obtained by the analysis, produced in each case a preparation closely resembling in appearance and taste that sold by the secret medicine vendor; further, the mixtures possessed the same specific gravity as the originals.

OZERINE.

"Ozerine," prepared by a chemist in Ireland, is described as an unfailing remedy for epilepsy, fits, or falling sickness. The bottle examined had no medicine stamp affixed.

The formula ascertained by analysis is as follows:

Potassium bromide 120 grains. Ammonium carbonate 16 " Burnt sugar q.s. to colour. Chloroform water to 1 fluid ounce.

Potassium bromide (111 grains) and potassium chloride (9■ grains) were found by analysis, but as some potassium bromide containing a large percentage of chloride had recently been in the market the latter was not regarded as an intentional addition.

Dose.—One teaspoonful before breakfast and dinner, and two at bedtime.

The price charged for a bottle containing 8 fluid ounces was 4s. 6d.; the estimated cost of contents was under 4d.

W. AND J. TAYLOR'S CELEBRATED ANTI-EPILEPTIC MEDICINE.

This preparation, sold in this country through an export agent in London, is said to be "simple, efficacious, harmless, and cheap." The effrontery of the following paragraph, extracted from a circular which was wrapped round the bottle, is amusing in view of the analytical results:

The principal drug is to be found in nearly every surgery, and yet not one doctor in a hundred would think of using it in Epilepsy, simply because he has no precedent to act upon—he is not directed by any of the great medical writers to prescribe or administer it in this disease; he knows not of its being so used, and he has not tried it himself, and thus he remains unaware of the one grand means of curing Epilepsy, even with the very drugs necessary at his elbow.

The formula ascertained by analysis was:

Tincture of iodine ¾ minim. Potassium bromide 13 grains. Ammonium bromide 4 " Water to 1 fluid ounce.

The mixture contained the proportion of iodine indicated in the above formula; but as it also contained traces of iodide, it was probable that tincture of iodine was used in its preparation. It may, however, have been prepared from an aqueous solution of iodine and potassium iodide.

Dose.—One teaspoonful three times a day.

The price of a bottle holding 12 fluid ounces was 2s. 9d.; the estimated cost of the contents is about 1d.

OSBORNE'S MIXTURE FOR EPILEPSY.

This mixture is stated to be prepared in a small town in England.

The following is an extract from a circular accompanying the bottle:

It scarcely ever fails to prevent the fits, loss of consciousness, convulsions, nervous twitchings, &c., of epilepsy, while at the same time it acts as a most valuable tonic; it allays irritation of the nervous system, purifies the blood, strengthens the frame, improves the general health, and helps to check the progress of disease on the intellectual faculties, and may be taken by the most delicate.

The formula ascertained by analysis was:

Potassium bromide 166 grains. Sugar 48 ” (= syrup ■j). Burnt sugar q.s. to colour. Peppermint water to 1 fluid ounce.

Traces of fixed ammonia were also present.

Dose.—One large teaspoonful morning and night.

The price charged for a bottle holding 5 fluid ounces was 2s. 9d.; the estimated cost of the contents is about 3d.

“PROFESSOR” O. PHELPS BROWN'S VERVAIN RESTORATIVE ASSIMILANT.

This preparation is recommended by the vendor—

“for the positive and speedy cure of epilepsy or fits, dyspepsia, indigestion, all derangements of the stomach and bowels, and for every form of debility, no matter from what source it may arise. An unequalled tonic and nervine.”

The formula ascertained by analysis was:

Decoction of Vervain (2 oz. to a pint) 4 fluid drachms. Port wine 1 ” ” Rectified spirit 2 ” ” Water to 1 fluid ounce.

The dose was stated to be one dessertspoonful three times a day before eating.

The mixture contained 25·75 per cent. of absolute alcohol by volume, and reacted towards lead acetate and lead sub-acetate exactly like a specimen prepared according to the above formula. It also contained the same amount of extractive, and had the same specific gravity.

The price is 2s. 9d. for a 6-oz. bottle. The estimated cost of the contents is about 5d.

TRENCH'S REMEDY FOR EPILEPSY AND FITS.

This is, or was, made by a company giving an address in Ireland. The package examined had no medicine stamp affixed.

Liquid Preparation.—The following formula refers to the liquid preparation supplied for use in the United Kingdom.

The formula ascertained by analysis was:

Potassium bromide 70 grains. Ammonium bromide 10 ” Sugar 72 ” (= syrup ■jss). Fuchsia q.s. to colour. Water to 1 fluid ounce.

The dose was stated to be one teaspoonful in the morning and two at night; the price for a 3-oz. bottle is 3s.; the estimated cost of the contents was about 1d.

“_Concentrated Form._”—This was supplied for export to the colonies, was a moist coarse brown crystalline powder in hermetically-sealed tins, with directions enclosed for dissolving in water. A quarter package (the smallest supplied) contained 11¼ ounces, and was directed to be dissolved in one pint of warm water. The resulting mixture was found to measure 25 fluid ounces.

From the formula given below it will be seen that the mixture thus prepared differed from the one issued for home consumption in two important particulars: (_a_) ammonium bromide was absent, (_b_) the dose of potassium bromide was considerably larger than that of the total bromides in the latter. Is this a form of colonial preference? or is it that our brothers beyond the sea are more robust and hence proof against the depressing influence of potassium salts? The formula of the powder ascertained by analysis was:

Potassium bromide 61 parts. Moist brown sugar 39 ”

The calculated composition of the finished mixture was:

Potassium bromide 120 grains. Moist brown sugar 77 ” Water to 1 fluid ounce.

The dose of the mixture directed to be taken was one teaspoonful in the morning and two at night.

The price charged for a quarter package was 15s., but the estimated cost of the contents is about 8d.

Such then are these secret remedies for epilepsy; with one exception they are weak preparations of well-known drugs supplied at considerably more than the usual cost, and administered without that careful adjustment of dose to the needs of the particular patient which is, after all, the most essential part in the treatment of epilepsy by bromide salts. The exception contains an old-fashioned herb once praised by the superstitious but abandoned time and again even by them; it has never been shown to possess any definite therapeutic properties and was long ago discarded by the medical profession because it was found useless.

SOME GERMAN NOSTRUMS.

Of five nostrums sold for the cure of epilepsy in Germany, examined by Dr. Zernik, three were found to contain bromide salts as chief constituents: _Lamma powder_ consisted of equal parts of bromide of sodium and bromide of ammonium; _Antiépileptique_ (Uten) was a solution of potassium bromide (16 per cent.), coloured green, and containing 1 per cent. of an indifferent bitter tincture, while _Berendorf’s powder for epilepsy_ contained potassium bromide 53·3 per cent., borax 40·3 per cent., and zinc oxide 4 per cent., the remainder being water. Borax is a remedy occasionally used to correct some undesired effect of bromides and has sometimes been prescribed for patients who could not tolerate the bromides. Zinc oxide has, or at one time had, a certain reputation as a nerve sedative. Of the two German remedies which did not contain bromide one consisted largely of formaldehyde which is used as an antiseptic and preservative for food, and the other consisted of pills containing nothing beyond inactive powdered leaves and roots.

CHAPTER XIV.

SOOTHING, TEETHING AND COOLING POWDERS FOR INFANTS.

The number of proprietary infants’ powders that can be said to be at all widely advertised is small, but some of them are sold in very large numbers. In addition, powders for the same purpose are very largely supplied by retailers, put up by themselves; they are usually of similar composition to one or other of those here described, but there is, of course, great scope for variations in the quantity and proportion, as well as in the nature of the drugs employed. It may, perhaps, be hoped that the efforts now being made by the employment of health visitors in many towns will, by the spread of instruction as to the common-sense management of infants, gradually lead to a great diminution in the custom so prevalent among the poorer classes of dosing infants whenever the curious foods, still so commonly given, cause indigestion.

STEDMAN’S TEETHING POWDERS.

The powders “with one e” are sold from an address in the north of London in boxes, price 1s. 1½., 2s. 9d., 4s. 6d., and 11s. The 4s. 6d. box contained 60 powders, and the 11s. box contained 216; the other sizes are stated to contain respectively 9 and 30 powders.

In a circular enclosed in the package it is stated that:

The returns of the Registrar-General tell us that the period of Dentition is one of more than ordinary peril to the child. It is a time of most active development, a time of passing from one mode of being to another, and we may fairly congratulate ourselves when this time of Teething be passed. To pass this time safely, and with the least risk to the child, one of “Stedman’s Teething Powders” should be given about twice a week, during the whole time of Dentition, according to the directions below....

When the bowels are moved regularly and the motions of a natural yellow colour, the Powders had better be omitted for a time, unless great irritability be present, accompanied with restlessness, then a dose had better be given. Diarrhœa will generally be checked by giving a dose at the commencement of the attack.

The directions are:

When the Child is under three months of age, the Third of a Powder only is to be given; from three to six months Half a Powder may be used; when above six months a Whole Powder may be taken.

The average weight of one powder was 2·4 grains; twelve powders weighed singly had weights varying from 2·25 to 2·6 grains. Analysis showed the powder to be composed of:

Calomel 29 per cent. Sugar of milk 71 ” ”

A trace of alkaloid was present also, and when extracted from the material of a large number of powders, was found to amount to only 0·016 per cent., or ¹/■■■■ grain in one powder. This trace of alkaloid did not show the behaviour of morphine, and did not give any reactions characteristic of any of the ordinary alkaloids, so far as it was possible to test for them on the minute amount available.

The estimated cost of the materials for the powders in a 4s. 6d. box is one-third of a penny.

STEEDMAN’S SOOTHING POWDERS.

The powders, “with two e’s,” are stated to be prepared in the south of London, and are sold in packets, price 1s. 1½d. and 2s. 9d. per packet; the 2s. 9d. packet contained twenty-four powders.

In a circular enclosed in the packet it is stated that:

The good effects of these Powders during the period of Teething have now had _Fifty Years’ Experience_, during which time _Thousands of children have been relieved annually_ from all those distressing symptoms which children suffer while cutting their teeth—viz., Feverish Heats, Fits, Convulsions, Sickness of Stomach and Debility, accompanied with Relaxation of the Bowels, and pale and green motions, or Inflammation of the Gums.

... the striking superiority both in the health and strength of those children who have taken the soothing Powders during the period of Teething has induced the Proprietor to make this MUCH-VALUED MEDICINE more generally known by this advertisement.

The directions are:

Dose.—From one to three months, the third of a Powder; from three to six months, half of a Powder; from six months and above that age, one Powder only and no more; ...

The average weight of one powder was 2·8 grains; twelve powders weighed singly had weights varying from 1·9 to 4·5 grains. Analysis showed the powder to consist of:

Calomel 27 per cent. Sugar 22 ” Maize starch 50·5 ” Ash 0·5 ”

A minute trace of alkaloid appeared to be present; the quantity was considerably less than in the Stedman’s powders described above, and so small, in fact, as hardly to give positive evidence of its alkaloidal nature.

The estimated cost of the ingredients of Steedman’s powders in a 2s. 9d. packet is one-eighth of a penny.

PRITCHARD’S TEETHING AND FEVER POWDERS.

The proprietors of these powders give an address in a large provincial city. The price charged is 1s. 1½d. for a box containing sixteen powders.

In a circular enclosed in the package it is stated:

The constantly increasing sale of these justly esteemed Powders proves them to be the most effectual Medicine that can be given to young children during the troublesome and anxious period of teething. By their gentle action on the Bowels, and valuable cooling

properties, they allay all irritation and Feverishness, prevent Fits, Convulsions, &c., ensure refreshing and natural sleep for the child, and therefore peaceful nights for the parents.

The directions are:

From one to three months, a third of a Powder; from three to six months, half a Powder; from six months and above that age, one Powder (not to be given if the child is relaxed).

The average weight of the powders was 2·1 grains; twelve powders weighed singly had weights varying from 1·9 to 2·3 grains. Analysis showed the powder to consist of:

Calomel 47 per cent. Antimony oxide 0·7 ” Calcium phosphate 1·4 ” Sugar of milk 50·9 ”

No trace of alkaloid was present.

The estimated cost of the ingredients of the powders in a 1s. 1½d. box is one-ninth of a penny.

FENNING’S CHILDREN’S COOLING POWDERS.

The proprietor gives an address in the south of England, and the prices charged are 1s. 1½d. and 2s. 9d. a box; the 2s. 9d. box contained 48 powders.

They were described in a circular enclosed with the box as:

The best medicine for infants cutting their teeth, preventing convulsions, thrush, disordered bowels, and for all the feverish diseases of infants and children.

The following directions are given:

For an Infant under _three_ years of age, give _one_ of Fenning’s Cooling Powders mixed with a little water, or it could be thrown dry as it is into the opened mouth of the baby, and gently holding back the head for half a minute it would be swallowed.

Whenever an Infant is restless or feverishly hot from Teething, when it is griped or sick from improper food, or over-feeding; has acidity, or a disordered stomach, _one_ of these Powders should be immediately given and, if necessary, repeated every day....

When a Child is attacked with Thrush, Measles, Hooping Cough, or Fever of any sort, always keep the feverish blood cool by giving a dose of _Fenning’s Cooling Powders_ every or every other day.

The powders had an average weight of 3·4 grains; twelve powders weighed singly had weights varying from 3·2 to 3·8 grains. Analysis showed the powder to consist of:

Potassium chlorate 70 per cent. Powdered liquorice 30 ”

The estimated cost of the ingredients of the powders in a 2s. 9d. box is one-sixth of a penny.

CHAPTER XV.

REMEDIES FOR EAR DISEASE AND DEAFNESS.

Some of the advertisements most frequently seen headed “Deafness cured,” “Eyes and Ears,” “Eye Diseases cured,” etc., do not refer to nostrums obtainable in the usual way through patent medicine dealers. The reader of the announcement is invited to write to the address given for particulars of special remedies, or an “interesting and convincing book post free,” dealing with the cure of diseases without operation, etc. Application for particulars brings much printed matter recommending the advertiser’s method, accompanied by a set of questions to be answered by the sufferer. If these answers are supplied and the fee demanded paid, medicine of some sort is sent. Medicines sold in this way, of which many other instances have been given in previous chapters, form a special class of “secret remedies,” and might be said, perhaps, to come rather under the head of prescribing at a distance, but it is, to say the least, very doubtful whether the composition of the medicines supplied is modified according to the answers given to the questions, and the two kinds of quackery are not sharply separated. In the case of the preparations now to be described, one or two belong more nearly to the class just referred to than to that of ordinary “patent medicines.”

We meet again the benevolent gentleman who having cured himself offers “to send particulars of remedy free,” but eventually sells his treatment at a price which would seem to represent no bad profit on the outlay for materials.

We also meet the dealer who to encourage the possible buyer sends a reduced price coupon only asking in return for the names and addresses of two or three friends who suffer in like manner.

ALFRED CROMPTON’S SPECIFIC FOR DEAFNESS.

This so-called specific, prepared in a town in the north of England, is sold in a bottle containing half a fluid ounce, and costing 1s. 1½d.

The label on the outside of the package was headed:

Deafness Cured!

and continues:

Alfred Crompton’s Specific for Deafness, Noises in the Ears, &c., is decidedly the best remedy out for this most annoying complaint. A single Bottle has in most instances effected a speedy and permanent cure.

The directions were:

Warm the Specific and Shake the Bottle. Two or three drops to be dropped in the Ear, night and morning, and rub behind and under the Ear with the Specific.

Analysis showed the following composition:

Soap 3·6 per cent. Glycerine 45·0 ” Oil 21·7 ” Water 29·5 ” Alcohol a trace. Oil of rosemary ”

There was a slight indication of a trace of camphor; probably this with the alcohol and oil of rosemary and part of the soap were added in the form of soap liniment. The oil gave analytical figures corresponding to a mixture of almond and colza oils in about equal proportions.

The estimated cost of ingredients, for ½-oz., is one farthing.

DELLAR’S ESSENCE FOR DEAFNESS.

This so-called essence, prepared it is stated by a company giving an address in London, and sold at the price of 1s. 1½d. for a bottle, containing two-fifths of a fluid ounce, is described on the label as “An old-established and valuable remedy.”

Directions for Use.—A small piece of wool, well moistened with the Essence, to be pushed into the cavity of the Ear every night at bedtime, and removed in the morning.

Analysis showed the composition to be;

Oil of turpentine 16 per cent. Fixed oil 84 ”

The properties of the fixed oil and the figures which it gave on further analysis corresponded to those of almond oil.

The estimated cost of the ingredients, for two-fifths of an ounce, is one halfpenny.

HERBERT CLIFTON’S TREATMENT FOR DEAFNESS.

This is brought to the notice of the public by an advertisement in the following terms:

A new cure for deafness. A Gentleman who cured himself after 14 years’ suffering will send particulars of remedy free.

Here followed the gentleman’s address, and an application brought a letter and a pamphlet entitled “Deafness and Noises in the Head, with Instructions how they may be Absolutely Cured,” which was marked “40th edition.” It professed to give an account of the writer’s own experiences. A few extracts will suffice to give an idea of it:

Those only who have suffered from the terrible calamity of deafness can understand the misery it brings into one's life; and only those who have had occasion to seek the assistance of men who profess to cure this awful affliction can appreciate how utterly its treatment is misunderstood by the various advertising empirics who profess to cure it, whether by electrical, galvanic, or any of the other methods which are so alluringly set forth as perfectly infallible by people who never suffered themselves, who can have no sympathy, therefore, with those whom they profess to assist, and whose only object is to extract as large a sum as they possibly can from the pockets of those whom they have been able to attract to their spider's parlour. The writer, however, of the present pamphlet is in a different position.... As a lad I began to suffer from noises in the head, which as time went on increased to such an alarming degree that I was taken to an Aural Surgeon.... The usual result followed. I became worse and worse, and, of course, weaker through his treatment.... Another doctor was consulted.... But the treatment failed, my affliction increased, and MY LIFE BECAME A BURDEN.... There seemed no hope for me. Nearly a dozen eminent surgeons had seen me, examined me, said different things about me, and indifferently treated me; but all to no purpose.... As a last resource I tried the various quack remedies which have allured so many to their bitter cost, and many a pound was wasted on mechanical, electrical, magnetic, and other useless appliances, and upon ear-trumpets, drums, tubes, &c., with no result.... Then the wild, yet happy, thought flashed across me: "Why not try and cure yourself?" I pondered and pondered over the idea, and at last, rather than submit to my fate, determined to study physiology and medicine and endeavour to discover the cause of my deafness, with the distant hope that I might alight upon the method of its cure.... The conclusion I came to was that what I really required was a medicine which should reach the minute muscles of the inner ear, as upon their proper action the sense of hearing almost entirely depends ... after a time I had succeeded in discovering a preparation which would do the required work.... My disease was of so long standing, that I had found it had caused the drums of my ears to become weak and shrunken ... and I soon devised a small appliance to fit inside each ear—the appliance which I now term the "Invisible Drum Support" ... in my gratitude to the Almighty for my merciful deliverance I vowed that I would publish to the world the method by which I had struggled out of the dark past into the brilliant light of the present.

A postscript to the letter stated that "No charge whatever is made for advice, so you need not hesitate to avail yourself of the benefit of my _opinion_," but no information was vouchsafed as to the price charged for the "treatment," except that it would be found extremely moderate. Paragraphs, of the usual inspired kind, were quoted from the _Family Doctor_, _Christian Union_, _Family Churchman_, _Health_, and local newspapers of varying degrees of obscurity.

The letter and pamphlet were followed after an interval by another letter, as follows:

Dear Friend,

Referring to your application for my Pamphlet some time back, I shall be glad to know whether you wish me to proceed further in the matter. As I have received no letter from you, I presume that you imagine the cost of treatment will be too high. I will, therefore, make you a Special Offer, that is, for the sum of 10s. (which may be paid in two monthly instalments of 5s. each, if more convenient) I will forward you the full Treatment and Directions. Should you avail yourself of this offer, kindly detach the form at the bottom of this letter and return to me. The Treatment is, without doubt, the most effectual ever placed before the Public, as will be found by the numerous testimonials received.

I am daily in receipt of letters similar to those enclosed herewith, and I feel confident that, should you give the treatment a trial, you will also be able to report quite as good results.

Kindly let me know your decision as soon as possible. If you will take my advice you will not further delay.

May I draw your attention to the letters on the other side?

I am, yours faithfully, HERBERT CLIFTON.

The "treatment form" was filled up and sent in with 10s., and, as was to be expected, "my candid opinion as to whether my system of treatment is calculated to efficiently meet the requirement," was apparently in favour of treating the case, as a pair of "drum-supports" and a bottle of fluid were received, together with a letter asking the recipient to follow out the directions given very carefully and not be disheartened "because you find no improvement immediately, you must give the Cure a fair trial. I shall be glad," the letter concluded, "to hear from you in about three weeks' time with a general report on your case."

The "drum-supports" consisted of half-inch lengths of narrow india-rubber tubing, as used for the valves of bicycle tyres, with an inner tube of "gum-elastic," the india-rubber being expanded at one end into a funnel ¼ in. long, and attached at the other to a small oval disc of sheet india-rubber. The prime cost of the pair would probably not exceed 3d. The bottle was labelled "No. 1. Price 3s.,"

and contained 1 fluid ounce of liquid; analysis showed this to have the following composition:

Glycerine 10 per cent. approx. Oil 28 ” ” Ether 2 ” ” Water to 100

A trace (about 0·01 per cent.) of an alkaline substance was present, which appeared to be borax. The oil showed the characters of almond oil.

The estimated cost of the ingredients, for 1 oz., is one halfpenny.

OHRSORB COMPOUND.

The following advertisement is taken from _Cassell’s Saturday Journal_:

DOCTOR MAKES DEAF HEAR.

A medical book just published describes a German doctor’s wonderfully simple cure for deafness and head noises (a real home cure). A limited number of those books have been secured for readers of _Cassell’s Saturday Journal_, and will be sent free by post by the publisher, M. Franckel.

Application to the London address given brought a pamphlet of sixteen pages, from which a few extracts are here given:

For years it has been known to Medical Men that the minute vessels or channels of the lymphatic system underlying the skin, covering the bone behind the ear, were intimately connected with those supplying vital nourishment to the middle and internal ear, where we find the common seat of deafness and head noises. If, then, we could medicate through the skin, this important current of lymphatic fluid, controlling the health of the essential parts of the organ of hearing, our medications could be made to flow inward to reach and to cure a disease so deeply hidden within the ear as to be otherwise regarded as incurable. It is the province of this little work to explain why the prescriptions of so many aurists have failed in years past, and to present a new chemical compound which is of the utmost value to deaf people.

Applications behind the ear are recommended in the writings of our greatest ear surgeons. Gruber, Politzer, Delstanche, Grünfeld, and numerous others have given us prescriptions of this kind, and, although their combinations of drugs have failed to produce any remarkable results, they have pointed out the remedies that would cure if combined with a substance which could penetrate the skin freely.... Until lately we possessed no basis for our ointments, embrocations, or plasters, which could freely penetrate the skin.... Happily there is a new basis lately brought to the notice of the medical profession, which has the remarkable property of uniting with the watery secretions of the body in such a way that it (_sic_) absorbed by the skin, and taken up by the lymphatic circulation (described on p. 1), together with any drugs that are combined with it in the form of an ointment.... To this new basis has been given the name “Ohrsorb.”

Quotations purporting to be from the writings of medical men are given, but no references are provided by which they can be checked; and, indeed, the extracts only refer to a “new preparation” and a “new treatment,” without any indication that the advertised article is the one intended. Another quotation is then given “From the Private Clinical Memoranda of Dr. Kupfinn,” described as an “Hon. Auris Chirurgis,” in which “Ohrsorb” is referred to in a laudatory manner; this is followed by an account of some “typical cases,” but it does not appear that this is part of the quotation, although it is so put that it might easily be taken to be. The pamphlet continues:

It should be clearly understood that Ohrsorb by itself is only a basis used solely for the purpose of providing the _active portion_ of the Author’s Absorption Treatment, and that the cure depends on the medicinal action of the drugs compounded with it in any special prescription. It is for this reason that certain particulars as to each patient’s case are asked for on the enclosed coupon, namely, that the individual form of deafness, head noises, or ear trouble may be treated by an “Ohrsorb” compound specially adapted to it.

The pamphlet proceeds to give reasons for supplementing the treatment by the use of other articles, of which the following are recommended: “Ohraseptic,” “Nazaseptic,” “Specially Prepared Catarrh Tonic,” a nasal irrigator, and a safety ear syringe. It was accompanied by a leaflet headed, “Medical Report on the ‘Ohrsorb’ Treatment,” in which many testimonials are given, but not one from a medical source or anything of the nature of a medical report; also by a “reduced price coupon,” offering a 2s. 9d. tube for 1s. 6d. or a 4s. 6d. tube for 3s., provided the applicant undertook to use it as directed and report the result, and a list of about fifty questions to be answered in connexion with deafness, &c., and catarrh of the nose and throat, concluding with the following

paragraph:

As a little return for supplying the tube of “Ohrsorb” compound at the reduced price, and for the very special attention that will be given to your case, the author will be grateful if you favour him with the names and addresses of two or three of your friends who suffer from deafness, head noises, or catarrh of the nose or throat. This is entirely confidential, and your name will not be mentioned.

In order to test the importance attached to the answers to the questions, a supply of “Ohrsorb Compound for Deafness” was sent for, without giving any particulars of the supposed case for which it was required. The compound was at once sent, together with a multiple-typed letter of the usual kind, as shown by the following extracts:

“I hope you will not neglect to write me about your progress with my treatment”; “of course you will appreciate that in obstinate cases Ohrsorb must be persisted with for some time before the improvement can begin to show itself.”

and offering for future supplies three 4s. 6d. tubes for 10s. 6d.

The “Special Ohrsorb Compound” is supplied in collapsible tubes, and the 2s. 9d. size contained just over ½ oz. of ointment. The directions were to rub the ointment once, twice, or thrice a day over the skin close behind the ear, and also from just beneath the ear around to the front of the throat, for three to five minutes.

The ointment, nearly black in colour, contained about 70 per cent. of vaseline, and about 4 per cent. of beeswax, a little soap, and a little saponifiable fat; sulphur and ammonia were present in combination, and the dark constituent appeared to be of the class represented by thiol, tumenol, and petrosulfol, artificial compounds intended to take the place of ichthyol, and like it containing much sulphur in combination but free from its disagreeable odour. The total sulphur found in “Ohrsorb Compound” was 0·8 per cent., which corresponds to about 8 per cent. of one of these substances. An ointment made up with tumenol, soft paraffin, wax, and a little ammonia soap resembled “Ohrsorb Compound” very closely, though the correspondence was not quite complete. It was not considered worth while to isolate the dark constituent in a state of purity permitting of more precise identification than is here indicated; to determine the detailed characterization of such a substance a large quantity would be necessary.

CHAPTER XVI.

REMEDIES FOR EYE DISEASES.

The proprietary articles advertised for the cure of diseases of the eyes, though perhaps not so numerous as some other classes of nostrums, vary a good deal in nature, but the claims made for most of them are equally comprehensive. The results of analysis of a few are here given and it will be seen that two of them, including one called “botanic,” are mercurial ointments. Another advertiser seems to think or pretends to think that cataract can be cured by bathing the eyes with soda alum dissolved in coloured water, while we come across also an “Ophthalmic Institution” selling for external application an anti-cataract mixture consisting of glycerine with a little potassium iodide and starch.

SINGLETON’S EYE OINTMENT.

This is stated to be prepared, by a person whose name is not Singleton, at an address in London. The price charged is 2s. for a pot containing about 55 grains.

The ointment is described on the outer package as

“An Absolute Specific for all Eye Troubles and Diseases.”

On a circular enclosed in the package it was stated:

“It cures Weak Sight, Inflamed Eyes, and all disorders of the Eyelids from whatever cause arising.... Singleton’s Eye Ointment requires great skill in making, and is composed of costly ingredients. One pot will cure you.... The Ointment also cures Piles and Scorbutic Eruptions.”

A book dealing with the ointment was also supplied, in which it is stated that

“Singleton’s Eye Ointment will cure all affections of the eye.”

Analysis showed the principal ingredient to be red mercuric oxide, of which 7·4 per cent. was present. The fatty basis contained about 4 per cent. of beeswax, and the remainder was a practically neutral and colourless substance which agreed in properties and analytical figures with a mixture of lard, Japan wax, and purified cocoanut oil. It is, of course, impossible to determine with certainty the composition of a mixture of fats, unless a large quantity is available for analysis; but the exact nature of the fatty basis is immaterial, and no indication was obtained of any other medicinal ingredient.

The assertion that such an ointment "requires great skill in making" is absurd, and as to the costliness of the ingredients, the 55 grains in the pot are estimated to be worth one-ninth of a penny.

BOSTOCK'S EYE OINTMENT.

This ointment, stated to be manufactured by a limited company with an address in London, is sold in a pot containing half an ounce, and costing 1s. 1½d. It is described on the label as "An invaluable remedy for every Disease to which the Eye is subject." In a circular wrapped round the pot it is called "Bostock's Botanic Eye Ointment," which

is strongly recommended as a valuable Restorative and Preserver of the Sight, removing Inflammation, Bloodshots, Scorbutic Humours, Shooting Pains, Dimness, Swelling in the Eyelids, and numerous other diseases to which the Eye is subject; it also preserves the Sight against the injuries arising from extreme Heat and Cold.

Analysis showed the presence of small quantities of ammoniated mercury (commonly known as white precipitate) and an insoluble compound of lead which appeared to be the oxide; a little glycerine was present, and a bitter, light-coloured substance of the nature of an extract; this contained no alkaloid, and gave no characteristic reactions indicating the drug or plant from which it was derived; a trace of a vegetable powder was also found, the quantity being so very small that it was probably only an accidental contamination of the extract; when examined microscopically it appeared to consist chiefly of the tissue of a seed. The basis of the ointment contained soft paraffin and spermaceti, and a third constituent agreeing in its characters with lard. Determination of the amounts of the respective ingredients indicated the following approximate formula:

Ammoniated mercury 0·88 per cent. Lead oxide (litharge) 0·15 " Glycerine 2·25 " Extractive 3·32 " Spermaceti 31·0 " Soft paraffin 31·0 " Lard 31·4 "

Neglecting the extractive, the estimated cost of the ingredients for half an ounce is under one halfpenny.

A NEW AND MARVELLOUS REMEDY FOR THE EYES.

This substance, sold from an address in Wisbech at the price of 2s. 9d. for a packet containing 135 grains, was enclosed in a small envelope, on which was written, "Remedy for Eyes only"; there was no printed label except the revenue stamp. In the accompanying circular it was described in the following terms:

A Cure for Cataracts, Films, White Specks, &c. without Operation. The Remedy Cures and Improves the Sight when every other remedy and human skill fails. The Remedy within Twelve Months has proved itself to have no equal for removing Cataracts, Films, White Specks, &c., and is guaranteed the greatest and most marvellous Remedy in the world for such, and for all Eye Sufferers.

Directions for use were given in another circular, as follows, and seem worth quoting as an illustration of pretensions so preposterous that they seem calculated to defeat their own object even when addressed to the most credulous:

Divide the packet of powder into four parts; into an ordinary six ounce medicine bottle put one part out of the four, then fill up the bottle with pure water. Filter or strain the water before so doing, then let the Lotion stand all night after it is made, it is then ready for use. Keep the remainder of the powder in a dry place until required for use.

Shake up the bottle well before using, and in case of Blindness or very bad eyesight, for deep-seated Inflammation, Cataracts, White Specks, &c., pour some of the Lotion into an earthen cup or basin, and bathe the eyes three times a day, about two minutes at a time, and let the Lotion go well into the eyes by winking them whilst bathing them—the Lotion will do no harm by going well into them, for good results can only be obtained in such cases by the remedy going well into the eyes. After bathing the eyes cover up the Lotion with a saucer or plate to keep dust, etc., out, until required for use again. Use a piece of linen rag for bathing the eyes.

N.B.—For Painful, Bloodshot, Weak, Dim, and Misty Eyes, or Floating Black Specks, or for Eye Strain, Etc., and for Strengthening the Optic Nerve, Etc., and for Inflammation, Short Sight, Etc.—Simply bathe the eyes twice a day, morning and night, just before

going to bed, about two minutes at a time, letting a little of the Lotion go into the eyes, and should the Remedy make the eyes smart too much, and too long, or make the eyes inflamed or water, etc., too much, make the Remedy a little weaker by adding a little more water to same quantity of Powder, or by not putting quite so much powder to same quantity of water.

This circular concludes with the following notice:

Please Note the Remedy can only be had direct from the Proprietor himself, as no other human being in existence sells it.

The package was accompanied by a written paper as follows:

Please note. Since instructions have been printed I find it necessary for a slight alteration for the benefit of those suffering from Cataracts, Films, and white specks. In such cases when first commencing to use the remedy divide the packet of powder into 4 parts make one bottle out of one part and use according to instructions. After the use of first bottle divide the rest of the powder into 2 parts you will then have sufficient for 2 bottles and will therefore have remedy much stronger of which is needed in case of Cataracts, etc. And when more remedy is required always divide the packet into 3 parts sufficient to make 3 bottles and follow instructions.

(P.S.) I may say for the benefit of those suffering from Cataracts, Films, and white specks the best and quickest results have been obtained by using one bottle per week.

The packet contained a coarse pink powder, with many white particles. Analysis showed it to contain:

Basic aluminium sulphate 48·2 per cent. Sodium sulphate (anhydrous) 18·3 ” Colouring matter a trace.

the remainder being water. The double sulphate of aluminium and sodium, or soda alum, contains 48·8 per cent. of aluminium sulphate and 20·3 per cent. of sodium sulphate, and the substance under examination thus practically consisted of this salt, somewhat deficient in sulphuric acid. The colouring matter did not quite agree in its behaviour with any of the common pink colours, though it was very similar to acid magenta.

The estimated cost of 135 grains is one-twentieth of a penny.

POMIES’ ANTI-CATARACT MIXTURE.

This application is sold from a place called an Ophthalmic Institution in London at the price of 2s. 6d. for a pot containing 162 grains.

It is one of a series of preparations sold under the name “Pomies,” including anti-cataract oil, anti-inflammation eye lotions Nos. 1 and 2, sedative collyrium, and others. The package itself was singularly free from printed matter; the directions on the label were as follows:

“Take some of the Mixture on a camelhair brush and introduce it into the eye in wiping the brush between the lids two or three times, twice a day.”

Analysis showed the composition of the substance to be:

Potassium iodide 5·6 per cent. Glycerine 56·5 ” Starch 6·4 ” Water 31·5 ”

The estimated cost of the ingredients, for 162 grains, is one-third of a penny.

SOME GERMAN NOSTRUMS.

The eye preparations analysed by Dr. Zernik are not very interesting. One called _Okterin_ is a sulphate water, colourless, odourless, acid, and astringent, apparently pumped out of a mine containing ochre. Another sold under the name _Opthalmol_, and described as a natural remedy for all kinds of eye disease is supposed to be made from the glands of a fish. It yielded analytical data which appeared to prove that it was rancid olive oil, with 6 or 7 per cent. of a mineral oil like paraffin. A third wonder-working application, _Augenwol_, said to be made from various plants obtained from many countries proved to be a coloured and perfumed solution of common salt containing a little glycerine and some extractive substances.

CHAPTER XVII.

REMEDIES FOR PILES.

The series of analyses of secret remedies for hæmorrhoids, and the extracts from the advertisements by which these nostrums are commended to the public, make it evident that the prevalence of this complaint, which is always disagreeable and painful, and sometimes incapacitating, provides a happy hunting ground for the nostrum monger. An additional attraction is, perhaps, to be found in the fact that considerable variety is possible in the method of treatment. Local applications, represented by suppositories and ointments, appear to be most in favour, but there is an obvious opportunity for the man who wishes to sell a medicine to be taken internally to declare that local applications "only afford temporary ease, and do not tend to remove the cause. Only internal treatment can cure." The further possibility of extracting double or threefold payments from sufferers by insisting on the necessity of both local and internal remedies has by no means been neglected; in some cases one preparation only is advertised, and after obtaining this the sufferer learns that something further must be bought if the promised cure is to be effected. In another case, where the remedy is a "threefold treatment, because there are three avenues of approach to the seat of the ailment," it is advertised to be sent without payment, the money to be paid after a week's trial if benefit has been received; any one availing himself of this offer necessarily supplies the vendors with his name and address, and will then, it seems, become the recipient of numerous letters, emphasizing the dangers of neglect, and offering "our full-size guinea treatment" on special terms. It has been shown in previous chapters that this method of doing business directly with the persons taking quack remedies is in great, and apparently growing, favour with makers of such things. The letters with which the sufferer is inundated are, as a rule at any rate, printed in imitation of typewritten letters or reproduced by some manifolding process, and the recipient, unless he be something of an expert, is likely to suppose that he is receiving letters composed for his personal benefit, an illusion that is sedulously maintained by a profession of "special interest in your case," or some equivalent fiction. The majority of the preparations described in this chapter contain substances commonly employed for the relief of piles, such as hamamelis (witch hazel), lead acetate, zinc oxide, calomel, or others, if possible, still more old-fashioned; some, like the "Muco-Food Cones, containing concentrated glutinous nourishment," consist of flour and cocoa butter, and are innocent of medicinal ingredients. Advertisers, of course, indulge in the usual impudent reflexions on the work of the medical profession; one, for instance, hazards the statement that "for centuries piles have been treated in a careless, listless, manner by physicians, who, through ignorance or indifference, were unfit to be entrusted with such cases." These same advertisers remark: "The people do not like to be humbugged"—a statement, perhaps, as far from the truth as some other assertions in the advertisements and letters. One company—two of whose "cures" have been shown in previous chapters to consist of sugar only, and whose ointment for piles is about equally active—invites those who are not cured by it to detail their symptoms to "our medical correspondence department"; it is easy to believe that "you will receive the same thorough attention from our medical staff as if you were examined personally," but how much attention that would be is wisely not stated. The majority of the articles are of American origin, some of them being marked "Made in U.S.A.," and others being now prepared in this country, but having originally come from across the Atlantic. Whether English or foreign, however, the usual disproportion is to be found between the prime cost and the price charged. If in the present series the highest price is charged—and the greatest pertinacity in extracting the sufferer's money is shown—by a transatlantic concern, in other chapters English quacks have been shown well to the fore as regards both price and methods.

BUER'S PILES CURE.

On purchasing from an address in one of the Home Counties Buer's "Piles Cure" for 1s. 1½d., it proved to consist of a box of Buer's Mul'la, and a single sample powder of Buer's Pile Powders, which cost a further 1s. 1½d. for a box. Several circulars were enclosed in the package. The trade mark was a picture of a donkey; a few extracts will suffice as specimens of the statements made:

Is it money (1s. 1½d.) or your life? Buer, the founder, the proprietor is the seventh son, not trading on his birthright but on his cure, testified by hundreds. Warrants it will cure you. If you suffer, will you try it?

The pains experienced range all the way from the slightest itch to the most terrible sufferings, which appear like tearing the body asunder, and unless the piles are cured with Buer's Mul'la there is no relief....

They cause you to be despondent, caring little to live; no go in you; quarrelsome in yourself; weakening to the constitution; until something gives way and hastens your death. It is therefore money or your life; no hesitation.

But one thing—not for the sake of selling the Powders—keep a box of Buer's Pile Powders in house—12 for 1s. 1½d. ain't dear—and take one as directed whenever you feel any irritation.

The box of ointment contained two-fifths of an ounce. The directions were:

Apply this Mul'la to parts affected.

Analysis showed the ointment to contain:

Lanoline (anhydrous) 66·5 per cent. Beeswax 1·5 " Water 32·0 "

Hamamelis ointment is usually made from the liquid extract which contains rectified spirit, but no alcohol was present in this oddly-named preparation; it may have been made with liquor hamamelidis prepared without the use of alcohol; a minute trace of water-soluble substance contained in the ointment suggested by its behaviour with reagents that such was the case. The estimated cost of ingredients is three farthings.

Twelve of the powders are supplied in the 1s. 1½d. box. The directions are:

To be taken at bedtime in a glass of milk or water.

Analysis showed the composition to be:

Precipitated sulphur 14·9 grains. Calcined magnesia (partly carbonated) 23·6 "

in one powder of average weight. Single powders in one box varied from 28 to 48 grains. The estimated cost of the ingredients for twelve powders is 1¼d.

MUNYON'S PILE OINTMENT.

This ointment is supplied by the same Homœopathic Home Remedy Company as has been encountered in earlier chapters. The price charged was 1s. a package, containing a collapsible tube holding 1 oz. of ointment and a metal tube for introducing it.

On the outside of the package it was stated that the ointment

permanently cures all forms of Piles or Hemorrhoids, and immediately relieves pain, burning, itching, and distress at the outlet of the bowels.

In the circular enclosed in the package, in which thirty of this company's preparations for different complaints were advertised, it was stated that the ointment

cures piles, blind or bleeding, protruding or internal, stops itching instantly, allays inflammation, and gives ease at once to the sore parts, heals fissures, ulcerations, cracks, and all anal troubles."

A label on the tube of ointment asked the purchaser

if this remedy fails to cure him, to write to the proprietor stating fully all your symptoms. He will have your case carefully diagnosed, and, you will receive the same thorough attention from our medical staff as if you were examined personally. All communications are kept strictly confidential, and replies are sent in plain envelopes. Our Medical Correspondence Department is having great success in curing old obstinate cases. Remember we sweep away all fees for medical advice, we put special medical attention at your service absolutely free. We want you to feel at liberty to write us whenever you need any medical advice, and to fully understand that there will be no charge of any kind for our service.

Analysis showed the ointment, which was directed to be applied three times a day, to consist of soft paraffin, with a trace of ichthyol sufficient to give a slight odour, but not enough to affect the appearance of the ointment. Experiments showed that 0·2 per cent. or over of ichthyol appreciably darkens the colour of soft paraffin, and it appears therefore that less than this proportion was present. The estimated cost of one ounce of the ointment is one farthing.

DOAN'S OINTMENT.

This is sold by a company giving an address in London; the price is 2s. 9d. a tin, containing 1■ oz.

On the package it was stated that

Doan's Ointment cures Piles, Salt Rheum, Chilblains, Eczema. Cures Black-headed Pimples, Hives and any itching disease.

In the enclosed circular it was referred to as:

The “Thorough” Cure for Piles, Eczema, Shingles, and Itching Diseases of the Skin.

And the statement was made that:

Bleeding and torturing itching piles are quickly and thoroughly cured by Doan’s Ointment, relief being usually obtained from the first application. A cure will follow—a “thorough” cure.

A “Pile Pipe” was supplied at 6d. for applying the ointment to internal piles; for external piles it was directed to be applied with the finger or a piece of clean soft rag. Analysis showed the composition of the ointment to be:

Calomel 36·0 per cent. Zinc oxide 11·2 ” Phenol 1·3 ” Beeswax 2·3 ” Soft paraffin 49·2 ”

The estimated cost of the ingredients is 2d.

OXIEN MEDI-CONE PILE TREATMENT.

The sole proprietors of this treatment are stated to be “The Giant Oxie Co.,” of a town in the U.S.A., but having a British depôt in London. The price charged for a box was 2s. 3d.; it contained twelve suppositories, described on the label as:

Warranted to cure Blind, Bleeding, or Itching Hemorrhoids, and all other Diseases of the Lower Bowel and Rectum.

The following extracts are quoted from the enclosed circulars:

Just so far as an electric light is ahead of a tallow candle, is the Oxien Medi-Cone Pile Treatment in advance of and superior to all other remedies for Rectal Diseases.

The people do not like to be humbugged. Modern Men and Women demand modern methods of treatment. With this in view we have after careful painstaking study and experimenting organized a radically new method for the positive cure of Bleeding or Itching Piles or Hemorrhoids, Rectal Ulcers, Fissure, Polypi, Fistula, and all ailments of the Rectum and Lower Bowel....

If you are a sufferer from this terrible malady which has scourged people of all classes of society, in every clime since Bible times, do not now give up. You can be cured. For centuries Piles have been treated in a careless, listless manner, by physicians who through ignorance or indifference were unfit to be entrusted with such cases, or by quacks who by questionable methods and high-titled nostrums extracted dollar after dollar from patient sufferers. During the past few years, however, a great awakening has taken place. The people demanded a suitable and satisfactory treatment and students have been at work, and the subject and its cures have had the most careful and scientific attention.

The result of the careful and scientific attention of the students is these suppositories, which were found on analysis to have the following composition:

Lead acetate 5·6 per cent. Creasote, about 2·0 ” A resinoid substance 3·0 ” Vegetable tissue 1·0 ” Hard paraffin 7·0 ” Oil of theobroma (cocoa butter) 81·4 ”

The resinoid substance showed the presence of tannin; it could not be identified with any certainty, but may have been “hamamelin,” an extract of hamamelis (witch hazel) for which there is no official standard or method of preparation, but it did not agree closely in character with the hamamelin ordinarily supplied in this country. The vegetable tissue appeared to be that of a young leaf, and from the peculiar nature of the hairs was probably hamamelis leaf; the mature leaves as imported into Great Britain, however, possess characters which were absent. The suppositories were of the average weight of 19 grains, and the estimated prime cost of the ingredients for twelve is 1¼d.

HEMOTORA.

The fluid to which this name is given is stated to be manufactured for a company by a chemist in Cheshire. A bottle containing nearly 4 fluid ounces, costs 2s. In the accompanying circular the company’s views as to the cause of piles are expounded as follows:

Hemotora is a Concentrated Extract of Herbs which has been tested and proved beyond doubt to be a “Certain Specific for Piles.” A short explanation will clearly show the action of Hemotora. Should any hindrance occur to the flow of blood through the hæmorrhoidal veins, they naturally become congested and distended; this further brings about a thickening of the vein walls, eventually developing painful tumours called “Piles,” or technically, “Hæmorrhoids.” The many and various conditions that eventually produce Piles can always be traced to this accumulation of blood, and it is in this direction, the very basis of the complaint, that the active principles of Hemotora display their wonderful efficiency by removing the obstruction to the natural flow of blood; the parts will then return to their original condition and functions. Relief may be obtained from the external use of Ointments, Creams and Suppositories, but these preparations only afford temporary ease, and do not tend to remove the Cause. Only internal treatment can cure. Results show that External, Internal, and Bleeding Piles alike soon yield to this remedy; after a few doses the pain is greatly alleviated, accompanied by a sense of relief from the sickly feeling of lassitude and depression. The tonic properties of Hemotora quickly restore the general health.

From another circular it appears that

The “Hemotora Salve” for Itching Piles is sold in small 1s. Jars, large size, 2s. 6d.

Analysis of “Hemotora” showed it to be an aqueous liquid containing about O·09 per cent. of a bitter amorphous alkaloid and 2·7 per cent. of vegetable extractive, including a little of a substance of the nature of a tannin, but not medicinal tannic acid. The liquid appeared to be produced by aqueous extraction, infusion or decoction, of some bitter vegetable substance.

ROLLO’S REMEDY FOR PILES.

This ointment, made by a Scottish company, is sold in tins, price 1s. 1½d., containing rather under 1 oz. It is described in an accompanying circular as a remedy for a good many disorders besides Piles:

Rollo’s Remedy for Piles, Eczema, Rheumatic Pains, Burns and Scalds, Chilblains, Soreness or Roughness of the Skin, Itching.

Rollo’s Remedy is a Vegetable Extract in the Highest Possible State of Purity, without any addition whatever. It is obtained from a little known part of Africa, and has been brought to its present perfection after a long series of scientific experiments. It does not contain any Poisons, Drugs, Chemicals, or Impurities of any kind, and although intended for external use only, it is so pure that even if eaten it would be quite harmless.

Analysis showed the ointment to contain over 99 per cent. of fatty basis, with a very small quantity of a dark substance which appeared to be vegetable extractive. It contained no alkaloid and no tannin, and possessed no characters indicative of the drug or plant from which it was derived. The basis showed the characters of a mixture of fats in which oil of theobroma (cocoa butter) predominated, with about 15 per cent. of lanoline (anhydrous).

DR. VAN VLECK’S COMPLETE ABSORPTIVE PILE TREATMENT.

The preparations sold under this name are, or were, very widely advertised by a company giving an address in London. They are offered without previous payment, as indicated by the following extracts from an advertisement:

To every person who sends us the coupon below at once, we will send—Free to try—our complete new threefold absorption cure for Piles, Ulcer, Fissure, Prolapse, Tumours, Constipation, and all rectal troubles. If you are fully satisfied with the benefits received, send us 4s. 6d. If not, we take your word, and it costs you nothing; you decide after a thorough trial.

Our valuable new Pile Book (in colours) comes free with the approval treatment all in plain package. Send no money—just the coupon—to Dr. Van Vleck Co.

The “new Pile Book,” a pamphlet of 40 pages, entitled “The Rational Treatment of Rectal Diseases,” included a description of the rectum, with eleven illustrations—several of them coloured—with descriptions of various kinds of piles and treatments, and of the Van Vleck remedies. A few extracts only can be given:

Unless you are beyond every chance of recovery, this wonderful threefold Absorption treatment will cure you....

The Absorption Cure is Threefold because there are three avenues of approach to the seat of the ailment. To neglect one of these avenues means to leave an open gateway for the return of the malady. Dr. Van Vleck struck at the well spring of the disease, as well as at the visible effect of it. Once cured by our treatment the disease is cured to stay cured. There is no pain, no confinement,

no heavy doctor's or surgeon's bill, no operation. The cost is placed within the reach of all, and the treatment is accompanied by a positive guarantee of cure. The treatment embraces:

1. Dr. Van Vleck's Absorptive Plasma. 2. Dr. Van Vleck's Muco-food Cones. 3. Dr. Van Vleck's Pile Pills (and System Regulator).

The "positive guarantee" is given inside the back cover of the pamphlet, as follows:

GUARANTEE.

The Dr. Van Vleck Co.... Hereby positively agrees that Dr. Van Vleck's Absorption Cure for Piles, when taken and used in accordance with our simple instructions and directions, will cure any case of Piles, and in the event of its failure to cure,

AGREES TO REFUND

The entire amount paid immediately upon required statement that benefit has not been received.

The Dr. Van Vleck Co.

It will be observed that this purported to be a guarantee to cure, and would be read by most as a promise to refund the amount paid if the treatment did not cure; whereas it was only a promise to refund if a "required" statement were made that benefit (that is, any benefit) had not been received, a statement most uncured persons might hesitate to make.

On application for the 4s. 6d. treatment, 5 suppositories, 10 pills, and about 65 grains of "plasma" in a collapsible tube were sent, with a long circular letter of the usual type, offering the:

Large special treatment, including our new Rectal Applicator, made from pure Stannum,[2] for 21s., or for 16s. 6d. in addition to the 4s. 6d. to be sent for what was supplied.

[2] _Stannum_: tin. _Latin Dictionary._

The labels of the preparations were stamped "made in U.S.A."

Letters subsequently received urging continued use of the treatment and pressing for particulars of the case, were much like those from other nostrum dealers which have been printed in earlier chapters, and included such statements as:

We have made a special study of your case, and we are convinced that if this, our final offer to _you_, is accepted, a permanent cure will be assured.

No "case" had been even mentioned in sending for the preparations. The "final offer" was:

On receipt of 12s. 6d. we will forward you our Full Size Guinea Treatment, post free. We are perfectly willing to trust to you to remit us the balance of 4s. on completion of the cure. Remember you are absolutely protected by our guarantee (see last page of booklet).

Other papers sent were a "Patient's Special Symptom Form," to be filled up after using the "treatment," and including such questions as "Are your Piles better?" "Please state in what way your condition has changed since you commenced taking our treatment," and a form for names and addresses of other persons suffering from piles.

Analysis of the "plasma" showed it to be a paraffin ointment containing about 6 per cent. of powdered galls and a small quantity of menthol (approximately 1 per cent.); the basis consisted principally of soft paraffin, with a dark substance which appeared to be the natural impurities of crude petroleum. The formula is thus approximately:

Powdered galls 6 parts. Menthol 1 " Crude petroleum jelly to 100 "

The "Muco-food Cones" had an average weight of 21 grains; analysis showed them to consist of:

Wheat flour 28 per cent. Oil of theobroma (cocoa butter) 68 " Water 4 "

Careful search failed to show any other ingredient.

The pills were coated with a mixture of talc and sugar, tinted an orange colour; after removing the coating they had an average weight of 1·1 grain. Analysis showed them to contain small quantities of powdered capsicum, powdered liquorice, and maize

starch; 23 per cent. of ash, about half of which consisted of silicious matter and was apparently talc that had got into the pill from the coating; the remainder of the ash showed the usual constituents of the ash of vegetable drugs and extracts, together with a small quantity of zinc, which was present in the pill in the metallic state and was presumably derived from some vessel used in the preparation; a bitter extract, agreeing in its properties with extract of cascara sagrada, constituting the major portion of the pill; and a resinoid substance which resembled iridin. As a definite formula cannot be given for such a pill, the cost of ingredients can only be estimated somewhat roughly. After making liberal allowance for the unknown resinoid, the estimated cost of the ingredients of the quantities of the three preparations supplied for 4s. 6d. is three-farthings.

CHAPTER XVIII.

PREPARATIONS FOR RUPTURE.

Advertisements of means of curing rupture without operation are very common, but in most cases the advertiser has for sale a special form of truss or other appliance. The disorder is so well-known to be of a mechanical or structural nature, that it might have been thought that it would hardly have been worth anybody's while to advertise drugs for its cure. Nevertheless there are, at least, two instances in which medicine for internal or external use is supplied; the results of examination of these are here given.

RICE'S TREATMENT FOR RUPTURE.

The following is a specimen of the wording of the advertisement of this "treatment" which used to be, and perhaps still is, very commonly illustrated by a picture of a bricklayer filling up a hole in a wall:

RUPTURE CURED.

Do You See this Bricklayer Closing up the Opening in that Wall. That is the way to cure _Rupture_, by filling in the opening with _new_ and _stronger_ tissue.

A rupture is simply a break in a wall—the wall of _muscle_ that protects the bowels and other internal organs.

It is just as easy to cure a wound or break in _this_ muscle as one in the arm or hand.

Now this break may be no larger than the tip of your finger. But it is large _enough_ to allow part of the intestines to crowd through. Of course, this cannot _heal_ unless nature is _assisted_. That is just what this Method does. It enables you to retain the protrusion inside the wall in its proper place.

Then we give you a Developing Lymphol to apply on the rupture opening. This penetrates _through_ the skin to the edges of the opening and removes the _hard ring_ which has formed around the break.

Then the _healing_ process begins. Nature, no longer handicapped by the protruding bowel and hardened ring at the opening, and stimulated by the action of the Lymphol, throws out _her_ supply of lymph, and the opening is again filled with _new muscle_.

Isn't this simple? Isn't it _reasonable_?...

Simply _write_ us and we will post you a _free sample treatment of_ the Developing Lymphol and a finely illustrated book on The Nature and Cure of Rupture. Do _not_ send any money. Just your _name_ and _address_ on this Coupon.

Application for particulars of the method of cure brought a book of 40 pages, entitled "The Nature and Cure of Rupture," with a letter, directions for measurement, and other papers. It would seem that if the applicant does not at once become a customer, other letters and booklets are sent at intervals. The titles of some of these booklets which are before us are: "First Aid to the Ruptured," "The Value of a Cure," "A Fireside Reverie," "Facts and Faces," "The Story of Christopher Columbus," and "The Man Who Wondered Why." However much the matter varies, it always leads to the subject of the cure of rupture by Rice's Treatment. The treatment consists of the wearing of an "Appliance" (occasionally referred to as "my perfect truss") and the application of "Developing Lymphol." The respective parts stated to be played by these are indicated by the following extracts from some of the pamphlets referred to:

To be cured of rupture it is necessary to apply my Lymphol Developing Treatment regularly as directed, for it is the Lymphol, not the Appliance, that performs the cure.

The Appliance is simply a means of support to retain the rupture, and prevent the protrusion from tearing down the new particles of tissue with which the opening is being filled under the vitalizing and healing influence of the Lymphol.

The appliance is supplied in two grades or qualities. The price of the Appliance and Lymphol together ranged from 21s. for a child's single appliance of the cheaper grade to £4 10s. for an "Abdominal Supporter and Navel Appliance Combined," of the higher grade. It was stated in the price list that the lymphol and appliance were not supplied separately; but in another list sent with the goods the lymphol alone was priced at 16s. 6d. The bottle sent held just over four fluid ounces.

The directions were:

Lie on your back, remove appliance, unscrew stopper, and sprinkle a few drops of the Lymphol on to the point where the rapture leaves the cavity of the abdomen. Apply night and morning, rubbing in thoroughly with fingers. If irritation is produced, use less Lymphol, or discontinue its use for a few days. The Lymphol may be reduced in strength by adding Spiritus Rectificatus which can be obtained from any chemist.

The "appliance" consisted of an elastic band to go round the body, fitted with an adjustable pad and an understrap. Analysis showed the "lymphol" to be an alcoholic solution containing essential oils and capsicum resin, and a trace of red colouring matter. Oils of origanum (thyme), peppermint, and spearmint were recognized; the proportion of capsicum was estimated by determining the total solid matter, and by comparing the pungency of dilutions of the lymphol with dilutions of the solutions prepared in imitation; the red colouring matter was not cochineal, or one of the common vegetable colours, but appeared to be one of the artificial dyes. Careful comparisons indicated the following formula:

Tincture of capsicum (_B.P._ strength but prepared with strong alcohol) 60 parts by measure. Oil of origanum 6 " " Oil of peppermint 1 " " Oil of spearmint 0·3 " " Red dye q.s. " " Rectified spirit to 100 " "

The estimated cost of the ingredients for 4 fluid ounces is 9d.

HEALINE TREATMENT.

This is advertised from a town in the south of England as follows:

Rupture cured

speedily and permanently, with inexpensive home treatment. A certain remedy for Man, Woman, and Child. Full particulars on receipt of two stamps.

Application to the address given brought a booklet of 28 pages, headed:

The following is a description of Rupture, Its causes, Symptoms, Treatment, and Cure.

An extract from this booklet is here given:

The only possible way to effect a permanent cure is by taking a remedy that will fortify and strengthen the weakened vessels, and so enable them to bear an ordinary strain without injuring them. HEALINE TREATMENT No. 1 has been found by experience to perform this operation after all other so-called treatments have failed. External treatment cannot cure you, for the cause is internal; therefore to effect a cure the cause must be removed. By taking this remedy as directed, a cure may be expected from two to four months, according to description of complaint and length of time affected. From six to nine bottles of this preparation is generally sufficient to effect a cure, or the same quantity of pills. I do not guarantee to completely cure every case, but it will do as much good as nature will allow, and prevent strangulation in every case. I find, after a few years' experience with this remedy, that it is able to absolutely cure ninety out of every hundred cases of rapture, where nine to a dozen bottles have been taken.

Other sections of the pamphlet are devoted to varicocele and varicose veins, for which it appears that "Healine No. 2" and "Healine No. 3" respectively are recommended.

The prices of the preparations (post free) were thus given:

Liquid Form.—3s. per bottle; Three for 8s. 9d.; or Six prepared bottles for 15s.

Pill Form (recommended).—2s. 9d. per box; Three for 8s.; or Six for 13s. 9d.

Healine Lotion (same price as Internal Healine) is always necessary for bad Ulcerated Legs and open or deep-seated Wounds, and never fails to cure when used as directed.

Consultation by appointment only, for which a fee of 2s. 6d. will be charged.

An application for a bottle of liquid “Healine No. 1,” with a remittance of 3s., brought in return a box of the pills, with an intimation that these were recommended in preference. The box contained 60 pills, two to be taken three times a day.

The pills were coated with talc, after removal of which they had an average weight of 4 grains. No metallic salts were present, and no alkaloid; about 1 per cent. of an oily liquid of acid nature, apparently oleic acid, was found; small quantities of a tannin, gum, and phlobaphene, a decomposition product of tannin, were present, and a bitter substance which showed no characters by which it could be identified; aloin and extract of cascara sagrada were absent, and all resinous substances, unless in minute quantity; the pill consisted chiefly of indefinite extractive, with about 20 per cent. of a vegetable powder, one ingredient of which was liquorice, a second appearing to be gentian, but it was not identified with certainty; a considerable portion of the vegetable powder had no identifiable properties.

CHAPTER XIX.

CURES FOR INEBRIETY.

For a good many years past cures for inebriety have been freely advertised in various ways, some of them commonplace and others showing a good deal of ingenuity. Some are advertised and sold in the same way as ordinary secret remedies, that is to say, the purchaser sends so much money and receives a box or bottle with directions for administering the contents. In other instances the inebriate is required to submit himself to inspection, and in certain cases must enter a home maintained by the proprietor or his agents. Between these two extremes there are intermediate plans, the methods followed shading off on the one hand into those of the ordinary nostrum seller, and on the other into the more elaborate system of the “treatments” with which transatlantic enterprise has made us familiar. The last of the remedies described by name below approximates very closely to this class.

COZA POWDER.

This powder is supplied by the Coza Institute, 76, Wardour Street, London, W., formerly 62, Chancery Lane, London, W.C. The price charged for a box, containing 30 powders was 10s.

The preparation was advertised with an offer of a free sample. An application for a sample brought a single powder together with a 10s. box to be paid for or returned, a book of 130 pages (which is referred to below), and a letter, from which the following is an extract:

Coza Powder has the marvellous effect of producing a repugnance to intoxicating drink of any kind, and may be administered in coffee, tea, milk, water, beer, whisky, brandy, or solid food without the partaker’s knowledge.

Coza Powder does its work so silently and surely that any person interested in the intemperate can administer it to him or her without his or her knowledge and without him or her learning what has effected the reformation.

Coza Powder has reconciled thousands of families, saved from shame and dishonour thousands of men and transformed them into sturdy citizens and capable business men. It has led many a young man along the direct road to good fortune, and has prolonged by several years the lives of many individuals.

We particularly wish to draw your attention to the fact that we guarantee Coza Powder to be absolutely harmless.

The book which was sent, entitled _No more Drunkenness_, opens with the statements that—

Coza Powder is one of the greatest discoveries of the day. There is nothing in the whole world to compare with it. It is the only powder to cure the craving for drink and drug habits.

The first few pages are devoted to a disquisition on drunkenness; then follow further claims for Coza Powder, such as—

Coza is the name of a marvellous powder which possesses the quality of occasioning in him who takes it a dislike for alcoholic liquors and all intoxicating drinks. The drinker finds alcohol so detestable that even on the most tempting occasions it will be

impossible for him to take a single drop.

A large part of the book is given up to what are called testimonials, with portraits stated to represent the writers; the large majority of these are dated from Continental countries. Those to which English names and addresses are appended are for the most part expressions of hopefulness, or records of slight variations in drinking which are believed to be due to the powders; for instance:

My friend has been taking “Coza” this last two days, and he has had no desire for drink.

Enclosed you will find P.O. for which send me another box. I think the powders are doing my friend good. Send at once.

The last pages of the book are devoted to advertisements of Canexia Hair Elixir, Canexia-Brilliantine, and Canexia-Shampoo Powder, supplied from the Canexia Chemical Works, 61, Chancery Lane; and Anticelta Tablets for Obesity, and Brixa Tablets for Thin People, supplied from 62, Chancery Lane.

A visit to the address showed that the Canexia Chemical Works, the Coza Institute, and the offices of Anticelta and Brixa Tablets were all at that time accommodated in three rooms on the second floor at 61 and 62, Chancery Lane, the double number representing the one entrance of a large block of buildings containing hundreds of different offices. A photograph of the entire block, inscribed “Coza Institute,” is given in the book just referred to. The address has since been changed to that given above.

The powders had an average weight of 1½ grains, the weights of single ones varying from ■ grain to 3 grains. Analysis showed them to contain 90·5 per cent. of sodium bicarbonate, the remainder being a vegetable powder; microscopic examination of this powder showed that it agreed in all its characters with a mixture of equal parts of cummin fruit and cinnamon. No alkaloid was present, and no other ingredient of any kind could be detected. The formula is thus:

Sodium bicarbonate 90 parts. Powdered cinnamon 5 ” Powdered cummin 5 ”

Cummin fruit (seeds) have a bitter aromatic taste and a peculiar strong heavy odour. Owing to its disagreeable taste and odour cummin is seldom used in medicine, any medicinal properties it possesses being the same as those of other aromatic and less nauseous umbelliferous fruits.

The estimated cost of the ingredients for 30 powders was one-thirtieth of a penny.

DIPSOCURE.

This nostrum is prepared by a “Chemical Co.,” giving an address in Birmingham. The price charged for a box, containing 50 powders, 25 being white and 25 tinted reddish-buff, was 9s.

This article, like the preceding, is advertised with an offer of a free sample. Application for a sample brought also a stream of letters at short intervals, with abundant printed matter. A few extracts from the letters are here given:

Eminent medical men have over and over again declared that if a cure for drunkenness could be discovered both TASTELESS AND ODOURLESS, and placed in the hands of a devoted woman to administer SECRETLY, the greatest difficulty in effecting cures would have been overcome. “Dipsocure” IS TASTELESS and ODOURLESS, and CAN BE administered SECRETLY; so that it has been our privilege and good fortune to have solved the problem. Whilst counteracting and freeing the alcoholic-laden system of the poison, it is soothing to the nerves and restores the health, and is harmless to the most delicate person.

... when a cure has been effected we ask you kindly to acquaint us of the fact, and perhaps you will then consider our agency proposal, showing how a good income can be made by introducing the cure to others. To show you the ease with which it can be sold, if you remit us 10s. three packages will be sent, two of which you can readily dispose of to other sufferers at 9s. each, thus making 8s. profit and obtaining one packet quite free.

The directions for use were:

Give one powder three times a day, before meals, dissolved in half a tea-cup of Hot Coffee, Tea, Whisky, Milk, Gin, &c.

Use either the brown or white powder, as the colour of the liquid may require.

The powders had an average weight of 4·2 grains, single powders varying from 2·9 to 6·0 grains. The composition of both kinds was found to be the same except for the trace of colouring matter contained in the tinted powder. Analysis showed the composition

to be—

Acetanilide 6 parts. Potassium bromide 35 ” Sugar of milk 59 ”

The estimated cost of the ingredients for 50 powders was one-third of a penny.

ANTIDIPSO.

This is supplied by another “Chemical Company,” giving an address in London. The price of a box, containing 48 powders, 24 being white, and 24 tinted pinkish-buff, was 10s.

The statements made about this article, in circulars and letters, were very similar to those made about the preceding one. A few extracts will suffice:

You will not forget that to insure an absolute complete and permanent cure for the craving, two boxes are invariably required. We have had data of cures effected with one box, but to make absolutely sure you will do well to immediately send us remittance, to the same value as the last, and get the second box of the specific. Antidipso may be administered with or without the knowledge of the patient.... We enclose you a booklet showing our agency terms. Kindly give it your attention, as we are confident you will be so surprised and satisfied at the cure which will be effected that you will either yourself want to take up agency with us, or get some one in your district to do so.

The directions were:

Give one powder, dissolved in half a tea-cup of hot coffee, whisky, milk, gin, &c. (using either Brown or White Powder as colour of liquid may require) 3 times a day before meals.

The powders had an average weight of 5·3 grains, single powders ranging from 3·7 to 9·9 grains. The white and tinted powders were made of the same constituents, with a trace of colouring matter added in the latter case, but in different proportions. Analysis showed the composition to be:

WHITE POWDERS.

Potassium bromide 24·5 parts. Sugar of milk 75·5 ”

COLOURED POWDERS.

Potassium bromide 35 parts. Sugar of milk 65 ”

The estimated cost of the ingredients for 48 powders was one-third of a penny.

THE TEETOLIA TREATMENT.

The following is an extract from an advertisement of a “Teetolia Treatment Association,” giving an address in London:

After years of Drink and Drug taking—

Cured in 4 days.

... The Teetolia treatment acts so rapidly and so efficiently that within four days from the commencement of administration the insistent craving for drink is absolutely destroyed—so much so, that even the thought of alcohol becomes nauseating.... Thousands have been cured by this treatment, and we guarantee to cure you. If you write to-day, you will receive by return of post a private consultation sheet, together with a valuable book on this subject, post free in plain envelope, and you will be a free man within a week.

On application being made for further particulars, a booklet of twenty pages, entitled _The Teetolia Treatment for Alcoholic Excess, Drug Habits, and Resultant Nervous Diseases_, was sent, together with a letter and a form to be filled up with particulars of the case to be treated. The following are extracts from the booklet:

The discovery of the Teetolia method and treatment for the permanent eradication of the crave for drink and drugs marks an era in medical science. It is the outcome of a life’s study of the subject by one of our best known West-End physicians.

You can, whilst undergoing the treatment, pursue your ordinary methods of living. You continue to take your daily modicum of alcohol; but somehow about the third or fourth day of treatment, without having made any physical or mental effort, you feel that you no longer want a drink; it holds out no attractions to you; its magnetic influence has gone....

We are willing to supply you with sufficient medicine for eight days' treatment free of all charge. This will enable you to determine whether the treatment is acting successfully, for at the end of the fourth day an obvious and perceptible effect should be experienced. We impose no condition; we rely on your candour, honesty, and gratitude that at the end of the eight days' treatment, if you are convinced of the value of the Teetolia Treatment, you will forward to us the ordinary fee—£1 1_s._—for same, but if you have derived no benefit from the treatment at the end of the same period, then you are under no obligation whatever to pay us one single penny.

The letters were on headed paper, at the top of which was printed, "All communications strictly confidential," and "Consultations with Physician by appointment." The first letter concluded as follows:

Please therefore fill in and return without delay the special statement sheet and upon our receiving it the Physician will go carefully into the case and will prescribe special medicine, which will reach you with expert advice in the course of two or three days in a perfectly plain sealed package.

The "expert advice," in a letter purporting to be from "The Medical Superintendent," sent with the medicine, contained these passages:

I want, if possible, the patient to use his own endeavours to try and keep off alcohol during the first few days of treatment; if this cannot be done, then the treatment must be commenced when the patient is not drinking, in order to give the medicine a better hold on the system. The dislike for alcohol, which we claim, does not come on all at once.

The eight days' treatment is enough to show you that it will do good, but not sufficient in this case to effect a permanent cure. I would advise the patient to continue for at least a month to six weeks.

This is somewhat widely at variance with the statements quoted above. "You continue to take your daily modicum of alcohol" and "you will be a free man within a week."

The one guinea "treatment" consisted of 2■ fluid ounces of a liquid of the nature of a vegetable fluid extract.

The directions were:

Half a teaspoonful to be taken in a little water every four hours during the day at 10, 2, 6, and 10 o'c.

Analysis showed this to contain 29·3 per cent. by volume of alcohol and 2·3 per cent. of alkaloid, which consisted principally of quinine. The liquid agreed generally with a diluted liquid extract of cinchona; the amount of alkaloid was just under half what is contained in the official liquid extract of cinchona. Treatment with suitable solvents extracted a trace of a non-alkaloidal bitter substance resembling the bitter substances obtainable from quassia, chiretta, &c.; a preparation of chiretta appeared to be the more probable. No strychnine was present, and no evidence was obtained of any other ingredient.

SOME OTHER DRUG CURES FOR INEBRIETY.

A somewhat frequent constituent of preparations for the treatment of inebriety is atropine, while other preparations contain one or more of the alkaloids belonging to the same group, usually known as the solanaceous alkaloids from the fact that they are all derived from plants of the nat. ord. _Solanaceae_. These alkaloids closely resemble each other in their chemical nature and in their pharmacological properties; the principal members of the group are:

Atropine, C■■H■■NO■; obtained chiefly from _Atropa belladonna_ (deadly nightshade) and _Scopola carniolica_.

Hyoscyamine, C■■H■■NO■, obtained chiefly from _Hyoscyamus niger_ (henbane) and _Scopola_ species.

Hyoscine, or scopolamine, C■■H■■NO■, obtained chiefly from _Scopola_ species, _Hyoscyamus niger_, and _Datura alba_.

The two following were originally described as separate substances, but have more recently been shown to consist of mixtures:

Duboisine, obtained from _Duboisia myoporoides_, consists chiefly of hyoscyamine and hyoscine.

Daturine, from _Datura stramonium_ (thornapple) consists chiefly of hyoscyamine, with a variable proportion of atropine.

A certain preparation for inebriety is said to contain “stramonine”; as no alkaloid has been described and characterized under this name, it is probably only a variant of daturine, which, as has been said, consists of a natural mixture of hyoscyamine and atropine.

To the above may be added the artificial alkaloid homatropine (C■■H■■NO■), which has not been found in a plant, but is prepared synthetically; in chemical constitution it is mandelyl-tropeine, atropine being tropyltropeine.

The differences in the action of the four principal solanaceous alkaloids are briefly as follows:

Atropine has a stimulant action on the central nervous system especially on the motor area; it depresses and in large doses paralyses the nerve endings of secretory glands, plain muscle, and the heart.

Hyoscyamine is intermediate in its action between atropine and hyoscine; causes less stimulation of the central nervous system than atropine, and is a weaker sedative and hypnotic than hyoscine. It has the same action peripherally as atropine but is twice as powerful.

Hyoscine resembles atropine in its paralysing effect upon peripheral nerve endings, the action being quicker, more powerful, and less lasting. It does not possess the stimulating effect of atropine upon the brain; depression of the motor area is marked from the first.

Homatropine resembles atropine in its action but is less powerful.

CHAPTER XX.

CURE ALLS.

The greater number of the proprietary medicines described in these pages are advertised as cures for a wide range of ailments, but usually there is some one disease for the treatment of which they are particularly recommended, so that it has been possible to classify them according to their alleged purposes. In very many other cases, however, the claims made are so wide that the article is put forward as a sort of cure-all. Thus one of the articles described is stated to cure such different disorders as constipation, rheumatism, St. Vitus’s dance, heart disease, rickets, sleeplessness, kidney complaints, and women’s special ailments, among many others, and is said to be “a real elixir of life in solid form”; the facts as to its composition, ascertained by analysis, show what the possibility of its being a “cure”—for heart disease, for instance—is. As to “Pink Pills,” another of the nostrums analysed, which probably owes its popularity partly to bold advertisement and partly to its alliterative name, the method followed appears to be to recommend them for different diseases in different advertisements; personal testimony, or what is put forward as such, from sufferers who have been cured, is made the basis of most of these, and illustrations are employed to catch the eye of the casual reader. Analysis showed that these pills were practically the ordinary iron-carbonate pills commonly called Blaud’s pill, which ought to be freshly made. The Pink Pills are of lower strength than usually prescribed, and to judge by the proportion of iron that was found to be in the higher state of oxidation, very carelessly prepared. They differ vastly, however, from other Blaud’s pills in the price charged for them. Thus the proprietary Pink Pills are sold at a little over a penny each, while coated Blaud’s pills can be bought retail at a few pence a gross, and wholesale in large quantities at a little over a penny a gross. The analyses of other proprietary preparations show a similar disparity between the market price of the drug supplied and the price charged to the person who is beguiled into purchasing; thus thirteen-pence-halfpenny, two shillings and sixpence, and two shillings and ninepence are the selling prices of nostrums, the ingredients of which are estimated to cost respectively one-eighth, one-third, and one-tenth of a penny.

Preparations of this class are not in all cases very clearly marked off from those recommended for some special disease, such as have been dealt with in previous chapters, for many of them are recommended for some one disease, of which nearly all others are asserted to be variations.

DR. MARTIN’S MIRACLETTS.

These wonders are supplied by a Medicine Co., from an address in London. The prices are 1s. 1½d., 2s. 9d., 4s. 6d., and 11s. per bottle. A 2s. 9d. bottle contained sixty tablets.

They are described on the package as:

A real Elixir of Life in solid form. The world's greatest remedy.

Cures Constipation, Indigestion, Headache, Neuralgia, Anæmia, Nervous Disorders, Liver Troubles, Rheumatism, Sciatica, Gout, St. Vitus' Dance, Hysteria, Rickets, Heart Disease, Kidney Complaints.

Cures Melancholia, Loss of Appetite, Sleeplessness, Lassitude, Mental Depression, Brain Fag, Palpitation, Stomach Disorders, Women's Special Ailments and Irregularity of Health, etc., etc.

A little book, entitled "A Fortune for All," enclosed in the package, contained the following statements:

Whatever you may be suffering from do not worry or fear, as Dr. MARTEN'S MIRACLETTS will be certain to cure you!

Dr. Martin's Miracletts make the weak and sickly become strong and healthy, and the aged become youthful and full of energy; the tired worn-out look being replaced by an appearance of cheerfulness and vivid health. The pale and wrinkled face with bad complexion gives way to rosy cheeks and a clear skin; the thin gain flesh, and the stout lose superfluous fat; indigestion quickly disappears, the appetite returns, and a _new life_ is open to all.

A separate small slip enclosed in the package was worded as follows:

GUARANTEE.

Dr. Martin's Medicine Company being absolutely confident of the marvellous curative properties of their Miracletts, will willingly refund the money to any purchaser who has taken eighteen Miracletts according to directions, and is not satisfied with the results.

Much less conspicuously, on another slip chiefly devoted to the relative quantities in the packages of different size, it was stated:

Those whose ailments have been of long standing must not expect immediate perceptible results, but with a little patience and perseverance the result is SURE.

The "Miracletts" consisted of sugar-coated tablets, the coating being coloured brown with ferric oxide (so-called chocolate coating). After removal of the coating they had an average weight of 4·3 grains; this included the weight of a strong coating of varnish, which was not removed with the sugar-coating. Analysis showed them to contain valerianates of quinine and zinc, iron oxide, menthol, kaolin in considerable quantity, and a little talc. A substance of extract nature was also present to the extent of about 5 per cent.; it possessed no characteristic taste or other property by which it could be identified; a resinous substance, which was found in small quantity, appeared to be merely the varnish with which the tablets were covered. The quantities of the different ingredients were determined as nearly as possible, and the results indicated the following amounts:

Quinine valerianate 0·4 grain. Zinc valerianate 0·1 " Ferric oxide 0·3 " Menthol 0·03 " Kaolin and talc 2·3 grains In one tablet.

The estimated cost of the ingredients of the tablets is 4d. a hundred.

THERAPION.

Another "medicine company," also with an address in London, advertises three preparations which it calls Therapion. Therapion No. 1 was described as "the most efficacious remedy" for "all discharges"; Therapion No. 2 as "the great remedy for impurity of the blood, scurvy, pimples, spots, blotches, pains and swellings of the joints, gout," and so on; and No. 3 as a new French remedy, by the use of which the shattered health will be restored.

The Expiring Lamp of Life Lighted Up Afresh,

and a new existence imparted in place of what had so lately seemed worn, "used up," and valueless. This wonderful medicine is suitable for all ages, constitutions, and conditions, in either sex, and it is difficult to imagine a case of disease or derangement, whose main features are those of debility, that will not be speedily and permanently benefited by this never-failing recuperative essence, which is destined to cast into oblivion everything that had preceded it, for this widespread and numerous class of human ailments.

The claims for No. 3 being so inclusive, it was deemed sufficient to analyse it only. The dose of all three was stated to be the same—a piece about the size of a small marble three or four times a day; as the package, costing 2s. 9d., contained 1■ oz., and as it was referred to as providing twenty ordinary doses, a single dose would be about 30 grains. The substance consisted of a dark

stiff paste smelling strongly of camphor. Analysis showed it to contain, in addition to camphor, glycerine, powdered liquorice, a bitter extract agreeing in all respects with extract of gentian, calcium glycerophosphate, and a trace of alkaloid; there also appeared to be a second extract present. The alkaloid, which amounted to 0·06 per cent. only, could not be identified with any of the ordinary medicinal alkaloids. There was some evidence that the second extract was that of damiana, and a paste made up with this and the other ingredients agreed well with the original; but extract of damiana possesses no distinctive characters by which it can be identified in a mixture. Quantitative determinations were made of those ingredients capable of it, and the proportions of the others estimated by comparison. The results indicated the following formula:

Camphor 2·5 parts. Glycerine 24 ” Powdered liquorice 40 ” Calcium glycerophosphate 1·8 ” Extract of gentian 5·0 ” Extract of damiana (?) 8 ” Alkaloid 0·06 ” Water to 100 ”

In addition, there appeared to be present a slight trace of the oil of one of the umbelliferous fruits, probably anise or fennel. Disregarding the trace of alkaloid, the estimated cost of the ingredients for 1■ oz. is 2d.

PINK PILLS FOR PALE PEOPLE.

These pills, sold by the Dr. Williams Medicine Company, from an address in London, are stated to be manufactured in the United States of America. The price is 2s. 9d. a box, containing 30 pills.

The pills are advertised for a great variety of diseases, prominence being usually given to one disease in each advertisement; thus four long advertisements appearing simultaneously in different papers were respectively headed:

Afraid of being touched. So sore with Rheumatism. A once-crippled victim tells how Dr. Williams’ Pink Pills cleansed his system of Rheumatism.

Eczema expelled. Mr. John Chamberlain tells how his sufferings from Skin Disease were cured by Dr. Williams’ Pink Pills.

Sciatica’s Swift Pains rendered this Lady helpless. Her case had defied treatment, but Dr. Williams’ Pink Pills succeeded by curing the cause of Sciatica.

The Dark Days of Dyspepsia.... Dr. Williams’ Pink Pills go to the very cause of the mischief.

Each advertisement included a long description of a “case,” and as a rule a picture was introduced. The following is from the concluding paragraph of the first of these advertisements, and the others ended in a similar way.

THE DR. WILLIAMS’ WAY.

When the muscles and nerves are tortured by poisons in the Blood, be the result Rheumatism, Sciatica, or Lumbago, the only way to a cure is to Enrich and Purify the Blood. Dr. Williams’ Pink Pills, in this way alone, have cured not only Rheumatism, but Anæmia, Indigestion, Palpitations, Influenza’s After-Effects, Eczema, Sciatica, St. Vitus’ Dance, Spinal Weakness, the many forms of Nervous Disorders dreaded by men; also the special ailments of women.

The pills were ovoid in shape and coated with sugar, coloured pink; after removal of the coating they had an average weight of 3 grains. Analysis showed them to contain ferrous sulphate, potassium carbonate (these two having reacted more or less completely, and about one-third of the iron having become oxidized to the ferric state), magnesia, powdered liquorice, and sugar. Since it has been stated that these pills contain arsenic, careful search was made for it, but it was not found, The pill is thus merely one of the many variations of Blaud’s pill. The quantities of the different ingredients found indicated the following formula:

Exsiccated sulphate of iron 0·75 grain. Potassium carbonate, anhydrous 0·66 ” Magnesia 0·09 ” Powdered liquorice 1·4 ” Sugar 0·2 ” In one pill.

The estimated cost of the ingredients for 30 pills is one-tenth of a penny.

BEECHAM’S PILLS.

A box of these pills, advertised to be worth a guinea, is sold for 1s. 1½d., and the prime cost of the ingredients of the 56 pills it contains is about half a farthing.

In a circular wrapped round the box it is stated that “these renowned pills are composed entirely of Medicinal Herbs,” and cure Constipation, Headache, Dizziness or Swimming in the Head, Wind, Pain, and Spasms at the Stomach, Pains in the Back, Restlessness, Insomnia, Indigestion, Want of Appetite, Fullness after Meals, Vomitings, Sickness of the Stomach, Bilious or Liver Complaints, Sick Headaches, Cold Chills, Flushings of Heat, Lowness of Spirits, and all Nervous Affections, Scurvy and Scorbutic Affections, Pimples and Blotches on the Skin, Bad Legs, Ulcers, Wounds, Maladies of Indiscretion, Kidney and Urinary Disorders, and Menstrual Derangements.

The pills had an average weight of 1¼ grains, and analysis showed them to consist of aloes, ginger, and soap; no other medicinal ingredient was found. The quantities were approximately as follows:

Aloes 0·5 grain. Powdered ginger 0·55 ” Powdered soap 0·18 ” In one pill.

NERVLETTES.

Of these pills, which are sold in a bottle, price 1s. 1½d., containing 27 pills, a circular enclosed in the package said

Coleman’s Nervlettes or Nerve Pills generate brain and nerve-force.

The pills were coated with talc; after removal of the coating they had an average weight of about 1½ grains. Analysis showed them to contain free phosphorus, quinine sulphate, a little powdered liquorice, and about 20 per cent. of a powdered vegetable tissue, which could not be identified; the remainder of the pill appeared to be of the nature of excipient only. The amounts of phosphorus and quinine were determined, and indicated the following formula:

Phosphorus 0·005 grain. Quinine sulphate 0·07 ” Vegetable powder 0·3 ” In one pill.

MOTHER SEIGEL’S CURATIVE SYRUP.

The price of a bottle of Mother Seigel’s Syrup containing 3 fluid ounces is 2s. 6d.

Although this was described on the wrapper as “for dyspepsia” so many disorders were stated to be due to this cause, and amenable to treatment with this preparation, that it may fairly be included in this chapter. On the other side of the wrapper it was called “A cure for impurities of the blood,” and “A cure for dyspepsia and liver complaints.” In a circular enclosed with the bottle it was stated:

The symptoms mentioned above are the smoke of the fire of indigestion—a fire that will eat out your very vitals and sap your strength and vitality. For it can’t be too often repeated that indigestion is the root of a great deal of evil; the origin of a great many disorders which no man quite understands how he came by. And why this is can easily be explained. Disease is poison; its symptoms are the manifestation of the poison. Indigestion creates many dangerous poisons, and is therefore the cause of many diseases.

So let us get rid of the smoke by putting out the fire, and purify our blood and system with Mother Seigel’s Syrup, which will sweep away the poisons and make us healthy and strong.

Mother Seigel’s Syrup is a highly concentrated, purely vegetable compound, having a specific action on the stomach, liver, and kidneys.

Analysis showed the presence of free hydrochloric acid, which is not usually classified as a vegetable compound, tincture of capsicum, a bitter substance agreeing in its properties with aloes, and sugar (partly as invert sugar); the colouring and flavouring substances also present indicated that the sugar had been added in the form of treacle. Quantitative determination of those ingredients capable of it, and estimation of the others by comparison with known mixtures, indicated the following formula:

Dilute hydrochloric acid (_B.P._) 10 parts by measure. Tincture of capsicum 1·7 ” ” Aloes 2 parts. Treacle 60 ” Water to 100 parts by measure.

The estimated cost of the ingredients for 3 fluid ounces is one-third of a penny.

THE ILLS OF HUMANITY.

Several examples have been encountered in previous chapters of the system of getting into personal communication with a possible customer, and addressing to him a series of letters warning him of the dire consequences should he fail to purchase the advertiser's "treatment." Over and beyond the chance of frightening the customer, the system, which seems to have originated in the United States of America, has the advantages that a profession can be made of adapting the treatment to the individual case, that the price may be lowered if the charge first made is considered too high and that possibly, in return for this concession, testimonials and the names of other sufferers may be obtained. A letter-writing system of this kind is found at work behind the advertisement from which the following paragraphs are extracted:

Free! Free!

To the Sick and Ailing Everywhere.

The Cure for your Disease—Delivered Free—Free for the Asking—Free to You.

To the sick—the suffering—to every man and woman victim of organic disease—local trouble or broken general health—Dr. Kidd's offer of free treatments is given in the absolute faith and sincere belief that they can and will stop disease, cure it, and lift you up again to health and vigour....

Rheumatism, kidney trouble, Bright's disease, diabetes, heart disease, partial paralysis, bladder troubles, stomach and bowel troubles, piles, catarrh, bronchitis, weak lungs, consumption, asthma, chronic coughs, nervousness, all female troubles, lumbago, skin diseases, scrofula, impure blood, general debility, organic vital ailments, etc., are cured to remain and continue cured....

Will you let me do this for you—will you let me prove it—brother and sister sufferers? Are you willing to trust a master physician, who not only MAKES this offer, but PUBLISHES it and then sends the test and proof of his remedies without a penny of cost to anyone except himself?...

My home office is at Fort Wayne, Indiana, U.S.A., but for the benefit of my thousands of English patients, I have established an office in London. Please address Dr. James W. Kidd, "Box" No. ____, E.C.

The advertisement was illustrated by the portrait of a man who, it might be assumed, was the "master physician" in question, but that in a book of some hundred pages, entitled "The Ills of Humanity, by Dr. James W. Kidd, Fort Wayne, Ind.," issued apparently by "the J. W. Kidd Co.," there is a portrait of Dr. James W. Kidd, which seems to represent a totally different person.

The book is principally occupied with a series of paragraphs on different complaints, rather over a hundred being dealt with; in the majority of cases the description leads up to reference to Dr. Kidd's treatment, or medicines, etc. Dr. James William Kidd, the book states, possesses a profound knowledge of medicine, a remarkable power over disease, and has "among his resources remedies that enable him to treat successfully many diseases that are generally considered incurable." After this the fact disclosed by analysis that his remedies seem in reality sadly lacking in originality and novelty, must excite a mild surprise.

It appears that persons writing to Dr. James W. Kidd, or the J. W. Kidd Co., receive a "Self-Examination and Consultation Blank." In one instance in which the blank was filled up, the reply was as follows:

Diagnosis and Case Record. By Dr. James W. Kidd, Fort Wayne, Ind.

For a complete description of your case, the probable results and my method of treatment, see pages 46, 99, 29, 13, 9, of the pamphlet "The Ills of Humanity," sent you under separate cover.

I find that you are afflicted with Rheumatism, Scrofula, Catarrh, Dyspepsia and Gastritis.

Rheumatism MEANS an excess of uric acid in the blood.

Scrofula is a constitutional disease almost synonymous with tuberculosis.

Catarrh is an excreting inflammation of the mucous membrane.

Dyspepsia (Indigestion) MEANS impaired secretion of pepsin and consequent imperfect digestion.

Gastritis MEANS catarrh of the mucous membrane of the stomach.

TAKE THE REMEDIES ACCORDING TO THE FOLLOWING DIRECTIONS:

One Tablet “A” before breakfast. One Tablet “B” before dinner. One Tablet No. 18 before supper. One Tablet No. 7 after dinner and after supper. One Tablet No. 45 on retiring.

This was accompanied by tablets marked “A,” “B,” and “18,” three of each, four marked “45,” and five marked “7”; also by a letter which appeared to be lithographed, and although the name and address were in the same writing and the same ink, they showed evidence of having been added afterwards. It seems probable, therefore, that, although professing to be a personal letter, it was one in regular use. It stated that Dr. James W. Kidd has “to-day selected and will forward to your address upon receipt of your remittance of 1_l._ the complete course of treatment,” the tablets sent being only samples. The letter apologizes for the smallness of the samples on the ground that the drugs “are very expensive.” The writer adds: “I have taken special interest in your case, because I want a cured patient in your immediate vicinity.” The tablets were analysed as completely as was possible with the small quantities sent, with the following results:

Tablet A (triangular) was coloured externally with a salmon-pink dye; the outer coating was of sugar, and below this was a rather thick coating of chalk, forming a very hard and resistant covering to the tablet. The decoated tablets weighed about 3-¼ grains each; they contained 52 per cent. of sodium bicarbonate, and the remainder consisted principally of a bitter extract agreeing in all respects with extract of gentian; small quantities of potato starch and a substance of resinoid nature, which could not be identified, were also present. No other medicinal substance could be found.

Tablet B (triangular) was coloured externally with a bluish-purple dye; the coating and the material of the tablets agreed in all respects with Tablet A, and the two were apparently identical.

Tablet 18 (circular) was white; the coating was of similar composition to that of A. The decoated tablets weighed about 3·8 grains each; analysis showed the presence of about 1 grain of sodium benzoate in each, together with a small quantity of a greenish, moderately bitter resin which could not be identified, and a trace of oil of wintergreen. Faint indications were obtained of a trace of an alkaloid, but not enough to amount to positive evidence. No other medicinal substance could be found; the remainder was of “extractive” nature.

Tablet 45 (circular) was coloured externally with a pink dye; the coating was of similar composition to that of A. The decoated tablets weighed about 1·1 grain each; the chief constituent was aloes, and there was also present a very small quantity of ginger extract, and a small quantity of a resin, which was probably jalap or scammony resin; also a moderate trace of alkaloid, which was not the alkaloid of nux vomica, belladonna, or hyoscyamus, but was not present in quantity sufficient to be identified; the only other ingredient found was a little potato starch.

Tablet 7 (circular) was not coated. The average weight of these was 6·5 grains each, and they consisted principally of charcoal, with some sugar and a very little saccharin.

“These special remedies are very expensive!”

BURGESS’S LION OINTMENT.

The results of an examination of Burgess’s Lion Ointment may be given here inasmuch as it will be seen that it is recommended for the cure of a great number of disorders. It is supplied in boxes at 1s. 1½d., 2s. 9d., 4s. 6d., 11s., and jars at 22s.; the 1s. 1½d. box contains 1 oz., and the next size 3 oz.

A circular wrapped round the box was headed “Amputation avoided—the knife superseded,” and continued:

E. Burgess’s Lion Ointment and Pills Have deservedly become the popular remedies for curing all diseases of the Skin, Old Wounds, Ulcers, Abscesses, (including Tuberculous), Tumours, Polypuses, Piles, Fistulas, Shingles, Venerea Sores, Whitlows, Broken Breasts, Bad Legs, Boils, Scurvy, Scrofula (_King’s Evil_), Scorbutic Eruptions, Poisoned Wounds _of all kinds_, Stings, Venomous Bites, Scurf, Ringworm, Itch, Corns, Chilblains, Chapped Hands, Cracked Lips, Cuts, Burns, Scalds, Gatherings in the Ear, Toothache, Earache, Neuralgia, Rheumatism, Gout, Sciatica, Quinsey, Bronchitis, Asthma, Deafness, etc.; also Ulcerous Affections of the Womb, for the treatment of which apply to the Proprietor, personally, or by letter, _in all cases free_. These invaluable medicines have not been introduced as remedies for any of the above complaints, or diseases, until they have in each case PRACTICALLY proved EFFECTUAL. To those who are suffering from diseases _apparently_ rendering amputation necessary, they are especially recommended, as they entirely do away with the necessity for the same by drawing all the cause of the disease from the affected part, cleansing the blood, and restoring the system to a sound, healthy condition.

They are vegetable preparations, and the Ointment can be applied with perfect confidence to the most tender skin. It is entirely free from all poisonous ingredients, a great recommendation for the nursery—for which it is invaluable.

In spite of the ointment being a “vegetable preparation,” analysis showed the principal ingredient to be lead oleate (lead plaster); this is blended with resin, wax, and fatty ingredients; vegetable extracts and active principles were found to be absent. It is not possible to separate the ingredients of an ointment like this sharply one from another; and, since the ingredients are not themselves simple bodies but mixtures liable to rather wide variations, they can only be approximately determined, and, as regards the lard and oil, even identification cannot be placed beyond doubt nor can small quantities of some other fats be certainly stated to be absent. These, however, are matters of minor importance. The composition given below has been checked by varying the analytical methods, as well as by comparison of various ointments prepared according to formulæ suggested by analysis. As a result of the investigation, the following formula was arrived at, which gives an ointment similar to the “Lion” ointment:

Lead plaster 13 parts. Beeswax 20 ” Resin 11 ” Olive oil 12 ” Water 6 ” Lard, to 100 ”

The estimated cost of the ingredients is about 1Od. per lb. of ointment.

APPENDIX.

STAMP DUTY ON SECRET REMEDIES.

The duty on secret medicines is regulated by the Stamp Act of 1804 as amended by the Stamp Act Amendment Act of 1812. The Act of 1804 was itself in part an amending Act and regulated the duties to be paid on paper, on books, on advertisements, and imposed _ad valorem_ duties on hats and proprietary medicines. The tax on proprietary medicines remains, but that on advertisements through and by which they continue to exist and flourish has gone the way of the duties on hats, and books, and paper. The Act of 1804 contained a schedule of medicines to the number of some 450. In the Act of 1812 this was replaced by a new schedule in which about 550 proprietary medicines were mentioned by name. The final clause of this Act, however, is expressed in very general terms, for it includes “all other pills, powders, lozenges, tinctures, potions, cordials, electuaries, plasters, unguents, salves, ointments, drops, lotions, oils, spirits, medicated herbs and waters, chemical and officinal preparations whatsoever, to be used or applied externally or internally as medicines or medicaments for the prevention, cure, or relief of any disorder or complaint incident to or in any wise affecting the human body,” if the person making or selling these various preparations claim to have any occult secret or art for making them or claim to have any exclusive right or title to make them, or prepares and sells them under the authority of letters patent, or if by public notice or advertisement, or by papers or labels on, or with, the enclosures, bottles, or cases in which the preparation is sold, the maker vendor, or proprietor recommend them as “nostrums, or as proprietary medicines, or as specifics, or as beneficial to the prevention, cure, or relief of any distemper, malady, ailment, disorder, or complaint incident to or in any wise affecting the human body.”

The Inland Revenue returns show that during the last ten years the amount received by the State from the stamp duty on patent medicines so-called has increased from £266,403 10s. 3d. in the year ending March 31, 1899, to £334,141 19s. 2½d. in the year ending March 31st, 1908. The net receipts are the gross receipts after deducting repayments and allowances, but the aggregates of these deductions are small. The following table shows the net receipts in each of the ten years, and the average for the two quinquennial periods, 1899-1903 and 1904-1908:—

TABLE SHOWING NET RECEIPTS FROM STAMPS ON “PATENT MEDICINES” FOR TEN YEARS, 1899-1908.

-----+---------- Year.| Yearly. |Quinquennial average. -----+---------- | £ s. d. | £ s. d. 1899 | 266,403 10 3 |} 1900 | 288,827 8 1½ |} 1901 | 297,479 19 6 |} 298,483 18 3 1902 | 306,337 5 9 |} 1903 | 333,371 7 9 |} | | 1904 | 323,445 14 0 |} 1905 | 331,438 17 6½ |} 1906 | 324,111 14 2 |} 328,048 16 0 1907 | 327,105 15 3½ |} 1908 | 334,141 19 2½ |} -----+----------

The value of the stamp which the vendor must affix to the bottle or package varies according to the price charged for the medicine, and the returns show the number of articles for which the several rates are paid. The following table gives the amount of the stamp duty on the several prices, the number of articles stamped in the fiscal year 1908, and the amount of the stamp. An attempt has also been made to estimate the total amount paid by the public for the articles stamped:—

TABLE SHOWING RATES OF DUTY, NUMBER OF ARTICLES STAMPED AND APPROXIMATE SUM PAID BY THE PUBLIC IN THE YEAR ENDING MARCH 31ST, 1908.

---------- Price of Article| Stamp. |Number of articles|Price paid by public. without stamp. | | stamped. | ---------- £ s. d. | s. d. | | £ s. d. 0 1 0 | 0 1½ | 33,037,202 | 1,858,342 12 0 0 2 6 | 0 3 | 7,565,822 | 1,040,300 10 0 0 4 0 | 0 6 | 1,002,549 | 225,573 10 6 0 10 0 | 1 0 | 122,249 | 67,236 19 0 1 0 0 | 2 0 | 18,445 | 20,289 10 0 1 10 0 | 3 0 | 11,308 | 18,658 4 0 ---------- 41,757,575 | 3,230,401 5 6 ----------

This estimate of the total amount paid by the public must be too high. In the first place it will be seen that the stamp duty does not rise by regular increments _ad valorem_. An article, the nominal price of which is 1s., must bear a stamp of 1½d., but if the nominal price be 1s. 6d., the stamp is 3d., and for an article of the nominal price of 2s. 6d. it is the same. In the second place, a large proportion of all the articles, probably the great majority of those at 1s., are sold at a discount, “store prices.” In the above table the maximum price for each rate of stamp duty and the full nominal prices are assumed. If a deduction of 25 per cent. is made to meet these sources of error, we have a sum of £2,422,800 19s. 1½d., as an estimate of the amount spent by the public on patent medicine in the financial year ending March 31, 1908.

At one time some of the vendors of nostrums took to inserting in their advertisements phrases intended to suggest that the Inland Revenue stamp upon their packages implied some sort of Government guarantee of the efficacy of the remedy. Though the Inland Revenue authorities do not as a rule display any anxiety with regard to the welfare of the public in the matter of the sale of nostrums, their efforts being confined to the collection of the duty, and the enforcement of the provisions of the Act should any vendor show a disposition to evade them, the stamp in recent years has borne the statement “This stamp implies no Government guarantee.” In spite of this vendors still sometimes contrive to convey the suggestion that the stamp conveys some sort of government guarantee; the suggestion looks the more plausible if the vendor has his name or autograph printed on the stamp by the government authorities; this will be done for him if he pays the cost of the die, and by the use of such an endorsement the incautious buyer may be led to assume that the Inland Revenue in some way shares the vendors’ responsibility for the genuineness of the article, that is to say for the genuineness of its claims. It has been suggested that the Legislature might go further and require the composition and ingredients of any secret remedy to be stated upon the label, box, or package, and looking to the nature of the facts disclosed by the analyses published in this book, it may well be believed that such publications on the labels would act to a certain extent as a warning to the public, for it would be apparent even to the least instructed that the claims in the vendors’ circulars were not quite consonant with the commonplace nature of the ingredients of the mixture, powder, pill, lotion, or ointment.

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Lou Andreas-Salomé

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Muschka

gewidmet.

I.

In der Morgenstille war nichts vernehmbar als das helle, langgezogene Trillern der kleinen Buchfinken im jungen Birkenlaub. Die breite, ungepflasterte Straße, die sich, nicht weit von der russischen Hauptstadt, in der Richtung der finnländischen Bahnlinie ins flache Land erstreckte, lag einsam im Frühnebel da. Dann holperte ein Leiterwagen, mit einigen Möbelstücken bepackt, schwerfällig des Weges; der Fuhrmann kletterte von seinem Sitz, warf den kurzen Schafspelz von den Schultern, und, im roten Hemde neben seinen beiden magern Gäulen hergehend, stimmte er eine Volksweise an, die schwermütig in den Vogelgesang hineinklang.

Hinter den Birken tauchte hie und da ein Landhaus auf, meist ein Holzbau, mit geflossenen Fensterläden und bretterverschlagener Balkonthür; oder es schimmerte ein Garten hervor, in dem man eifrig beschäftigt war, das Winterlaub zusammenzukehren und die Beete für den Sommer in stand zu setzen. Aber erst nach Beginn der städtischen Schulferien wurde es in dieser Gegend lebendig.

Der Möbelwagen hielt vor einem Hause, das ganz abseits, weit entfernt von jeder Nachbarschaft, zwischen niedrigem Weidengebüsch und etwas feuchtem Wiesengrund lag. Es war nicht sonderlich groß, besaß aber den schönsten Garten von allen.

Die Frühlingsbäume, die es umstanden, breiteten einen zarten, bräunlichen Schleier darüber, und rings über den verwitterten Lattenzaun drängte sich der Flieder in hellgrünen Blattknospen.

»Die Pforte von außen aufstoßen!« schrie eine vergnügte Stimme in gebrochenem Russisch dem Fuhrmann entgegen, und gleich darauf kam ein halbwüchsiger Knabe durch den Garten gelaufen. Langsam bewegte der Wagen sich über den Kiesweg bis hinter das Haus, wo einige Stufen zur offenen Terrasse mit der Eingangsthür emporführten.

Eine ältliche Magd, mit einer sonderbaren Friesenhaube auf dem Kopf, wartete schon unten, griff kräftig mit an und ließ die abgeladenen Möbelstücke in dem Wohnzimmer niedersetzen, das mit seinem breiten Fenster auf die Terrasse hinaussah. Im Wohnzimmer stand die Thür zu einem kleinem Nebengemach auf, das bereits vollständig eingerichtet zu sein schien. Von den Sachen, die man, beim Auszug aus der Stadtwohnung, im gemieteten Landhause vorrätig gefunden hatte, war offenbar alles Beste und Bequemste hier zusammengetragen worden, um Ordnung und Gemütlichkeit zu schaffen.

An der Thür, auf einem deckenumhangenen Ruhebett, lag eine bleiche, nicht mehr junge Frau, deren feine Gesichtszüge jedoch Spuren ungewöhnlicher einstiger Schönheit zeigten. Unter halbgesenkten Augenlidern folgte sie aufmerksam jeder Bewegung der Kommenden und Gehenden.

Da vernahm sie von der Terrasse her eine Stimme, bei der ein Lächeln durch die großen blauen Augen ging.

»Erik!« rief sie bittend, »komm doch her zu mir. Komm doch her.«

Er stand vor dem Terrassenfenster, in dunkler Morgenjoppe, die Hände in deren Seitentaschen versenkt, zwischen den Zähnen eine Zigarette. Auf den Zuruf seiner Frau wandte er sich um und ging über den Flur in das Zimmer.

Ihr schien immer: ein Strom von Leben käme mit ihm, wenn er so zu ihr trat.

»Nun, Bel,« sagte er heiter, »du sollst sehen, jetzt bricht die Sonne durch den Nebel, und dann trage ich dich in den Garten hinaus. Deinen großen Liegestuhl haben wir schon dort hinten am Springbrunnen aufgestellt.«

Sie schüttelte den Kopf.

»Ich habe keine Ruhe draußen, solange hier alles noch in solcher Verwirrung ist. Wie mag es nur in deinen Zimmern aussehen, Erik? Seitdem wir gestern herkamen, habt ihr nur für mich gesorgt. Ach, weißt du, das ist das Schlimmste: im ganzen Leben wird nichts mehr recht ordentlich werden. Alles wird herumliegen.«

»Aber, Bel!« versetzte er spottend, »welchen Sinn hätte es auch sonst, aufzuräumen? Was sind das für Sorgen und Schmerzen!«

Doch Klare-Bel stimmte in den scherzenden Ton nicht mit ein, sondern sah betrübt vor sich hin. Da fügte er ungeduldig hinzu: »Damit mußt du dich ernstlich abfinden. Nicht immer wieder davon anfangen. Sicherlich bist du dazu geschaffen, als die peinlichste aller Hausfrauen hinter der blitzendsten aller Theemaschinen zu sitzen, und mußt nun statt dessen, jahraus, jahrein, daliegen und es unthätig mit ansehen, wie deine beiden männlichen Hausfrauen, Jonas und ich, es sorglos treiben. Das ist schwer, ich weiß. Es ist schwer, sein Talent zu unterdrücken. Aber es kann dir nicht erspart werden, du mußt es endlich überwinden.«

»Jonas könnte mir darin fast wie eine Tochter sein, Erik, wenn du nur wolltest.«

»Daß er wie eine Tochter ist? Nein, natürlich will ich das nicht. Wie kannst du nur solchen Unsinn sagen, Bel.«

»Es ist kein Unsinn, Erik. Du bist so streng gegen ihn, und daher ist er gegen dich oft schüchtern, geht nicht recht aus sich heraus. Aber mir zu dienen macht ihm Freude, -- auch in den häuslichen Dingen. Kannst du mir diese Freude nicht lassen?«

»Nein,« sagte er kurz, »nicht so, wie du es meinst. Ich wünsche nicht, daß er verweiblicht wird. An mir ist es, dir zu dienen --«

Er brach ab, weil die Magd hereintrat; sie wollte den Fuhrmann ablohnen.

Erik legte Geld auf den Tisch, der, noch staubig, in die Mitte der Stube gesetzt worden war.

»Dies ist das Trinkgeld, Gonne. Nein, es ist nichts darauf herauszugeben. Wenig genug für viel Arbeit.«

Als sie hinausgegangen war, blickte er mit einem unterdrückten Lächeln in den Geldbeutel und dann zu seiner Frau hinüber.

»Wir haben entsetzlich viel Geld, Bel. Natürlich. Wer sollte es uns auch in diesem Winkel abnehmen. Nicht wahr?«

»Ach, Erik, das kann doch gar nicht sein. In diesem ›Winkel‹ haben wir uns eins der teuersten Landhäuser ausgesucht. Ich habe ja nichts dagegen zu sagen gewagt. Aber wenn du wüßtest, wie es mich im stillen drückt. Denn du bist es ja, der seine ganze Kraft aufwenden muß, um das viele Geld zu verdienen.«

»Meine ganze Kraft aufwenden!« wiederholte er langsam, »wie schade ist es doch, Bel, daß es nicht wahr ist. Ich glaube fast, das wäre so schön, daß ich's sogar umsonst thäte! Es dürfte dann freilich nicht bei den paar armseligen Schulstunden bleiben. -- Nein, du, in diesem heiligen Lande vergesse ich bald, daß ich überhaupt Kraft anzuwenden ~habe~. Und da wollen wir uns doch wenigstens des Lebens freuen, wenn -- ich Geld habe. Sind wir nicht ganz eigens dazu vor einem halben Jahr hierher gepilgert?«

Sie hörte nicht die Ironie aus seinem Ton heraus.

»Nun ja, Erik, es ist nur gut, daß dir immer alles zu leicht und zu wenig scheint,« sagte sie, »du hast eine solche merkwürdige Frische. Aber ich wüßte doch wahrhaftig nicht, wo du beim besten Willen noch mehr Schulstunden hineinstopfen könntest?«

Ein Zug von Pein ging über sein Gesicht. Er antwortete nicht, sondern kehrte sich ab und lehnte sich in das breite Fenster des Wohnzimmers. Jonas war aus dem Garten hereingekommen, blieb neben dem Vater stehen und blickte hinaus.

Draußen kämpfte der letzte Nebel gegen die Maisonne; man konnte in der Tiefe des Gartens einzelne Obstbaumgruppen unterscheiden, in deren Mitte ein zusammengebrochener Springbrunnen stand. Im Hintergrunde schloß ein kleines Gehölz von Birken, Pappeln und Weiden, an denen noch die Kätzchen niederhingen, die Aussicht ab. Näher zum Hause streckten ein paar mächtige Ulmen ihre Zweige bis über das Dach.

Süß und laut schlug den beiden am Fenster die erste Nachtigall des Jahres entgegen. Einen Augenblick lauschten sie stumm.

Wie die Gesichter von Vater und Sohn einander so nahe gerückt waren, fiel die Aehnlichkeit zwischen ihnen auf; sie trat noch stärker dadurch hervor, daß Erik sich bartlos trug. Derselbe blonde Kopf, breit ausgebaut in Stirn und Schädelform, dieselbe ein wenig stumpf abschließende Nase und derselbe große, im Sprechen und Lachen sehr ausdrucksfähige Mund. Aber diese ein wenig groben Züge bedurften sichtlich mancher Jahrzehnte, um durchgeistigt und fesselnd zu wirken. Eriks Züge waren beredt geworden in all jenen feinen Linien und Schatten, die ihnen erst seelischen Reiz verliehen, als die Jugend von ihm ging. Jonas dagegen besaß noch ein frisches Apfelgesicht, das in seiner vollendeten Harmlosigkeit ihn oft minder geweckt erscheinen ließ, als er wirklich war. Schön konnte man an ihm nur die großen Blauaugen der Mutter finden, und deren blendende Haut, die nur das Krankenlager an ihr entfärbt hatte.

Klare-Bel lag still und blickte auf ihre beiden liebsten Menschen. In ihren Gedanken sah sie Jonas schon herangereift zu der hochgewachsenen Gestalt ihres Mannes; sie glaubte im Knaben ihn wiederzuerkennen, so wie er damals war, als sie ihn kennen lernte und er um sie warb. Es war ja auch gar keine so bedeutende Anzahl von Jahren, die ihn damals von Jonas' Alter unterschied -- einundzwanzig Jahre zählte Erik erst, als sein Knabe ihm geboren wurde. Sie fühlte jedesmal eine kleine Regung von Stolz, wenn sie daran dachte. Hatte er sich doch toll genug in sie verliebt, um sie, mitten in seiner leichtlebigen Pariser Studentenzeit, frischweg vom Fleck zu heiraten! Er, der begabte, ehrgeizige, früh weltmännisch geschulte Mann band sich an sie, das einfache Kinderfräulein, das nur der Glücksfall einer günstigen Stellung aus ihrer kleinen holländischen Vaterstadt Haarlem in die vornehmen Gesellschaftskreise von Paris geführt hatte. Die fremden Kinder an der Hand, hatte sie bewundernd in den Salon gelugt, in dem er verkehrte. Später gingen sie von Paris nach Deutschland und nach England und lebten ein paar Jahre von dem ganz geringen Vermögen, das schnell verbraucht war. Eriks Studien waren breit angelegt gewesen, sie sollten Geistes- und Naturwissenschaften gleichmäßig umfassen, aber als Jonas zwei Jahre alt wurde, da galt es, sich mit eisernem Fleiß zu konzentrieren und abzuschließen, um Brot zu erwerben. Eine kleine Lehrstelle bot sich ihm, ganz aus der Welt, weit draußen im Meer, auf einer friesischen Insel. Klare-Bel freute sich im Grunde, daß ihre verrückte, glückliche Studentenehe in so stille, geordnete Verhältnisse mündete, aber für Erik that es ihr leid. Denn erstens war er sicherlich zu viel Größerem berufen, als zu diesem abhängigen Stillleben für Weib und Kind, und dann konnte sie ihn sich auch gar nicht anders vorstellen, als im ungeheuren Rahmen einer Weltstadt und im vollen Verkehr mit einer gebildeten, raffinierten Gesellschaft, die ihn fortriß, und die er fortriß. Wie sie ihn zuerst unter den einfachen Menschen des Volkes dastehen sah, kam er ihr vor wie ein verzauberter Prinz. Aber sie kannte ihn und zweifelte nicht: irgendwie werde er auch schon die Leute verzaubern, bis sie seinen prinzlichen Ansprüchen besser entsprächen.

Zu ihrer Verwunderung kam es jedoch ganz anders. Erik lehrte niemand seine Art, wohl aber nahm er die der Leute an. Bald sah man ihn ebenso oft im Schifferwams und in Lederhosen, wie in seiner frühern Kleidung. Seine Umgebung färbte so stark auf ihn

ab, daß er geradezu echt in der Farbe erschien. Aber die Folge war, daß er seine Umgebung beherrschte. Er gab sich nicht, wie Bel gefürchtet, Grübeleien über seine weitausschauenden, ehrgeizigen Wünsche hin, vielleicht war er eine zu aktive Natur dazu.

Was es nur gab, raffte er zusammen, um sich in der Gegenwart voll zu bethätigen, und an die Zukunft, -- an die glaubte er so fest, wie ein Kind an Gott.

Klare-Bel richtete sich ein wenig höher auf in ihren Kissen und stützte den Kopf in die Hand. Weiter als bis hierher dachte sie niemals.

Ein Glanz froher Erinnerung lag auf ihrem Gesicht, der es verjüngte. Die kunstvoll geordneten Locken, die, statt jeder festen Frisur, dies Gesicht umrahmten, trugen noch dieselbe wunderhübsche Goldfarbe wie damals. Nur am Hinterkopf waren sie durch das lange Liegen dünn geworden, ja, dort hatte sich sogar eine ganz kleine, verheimlichte Glatze gebildet.

»Jetzt müssen wir in die Schule wandern, Jonas,« bemerkte Erik und wandte sich vom Fenster.

»Gehst du heute zu den Mädchen, Papa?« fragte der interessiert.

»Ja. Aber deshalb brauchst du mich nicht wieder am Thorweg der Mädchenschule abzuwarten und dort herumzulungern,« versetzte Erik mit einem Seitenblick, der Jonas verlegen machte. Ohne ein Wort zu erwidern, trollte dieser sich aus der Stube.

»Jonas fängt früh an! Er artet dir nach, Erik!« sagte Klare-Bel lächelnd, und als stände es mit ihren Worten in irgend einer Gedankenverbindung, griff sie zwischen allerlei Sachen, die auf einem niedrigen Tischchen neben ihrem Ruhebett standen, einen geöffneten Brief heraus. »Hier liegt noch die Einladung. Wenn du wirklich absagen willst, vergiß es nicht heute in der Stadt, oder gehst du persönlich vor?«

Er streckte die Hand nach dem Brief aus und überflog ihn flüchtig. Es war eine kurze Einladung, unterschrieben: Warwara Michailowna. Erik kniff das Papier zerstreut in kleine Falten und warf es auf den Tisch.

»Ich möchte dich wohl was fragen, Erik.«

»Ja, Bel?«

»Sage mir: gehst du vielleicht nur deshalb nicht mehr in diesen ganzen Kreis, weil sie dir gefährlich geworden ist?«

Er fing an zu lachen.

»Nein, Bel, darüber kannst du ruhig sein.«

»Aber hat sie dich nicht doch einen Augenblick recht stark gefesselt?«

»Das hat sie wohl. Das gelingt doch wohl jeder so reizenden koketten Frau.«

»Junge Witwen hält man immer für kokett. Von Warwara würde ich es nicht denken. Glaubst du das von ihr?«

Er sah seine Frau verwundert an.

»Ja, natürlich. Alle schönen Frauen sind es. Auch ist ihr nicht der geringste Vorwurf daraus zu machen. Das gehört zu ihnen, wie die Schönheit. Das Gegenteil wäre fast stilwidrig. -- Und es ist gut, -- vielleicht ein Grund, warum die Schönheit keinen tiefern Schaden anstiftet. Adieu, Bel: es ist Zeit für uns zum Bahnhof.«

Sie hielt ihm das Gesicht zum Kusse hin. Wie er sich aber zu ihr niederbeugte, umfing sie seinen Hals mit beiden Händen und hielt ihn einen Augenblick, zu ihm aufschauend, fest.

Er hielt geduldig still.

»Du!« sagte sie lachenden Mundes, ließ sich küssen, und ließ ihn los.

Erik und Jonas waren schon fortgegangen, und Gonne räumte eifrig und geräuschvoll in den Stuben auf, als Klare-Bel noch über das letzte Gespräch nachsann. Sie war wahrhaftig nicht grüblerisch und versonnen angelegt; alles andre eher. Aber wenn man ewig so stillliegen mußte, immer auf dem Rücken, und die Augen an der geweißten Zimmerdecke, so geriet man zuletzt auf alles mögliche, und auch auf das Nachdenken. An sich selbst dachte nun Klare-Bel eigentlich nie, stets nur indirekt. Sie kannte im

Grunde nur drei ernstliche, sozusagen hauptsächliche Gedanken, die Sammlung heischten: Erik, Jonas, und die gefürchtete Unordnung im Haushalt. Aber es war merkwürdig, wie viel man aus den dreien machen konnte, wenn man sie geschickt kombinierte. Man hätte meinen können, es seien tausend.

Erik hatte vorhin also gesagt: die Schönheit stifte keinen tiefern Schaden an. Ja, das war gewiß ein rechtes Glück. Denn Erik war sehr empfänglich für die Schönheit. Schon, als sie noch gesund herumging, beunruhigte es sie. Sie selbst war glücklicherweise sehr schön, aber sie war blond, und ihr schien es, als ob die Braunen ihn ebenfalls interessierten. Gewiß hatte er sich ungezähltemal etwas verliebt. Aber nur ein einziges Mal erschrak sie, -- schrak förmlich auf aus aller bisherigen Freude. Während des zweiten Jahres auf der Insel. Da fing er an, sie so viel allein zu lassen; manchmal war es ihr, als ob sie ihm nicht mehr wie sonst genüge. Er wurde auch wortkarger. Und endlich -- ja endlich that sie dann, was er nie im Leben erfahren durfte: sie ging ihm heimlich nach.

An einem weichen, dunkeln Aprilabend war's. Das Meer lag regungslos, und am Himmel stand das erste Frühlingsgewitter. Sie sah ihn aus einem kleinen Hause, hart an der Düne, heraustreten und an ihr vorbei, in Gedanken verloren, heimgehen. In dem Häuschen wohnte die merkwürdigste Frau auf der ganzen Insel. Bei allen stand sie in hohem Ansehen, wegen ihres Verstandes, wegen ihrer Haltung in schweren und wechselvollen Schicksalen, wegen eines seltenen Schatzes von Weisheit und Erfahrung, aus dessen Fülle sie schöpfte, wenn ein feiner, liebevoller Menschenkenner sie zum Sprechen brachte.

Es war Frau Larsen, eine lahme, sechzigjährige Frau.

Seit diesem Abend hegte Klare-Bel ein unbegrenztes Vertrauen zu ihrem Mann. --

Erik verbrachte die ersten Morgenstunden mit Jonas in dessen Gymnasium; gegen Mittag begab er sich in die große Hauptschule für Mädchen, die ziemlich entfernt lag.

Er war in eine vorüberfahrende Pferdebahn eingestiegen, und an einer der letzten Haltestellen sprang ein Kollege zu ihm ein. Dieser sah erhitzt aus, behielt nach der Begrüßung den Hut in den Händen und fächelte sich mit dem Taschentuch.

»Wie geht es, Herr Matthieux?« fragte er Erik, hastig atmend, »hier in der Stadt ist der Mai schon unerträglich, -- wirklich, -- wenigstens im Gehen. Und dabei wagt man nicht, den Sommerüberzieher abzulegen; jeden Augenblick erwartet man wieder von der Newa her einen eisigen Windstoß. Ohne Uebergänge, ohne Normaltemperatur. Ein möderisches Klima.«

Er begleitete seine Worte mit so vielen Gestikulationen, daß man den Eindruck empfing, er werde sich nie im Leben wieder abkühlen. Erik betrachtete mit raschem Blick den ihm gegenübersitzenden, ungefähr gleichaltrigen Mann, auf dessen entblößtes, bereits stark gelichtetes Haupthaar die grelle Maisonne wie spöttisch von draußen hereinsah.

»Ob das meine Zukunft hier ist? -- der Mai unerträglich!« dachte er, und sagte laut: »Ich muß gestehen, ich habe eine Schwäche für diesen russischen Frühling. Er mag unartig sein, vielleicht launischer und gefährlicher wie jeder andre, aber dafür ist er ein Wunder. Er zögert so lange und kommt dann so unerwartet und so unwahrscheinlich schön, daß man seinen Augen nicht traut.«

»Ja, ja. Wenn man Augen dafür behalten kann. Ich reise nach Schulschluß immer nach Deutschland zurück und erhole mich von den russischen Windstößen und Verhältnissen. Ich schreibe an einem Werk, -- immer in den Ferien in Deutschland. ~Das~ ist meine Erholung. Da bleibt für den Sommer wenig übrig. So geht es uns eben allen -- allen, die wir uns geistig überarbeiten müssen.«

Erik schwieg einen Moment, dann erwiderte er, wie wenn er einen stummen Gedanken beende, ruhig: »Ich weiß mich freilich nur sehr zum Teil als ›Geistesarbeiter‹.«

»Ach, Sie meinen doch nicht, weil Sie da drüben, -- weil Sie etwas lange in ländlichen Verhältnissen --? aber ich bitte Sie, bei Ihrem Wissen und Ihrer Begabung! Warum sollten Sie nicht auch noch ein Werk schreiben?«

Erik lachte.

»Nein, so meinte ich es nicht. Nicht daß ich drüben vielleicht ein wenig verbauert sein könnte. Nicht den Mangel an Büchern. Denn wir -- der Lehrer vor allen Dingen, arbeitet doch vorwiegend mit Menschenmaterial. Wir gehören schon einigermaßen außerhalb der Gelehrtenstube, scheint mir. Mitten in das Leben hinein.«

»Hm!« machte der Kollege, »ich finde, an die Menschen kommt man doch nur sehr oberflächlich heran. Es bleibt wirklich nur die Schreibtischarbeit. Aber sagen Sie doch mal: man sprach davon, daß Sie vor ein paar Monaten eine Reihe von Vorträgen haben eröffnen wollen? Was war es damit?«

Eriks Augen verdunkelten sich.

»Nichts war es damit!« sagte er kurz, »man hat mir den Saal verweigert.«

»Sehen Sie, -- sehen Sie! das kommt von Ihrer unbequemen Auffassung des Lehrerberufs außerhalb der Arbeitsstube. Man fürchtet, daß Sie ein wenig lebhaft werden könnten. Wir gehen hier ja eben alle mit gebundenen Händen, -- Sie wissen's doch! Aber mit Einem sollten Sie sich wirklich trösten: es ~gibt~ hier ja gar keine Menschen, unter denen irgend etwas zünden und wirken kann. Es gibt nur das Volk, zu dem wir weder sprechen dürfen noch können, -- und ein Publikum, das sich amüsieren will.«

Er hatte sich in Eifer gesprochen. Erik antwortete nicht. Die Pferdebahn hielt und beide stiegen aus.

»Nun haben Sie noch neue Stunden an der Mädchenschule übernommen!« nahm sein Begleiter das Gespräch wieder auf, und wie er jetzt langsam einherschritt und das Straßenpflaster durch seine Brille fixierte, sah er ebenso schwerfällig und versonnen aus, wie vorhin hastig und zerfahren, »ja, da möchte man Sie am liebsten für alles ausnutzen! Sie hatten diese Klasse ja erst im Herbst anzutreten.«

»Es war aber Not am Mann. Auch wollte ich die Mädchen kennen lernen, Fühlung gewinnen, ehe ich sie im Herbst ganz übernehme.«

»Nun, Sie werden es satt kriegen. Wissen Sie, dieses Geschlecht ist entsetzlich! Und nicht das geringste Talent für Mathematik unter ihnen. Auch nicht das geringste. Rechnen können sie alle nicht.«

»Gott sei Dank!« sagte Erik.

»Nein, nehmen Sie es nicht humoristisch. Als Mädchenlehrer verlernt man das Lachen. Unmöglich gefallen Ihnen die Backfische in Ihrer Klasse?«

»Hübsche Mädels!« entfuhr es Erik beinahe; als er aber die fast bekümmerte Miene seines Begleiters gewahrte, verschluckte er es noch rechtzeitig und erwiderte nur: »Sie bringen doch Anregung, Abwechslung. Sehen Sie, hier in meiner Lederrolle: ein ganzer Stoß Aufsatzhefte. Das kurioseste Zeug. Sie gehen noch auf meinen Vorgänger zurück; ich ließ sie mir nur geben, um mich zu orientieren. Auch habe ich eine wirkliche Merkwürdigkeit darunter gefunden.«

»Da bin ich nicht neugierig!« versicherte der Kollege von der Mathematik und kniff die Augen zu, »wahrhaftig nicht. Aber Sie sind ein beneidenswerter Mensch. Von Ihrem Vorgänger weiß ich, daß diese blauen Aufsatzhefte ihm bisweilen noch des Nachts Alpdrücken verursachten.«

»Das war nur gerechte Strafe!« meinte Erik lachend, während sie einen hohen Thorbogen durchschritten und in das Schulgebäude eintraten, »warum gab er auch Aufsatzthemata, wie zum Beispiel das letzte hier: ›Ueber das Glück‹. Arme Mädels, die da in schönem Deutsch beschreiben sollen, was sie doch noch gar nicht genossen haben.«

Sie blieben vor dem breiten steinernen Treppenhaus stehen, das von der Flurhalle zu den Klassen emporführte.

»Deutsch schreiben lernen könnten sie doch jedenfalls daran, und das ist ja wohl der Zweck,« bemerkte der Kollege steif, denn die letzte Bemerkung hatte ihm höchlich mißfallen, »Ihr Vorgänger hat gewiß an kein Glück gedacht, zu dem man die Schule verlassen haben muß. -- Aber hier trennen sich wohl unsre Wege. Ich meine: wörtlich.«

»Also auf Wiedersehen!«

»Wünsche beste ›Anregung‹.«

Erik stieg hinauf und ging durch den hohen Hallengang, an welchem die Klassenzimmer lagen. Er öffnete eines derselben und blickte auf seine Uhr. Noch war die Frühstückspause nicht vorüber. Die meisten Mädchen hatte der Maisonnenschein in den großen Schulhof gelockt; man konnte sie durch das offene Fenster unten paarweise herumgehen und spielen sehen. Dicht unter dem Fenster, an das er sich setzte, stand der Brunnen mit einer Holzbank; dort machte es sich eine Gruppe halberwachsener Mädchen bequem, -- das Kichern und Schwatzen drang deutlich bis zu Erik herauf.

In den umliegenden Klassen und auf dem Gang war es ganz still; selten nur klappte eine Thür oder wurde ein Ruf laut. Aus den zur Hälfte niedergelassenen Fensterrouleaux brütete die Sonne und einzelne Brummfliegen surrten um ein paar Brotkrumen aus den staubigen Pulten.

Erik hatte die blauen Hefte hervorgezogen und blätterte darin, wobei er jedoch von Zeit zu Zeit einen Seufzer ausstieß. Im Grunde waren dies wirklich recht langweilige Schulhefte. Solch ein Backfisch ist interessant, ohne Zweifel, er ist als Mensch, als Weib, als Backfisch interessant, und eine Welt für sich; aber von alledem kommt in den Schulaufsatz nichts hinein. Kein Wunder! Ist es nicht schließlich ebenso mit allen geschriebenen Büchern der Welt? Ist nicht der kleinste Ausschnitt des wirklichen Lebens tausendmal reicher, aufschlußgebender?

Er stand auf und warf einen Blick auf die lachende, schwatzende Mädchengruppe am Brunnen. Diejenigen, welche er von seinem Standort sehen konnte, gehörten sicher seiner neuen Klasse an, hatten also die langweiligen Aufsätze auf dem Gewissen. Er verzieh sie ihnen, während er sie so anblickte, -- diese frischen Geschöpfe, die noch das Vorrecht besaßen, ohne Schönheit schön zu sein. Es waren ganz bestimmte Typen unter ihnen leicht zu unterscheiden, obgleich sie verschiedenen Nationalitäten angehörten. Drei Sprachen schwirrten durcheinander. Er unterschied am deutlichsten den mehr hausfraulichen und den mehr weltlichen Typus. Beide besaßen etwas Anziehendes, -- sowohl dieser schelmische Blick, der so weiblich ahnungsvoll unter den sorgfältig gekrausten Stirnlöckchen hervorlugte, als auch der sanfte, sittsam stille Augenaufschlag unter dem Madonnenscheitel. Das eigentlich kindliche Genre war unter diesen Backfischen fast gar nicht mehr vertreten. Und vielleicht deshalb auch so wenig Urtypisches im ganzen, wenig Individuelles, -- man konnte sie schon klassifizieren, sie waren schon fest geprägt durch ihre Umgebung, in der sie erzogen wurden, in der es aber keine geborenen Erzieher und Menschenfischer nach Eriks Ideal gab, sondern nur gewöhnliche Amts- und Standespersonen.

Unwillkürlich suchte seine Hand zwischen den Heften, als wünsche er sich selbst Lügen zu strafen. Ja, hier stand die »Merkwürdigkeit« unter den Aufsätzen, -- etwas höchst Individuelles jedenfalls.

Anstatt des vorgeschriebenen Titels »Ueber das Glück« trug er die Ueberschrift »Seligkeit!« -- und wie ein Sehnen und Jauchzen klang dem Lesenden etwas von dieser Ueberschrift aus jeder Zeile entgegen. Er war nicht in vernünftiger, oder doch wenigstens korrigierbarer Prosa geschrieben, sondern in Versen, -- in gänzlich unkorrigierbaren und wilden Versen, in denen die Sprache Reißaus genommen hatte. Trotzdem wirkten diese Verse, so fehlerhaft sie hingeschrieben waren. Oder vielmehr: hingeträumt. Denn im Grunde glich dieses einem unklaren Traum, einem bloßen Gedankenstammeln, einem Sichauflehnen gegen Wort und Logik, aber es steckte eine mit sich fortreißende Gefühlsmacht darin. Man wurde im höchsten Grade ungeduldig bei der Lektüre, aber man wurde auch vom ungeduldig drängenden Wunsche überfallen, dem, der hier träumte und stammelte, mit Gewalt die Zunge zu lösen, daß er Aufschluß gäbe über seine Seele. Solche Verse mochte die heilige Therese als Kind gedichtet haben, ehe sie ihre Visionen aus Gott bezog, dachte Erik. Welche von denen im Hof mochte das sein?

Einzelne Worte tönten laut und erregt zu ihm herauf und rissen ihn aus dem Lesen auf. Er hörte eine von den Mädchenstimmen mit größter Energie sagen: »Er ~muß~ unglücklich sein. Ich will es so. So unglücklich wie nur möglich. Sonst thue ich es nicht.«

»Nein, nein, dagegen bin ich ganz!« rief eine andre in mitleidigem Ton.

»O, ich wäre schon dafür,« suchte eine dritte zu vermitteln, »wenn es nur für eine Weile ist. Denn später, da heiratet sie ihn ja dafür.«

»Heiratet?« fragte die erste Stimme erstaunt, »nein, ich denke nicht daran! Er ist und bleibt unglücklich, sage ich euch. Ein für allemal. Aber heiraten werde ich ihn nicht.«

Erik fiel das Heft aus der Hand. Er stützte sich auf das Fensterbrett und sah vorsichtig hinab. Er hätte gern gewußt, wie das grausame Geschöpf aussah, das den Unglücklichen lebenslang gemartert wissen wollte und ihn nicht einmal heiratete.

Aber sie saß offenbar dicht an der Hausmauer und war von den andern so umstellt, daß Erik sich nicht tiefer hinabbeugen konnte, ohne von unten her gesehen zu werden. Er erblickte nur zwei schmale, weit vorgestreckte Füße in ausgeschnittenen Schuhen und dunkeln Strümpfen.

Jetzt zwitscherten alle so durcheinander, daß man nichts verstand.

Dann sagte ein bildhübscher, dunkelhaariger Backfisch, während er herzhaft in einen Apfel hineinbiß: »Ich finde es wirklich komisch von dir. Denn wozu haben wir ihn sonst mit so vielen und besondern Eigenschaften ausgestopft, wenn du ihn doch nicht

nimmst? Er hat doch das Allerbeste abbekommen. Wenn er nur edel und unglücklich sein soll, so hätte er auch gewöhnlicher bleiben können, -- meint ihr nicht?«

»Laß sie doch, Wjera, du sollst sehen, sie hat im stillen schon wieder etwas Neues vor, -- vielleicht was viel Schöneres,« meinte ein kleines, blondes Mädchen in zierlich gestickter Latzschürze, »und wenn ihr sie nicht in Ruhe laßt, so sagt sie es uns am Ende nicht.«

»Hast du was? Hast du was? Ist es schön?« schrieen sie erwartungsvoll.

»Es ist nichts für euch! Aber von allen die allerschönste Märchengeschichte!« erklärte die Angeredete an der Hausmauer, »kennt ihr die Verse von Uhland?« Und sie begann mit einer weichen Stimme zu deklamieren:

»In Liebesarmen ruht ihr trunken, Des Lebens Früchte winken euch; Ein Blick nur ist auf mich gesunken, Doch bin ich vor euch allen reich.

Das Glück der Erbe miss' ich gerne, Und blick', ein Märtyrer, hinan, Denn über mir, in goldner Ferne, Hat sich der Himmel aufgethan.«

Sie lauschten mit ganz feierlichen Gesichtern, bis die letzten Worte, gedämpft, in einer Art von schwärmerischer Andacht, verklangen.

»Huh!« sagte die hübsche dunkle Wjera, ordentlich ergriffen, und eine zweite fügte besiegt hinzu: »Ja, dann freilich --«

Aber die, welche deklamiert hatte, lachte nur. Sie lachte so von innen heraus, so frisch und mit so überzeugenden Trillern in der Kehle, daß Erik oben an seinem Fenster beinahe angefangen hätte, mitzulachen, und sich plötzlich mit ihr wie im Bunde fühlte. Auch von den Mädchen begannen einige zu kichern. Aber die meisten verstimmte es.

»Du hast gar keinen Lebensernst!« sagte die Erste der Klasse strafend, eine andre aber behauptete sogar: »Sie hat kein Herz. Sie verlacht ihre eigene Sache, und uns mit.«

Nur das blonde niedliche Mädchen schien sich zärtlich an die Lachende zu schmiegen und erinnerte sie: »Du hast doch versprochen, uns den ›Unglücklichen‹ endlich zu zeigen. Willst du es heute auf dem Heimweg thun?«

»Ja, das will ich. Denn ich will ihn euch überlassen. Macht ihn so glücklich, als ihr wollt.«

»Also denkst du an einen andern?«

Die Glocke, die zum Klassenbeginn läutete, unterbrach das Geplauder in diesem kritischen Augenblick. Arm in Arm schlenderten sie gemächlich ins Schulgebäude hinein. Die schmalen Füße aber lagen noch ausgestreckt in der Sonne.

»Jetzt muß ich sie sehen können,« dachte Erik und beugte sich mit ernstem Gesicht vor. Das Gespräch der Mädchen hatte ihn ganz betroffen gemacht.

Und er sah sie.

Gegen die grau getünchte Hausmauer nachlässig zurückgelehnt, die Arme hoch über dem Kopf verschränkt, saß sie auf einem umgestülpten Regenfaß, das, in diesem beliebten Brunnenwinkel, gelegentlich als Sitzbank benutzt wurde. Sie trug das entschieden aschblonde, glanzlose Haar offen, so daß es, weich und lockig, in einiger Verwirrung, ihr über Brust und Schultern fiel. Das tiefrote Bändchen, welches es wohl am Hinterkopf zusammenhalten sollte, war hinabgeglitten und bewegte sich leise im Luftzug. Es war der einzige bunte Punkt und Schmuck am Bilde. Denn die ganze schmächtige Gestalt steckte in einem losen, graublauen Gewande, das keinerlei Aehnlichkeit mit den hübsch gearbeiteten Kleidern, Miedern, Schleifen und Schürzen der andern aufwies. Ueber den schmalen Hüften durch einen einfachen Ledergürtel kittelartig geschlossen, ließ es zwischen den weichen Falten kaum den zarten Ansatz der Brust erkennen und verlieh dem Mädchen etwas sonderbar Knabenhaftes. Aber darüber erhob sich ein unregelmäßiges Gesichtchen, das geradezu ansteckend in seinem ausgelassenen Uebermut wirkte. Wie sie so dasaß, den Oberkörper zurückgezogen, die ziemlich dunkeln Augen leuchtend erhoben, die Lippen, wie in beginnendem Gelächter oder wie in verlangendem Durst, halb geöffnet, so daß unter der zu kurzen und stark geschweiften Oberlippe die weißen Zähne hervorschauten, -- da machte sie den Eindruck, als bäume sie sich auf in überschäumender Lebenslust, bereit, jeden Augenblick jauchzend über alle Stränge zu schlagen, -- fast unwillkürlich dachte man sich einen Thyrsusstab in die

hinaufgestreckten verschlungenen Hände, -- und der Bacchusknabe war fertig.

Als sie sich rasch und unvermittelt aufrichtete und ins Haus sprang, erhob sich Erik aus seiner vorgebeugten Stellung am Fenster und raffte hastig seine Hefte zusammen. Während er den Weg in seine Klasse antrat, kam ihm ein Lachen über seine eigene Verdutztheit. Zwei Lämmer in seiner Herde gehörten jedenfalls nicht dem langweiligen Durchschnitt an: die heilige Therese, und dann dieser arge Schlingel und Taugenichts.

Im Hallengang war es inzwischen von allen Seiten, in allen Ecken lebendig geworden, und einige Minuten lang schwirrte es dort durcheinander gleich einem Mückenschwarm in der Maisonne. Dann schwächte der Lärm sich ab, die Klassenthüren fielen ins Schloß; hie und da eilte noch ein Nachzügler an seinen Platz; einzelne Lehrer, sämtlich in ihrem dunkelblauen Frack, der an diesen Schulen vorgeschriebenen Uniform, schritten grüßend aneinander vorüber oder blieben, ein paar Worte wechselnd, im Gange stehen. In Eriks Klasse war alles schon mäuschenstill und in schönster Ordnung beisammen, als er mit belebtem Gesichtsausdruck hereintrat. Einen Augenblick lang ließ er, auf dem Katheder stehend, seinen Blick über die blonden und braunen Mädchenköpfe schweifen, die fast alle mit lebhaften und aufmerksamen Augen zu ihm ausschauten. Obgleich er erst zum zweitenmal aus diesem Platz und seinem jungen Auditorium gegenüberstand, fühlte er doch schon sehr deutlich die Stimmung der Sympathie, die ihm aus allen diesen Augen entgegenleuchtete. Er verdankte sie seinem eigenen Entgegenkommen. Denn die da merkten recht wohl das thatsächliche Interesse, das er ihnen als Lehrer zubrachte, -- den Blonden wie den Braunen, den Klugen wie den Dummen, den Willigen wie den Widerspenstigen. Welche Fehler er auch besitzen mochte, einen wenigstens besaß er nicht: seinen Unterricht als eine leblose Pflichtmaschine zu absolvieren.

Erik schob die blauen Hefte an den Rand des Kathederpultes und sagte, sich niedersetzend: »Die Hefte können wieder verteilt werden. Sie sind zum größern Teil recht bedauerlichen Inhalts. Hoffentlich lautet die Fortsetzung viel besser. In Bezug auf einen Aufsatz darin möchte ich aber eine Erkundigung einziehen.«

Er schlug den Deckel des obersten Heftes zurück und fragte, den Namen ablesend: »Wer ist Ruth Delorme?«

Die Aufgerufene schien diese Frage erwartet zu haben; sie hatte sich bereits erhoben, ehe ihr Name von seinen Lippen fiel.

Er richtete einen bestürtzten Blick auf sie. Es war der Bacchusknabe aus dem Schulhof.

Jetzt freilich machte sie den kuriosen Eindruck nicht mehr so ganz. Das ordentlich zusammengenommene Haar und der »Klassenernst« aus ihrem Gesicht störte ihn, -- vielleicht auch, daß sie die Augen niedergeschlagen hatte. Am liebsten wäre Erik ihr mit der Hand über das Gesicht gefahren, wie um eine Maske abzustreifen, damit er darunter die wirkliche Ruth zu sehen bekäme. Aber das wäre dann der mutwillige, lachende Junge von vorhin gewesen, -- und das deckte sich so wenig mit der Vorstellung, die der Aufsatz von ihr weckte. Das wunderliche Geschwätz der Mädchen am Brunnen fiel ihm ein.

»Unmöglich!« entfuhr es ihm.

Sie sah verwundert auf.

»Doch!« sagte sie.

»Das kann sie! sie kann Verse machen!« riefen einige Stimmen. Man konnte es ihnen anhören, wie stolz sie auf diese Schwarzkunst waren, und wie interessant sie das unerwartete Intermezzo fanden.

»Verse, -- das ist ja möglich,« gab Erik zurück, »auch sind sie keineswegs schön. Ganz im Gegenteil. Aber ein Schulmädchen --«

Er brach etwas verlegen ab und ärgerte sich. Die Bemerkung war auch gar zu einfältig. Schulmädchen waren sie ja alle, und ~eine~ von ihnen mußte es doch gewesen sein. Mußte? Da kam ihm ein Gedanke: vielleicht ist es gar kein selbständiger Aufsatz?

Er blätterte im Heft zurück. »Es ist noch ein früherer Aufsatz darin. Etwas Literarhistorisches. Der fällt stark dagegen ab. Lauter mühsam nachgezogene Linien -- und falsche Linien. Es geht die Sage, daß bei den Aufsätzen nicht immer fremde Hilfe verschmäht wird. Sollte das nicht die Lösung des Rätsels sein?«

Während er aber noch sprach, war er schon überzeugt, daß er sich irrte, und daß sie sogleich auftrotzen und mit beleidigtem Stolz behaupten werde, ihr habe niemand geholfen.

Jetzt schüttelte sie auch wirklich den Kopf und sagte: »Mir hilft niemand.«

Aber wieder schaute er betroffen auf. Wie klang das! Gerade so, als habe sie unter Thränen gesagt: »Ich bin ja so mutterseelenallein!« Ein stiller Ton war darin, der ihn rührte, -- etwas so ganz Neues, Unerwartetes, das er wieder mit dem übrigen nicht zusammenreimen konnte.

Es litt ihn plötzlich nicht mehr auf dem Katheder, in der ruhigen Haltung des Lehrers. Ein zwingendes Gefühl von Interesse fand gleichsam seinen Ausdruck darin, daß er herabstieg und zu ihr hintrat an die Bank, in die Mitte der übrigen.

Als er dicht vor ihr stand, ward er sich einer Uebereilung bewußt und kehrte, wenn nicht zum Platz, so doch zur Rolle des Lehrers zurück.

»In der Aenderung des Titels und der Anwendung von Versen liegt eine auffallende Abweichung vom Vorgeschriebenen; hier galt wohl eine Ausnahme, die mein Vorgänger machte?« fragte er.

»Er zog sie vor! sie durfte thun, was sie wollte!« schrieen einige.

»Sie gehört nicht mehr zur Schule! Sie kommt nur zu einigen Stunden!« riefen andre.

»Ich gehe bald fort,« sagte Ruth.

»Fort? Vom Ort?« fragte er, und ein brennendes Bedauern überfiel ihn.

Sie hob die Augen.

»Nein. Nur aus den Stunden.«

Wie beider Blicke sich trafen, sah er ihr Gesicht aufleuchten. Nicht nur die Augen thaten's, das Leuchten ging über Stirn und Augen, wie ein Lächeln, obschon sie ernst blieb. Der »Klassenausdruck« fiel von ihren Zügen wie ein vorgehaltener Schleier.

Er gab ihr einen Wink, daß sie sich setzen möge.

»Das ist sehr schade,« meinte er dann, ein paarmal auf und ab gehend, und es war ihm selbst nicht klar, für wen es eigentlich schade sei, ob für den Lehrer, oder für die Schülerin, oder für beide. Doch setzte er rasch hinzu: »Es ist zu früh. Ein Zeichen von Reife ist der Aufsatz nicht.«

Dann richtete er, mit dem Aufnehmen des Unterrichts, keine Bemerkung mehr an sie, vermied es auch während der Stunde ihren Namen aufzurufen, obgleich es ihn beschäftigte, daß sie fortgehen wollte. Aber er begriff, daß dieses lebhafte Interesse an einem merkwürdigen Kinde, wenn es auch ausschließlich den Erzieher in ihm reizte, von ihm selbst erst völlig beherrscht werden und in ihm selbst sich erst völlig geklärt haben mußte, ehe daran zu denken war, ihr vor einigen Dutzend neugieriger Mädchenaugen nachzugeben. Er kannte sehr wohl die üblichen Schwärmereien für den Lehrer, zweifelte auch nicht daran, daß auch er bereits Gegenstand solcher Schwärmereien sei, hielt aber doch möglichst daran fest, daß sein eigenes Benehmen ihn nicht verriete, wenn einmal eine kleine Schülerin Eindruck auf ihn machte, -- was doch unvermeidlich geschah unter Menschen von Fleisch und Blut.

Ruth saß still auf ihrem Platz und folgte seinen Worten und Bemerkungen mit verträumten Augen. Sie war eine ziemlich zerstreute Schülerin, und so nahm sie auch jetzt im Grunde nichts von dem auf, was er vortrug, sondern merkte sich nur die Art, ~wie~ er vortrug, und die ihm eigentümliche Gebärde der Hand dabei. Daß er schmale, nervige Hände von edler Form besaß, daß sie aber leicht gebräunt waren, wie bei einem, der sich viel der Luft und Sonne ausgesetzt hat, merkte sie, -- und es kam ihr wie ein Widerspruch vor, der sie beschäftigte. Die breite, etwas steile Linie seiner Schultern prägte sich ihr ein, wie ein Bild, und dann, daß ihm das Haar beim Sprechen in einem straffen, kleinen Büschel in die Stirn fiel, und er es stets mit einem kurzen Ruck zurückwarf, wobei der Kopf ein wenig hochmütig oben blieb. Es war kurzgehaltenes, schlichtes, dichtes Haar, und es ärgerte sie förmlich, daß es sich nirgends ein klein bißchen locken wollte, -- nur ein bißchen; in Gedanken ließ sie ihm lange Locken wachsen; die sahen aber drollig aus, und so schnitt sie sie ihm wieder ab. Darüber mußte sie lachen; sie hätte fast laut aufgelacht, und der Sicherheit halber stützte sie den Mund auf die Hände.

Aber bei alledem sah sie nicht aus, als ob sie sich in losem Mutwillen mit solchen Aeußerlichkeiten beschäftige, sondern als sinne sie angestrengt und ganz in sich vertieft einem schwierigen Problem nach. So hatte sie schon neulich, in seiner ersten Stunde, dagesessen, von ihm unbemerkt.

Ruth machte noch immer dasselbe verträumte, nachdenkliche Gesicht, als nach Beendigung des Unterrichts ein ganzer Schwarm von Mädchen sich zum Heimgehen um sie drängte. Sie hatte diesen Augenblick kaum erwarten können, denn nun sollte Ruth

ihnen ja den »Unglücklichen« zeigen, der aller Phantasie beherrschte. Arm in Arm, hintereinander, und mit den Ranzen schlenkernd, gingen sie lachend und schwatzend die Straße hinab und bogen in den Newsky Prospekt ein, Ruth voraus und ohne auf sie zu achten. Einige sahen sich vorsichtig um, ob ihnen auch niemand folge, auf den Wegen, die Ruth sie führen sollte; aber die Straße war ziemlich menschenleer, nur ein paar Dienstmädchen, die den Verwöhntesten den Schulsack trugen, folgten in bescheidener Entfernung, und hinter diesen sah man Erik herankommen.

»Eigentlich ist die Ruth doch eine Glückliche!« sagte die hübsche Wjera zu ihrer Nachbarin, »daß sie solche Geschichten treiben kann. Ich glaube, ihre Verwandten kümmern sich gar nicht darum. Ja, es ist ganz anders, wenn man noch Eltern hat.«

»Pfui, schäme dich!« empörte sich das Mädchen, das neben ihr ging, und stieß sie mit der Frühstücksbüchse in die Seite, »es ist doch ein schreckliches Unglück, seine Eltern so früh zu verlieren. Die arme Ruth! Denke nur, wo sie von ganz klein auf schon alles gewesen ist, -- in Belgien und Deutschland, und immer unter fast Fremden.«

»Ja, da kommt man eben auch weit herum,« beharrte der gemütlose Backfisch, »sogar in einer Schweizer Pension ist sie gewesen. Und gerade da möchte ich so gern hin.«

»Sogar in einem Glaspalast hat sie einmal gewohnt,« behauptete eine von ihnen etwas unsicher.

Ein schallendes Gelächter erhob sich.

»Ja, im Traum! Das ist doch nur ein Märchen, das sie erzählt hat. Höre nur, Ruth, das hält sie für Wirklichkeit.«

»Da kommt er!« sagte Ruth mit einemmal.

Das Wort fiel wie ein Schrotkorn in einen Haufen lärmender Spatzen. Im ersten Augenblick stoben sie fast auseinander, aber dann sammelten sie sich wieder, räusperten sich, zupften an ihren Kleidern, reckten die Hälse, und die meisten von ihnen wurden rot.

»Hier, der Blonde.«

»Nein! Der Herr im Cylinderhut.«

Es war keiner von beiden. Ruth blickte ernsthaft geradeaus, und einem Herrn ins Gesicht, der auf sie zuschritt. Ein junger, brünetter Mann, im hellen Sommerüberzieher, mit etwas verlebten Zügen, einem kleinen Schnurrbart und mandelförmigen Augen.

Er schien wie geschaffen zum Helden der Tragödie, -- darüber waren alle einig. Aber während sie ihn noch anstarrten, wie ein Meerwunder, passierte vor ihren Augen das Ungeheuerliche, woran sie eigentlich doch nicht im Ernst geglaubt hatten: Ruth grüßte ihn; ganz ernsthaft grüßte sie ihn, ohne eine Miene zu verziehen, aber doch so wie einen alten Bekannten.

Ein halbes Lächeln glitt über sein Gesicht; er hatte sie fest fixiert, jetzt griff er eilig an den kleinen runden Filzhut und grüßte wieder. Ziemlich vertraulich that er das.

Die hübsche Wjera schrie fast aus vor Ueberraschung und Vergnügen; sie war feuerrot geworden, und um ihrer Herzensbewegung Herr zu werden, mußte sie ihre Begleiterin unwillkürlich in den Arm kneifen. Ein paar von den andern aber hielten sich von der Gruppe etwas getrennt, sie genierten sich sichtlich, gingen verlegen neben dem Trottoir auf dem Straßendamm einher und schlugen die Augen nieder. Doch fand der heldenhafte Unbekannte noch eine beträchtliche Anzahl unter ihnen, die mit Augen und Mienen das Spiel fortsetzten. Während er mit ganz verlangsamten Schritten an ihnen vorüberging, flogen Blicke und Lächeln zu ihm hinüber, empfingen deutliche Antwort und wurden wiederholt. Ein paar Köpfe drehten sich auch noch nach ihm um, und auch er wurde nicht müde, zurückzusehen.

»Nein! Das ist aber zu arg!« brach eine von den Sittsamen auf dem Straßendamm los, »es ist geradezu sündhaft!«

»Ach, du liebe Tugend! Wir sind es ja gar nicht gewesen, die angefangen haben. Ruth hat es gethan. ~Sie~ hat ihn gegrüßt. Wenn sie jetzt auch so gleichgültig drauf los geht, als ginge es ~sie~ nichts an.«

»Ja, was schadet es denn auch?« verteidigten mehrere ihr Benehmen etwas betreten.

»Gewiß schadet es, -- abgesehen davon, daß es sündhaft ist,« behauptete die Sittsame, »hast du nie gehört, daß man nicht geheiratet wird, wenn man ein Verhältnis gehabt hat?«

»Ja, sie hat ganz recht; es bringt uns in Verruf,« half ihr eine zweite, »und der da würde euch gewiß nicht heiraten, bildet euch das ja nicht ein. Er kann euch ja auch gar nicht alle heiraten!« setzte sie schlagend hinzu.

Einzelne suchten zwischen den Streitenden zu vermitteln.

»Es ist doch alles nur Unsinn. Eine bloße Phantasiegeschichte. Also laß doch! Morgen in der Frühstückspause spielen wir mit verteilten Rollen weiter, dann ist wieder eine von uns der edle Unglückliche, und alle Gefahr ist vorbei.«

»Nein, nun ist es keine bloße Phantasiegeschichte mehr. Du hättest ihn uns nicht zeigen sollen, Ruth.«

Diese zuckte ungeduldig die Achseln.

»Das kann ich nicht ~so~ trennen. Wenn wir's spielen, leben wir's ja auch. Aber macht es doch, wie ihr wollt,« sagte sie zerstreut.

»Nein, erst mußt du es weiter ausdenken. Eigentlich ist es auch sehr lustig. Gerade als ob man zweimal lebt: einmal zu Hause und in der Schule -- und dann noch einmal ganz wo anders, wo alles gerade so ist, wie man es sich ausdenkt. -- Aber diesen Weg wollen wir lieber nicht wieder gehen.«

»Ach, seid ihr Feiglinge!« rief Wjera dazwischen, die sich bis jetzt am Streit nicht beteiligt hatte, weil sie sich noch mit dem »Unglücklichen« zu thun gemacht, der irgendwo an einer Straßenecke stehen geblieben war, »ich finde diese Geschichte tausendmal interessanter, als all die Phantastereien drum herum. Was hat man denn von denen? Sie amüsieren uns nur, weil man uns eingesperrt hält!«

Ueber ihrem Hin- und Herreden beachteten sie es gar nicht, daß sie an Ruths Wohnung am Isaaksplatz angelangt waren, das heißt, daß die meisten von ihnen sich recht beträchtlich von ihrem eigenen Heim entfernt hatten. Sie liefen gewohnheitsmäßig mit, wie eine Hammelherde, Ruth selbst aber war geradeswegs nach Hause gegangen. Jetzt blieb sie zaudernd stehen und kämpfte zwischen der Lust, nach einer Seitenstraße umzubiegen, und der Nötigung, zur gewöhnlichen Stunde bei ihren Verwandten einzutreten. Bis zu Tisch blieb noch viel Zeit, einen Vorwurf zog sie sich nicht zu, und was ihr jetzt vorschwebte, war süß und lockend gleich einem Frühlingsmärchen.

Aber es gab da etwas andres, das sie zurückhielt: wenn sie jetzt hineinging, so blieb sie, wie immer, gänzlich unbemerkt und unbeachtet im ganzen Hauswesen; wenn sie dagegen bis zum späten Mittagessen fortblieb, so wurde sie vielleicht bemerkt, befragt, belästigt. Und das entschied.

Wie eines jener kleinen Insekten, welche zum Schutz vor feindlichen Mächten die Farbe des Holzes oder des Laubes annehmen, auf dem sie sitzen, so verhielt sich, halb unbewußt, auch Ruth gegenüber ihrer Umgebung. Es war ihre Art sich zu wehren.

Ruth löste sich aus der schwatzenden Mädchengruppe und verschwand hinter den hohen Thürflügeln eines umfangreichen steinernen Gebäudes, vor dem ein Soldat Wache stand. Eine Abteilung des Kriegsministeriums lag darin, nebst mehreren großen Kronswohnungen, von denen Ruths Onkel, der Staatsrat war, eine inne hatte.

Ihr Verschwinden gab das Signal zum allgemeinen Aufbruch. Jetzt erst erschraken manche über die lange Versäumnis und suchten laufend eine Pferdebahnlinie zu erreichen oder unterhandelten mit den Droschkenkutschern, welche sofort, laut schreiend und sich gegenseitig nach Möglichkeit unterbietend, sie umringten.

Bis morgen vermißten sie Ruth nicht mehr; sie hatten sich ausgezeichnet unterhalten, sich ordentlich echauffiert! Morgen, wenn sie nach neuer Nahrung begierig wurden, kam sie wieder.

* * * * *

Erik war den Mädchen nur einen kleinen Teil des Weges gefolgt, denn er hatte noch in einem Knabengymnasium und in einer Privatschule Stunden zu geben. Dann ging er in seine Stadtwohnung hinauf, die geräumig und freundlich, aber vier Treppen hoch lag: dafür konnte man aus den Fenstern die Newa überschauen, durch deren blaue, mächtige Wogen noch der Ladogasee seine letzten Eisschollen trieb. Sie schimmerten durchsichtig im blendenden Maisonnenschein. Ueber seine Aussicht freute Erik sich täglich von neuem.

Nach Schulschluß pflegte er hier vorzusprechen, allerlei zu erledigen und eingelaufene Briefe mitzunehmen, denn die Landpost galt als unzuverlässig. Heute war er kaum eingetreten, als es klingelte.

Er öffnete die Thüre und blieb mit einem Lächeln neben derselben stehen.

»Warwara Michailowna!« sagte er.

»Was ist denn das?« fragte sie, rasch um sich blickend, »schon auf dem Lande? umgezogen? allein hier? Ich wußte es nicht! Dann haben Sie also meinen Brief -- --?«

»Ich habe ihn gestern hier vorgefunden,« versetzte er, sie in die angrenzende Wohnstube führend, wo die Polstermöbel schon ihre Sommertoilette empfangen hatten und in ihren weißen Leinwandhülsen gleich Gespenstern herumstanden. Unter dem runden Sofatisch war der Teppich entfernt worden, und ein leichter Geruch von Kampfer schwebte in der Luft.

»Ich wollte mir Ihre Antwort lieber selbst bei Ihnen holen -- oder bei Ihrer Frau!« sagte Warwara Michailowna und ließ sich in einen der weißbezogenen Sessel sinken, »trotz Staub und Sonne bin ich also da. Ich muß wissen, weshalb Sie nicht kommen wollen.«

Sie sah wunderhübsch aus in der gewählten Einfachheit ihrer Frühjahrskleidung, mit ihrem reizenden Mund und mit der Melancholie in den tiefdunkeln Augen, die einen so pikanten Gegensatz zu ihrem munteren Wesen bildete.

»Ich danke Ihnen!« erwiderte Erik und blickte sie an, »aber Sie nehmen mir in der That die Antwort schon von den Lippen: ich wollte wirklich nicht kommen. Mich eine Zeit lang ganz auf dem Lande vergraben. -- Dort können wir ja, wenn Sie erst hinausgezogen sind, so poetisch Fangball spielen und Croquet. -- Ich bin diesen Winter gar zu stark ins Gesellschaftstreiben geraten.«

»Und was schadet das? Fragen Sie nur Klare-Bel, ob sie Sie nicht auch im Gesellschaftsrock am liebsten sieht? Der Salon ist Ihr natürliches +milieu+. Sie sind nun einmal kein solcher deutscher Bär und Philister, wie sie mitunter mit goldenen Brillen und blonden Vollbärten zu uns kommen! Erst seit einigen Generationen hat sich Ihre Familie dort niedergelassen -- an der friesischen Grenze irgendwo, -- französische Emigranten, -- weiß ich's nicht gut?«

»So weit wollen Sie den Beweis herholen, daß ich in Gesellschaft gehen soll?«

Sie lachte und stieß belustigt den Elfenbeingriff ihres Sonnenschirms gegen die Tischplatte.

»Sie sind ein Spötter. Ich wollte nur sagen: bilden Sie sich nicht ein, daß Sie zum Schulmeister geboren sind. Trotz der blauen Uniform da, die Sie noch anbehalten haben, -- die Ihnen übrigens gut steht, weil es ein Frack ist. Sie sind zum Weltmann geboren. Wenn Sie uns -- +mondains+ -- meiden, thun Sie sich selbst weh. -- -- Ich weiß es. Lachen Sie nicht.«

»Ich lache ja nicht. Sie sind sehr scharfsichtig, Warwara Michailowna. -- Vielleicht zu sehr.«

Sie schüttelte den Kopf.

»Sie würden unsrer verwöhnten Gesellschaft nicht so gut gefallen, wenn Sie nicht selbst ein wenig von ihr berauscht würden. Habe ich nicht recht?«

»Nun, nehmen wir also an, ich will nicht berauscht werden,« sagte Erik und kreuzte die Arme; »daß gerade Sie als Versucherin kommen, ist freilich schlimm für mich. Ein Glück, daß die Saison zu Ende geht.«

Sie machte einen schmollenden Mund.

»Ich weiß schon. Mich halten Sie für die Inkarnation weltlicher Oberflächlichkeit.«

Er widersprach nicht.

Einige Augenblicke lang schwiegen sie beide, und zwischen ihnen lag, unmöglich zu überhören, Warwaras stumme Frage: »Bin ich es, die dich berauscht?«

»Sie sind ein Egoist,« sagte sie dann aufblickend, »sonst hätten Sie bemerken müssen, daß Sie sich irren. Wissen Sie nicht, weshalb ich Sie so gern da habe, mitten unter den Menschen? Weil ich gerade ebensogut fühle wie Sie, daß dieses Treiben im Grunde eitel und hohl ist, -- inhaltsleer, -- und es mich dennoch berauscht -- wie Sie. Ihre Anwesenheit war also die eines Leidensgenossen für mich. Hand aufs Herz! sind wir nicht so etwas wie Leidensgenossen? Wir haben eine gemeinsame Versuchung.«

Er blickte sie fest an. Sie sprach rasch, ein wenig erregt, mit dem weichen, klingenden Tonfall, den er an den Slaven so einschmeichelnd fand. Ihr selbst war es in diesem Augenblick nicht ganz klar, ob sie mit ihm kokettierte, oder ob sie nicht vielleicht ehrlicher mit ihm sprach, als je mit sich allein. Es schien ihr wirklich manchmal -- und besonders in den seltenen Stunden des Alleinseins, -- als triebe ein verwandter Zug sie zu einander. Und dann war ihr Erik interessant: als Mensch. So, wie unter lauter Satten ein Hungriger interessant ist. Unter den Gesellschaftsmenschen ihrer Umgebung kam er ihr vor wie einer, der ungeduldig auf Beute ausgeht, und, weil er die ihm gemäße dort nicht findet, seinen Hunger mit Naschwerk zu betäuben sucht.

»Also: Kameradschaft in einer gemeinsamen Versuchung!« sagte Erik wegblickend -- »vielleicht ein Wettkampf, wer ihr besser erliegt?«

Sie erhob sich, um zu gehen.

»Sie haben vielleicht recht zu spotten, und es würde nur sentimental klingen, wenn ich antworten wollte: nein! mehr als das, -- eine gemeinsame Sehnsucht,« entgegnete sie, dicht neben ihm, der ebenfalls aufgestanden war, »Sie haben tausendmal recht. Wir haben ja nie ein ernstes Wort miteinander gesprochen. Und ein Mann braucht keinen Bundesgenossen. Er kann's allein.«

Sie sprach ganz ernst, es klang beinahe echt, und was sie sprach, stimmte so eigentümlich zu der Schwermut der dunkeln Augen. Eine Minute, -- eine verschwindende Minute lang, fühlte Erik, wie seine Phantasie ihm etwas vorgaukelte. Eine Sehnsucht brach heiß in ihm auf, über die der Verstand lachte, -- und ein wilder, herrischer Wunsch, den lachenden Verstand unter die Füße zu treten und einen schönen Selbstbetrug wahr zu machen.

Ohne genau zu wissen, was er that, hatte er die Hand ausgestreut; es war eine fast befehlende Bewegung, wie ein: »Bleib!« Er sah nichts mehr deutlich, er empfand nur die Nähe dieser schmiegsamen Gestalt, dieser Augen, von denen Sehnsucht ausging.

Und plötzlich küßte er sie mit geschlossenen Augen auf den Hals und die Wange. Nicht tändelnd, versuchend. Rasch, heftig, fast gewaltthätig.

Er murmelte halb unverständlich: »Mach es wahr! mach es wahr! laß mich nicht aufwachen! Suchtest du mich?«

Bei seinen bewußtlosen Küssen überfiel Warwara ein plötzlicher Schreck. Sie war selbst berauscht gewesen, einen Augenblick lang, aber die Wucht, mit welcher er darauf einging, ernüchterte sie ebenso rasch. Durch die momentane Erregung seiner Sinne hindurch spürte sie etwas von dem tiefinnersten Hunger und der Sehnsucht in ihm, an die sie unvorsichtig gerührt hatte. Nicht wie eine Dreistigkeit die erstaunt oder verletzt, empfand sie seinen Kuß, sondern wie eine lähmende Gefahr für Leib und Seele, die zu verschlingen droht, was ihr zu nahe gekommen ist.

Mit einer heftigen Bewegung hatte sie sich freigemacht.

Ihr Blick lief über ihn hin. Eigentlich sollte er ihr wie ein Kind vorkommen, das so erfüllt ist von Lebensverlangen und ungeduldiger Erwartung, daß es nicht mehr zu spielen vermag. Es zerbricht gewaltsam das dargebotene Spielzeug, um zu sehen, was dahinter ist, und bleibt mit enttäuschtem Gesicht stehen.

Das wollte sie nicht. Lieber noch gespielt haben, als zu ernst genommen werden, -- so ernst, daß ihr Inneres bloßgelegt und an unmöglichen Illusionen gemessen würde. Sie fürchtete sich vor dem enttäuschten Gesicht.

Erik mißverstand die Heftigkeit ihrer Bewegung. Aber sie weckte auch ihn. Er hatte ja nur einen Augenblick vergessen, daß sie spielte. -- Seine Erregung verflog sofort. Nur etwas Spott blieb in den Augen und um den Mund zurück. Spott über sich selbst.

Die Luft im Zimmer war zum Ersticken schwül. Fast ungehindert schien die Sonne durch die dünnen, weißen Fenstervorhänge, und mißtönend klang von der Straße der Lärm der Droschken und Pferdebahnen herauf.

Warwara war langsam in den Vorflur gegangen, und Erik geleitete sie an die Hausthür. Sie wechselten kein Wort miteinander.

Erst an der Thür wandte sie sich um zu ihm und maß ihn mit einem sonderbaren Blick, den er nicht verstand. Bedauern lag darin, aber auch Ablehnung, eine kleine Ueberlegenheit über ihn, den Mann, und dann noch etwas, wie ein ganz leises Eingeständnis: »Ich möchte wohl die sein, die du brauchst, und die dich sättigen könnte, du Wilder. Aber ich bin's nicht.«

»Ich nehme an: Sie kommen nicht,« bemerkte sie dabei zerstreut.

»Mit Ihrer Erlaubnis: nein!« entgegnete er, und sann dem Blick nach.

Die Thür fiel ins Schloß. --

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Ruth war pünktlich um vier Uhr, zur festgesetzten Mittagsstunde, im Speisesaal erschienen, der, hoch und groß, mit dunkeln Mahagonimöbeln ausgestattet, in der Mitte einer Flucht von Gemächern lag. Sie hatte ihren äußern Menschen so glatt gebürstet und gestriegelt, wie der Onkel, die Tante und die Cousine sich zu tragen pflegten, und saß schweigsam auf ihrem Platz am Tisch, den ein Diener in weißbaumwollenen Handschuhen geräuschlos bediente. Während des Essens, das die Beteiligten in ausgiebigster Weise beschäftigte, blieb die Unterhaltung recht einsilbig. Der Onkel liebte keine langen Tischgespräche, und seine Frau hatte genug damit zu thun, ihn mit den richtigen Stücken zu versorgen.

Erst als die Mundspüler von grünem Glas, die kein Mensch benutzte, vor jeden einzelnen niedergesetzt waren, und vor der Tante die silberne Kaffeemaschine stand, auf der sie den Kaffee immer eigenhändig bereitete, wurde es ein wenig lebhafter bei Tisch. Darauf schien Ruth nur gewartet zu haben. Sie erhob sich leise von ihrem Sitz und wollte verschwinden.

»Gehst du schon auf dein Zimmer, mein Kind?« fragte die Tante, »dann sieh dich mal darin um. So unordentlich, so wenig zierlich sollte es bei keinem jungen Mädchen im Zimmer aussehen.«

Ruth machte eine Armesündermiene. »Ich will wunderschön aufräumen,« sagte sie eilig; »darf ich dann bis zum Thee noch einmal fortgehn?«

»Bis zum Thee? Ist es denn etwas so Dringendes?«

»Es ist etwas Dringendes,« sagte Ruth. Der Onkel sah auf.

»Zu wem willst du denn gehn? Es ist wohl jemand aus der Schule?«

»Ja,« erklärte Ruth und rieb ungeduldig den Thürgriff, den sie schon in der Hand hielt.

»Sage dem Diener, daß er dich begleitet und dort auf dich wartet.«

Der Onkel blickte ihr nach, wie sie leise die Thür hinter sich schloß.

»Ein merkwürdig bequemes Ding ist sie doch,« meinte er dann, seine Cigarette anzündend, »ich kenne niemand, der weniger verlangt und sich weniger bemerkbar macht als sie.«

»Weil man ihr alles gewährt,« ergänzte die Tante mit ihrer etwas hohen Stimme, die den baltischen Accent noch unangenehmer hervortreten ließ. Sie war eine Baronesse aus Livland.

»Alles? nun weißt du, ein andres Kind würde nicht so zurückhaltend sein. Sie weiß zum Beispiel: dies ist die Stunde des intimsten, ungestörtesten Beisammenseins, -- und immer geht sie fort. Aber mit knapp sechzehn Jahren handelt man doch nicht aus Takt.«

»Nein, das thut sie auch nicht. Du idealisierst Ruth immer. Sie liebt uns einfach nicht genug, um sich enger an uns zu schließen. Manchmal denke ich: sie ist vielleicht herzlos.«

»Aber Mathilde! wie kannst du dem kleinen Ding etwas so Böses nachsagen! Lies mal den letzten Brief aus Belgien, wie sie sie da in der Pension loben und zurückverlangen.«

»Ja, das kennt man, mein Lieber. Sie war ein einträglicher Pensionär. Und dann sind sie dort katholisch. Wie kann man ihnen trauen? Ich bin es gerade, die deswegen für Ruths Uebersiedlung zu uns gewesen ist. Wir sind doch schließlich verantwortlich für sie. Dafür, daß sie in Zucht und Ordnung aufwächst. Was hat man davon, daß ihre Verwandten dort von vlämischem Adel sind? Die Ansichten sind doch die Hauptsache. Und die Leute dort kennt man nach der Richtung gar nicht.«

Der Onkel schwieg mit verdrießlichem Gesicht. Er wußte, daß für seine Frau alle Menschen außerhalb der kleinen baltischen Provinzen »diese Leute« waren, -- während für ihn, gerade umgekehrt, die Welt erst jenseits der russischen Grenze anfing. Ihm kam nicht nur die beschränkte provinzielle Exklusivität seiner Frau lächerlich vor, sondern sogar auch ihr baltisches Heimatsgefühl. Mit seinem französischen Namen und den sowohl deutschen wie slavischen Elementen in seiner Familie fühlte er sich dermaßen als Kosmopolit, daß er nie eine Gemütsbeziehung zu irgend einem Lande und Volke besessen hatte. Er schalt und klagte nur deshalb nicht über Rußland, wie die meisten seinesgleichen, weil er dies für unvornehm hielt.

»Ruth würde jetzt gewiß nicht von hier fortgehen mögen, Mama,« bemerkte die Tochter, »jetzt, wo sie so gut wie erwachsen ist. Nirgends kann man doch so gut in die Welt geführt werden wie hier.«

»Aber mir scheint, das will sie gar nicht,« versetzte der Onkel lächelnd, der seine hübsche Tochter sehr gern in Gesellschaften begleitete, »sie hat ja ohnehin so viel Welt und Menschen gesehn und macht sich nichts daraus. Gott sei Dank also, daß wir mit ihr nicht noch einmal dieselben Umstände haben werden, wie seit einem Jahre mit dir, Liuba.«

»Nun bist du wahrhaftig im stande und setzest dein eigenes Kind für Ruth herab,« sagte seine Frau nervös, die kein Gehör für einen scherzenden Ton besaß, »laß sie doch nur in Gottes Namen nach Belgien reisen!«

»Nein!« entgegnete er ärgerlich, drehte seinen Stuhl vom Tisch ab, ergriff eine Zeitung und vergrub sich hinein. Als eine der unangenehmsten Eigenschaften an seiner Frau war ihm stets ihre unleugbare Vortrefflichkeit erschienen, gegen die es niemals einen Appell gab, aber beinahe noch unangenehmer erschien ihm dieser gänzliche Mangel an Humor.

Die Stunde des »intimsten, ungestörtesten Beisammenseins« war gründlich verdorben. --

Ruth freilich ahnte nicht, daß sie von ihrem leeren Platz am Tisch den unschuldigen Störenfried spielte, ja, sie hatte im Augenblick vielleicht fast vergessen, in welchem Lande der Erde, ob in Belgien oder Rußland oder Deutschland oder sonstwo sie sich befinde. Die Hände auf dem Rücken verschränkt, den Kopf ein wenig gesenkt, ging sie rastlos in ihrer Stube auf und ab, und dabei trug ihr Gesicht den Ausdruck angestrengtesten Nachdenkens, wie vorhin auf der Schulbank während des Unterrichts. Ihre Wangen waren heiß und lebhaft gerötet, und von Zeit zu Zeit schüttelte sie den Kopf, als könne sie mir ihren Gedanken nicht recht ins reine kommen.

Nach einer Weile blieb sie stehen, strich sich das Haar aus der Stirn und entsann sich ihres Versprechens, »wunderschön aufzuräumen«. Damit ging es außerordentlich rasch. Jedes einzelne Ding, das herumlag, wurde in die ihm zunächstgelegene Schublade befördert, und als dies gewissenhaft geschehen war, zeigte es sich, daß im Zimmer verblüffend wenig Gegenstände übrig geblieben waren, die man nach der Vorschrift der Tante »zierlich« hätte ordnen können. Es war ein ganz wohnliches kleines Zimmer, mit hübschen Möbeln, einem rotsamtenen Ecksofa und sogar einer Nippesetagère, auf der ein gläserner Mops stand. Aber es trug nicht das Gepräge seiner Besitzerin, sondern das einer gut eingerichteten Hotelstube. Weder Arbeiten noch Liebhabereien plauderten etwas über das Wesen derjenigen aus, die hier schlief und lernte und träumte. Es hatte den Anschein, als sage Ruth täglich auch zu dieser Umgebung, wie vorhin in der Schule: »Ich gehe doch bald fort.«

Als Ruth fertig war, griff sie hastig nach einem weichen englischen Wollbarett von leichter grauer Strickerei, setzte es wie eine Knabenmütze auf den Kopf und rief den Diener aus der Dienerstube neben der Küche. Dieser saß in seinem geblümten Zitzhemde, die Messer putzend, rittlings auf einer Bank und sang dazu, so daß die Messer im Takte flogen. Es war ein junger Tatar, sehr gewandt und, als Mohammedaner, musterhaft nüchtern. Beten, singen und schlafen waren seine liebsten Beschäftigungen. Wie er Ruth rufen hörte, schlüpfte er eilig in seine dunkle Livree und öffnete ihr die Hausthür.

Sie ließ sich von ihm bis zum finnländischen Bahnhof begleiten; dort entließ sie ihn.

»Jetzt kannst du zu deinen Bekannten gehn, Basil,« sagte sie zu ihm, als er mit gezogenem Hut an der Waggonthür stand, »aber um neun Uhr mußt du mich hier wieder erwarten.«

Er nickte verständnisvoll mit dem kurzgeschorenen Kopf, der oben eine kreisrunde, glatt ausrasierte Stelle zeigte, sah aber dabei seine kleine Herrin etwas besorgt an. Er wollte gern zu »seinen Bekannten« gehn, aber unerhört kam es ihm vor, sie so schutzlos in die weite Welt hinauffahren zu lassen, namentlich gegen Abend, wo es so viele Betrunkene auf den Straßen gab.

»Dürfte ich nicht um die Erlaubnis bitten, mitzufahren?« fragte er und kämpfte mit dem heroischen Entschluß, freiwillig aus sein Vergnügen zu verzichten.

Ruth lachte über sein pfiffiges Tatarengesicht, das eben jetzt fast treuherzig aussah, und schüttelte den Kopf.

»Wo ich jetzt hingehe, darf niemand mitgehen!« sagte sie feierlich.

Während der Fahrt blickte sie ungeduldig hinaus, wie eine, die froh ist, alles hinter sich zu lassen; die kurze Strecke kam ihr lang vor, als führe sie wirklich weit -- weit, in eine ganz andre Welt. Aber als sie dann am kleinen Stationsgebäude ausstieg und sich nach dem richtigen Wege durchfragen mußte, da wurde ihr bänglich zu Mut. Was ihr vorgeschwebt hatte, -- zwingend, unwiderstehlich, -- war ein ganz bestimmtes Traumbild, und solange nur ihre Phantasie daran herummalte, schien alles sich ihr von

selbst zu verwirklichen. Das Wirklichkeitsbild aber, das ihr jetzt fremd entgegentrat und in den Traum eingriff, verschüchterte sie; es wäre eigentlich schöner gewesen, wenn alles sich auch noch weiter so von innen heraus geformt hätte, wie man es sich eben träumen läßt.

Die bange Empfindung nahm nicht ab, sondern zu, wie sie endlich dem Hause nahe kam, das sie suchte. Es war ihr, als erwache sie plötzlich und befinde sich todesallein in wildfremder Gegend. Eine förmliche Angst überfiel sie vor lauter Schüchternheit und wie gelähmt blieb sie am Gartengitter stehen.

Da lag das Haus vor ihr; eine Magd fegte auf dem breiten Kiesweg vorn die Strohhalme zusammen, die bis auf die Straße verstreut waren, und daneben stand ein Knabe, den Hut im Nacken, und sah zu. Der mußte sie sicher gleich bemerken. Am liebsten wäre sie wieder umgekehrt.

»Die Augen zumachen -- fortlaufen!« dachte sie sehnsüchtig. Aber das durfte sie nicht. Ihren eigenen Willen durfte sie ganz gewiß nicht hinterdrein im Stich lassen.

Da sang eine Nachtigall im Fliedergebüsch am Zaun.

Und leise -- leise, mit werbendem Klang, lockte aus der Tiefe des Gartens die zweite.

Ruths Augen schweiften am Hause vorbei über den Garten und blieben entzückt darauf haften.

»Der Frühling!« sagte sie jauchzend, ganz laut.

Sie hatte ihn noch gar nicht gesehen in diesem Jahr. Nun erst ward sie sich dessen bewußt, daß sie doch soeben, auf dem Wege vom Bahnhof, unter grünenden Birken gegangen war, und daß im Grase am Wegrand weiße Anemonen standen. Jetzt kam es ihr vor, als sei das nur so ein wenig Frühling gewesen, der von den Menschen, die aus diesem Garten traten, unterwegs verstreut wurde. Aber hier war der Frühling zu Haus, von hier mußte er kommen; und nun stand sie dicht am Gitter, hinter welchem er blühte. In dem rotgoldenen Duft, den die Sonne darum wob, schaute er mit der eben aufbrechenden Obstblüte und dem zarten Laub der Bäume wie ein Märchen hinter dem alten Hause hervor. Da einzutreten, das war fast, als ob man aus einem Traum gar nicht herauskam.

Jonas hatte sich neugierig der Gartenpforte genähert, an der jemand stand, von dem er nicht recht wußte, ob es ein Mädchen sei.

»Ich möchte hier herein!« sagte Ruth bittend. --

Erik und Klare-Bel saßen an dem noch nicht abgedeckten Mittagstisch im Wohnzimmer an der Terrasse, und wie immer erzählte Erik seiner Frau lebhaft und mitteilsam von den kleinen Begebenheiten des Tages. Voll Humor schilderte er ihr die Mädchenschule und Ruth. Warwaras Besuch in der Stadtwohnung erwähnte er nur flüchtig.

Da kam Jonas atemlos ins Zimmer gestürzt. »Papa! da ist jemand, der dich sprechen will. Ruth heißt sie. Ich habe sie in dein Arbeitszimmer geführt.«

»Aber Jonas!« rief seine Mutter, »wie konntest du das nur thun! Da drin muß es ja noch schauderhaft aussehen! Bringe sie doch herüber, Erik! bitte, bringe sie lieber herüber! Wenn Gonne nur abräumen möchte!«

Erik hörte es nicht mehr. Er war schon fort.

Als er raschen Schrittes über den Flur in sein Zimmer trat, stand Ruth mitten in demselben, etwas vornübergeneigt und die Hände fest gegen die Brust gedrückt. Der erste Eindruck, den er empfing, war wieder der des Scheuen, Vereinsamten, wie in dem Augenblick, wo sie so still gesagt hatte: »Mir hilft niemand!« Wie er sie so dastehen sah und sie ihm mit großen, bangen Augen entgegenblickte, erinnerte sie in keinem Zuge mehr an den ausgelassenen Jungen im Schulhof.

Erik kam nur undeutlich die Vorstellung davon, daß man im Fall eines unerwarteten Besuches zunächst einen Stuhl anbietet und irgend etwas Freundliches sagt. All dies Gethue kam ihm wie zu einer andern Welt gehörig vor, -- jedes konventionelle Wort vergaß er dieser schüchternen, kindlichen, sichtlich aufs tiefste ergriffenen Gestalt gegenüber. Es war, als stände sie auf einer einsamen Insel, am weiten Meeresstrande, ganz allein vor ihm -- ein Kind aus dem Volke -- und ringsum nichts als ein paar schwebende Möwen über ihren Köpfen.

Ganz unwillkürlich, aus diesem Eindruck heraus, fand er nur das Wort der Freude: »Kommst du zu mir?«

Das »Du« wirkte wie eine Erlösung auf sie. Es schien ihr in dieser Einfachheit ein Zauberwort, das die fremde, herzbeklemmende Wirklichkeit mit einem Schlage verwandelte, -- sie umwandelte zur traumhaften Verwirklichung dessen, was Ruth ersehnt und ersonnen hatte.

Sie machte einen Schritt auf Erik zu, ein heller Ausdruck flog über ihr ganzes Gesicht, und die Hände fester gegen die Brust pressend, deren Herzklopfen ihr den Atem benahm, sagte sie kindlich: »Danke!«

Er hatte sich auf einen der umherstehenden Stühle gesetzt und faßte ihre Hände in den seinen zusammen. Die Hände zitterten, und es fiel ihm auf, wie blaß und schmächtig sie aussah, wenn nicht der Ausdruck übermütiger Lebenslust, den er an ihr gesehen, darüber wegtäuschte.

»Fürchtest du dich?« fragte er, und sein Blick ruhte aus dem schmalen Gesichtchen.

Sie nickte ganz leise mit dem Kopfe, und noch immer zitterte sie, wie ein Vogel, auf den eine fremde Hand sich legt.

»Du fürchtest dich doch nicht vor mir, zu dem du kamst? Sage mir, weshalb du kamst.«

Sie nahm ihre Mütze vom Kopf und besann sich. In Gedanken durchlief sie die ganze Entstehungsgeschichte ihres Entschlusses, vom ersten Schuleindruck an, -- aber die ließ sich ja, so weitläufig und verworren wie sie war, ganz gewiß nicht wiedererzählen. Sie versuchte, die Hauptsache herauszuholen. Aber nun vergaß sie alles. Es war rein unmöglich.

Und plötzlich brach Ruth in Thränen aus.

»Mein liebes Kind!« sagte er sanft, und strich ihr das lose, lockige Haar aus der Stirn, das über das gesenkte Gesicht gefallen war. Dann nahm er ihre Hände wieder in die seinen.

»Hast du Vertrauen zu mir?« fragte er.

»Ja!« sagte sie leise.

»Unbedingtes?«

»Ja!« sagte sie wieder.

»Dann darfst du weder zittern noch dich fürchten. Versuche jetzt einmal ganz fest, es zu bezwingen. Ganz fest, hörst du? Es wird schon gehn.«

Sie machte eine Anstrengung, das nervöse Beben, das durch ihren Körper ging, zu unterdrücken. Er wartete ruhig einige Augenblicke, bis es ihr gelungen war. Dann beharrte er auf seiner ersten Frage: »So. Und nun sage mir, weshalb du kamst. Sage es, so gut du kannst. Versuche es nur. Ich werde dir helfen.«

Sie seufzte und begann unsicher. »Ich komme nun bald nicht mehr in die Schule --«

»Nein. Ich weiß. Und --?«

»Und da mußte ich hierher.«

Sie brach ab, wie um ihre Gedanken zu ordnen, dann fügte sie schüchtern hinzu, mit einem rührenden Ausdruck: »Ich bin ja allein!«

Erik wurde es warm bis ins innerste Herz. Nie noch meinte er eine so tiefe, so heilige Zärtlichkeit empfunden zu haben, wie diesem Kinde gegenüber. Der Wunsch, sich ihr zu widmen, die Hand auf sie zu legen, wie auf etwas, das ihm zugehörte, ward plötzlich so stark in ihm, daß er ihn unwillkürlich als bereits erfüllt nahm und kein Hindernis gelten ließ.

»Möchtest du hierher gehören, Ruth?« fragte er.

»Ach ja!« rief sie lebhaft, und dann sagte sie mit Inbrunst: »Immer!«

Ihr Gesicht hatte sich verändert, die Augen sahen jetzt ganz dunkel aus und lachten aus den nassen Wimpern. Sie hätte so gern wieder gesagte »Danke!« Denn es lag der Inbegriff all ihres Denkens und Fühlens in dem Worte ausgesprochen. Aber sie scheute sich, es zu wiederholen.

Erik sah ernsthaft vor sich nieder, als erwäge er nachdenklich einen Plan.

»Nach dem Verlassen der Schule würdest du wohl noch mancherlei Unterricht erhalten,« bemerkte er, sie zur Wirklichkeit zurückführend, »wenigstens wäre das in hohem Grade wünschenswert. Möchtest du ihn bei mir nehmen?«

Sie nickte eifrig.

»Gut. Wir würden also miteinander arbeiten,« -- und in leichtem Tone setzte er hinzu: »sehr viel arbeiten, Ruth! Wirst du das auch wollen? In dem Aufsatz da, -- der hat uns ja zu einander geführt, nicht wahr? -- nun, da steht fast ebensoviel zum Erschrecken wie zum Freuen. Einen so ungeordneten kleinen Kopf, mit so krausen, wilden, unfertigen Einfällen und Vorstellungen habe ich noch gar nicht gesehen. Glaubst du das wohl?«

Sie lächelte nur und sah ihn vertrauensvoll an, als ob sie dächte: »Du wirst es schon ordnen und entwirren!«

Er blickte schweigend auf sie hin, und wieder erschien sie ihm wie ein scheuer, kleiner, mattgeflogener Vogel, der sich hilflos verflattert hat, und sich mit einemmal in einemn weichen Neste findet.

Draußen zögerte die Maisonne am Himmel, und durch den feinen Nebel hindurch, der von den feuchten Wiesen jenseits des Gartens aufstieg, fielen ihre Strahlen beinahe rot, wie flüssiger Purpur. Die beiden noch vorhanglosen Fenster gingen direkt auf den Hintergarten hinaus.

Ein herber, frischer Duft nach Birkenknospen wehte mit dem lauen Abendwind ins Zimmer, und unermüdlich tönte das inbrünstige Locken der Nachtigallen.

Während Erik auf Ruth schaute, kam ihm eine störende Erinnerung.

»Erzähle mir doch,« sagte er unerwartet, »was denn das für ein Mann war, den du auf der Straße grüßtest?«

Sie errötete etwas und wurde verlegen, aber um ihre Mundwinkel zuckte es dabei, wie von verhaltenem Mutwillen. Auf den Wangen erschienen verräterisch zwei Schelmengrübchen.

»Ich -- -- -- ach, der! Den kenne ich ja gar nicht.«

»Aber er sah dich doch so an, als ob ihr euch recht gut kenntet. Wie kam denn das?«

»Ja, das kam so,« begann sie mit einem Seufzer, und überlegte, »-- es ist wirklich nicht leicht zu erzählen. Ich habe ihn mir ausgesucht, aber er weiß ja nichts davon.«

»Ausgesucht? Aber, liebes Kind, das kann doch kein Mensch verstehen,« sagte er ungeduldig, »nimm dich besser zusammen, Ruth! sprich deutlicher. -- Nun?«

»Ich will ja!« rief sie eingeschüchtert, »es ist bloß so schwer! Es war eine bloße Geschichte, -- die wir untereinander spielten, -- im Schulhof, in der Frühstückspause, -- und da mußte jemand vorkommen, der ungefähr so aussah. Und da -- habe ich mir diesen ausgesucht, weil es schöner geht, wenn man dabei an einen lebendigen Menschen denkt.«

»Aber was sollte er denn davon denken? Zum Beispiel schon davon, daß du ihn zuerst grüßtest?«

»Das mußte ich ja thun! Wie sollte er sonst wissen, was er zu thun hatte? Ob er grüßen durfte?«

»Und wenn er nun auf der Straße mit dir angebunden hätte? Hast du denn das nicht überlegt?«

Sie sah erstaunt auf.

»Das durfte er ja gar nicht. Das hätte gar nicht in seine Rolle gepaßt. Er mußte edel und unglücklich sein.«

Erik entfuhr ein kurzer Laut. Seine Augen blickten ernst, fast besorgt auf sie.

»In eurem kindischen Spiel -- ja. Aber in der Wirklichkeit?« fragte er langsam. »Kannst du deine Gedanken nicht besser in Zucht nehmen? Kannst du das nicht auseinander halten? Das mußt du können, Ruth! Und nun sage mir, was du gethan hättest, wenn er aus der eingebildeten Rolle gefallen wäre?«

Sie dachte nach.

»Dann hätte ich die Augen zugemacht und wäre fortgelaufen.«

»Wärst du denn dadurch unsichtbar geworden, daß du die Augen zumachst?«

»Ich? Nein! aber doch er. Denn dann hätte ich ja einen andern suchen müssen.«

»Einen andern?!«

Sie nickte.

»Es gibt ihrer viele!« versicherte sie treuherzig.

»Und das hättest du wirklich gethan? Besinne dich mal! Wäre es dir wirklich auch dann noch nicht klar geworden, wie kindisch und dreist dein Benehmen war?«

Ruth sah unglücklich aus. Offenbar machte er ihr einen Vorwurf. Sie dachte nach, was er nur damit meinen könnte? Sie konnte nicht begreifen, was dieser fremde Mann, außerhalb seiner Rolle, sie kümmern sollte?

»Ich brauchte ihn, und da nahm ich ihn mir!« rief sie mit kläglichem Gesicht.

Erik stand auf und ging ein paarmal durchs Zimmer. Dann blieb er vor Ruth stehen, die sich auf die Kante seines Stuhles gesetzt hatte.

»Sage mir, gibt es mehr solcher fremder Menschen, die du auf der Straße grüßest?«

»Ja. Alle Straßen sind voll davon.«

»-- Männer --?« fragte er zögernd.

»Auch Männer. Ich brauche immer frische für die Schule. Auch Frauen, Kinder, alte Leute.«

»Was meinst du damit, daß du Männer ›für die Schule‹ brauchst?«

»In den Geschichten für die Mädchen muß immer einer vorkommen. Am liebsten einer mit einem kleinen Schnurrbart. Aber ich habe auch andre Geschichten, -- viel, viel schönere, -- wunderschöne,« fügte sie lebhaft hinzu, -- »und die mit Kindern sind nur die liebsten.«

»Erzählst du die den Mädchen in der Schule nicht?«

Sie schüttelte den Kopf.

»Sie finden sie nicht schön!« sagte Ruth traurig.

Er setzte sich zu ihr auf einen Ledersessel, der am Fenster stand, und neigte sich ein wenig vor.

»Willst du sie künftig mir erzählen?« fragte er ernst, »aber alle, ohne eine Ausnahme. Und ohne einen Winkel, in den ich nicht hineinsehen könnte. Ich muß alles wissen und hören, was durch diesen phantastischen, unnützen Kopf geht. Wir wollen einen ordentlichen Vertrag machen: du sollst sie auch niemand sonst mehr erzählen. Nur mir. Immer, mit allem hierher kommen. Du wolltest ja hierher gehören. -- Wirst du es bedingungslos und gehorsam thun?«

Ihre Augen waren groß und dankerfüllt auf ihn gerichtet; er konnte es an ihrem Gesicht sehen, wie die Gedanken in ihr vergebens nach Ausdruck rangen, aber er hatte dennoch keine Ahnung davon, mit welch einem innern Jubel ein neues Glück ihr aufging. Sie wollte es ihm so gern sagen, aber in ihrem wortarmen Gefühl verstummte sie statt dessen gänzlich, und plötzlich, als müßte sie sich anstatt des Wortes wenigstens durch die Gebärde helfen, glitt sie nieder vom Stuhl und kniete bei Erik hin, -- wie auf einen ihr nun zugewiesenen Platz, erwartungsvoll, mit einem Blick wie ein Kind um Weihnachten.

Sie fühlte sich so glücklich. Zu Hause. Geborgen. Von hier aus mußte alles Gute kommen.

Er strich ihr leise über das Haar. »Also höre unsern Vertrag zu Ende,« sagte er in dem ruhigen Tone, unter dem sie ganz still wurde und lauschte, »wenn du mir deine Geschichten schenkst, dann schenke ich dir auch etwas. Du sollst, soweit es an mir liegt, nicht in deiner eigenen Phantasie stecken bleiben, sondern mit klarem Blick so weit schweifen lernen, wie das Leben -- das wirkliche, herrliche Leben -- reicht. Und, wenn es auch anfangs Anstrengung von dir verlangen sollte, meinst du nicht, daß ich dich damit

etwas Schöneres lehren werde, als du bisher dir geträumt und zusammengedichtet hast?«

»Ach ja!« rief sie sehnsüchtig, als strebe sie verlangend beide Hände nach etwas Erwartetem aus, -- »das ist sie ja: von allen die allerschönste Märchengeschichte!«

Ihm fiel der Ausdruck auf, weil sie ihn schon im Schulhof den Mädchen gegenüber gebraucht hatte.

»Gerade das sagtest du ja, als du heute morgen den Mädchen erklärtest, daß du etwas Neues vorhabest. Was war es denn?«

Zu seinem Erstaunen fuhr Ruth zusammen, und senkte den Kopf.

Erik sah betroffen aus.

»Was war es?« fragte er streng.

»Ich kann es nicht sagen,« versicherte sie scheu, »bitte, bitte nicht.«

Er faßte ihre Hand hart im Gelenk, so daß es sie schmerzte.

»Wenn es etwas ist, was dir so schwer fällt, auszusprechen, dann ist es um so notwendiger, daß du es sagst. Ich muß es wissen, -- jetzt gleich, Ruth.«

Sie versuchte, die schmerzende Hand aus der seinen zu ziehen, und als es ihr nicht gelang, senkte sie das Gesicht noch tiefer, so daß es sich an seinem Rockärmel fast versteckte.

Er bog ihren Kopf zurück und sah ihr in das Gesicht. Es war über und über in Glut getaucht.

»Es hilft nichts, sich zu verstecken,« sagte er unerwartet sanft, »du wirst mir immer nachgeben müssen, mein Kind. Mach es kurz!«

Ihre Hände schlangen sich nervös auf seinen Knieen ineinander, dann hob sie sie mit einer bittenden Gebärde zu ihm auf.

»Es war nur, -- ich hatte alle diese Geschichten auf einmal so satt; alles stockte auf einmal, -- nichts mochte ich mir weiter ausdenken. So schön ich es mir auch ausdachte, mit so vielen Menschen drin ich es nur auch ausdachte, -- ich blieb immer allein. Die Menschen grüßten, und gingen vorüber. Und da -- da kam eine solche Sehnsucht, -- seit vier Tagen solche Sehnsucht. Ich konnte nicht mehr spielen. Nie mehr.«

»Sehnsucht -- wohin?« fragte er halblaut.

»Hierher!« sagte sie mit leiser Stimme und wandte den Kopf hinweg.

Er ließ ihn frei, ließ zu, daß sie ihn wieder an seinem Rockärmel versteckte.

Beide Arme hatte er um sie geschlungen.

II.

Erik saß bei Ruths Onkel und Tante im Empfangssalon, hielt Hut und Handschuhe auf den Knieen und blickte nachdenklich darauf nieder, während er dem Gespräch der beiden zuhörte.

»Ich finde, mit deiner Reise stimmt es gut zusammen, Mathilde,« sagte der Onkel jetzt, »denn während du mit Liuba in Wiesbaden bist, ist Ruth gerade so ganz unbeaufsichtigt hier. Ich weiß ohnedies nicht, was die Kleine mit den langen Ferien anfangen soll, da in diesem Jahr die meisten Bekannten nicht aufs Land, sondern ins Ausland gehen.«

Erik besaß ein scharfes Auge für die Außenseite von Menschen und wurde stark durch dieselbe beeinflußt. Der Onkel, mit seinem aschblonden, schon etwas graugemischten Haar und Bart, mit den schmächtigen Schultern seiner elegant gebauten Gestalt und mit seinen frauenhaft feinen Händen, gefiel ihm recht gut. In Ton und Haltung erinnerte er ein wenig an Ruth. Dagegen empfand Erik gegen die Tante eine ausgesprochene Antipathie.

»Solche Besuche bei allerlei Bekannten auf dem Lande wären jetzt auch durchaus keine geeignete Beschäftigung für Ruth,« bemerkte er aufblickend; »sie muß zu thun haben, -- wirkliche Arbeit und Anstrengung muß sie haben. Selbst körperliche oder geistige Ueberanstrengung wäre noch besser als Mangel an Beschäftigung. In diesen Jahren braucht man starke Nahrung, und

Ruth braucht sie am meisten.«

»Siehst du; was sage ich immer?« fiel die Tante ein, und nickte ihrem Mann bedeutsam zu; »ich sage immer: man läßt sie viel zu viel gewähren. Aber du hast das immer am bequemsten gefunden.«

»Lieber Gott! was wolltest du denn auch mit solchem kleinen Frauenzimmer anfangen,« versetzte der Onkel begütigend, »man konnte sie doch nicht etwa anstellen, Stuben zu scheuern?«

»Nein, weißt du, lieber Louis! das brauchst du mir wirklich nicht vorzuhalten, -- es ist ja gerade, als ob ich Ruth Dinge verrichten ließe, die sich nur für den niedersten Dienstboten schicken!« sagte seine Frau, die scherzende Uebertreibung unerbittlich ernst nehmend, »aber ein wenig sich im Häuslichen umsehen, -- das hätte Ruth ganz wohl können. Liuba wird ja auch dazu angehalten. Es ist doch nun einmal der Beruf der Frau.«

Erik betrachtete mit schlecht verhehltem Spott in den Augen die große, stattliche Erscheinung der Tante, an der es ihm charakteristisch für ihr ganzes Wesen vorkam, daß die ihr gewohnten guten Formen des äußeren Benehmens einen gewissen Mangel an natürlicher Grazie nicht verdecken konnten.

»Was das anbetrifft,« unterbrach er sie ungeduldig, »so brauchen Sie sich dieser Versäumnis wegen nicht weiter anzuklagen. In einem so von allen Seiten bedienten Hause bleibt die sogenannte ›häusliche Hilfe‹, bestehe sie nun im Blumenbegießen oder Kaffeekochen, im besten Fall eine gleichgültige Spielerei, -- im schlimmern Fall weckt sie die Einbildung, man habe etwas geleistet. Dagegen hätte ich gegen das Stubenscheuern nicht viel einzuwenden.«

Der Onkel lachte erfreut auf. »Jetzt haben Sie es aber mit meiner Frau gründlich verdorben!« drohte er scherzend, »aber ich muß bekennen, daß ich gar nicht begreife, warum sie alle beide so versessen darauf sind, Ruth ins Joch zu spannen. Natürlich habe ich nicht das Geringste gegen den Unterricht, den Sie vorhin als wünschenswert vorschlugen, -- im Gegenteil, es freut mich für die Kleine. Aber ich möchte Sie doch bitten, das mit dem Stubenscheuern auch nicht einmal symbolisch auszuführen. Nicht ins Geistige zu übertragen. Machen Sie es nur nicht zu ernsthaft. Ruth ist es so gewohnt, umherzulaufen und in ihrer Faulheit vergnügt zu sein.«

»Ich glaube, Sie täuschen sich,« entgegnete Erik in bestimmtem Ton, »Ruth ist weder faul noch vergnügt. Sie ist es gewohnt, sich in einem selbstgemachten Traumdasein vollständig zu erschöpfen. Sie ist dadurch zum Teil ihrem Alter vorausgeeilt, zum Teil aber auch hinter ihrem Alter zurückgeblieben. Ich habe noch nie eine so ungleiche Entwicklung gesehen. Wenn dieselbe nicht rechtzeitig aufgehalten wird, so läuft Ruth Gefahr, an ihrer Phantasie geistig zu erkranken.«

Der Onkel schüttelte verwundert den Kopf.

»Das ist doch kurios,« sagte er, »ich habe Ruth stets für ein höchst praktisches kleines Frauenzimmer gehalten. Von Phantasie war doch nie eine Spur an ihr zu bemerken. Alles was sie sagt, ist ja so direkt und nüchtern. Und am liebsten sagt sie gar nichts. Sie sollten nur wissen, wie nüchtern sie in allem ist, wo die jungen Mädchen sonst ihre Phantasie sitzen haben! Das hat mir stets so gut gefallen. Da kann Liuba gar nicht mitkommen.«

Seine Frau sah ihn verletzt an.

»Glücklicherweise nicht!« bestätigte sie etwas erregt, »Liuba würde nicht umhergehen, wie in einen grauen Sack gekleidet, bloß weil es so am bequemsten ist. Und überhaupt, -- denken Sie nur, neulich höre ich, wie meine Tochter zu Ruth sagt: ›paß nur auf; wenn du ein Jahr älter bist, dann wirst du schon wissen, was schön und häßlich ist, und wirst am Spiegel fragen: Wie gefall' ich ihm?‹ -- -- Mein Gott, Sie wissen ja, wie junge Mädchen so untereinander reden! Aber was antwortet Ruth darauf? Sie lacht nur, und dann fragt sie erstaunt: ›Warum nicht lieber: wie gefällt er mir?‹«

In diesem Augenblick ging die Thür auf, und Ruth trat ein.

Sie kam aus ihrem Zimmer, ohne eine Ahnung, daß sie Besuch vorfinden würde. Als sie so unerwartet Erik erblickte, fuhr sie zurück und wurde glühend rot. Diese plötzliche Anwesenheit seiner Person inmitten der Ihrigen, die ihr so fern standen, -- die unerwünschte Vermischung eines sie ganz erfüllenden Bildes mit der Umgebung, die sie mied und floh, machte einen ganz seltsamen Eindruck auf sie. Etwa so, wie wenn eine Traumgestalt aus herrlichen Phantasien ins wirkliche Leben niedersteigt, um ein banales Gespräch zu führen; -- etwa so, wie wenn man das Intimste, was nicht einmal Worte besitzt, in die Sprache des Pöbels übersetzt findet.

Daß Erik herkommen, daß er sich überhaupt mit ihren Verwandten auseinandersetzen mußte, das fiel ihr nicht im geringsten ein. Er hätte das schon so einrichten müssen, daß es eine Angelegenheit aus einer andern Welt -- aus ~ihrer~ Welt blieb. Lieber noch wäre sie dann des Nachts, heimlich, und auf bloßen Füßen bis zu ihm hingelaufen.

Entsetzlich rot und linkisch sah sie aus, wie sie sich da, verlegen und mit scheuem Gesicht, in die Thürspalte drückte. Aber nicht Verlegenheit empfand sie, sondern eine unentwirrbare Mischung von Zorn und Scham, -- Scham darüber, daß etwas Zartes, ihr Zugehöriges, vor fremden Augen herumgezeigt und besprochen wurde.

»Nun, Ruth, benimmt man sich so?« bemerkte die Tante verweisend, »kannst du nicht näher kommen?«

Da that sie etwas Wunderliches. Sie hob beide Hände vor die Augen, und so, mit scheuklappenartig verdecktem Gesicht, ging sie, wie ein Kind, das sich vor fremden Gästen fürchtet, durch das Zimmer bis vor den geschnitzten, runden Sofatisch, um den sie saßen.

Der Onkel lachte, seine Frau schüttelte mißbilligend den Kopf und sagte strafend: »Ein so großes Mädchen!«

Erik, der bei Ruths Eintreten den Kopf nach ihr gewandt hatte, blickte sie schweigend und aufmerksam an. Als sie dicht neben ihm stand, hob er die Hand und zog ihr die Hände vom Gesicht fort. »Warum willst du mich heute nicht ansehen, Ruth?« fragte er sie.

Sie antwortete nicht. Noch war sie sehr rot und hielt die Augen zu Boden gesenkt. Dieses »Du«, das er zu ihr sagte, und das sie gestern so dankbar hingerissen hatte, verletzte sie heute beinahe. Es klang ganz anders -- hier, an dieser Stelle, -- es klang wie die Anrede, die man einem Kinde gegenüber wählt, das unter lauter Erwachsenen dasteht. Ja, sie stand ihm und den andern ~gegenüber~, und sie verhandelten da über sie, als wäre sie verraten und verkauft, -- als handle es sich gar nicht um ihre -- ~ihre~ eigene, ~eigenste~ Angelegenheit.

Durch Erik fühlte sie sich verraten und verkauft.

»Sie lernen ja Ruth von einer liebenswürdigen Seite kennen,« meinte der Onkel, noch immer lächelnd, »aber sie ist nicht so schlimm, wie es aussieht. Was ist dir nur in die Krone gefahren, Kleine? Verlegen hab' ich dich noch nie gesehen.«

Erik, der sie unverwandt ansah, suchte jetzt die Aufmerksamkeit von ihr abzulenken.

»Wir wollen schon mit einander zurechtkommen,« sagte er mit warmer Stimme und wandte sich an den Onkel mit einer Frage wegen Tag und Stunde des geplanten Unterrichts.

Ruth stand teilnahmlos daneben, ohne die Wechselreden der andern zu beachten. Nur die Röte wich allmählich von ihrem Gesicht und machte einem Ausdruck verhaltener Traurigkeit und Enttäuschung Platz. Sie blickte nicht auf, sondern studierte eingehend das glänzende Muster des Parkettfußbodens.

Da, als Erik schon Miene machte, sich zu verabschieden, hörte sie ihren Onkel sagen: »Also, wenn es Ihnen wirklich kein zu großes Opfer ist, erwarten wir Sie jedesmal hier, am Nachmittag, nach Ihren Schulstunden!«

»Nein!« warf Ruth plötzlich laut dazwischen. Es war, als ob sie aufwachte. Erstaunt und blitzend gingen ihre Augen vom einen zum andern; »~hierher?~ das ist ja ein Irrtum. Ich werde hinauskommen.«

Alle sahen sie verwundert an, als sie das so kategorisch, ohne eine Spur von Befangenheit erklärte. Erik aber erhob sich rasch.

»Das ist am Ende wirklich das Bessere,« stimmte er ihr unwillkürlich bei, »und wenn Ruth den Weg nicht scheut und den Abend dann bei uns verbringen will, so wäre es in der That während dieser Sommertage vorzuziehen.«

Er sprach nicht mehr mit ganz der gleichen, überlegenen Sicherheit wie vorhin, sondern etwas hastig. Ein schwacher Reflex von dem, was Ruth so peinigend und störend an der Situation berührt hatte, schien jetzt auch auf ihn überzugehen, als ahne oder begriffe er plötzlich ihre zornige Scheu. Als er ihre Augen so vorwurfsvoll und mit einem unkindlichen, fast strengen Blick auf sich gerichtet sah, da kam es ihm selbst mit einemmal sonderbar vor, daß er sie anderswo um sich hatte haben wollen, als in seinem eigenen, stillen Zimmer, -- dort, wo sie zu ihm gekommen war. Beinahe hätte der Zufall es so gefügt. Aber sie ließ keinen Zufall zu. Klar und zwingend wie eine Vision stand vor ihren Augen, was sie sich ersehnt und erträumt hatte.

Während Erik mit ihrem Onkel das Zimmer verließ, und die Tante hinausging, blieb Ruth regungslos stehen, die Hände auf dem Rücken, den Kopf gebückt, wie immer, wenn etwas sie sehr beschäftigte. Im Flur hörte sie die Hausthür gehen, dann einen

raschen Schritt auf der steinernen Treppe. Darauf wurde es ganz still.

Sie sah das Zimmer wie durch einen Schleier, überschüttet von blendendem Sonnenlicht, das durch die hohen Blattgewächse und Palmengruppen in beiden Fensterecken hindurchschimmerte und an den vergoldeten Rahmen der Gemälde aufblitzte, die schon einen dünnen Tüllbezug gegen Staub und Licht erhalten hatten.

Ruth ging langsam auf den Stuhl zu, auf dem Erik vorhin gesessen hatte. Sie setzte sich hin, legte beide Arme auf den Tisch und den Kopf darauf.

Und dann fing sie an bitterlich zu weinen. --

Bei Tisch, zu Mittag, beobachtete der Onkel Ruth nachdenklich. Es hatte ihm so sehr imponiert, daß Erik alles zu ergründen schien, was in ihr vorging. Da saß sie nun so schweigsam. Freilich konnte man nicht wissen, woran sie dachte. Aber das konnte dieser Lehrer doch auch nicht. Er war doch kein Hellseher.

»Woran denkst du eigentlich den ganzen Tag?« fragte Onkel Louis plötzlich ärgerlich.

»Ich? An gar nichts!« versicherte sie mit einem verwunderten Blick.

»Aber an irgend etwas mußt du doch denken. Das thut ja jeder Mensch. Woran dachtest du zum Beispiel jetzt eben?«

»Jetzt eben dachte ich an Großpapa,« sagte Ruth.

Darüber freute sich ihr Onkel und sah sie freundlich an. Er hatte seinen Vater unendlich lieb gehabt.

»Du warst erst fünf Jahre, als deine Eltern starben, und du damals hierher kamst; erinnerst du dich denn seiner noch?«

Sie nickte, und vor ihrem Blick tauchte die erste ganz bewußte und deutliche Erinnerung aus ihrer Kindheit auf: eine Generalsuniform, ein schneeweißer, großer Schnurrbart, und darüber zwei gütige blaue Augen -- Kinderaugen eigentlich.

»Einmal hob er mich aus dem Bett -- er sah so schön aus, mit Bändern und Sternen, und blitzte über und über, -- und da kam seine brennende Cigarette an meinen bloßen Arm. Ich schrie sehr. Und da kamen ihm Thränen in die Augen -- aber wirkliche, große Thränen, so daß die Augen ganz voll davon standen. Und dann drückte er mich an sich und küßte mich, -- auf den Arm und den bloßen Hals und das Gesicht und den ganzen Körper. -- So war Großpapa. -- Jetzt würde ich mir gern den Arm abbrennen lassen, wenn er mich nur noch einmal so küssen wollte!« fügte sie wild hinzu.

Man sah, wie es in ihr gärte. Großpapas Zärtlichkeit hatte sie nie vergessen können.

»Hast du Bilder und Andenken von ihm?« fragte der Onkel und dachte darüber nach, was er ihr schenken könnte.

Sie schüttelte den Kopf.

»Keine Bilder. Nur ein Knallbonbon. Das brachte er mir einmal vom Kaiser mit. Von einem Galadiner. Ich glaubte so bestimmt, es müßten goldene Kleider drin sein. Aber Großpapa meinte, es wären nur Kleider von dünnem Seidenpapier mit einem kleinen Rand von Flittergold. Da habe ich das Bonbon lieber nicht knallen lassen. Ich habe es noch. -- Und so sind eigentlich noch immer goldene Kleider drin.«

Dem Onkel kam ein Lächeln. Erik imponierte ihm lange nicht mehr so sehr. Großpapas Küsse, Knallbonbons, goldene Kleider und Kleider aus Seidenpapier -- das waren doch sicherlich normale und harmlose Phantasien eines Kinderkopfes. --

Als Ruth am nächsten Nachmittag zu ihrer ersten Unterrichtsstunde fortging, zupfte Onkel Louis sie tröstend am Ohrläppchen und raunte ihr zu: »Du! wenn du ihm weglaufen solltest, so nehme ich dich in Schutz!« --

Aber als Ruth diesmal am Gartenzaun des Landhauses stand, kam ihr nicht, wie neulich, der Gedanke an Weglaufen. Sie zauderte auch nicht mehr so lange einzutreten, sondern stieß die Pforte auf und ging geradeaus -- nicht hinten die Terrasse hinauf und in das Haus, sondern weiter, in die Tiefe des Gartens, der sie das erste Mal so gelockt hatte.

Dort stand Jonas bei den Obstbaumgruppen, emsig beschäftigt, Raupen zwischen den kleinen Blättern herauszusuchen. Eigentlich waren noch gar keine Raupen da. Aber er konnte es nicht erwarten, sie abzulesen.

Als er Ruth herankommen sah, riß er den breitrandigen Strohhut vom Kopf und machte ein verlegenes Gesicht, denn der Sonnenwärme wegen hatte er die Jacke abgeworfen.

»Papa ist im Hause!« bemerkte er diensteifrig und bückte sich nach seiner Jacke, die auf dem Rasen lag.

»Ja! Er stand am Fenster,« bestätigte Ruth, und lehnte sich gegen den dicken Stamm einer alten Ulme.

Daraus wußte er nichts zu entgegnen, und so schwiegen sie beide einige Augenblicke.

»Wie wunderschön!« sagte Ruth dann, ganz in ihren Frühling versunken, und breitete beide Arme nach den mächtigen, leise schwankenden Aesten empor, die über ihr rauschten.

Jonas sah angestrengt in die Höhe, gewahrte aber nichts.

»Wo ist das schöne?« fragte er verwundert.

»Diese kleinen, drolligen Ulmenblätter! Die andern Bäume haben schon viel größere Blätter. Aber diese sitzen noch so zusammengedrückt in den Knospen -- und alle miteinander an den Zweigspitzen, -- als getrauten sie sich nicht. Oder als guckten sie frierend nach den braunen, klebrigen Hülsen, die sie schon heruntergeworfen haben. Sieht es nicht aus, als wären sie in lauter kleinen Sträußchen auf dem Baum verstreut? Es sieht aus, als wären sie ihm nur so angeflogen. Und als könnten sie wieder wegfliegen.«

»Sie fliegen aber nicht weg,« versicherte Jonas und wandte sich wieder seinen vermeintlichen Raupen zu.

»Nein. Nur diese hier thun es,« bemerkte Ruth und streckte ihre Hand gegen den Kirschbaum aus, von dem unter Jonas' unvorsichtiger Berührung die zarten Blütenblätter auf ihren Arm niederschwebten.

»Dies hier sind gute Kirschen. Hoffentlich von den roten, durchsichtigen,« meinte Jonas, »denn die esse ich am liebsten. Sonst haben wir fast nur Apfelbäume und gewöhnliche Holzbirnen.«

»Sie sehen ebenso schön aus,« entgegnete Ruth; »wenn man am Gitter steht, sieht es aus wie ein Märchen. Aber später werden sie so grün und natürlich wie die andern Bäume. Nur kleiner.«

»Das muß so sein,« erklärte Jonas gleichmütig, »sonst würde der Rasenplatz ja niemals rechten Schatten kriegen. Und der ist das Beste vom Sommer. Denn gerade hier, am Springbrunnen unter den Obstbäumen, liegt meine Mutter im Ruhestuhl. Und sie kann die viele Sonne nicht vertragen.«

Ruth sah ihn mit Interesse an. Es kam ihr als etwas Besonderes vor, daß er sich seiner kranken Mutter wegen über die Bäume und den Schatten freute und die grünen Blätter besser fand, als all die wunderschönen weißen Blüten. Die Schulmädchen, die sie kannte, besaßen zwar meistenteils auch Mütter, aber die pflegten gesund zu sein, und nie hatte sie gehört, daß sie sich derentwegen auf den Sommer freuten, sondern immer nur wegen der Ferien. Und dann waren es Mädchen. Dies hier aber war ein Junge.

Sie betrachtete Jonas genauer, und er gefiel ihr sehr gut. Und auch er sah jeden Augenblick zu ihr hinüber, und auch sie gefiel ihm über die Maßen.

»Ist sie sehr krank?« fragte sie nach einer Weile zaghaft.

»Nicht sehr. Sie kann nur nicht aufstehen, -- schon viele Jahre nicht;« belehrte er sie, »wenn sie das thun will, dann nimmt Papa sie in die Arme und trägt sie. Das kann er so prachtvoll. Manchmal hat sie auch Schmerzen, und weint. Und dann muß Papa immer bei ihr sein, und das hilft ihr.«

Ruth wandte unwillkürlich den Kopf dem Hause zu, wo die kranke Frau lag, und wo er war, der sie trug, und der ihr half, wenn sie Schmerzen hatte.

»Hinter diesem Fenster,« sagte Jonas und wies mit der Hand über die Terrasse nach dem Wohnzimmer; »da ist eben ihr Stuhl der Sonne wegen hineingetragen worden.«

Aber im breiten Rahmen des geöffneten Fensters war nur Eriks Gestalt zu sehen, der ihnen den Rücken zukehrte. Und nun wandte er sich langsam um.

Ruth löste sich ein wenig hastig vom Stamm, an dem sie lehnte. »Jetzt will ich hineingehen,« sagte sie.

Nachdem Erik von der Straßenseite her Ruth in den Garten hatte treten sehen, war er wirklich an das Fenster des Wohnzimmers gegangen und hatte von Zeit zu Zeit nach der Obstbaumgruppe hinübergeblickt, wo sie mit Jonas stand und plauderte.

Klare-Bel lag neben dem Fenster, mit einer mühsamen und kunstvollen Handarbeit beschäftigt, die darin bestand, an einer schadhaft gewordenen Damastserviette das Muster nachzuziehen. Man nannte diese Arbeit in Holland »Maazen«. Und wer es ernst damit nahm, der wollte das »Maazen« bis auf das Ausbessern der Strümpfe und Unterjacken erstreckt wissen.

»Kommt Ruth noch immer nicht herein?« fragte sie nach einer langen Pause.

Er zog die Uhr.

»Nein. Noch fehlen einige Minuten an der Zeit,« bemerkte er einsilbig.

»Das ist doch eigentlich kein Grund, nicht hereinzukommen, wenn sie einmal da ist. Aber vielleicht steht sie viel lieber im Garten und plaudert mit Jonas, als daß sie im Zimmer sitzt und lernt, Erik. Das ist am Ende auch ganz natürlich.«

Er schwieg und blickte mit einem Ausdruck von Ungeduld auf ihre Handarbeit nieder. Erik konnte das »Maazen« nicht leiden. Er behauptete, es verdürbe die Augen, und sogar den Charakter.

»Bitte, hör' jetzt einen Augenblick mit dem Sticheln auf,« sagte er und nahm ihr einfach die Nadel aus der Hand, »ich weiß nicht, -- das Zeug macht nervös.«

Dann sah er aber doch wieder auf die Uhr.

Ihm war die Ahnung gekommen, daß es doch nicht so ganz von selbst gelingen werde, bestimmende Macht über Ruth zu gewinnen, wie er es sich an jenem wundersamen Maiabend gedacht. Sie wollte durch keine unerwartete oder unerwünschte Bewegung seinerseits in ihrem selbständigen Traumleben gestört werden, und erhob sie ihn auch zum Helden ihrer »allerschönsten Märchengeschichte«, so mußte er sich dabei doch ganz still verhalten und auf alle ihre Intentionen eingehen, -- sonst entglitt sie ihm leise wieder, so leise und traumhaft, wie sie in sein Leben gekommen war.

Das durfte nicht sein; der Erzieher in ihm litt es nicht, daß ihm mißlinge, was er sich mit Ruth vorgenommen hatte. Er wußte: er würde nicht eher ruhen, als bis er ihren Willen ganz in der Hand hielte. Aber welch eine zarte Hand wollte er dann für sie haben!

Neben diesen pädagogischen Erwägungen erfüllte ihn eine ungeduldige Freude. Freude über den Kampf, der ihm mit Ruth bevorstand. Erik, der andre weit besser zu erforschen verstand, als sich selbst, ahnte gar nicht, wie stark sich unter dem Deckmantel des Pädagogen ein jugendliches, herrschsüchtiges Verlangen in ihm regte.

Er wandte sich dem Garten zu.

»Jetzt kommt sie!« sagte er, und wirklich, es klang wie ein Seufzer der Erleichterung.

Seine Frau unterdrückte ein Lächeln und nahm ihre Arbeit wieder auf. »Nun, viel Erfolg, Erik! Vergiß nur nicht, daß wir um neun Uhr den Thee nehmen. Du wirst sie hungrig und durstig machen, denke ich mir.«

Er war über den Flur in seine Arbeitsstube gegangen und öffnete schon von innen her die Thür, als Ruth kam und anklopfen wollte.

»Endlich!« bemerkte er, während sie eintrat, »weißt du, Ruth, was meine Frau soeben meinte? Sie meinte, du seiest gewiß viel lieber mit Jonas draußen im Garten, als bei mir hier in der Stube. Was sagst du dazu?«

Sie blickte ihn unsicher an und setzte sich auf seinen Wink in den Ledersessel, der am Fenster stand. Dann erwiderte sie mit niedergeschlagenen Augen: »Ich bin doch gekommen, weil ich wollte, -- nur weil ich's wollte. Daß Jonas auch hier ist, wußte ich doch gar nicht. Das ist ja nur Zufall. Den fand ich hier.«

Er wußte nicht gleich, was ihn an der Antwort, die keine war, überraschte. Sie betonte ausschließlich, daß sie ganz aus freien Stücken hier sei. Auf einen Vergleich ließ sie sich vorsichtshalber gar nicht ein.

»Wenn es in der Folge nur nicht umgekehrt kommt, mein liebes Kind,« sagte er, an seinen Schreibtisch tretend, und legte einige Hefte und Bücher zurecht, »denn mit Jonas plaudern oder im Garten umhergehen wirst du ja in der Folge nur, wenn du ›willst‹, das

heißt, wenn Stimmung und Laune dir zufällig danach stehen. Hier hingegen, wo du freiwillig hergekommen bist, kann es doch nicht ganz so bleiben. Hier wird dich notwendigerweise etwas fest Bestimmtes erwarten, das vom Augenblick und seinen Stimmungen unabhängig ist. Also auch etwas, wovon du manchmal denken wirst: ›ganz so möchte ich's nicht, -- ganz so meinte ich's nicht, -- dies da soll anders sein, -- das da soll heute nicht da sein‹. Ist es nicht so?«

Sie schwieg hartnäckig und machte ein verschlossenes Gesicht. Es war ihr wirklich ungefähr das durch den Kopf gegangen, was er da sagte. Aber daß er das wissen konnte, kam ihr sehr unangenehm vor.

Er blieb bei ihr stehen und nahm ihr die Wollmütze, die sie aufbehalten hatte, vom Haar.

»Nun, Ruth, gestern hast du mich nicht ansehen wollen, und heute willst du mich nicht anreden. Hältst du so unsern Vertrag? Und ich hoffte bestimmt, daß du mir viel erzählen würdest. Viel -- alles. Alle deine schönsten Geschichten.«

»Nein,« erklärte Ruth, »nie und nimmer. Ich will nichts erzählen. Ich will alles für mich allein behalten.«

»Du Geizhals!« sagte er und lachte, »das ist sehr schlimm. Ist es nicht schlimm, wenn man einen zu Gaste geladen hat und dann die Hausthüre vor ihm zuschlägt? Aber zum Glück kannst du das gar nicht mehr, Ruth. Hast du mir nicht deine Geschichten geschenkt? Hast du das vergessen? Nun sind sie mein Eigentum. Ich kann mit ihnen machen, was ich will. Ich kann sie dir aus dem Kopf herausnehmen und für mich ganz allein behalten.«

»Ach nein!« fiel sie etwas lebhafter ein und griff unwillkürlich nach ihrem Kopf, »das geht ja gar nicht. Es geht nicht, wenn ich nicht will.«

»Du spricht so viel von deinem Willen, Ruth. Und daß du nur hier bist, weil du gerade willst. Aber weißt du denn eigentlich auch, ~wozu~ du es willst?«

Sie stutzte und blickte auf. Als sie nicht gleich eine Antwort fand, fügte er hinzu: »Ich weiß es für dich: du wolltest eben diesen Willen klären und erziehen lassen von jemand, der dich lieb genug dazu hat. Alles Lernen ist nur ein Mittel dazu.«

Ruth legte ihre Hände an die Seitenlehnen des Sessels, und ihr Gesicht wurde noch ablehnender. »Wie wenn sie ein Visier vorgelegt hätte!« dachte Erik, sie betrachtend. Aber hinter diesem Visier arbeitete eine steigende Erregung in ihr. Die passive Stimmung, in der sie heute hergekommen war, hielt unter Eriks Andrängen nicht stand, aber noch weniger vermochte sie den Traum und das seltsame Glück des ersten Abends wieder zu erhaschen. Sie verschloß und verbarg sich daher instinktiv vor ihm, wie vor einer Macht, die man sich erst genau ansehen muß, ehe man sich mit ihr einläßt.

»Alles ist heute anders!« murmelte sie.

»Es wird immer anders sein, als du es dir willkürlich ausmalst,« entgegnete er in ruhigem Ton, »und das soll es auch, Ruth! Es soll zu ernst sein für ein bloßes Spiel der Phantasie. Siehst du, auch ich habe mir etwas Schönes ersonnen und geträumt, das ich in dir verwirklicht sehen möchte. Ich versprach dir doch: für die Geschichten, die du mir ~erzählen~ wolltest, solltest du eine durch mich ~erleben~. Die Allerschönste -- sagtest du nicht so? Mit dem Erzählen mußt du es nun halten, wie du willst, aber mit dem Erleben wirst du es halten, wie ich will. Es war mein Geschenk für dich. Und wenn du heute auch nichts davon wissen willst, so wirst du es doch trotzdem annehmen müssen.«

Ruth wurde unruhig. Sie kannte nur zwei Sorten Menschen, und daß sie Erik in keiner von beiden unterbringen konnte, ängstigte sie. Die eine Sorte bestand aus ihrer jeweiligen täglichen Umgebung, die ihr meistens störend oder gleichgültig war und wirkungslos an ihr abglitt; die andre bestand aus den fremden Menschen, die sie, wie Schattenbilder, aus der Ferne betrachtete, und denen sie die äußere Anregung zu ihren Phantastereien entnahm. Zu denen konnte Erik nicht gehören, denn die thaten nur, was sie wollte, -- sie ~waren~ ja nur, was sie wollte. Er hingegen war eine Wirklichkeit, die auf sie eindrang. Sie konnte ihn aber auch nicht abwehren, wie sie die Ihrigen von sich abwehrte, denn es war etwas da, was sie mächtiger reizte und anregte, als es alle Schattenbilder zusammen gethan.

Sie sah ihn scheu an.

»Ich will lieber ein andres Mal kommen,« bat sie leise, »ich kann heute nicht lernen. Ich kann's nicht.«

»Doch! doch!« entgegnete er beschwichtigend, »du kannst es. Und im Grunde willst du es auch. Aber wir können nicht in jedem Augenblick den Kampf darum von neuem aufnehmen. Der muß ein für allemal entschieden werden. Du oder ich, Ruth! Einer von

uns beiden muß gehorchen.«

Da sprang Ruth plötzlich auf und sagte undeutlich: »Dann kann ich auch fortbleiben.«

Es war ihr ganz spontan, wider alle Ueberlegung, entfahren. Aber nun half es nichts. Nun war es heraus.

Erik sah, wie sie ganz blaß und über sich selbst erschrocken dastand, und ein heftiges Mitleid mit ihr erfaßte ihn. Ihm kam es vor, als habe er sie mißhandelt, und sein Blick wurde sehr weich.

Aber er dachte nicht daran, dieser weichen Regung nachzugeben. Er wünschte, die entscheidende Situation so scharf als möglich zum Austrag zu bringen. Am Gelingen zweifelte er nicht. Und voll Freude fühlte er: war es erst überstanden, so konnte er alle Strenge in die Rumpelkammer werfen. Dann war er Ruths für alle -- alle Zeit sicher.

»Gewiß kannst du fortbleiben,« bestätigte er ruhig, »wenn es sich für dich wirklich nicht um mehr gehandelt hat, als um einen solchen Zeitvertreib, wie ihr ihn unter euch im Schulhof treibt. Weißt du noch, was du von dem Fremden sagtest, den ihr in euer kindisches Spiel hereingezogen habt? ›Wenn er mir nicht gepaßt hätte, wenn er aus der Rolle gefallen wäre, die ich ihm zugewiesen, dann hätte ich mir einfach einen andern suchen müssen, -- ich hätte die Augen zugemacht und wäre fortgelaufen.‹ Ist es hiermit ebenso oder auch nur annähernd so, -- -- dann laufe nur fort.«

Während er sprach, fühlte er beständig das große Mitleid. Sie sah nur ein einziges Mal auf, und wie sie seinem weichen Blick begegnete, da war es, als ginge ihre passive Abwehr in eine Art von Angriff über, -- als suche sie nach einer Waffe, nach irgend etwas, was sie von ihrem Leiden befreien, ihm weh thun und ihr Macht geben könne. Ihm fielen die Worte ein, die sie vom Fremden gebraucht hatte: »Ich brauchte ihn eben, und da nahm ich ihn mir!«

Ruth langte nach ihrer Wollmütze, die auf dem Schreibtisch lag, und drückte sie zwecklos in den Händen zusammen.

»Ich will nach Hause gehen!« wiederholte sie, und zitterte am ganzen Leibe.

»Wie du willst.«

»Also adieu,« sagte sie, und ging langsam, wie gelähmt, der Thüre zu.

»Adieu, mein Kind.«

Sie hatte Mühe, den Thürgriff zu finden und niederzudrücken, ihre Hände waren kalt und gehorchten ihr nicht. Als aber die Thür offen stand, und sie in den Flur hinaustrat, da blickte sie beim Schließen der Thür mit brennenden Augen ins Zimmer zurück.

Erik saß auf dem von ihr verlassenen Ledersessel am Fenster. Er hatte den rechten Arm auf die Lehne desselben gestützt und die Hand über die Augen gelegt.

Und plötzlich überfiel Ruth das Bewußtsein: daß all sein Herrschenwollen im Grunde doch nur ein Dienenwollen sei. Plötzlich überfiel es sie: daß er eben jetzt leide, -- um sie leide, die ihn verletzt hatte.

Es traf sie mit einem Schmerzgefühl, aber dieses Gefühl war seltsam und berauschend; es lag Triumph darin. Es war ein Schmerz, der sich wie ein Glück anfühlte.

Noch immer zitterte sie am ganzen Körper, aber nicht mehr in der Angst der Flucht. Sie hatte mitten in der Angst ihrer Flucht Halt gemacht, sich gegen den Feind gekehrt und ihn besiegt gesehen.

Wer Ruth über den Flur gehen sah, der konnte meinen, sie sei trunken. --

Um neun Uhr -- Gonne hatte bereits den Thee und die gerösteten Brotschnittchen auf den Tisch gebracht -- kam Erik endlich in das Wohnzimmer herüber.

»Es ist doch nichts vorgefallen?« fragte seine Frau mit einem Blick in sein Gesicht, »Ruth ist ja schon so bald fortgegangen. Und ich dachte doch, daß sie mit uns bleiben sollte?«

»Für heute war es besser so,« versetzte er, und Klare-Bel fragte nicht weiter.

Aber Jonas that es statt ihrer.

»Ruth habe ich ganz ungeheuer gern,« versicherte er, »kommt sie bald wieder her, Papa?«

»Bald!« sagte dieser.

»Denke dir nur, sie wollte es mir nicht sagen,« plauderte Jonas weiter, »ich habe sie nämlich noch im Garten gesprochen, wie sie fortging. Da sah sie so kurios aus, Papa, ihre Augen waren so groß und glänzten so, -- sie sah aus, als ob sie gerade was geschenkt bekommen hätte.«

»Was geschenkt?« wiederholte Erik, und setzte das Theeglas, das er zum Munde führen wollte, hart auf das Tischtuch nieder.

»Ja, ganz gewiß, gerade so sah sie aus. Aber sie antwortete mir nicht, und dann, am Gitter, da bat sie mich um ein Glas Wasser.«

»Es ist ihr doch nicht unwohl geworden?« fragte Klare-Bel besorgt.

»Nein, aber sie zitterte ordentlich. Das Wasser habe ich ihr vom Brunnen geholt. Und dann ist sie fortgegangen. -- Ich habe ihr aber noch lange nachgesehen,« fügte Jonas hinzu.

»Gewiß warst du zu streng mit ihr, Erik,« sagte Klare-Bel, »ich konnte es dir schon ansehen, wie du hinübergingst.«

»Zu streng? Aber, Bel, dann sieht man doch nicht aus, als ob man etwas geschenkt bekommen hätte.«

Er sprach in leichtem Ton, doch beschämte ihn, was Jonas erzählt hatte. Es war etwas Neues, Unerwartetes, worin er sich nicht gleich zurechtfinden konnte. Daß sie trotzte und selbst, daß sie weglief, begriff er ganz gut und rechnete damit. Aber dies hier begriff er nicht. War es denn möglich, daß sie gern, -- mit Freude, fortging? -- -- Und daß sie nicht wiederkam? -- --

Während sie noch beim Thee saßen, zog draußen ein schweres Gewitter heraus. Klare-Bel blickte ängstlich nach dem Fenster, durch das man die dunkle, schwarzgelbe Wolkenbank am Himmel stehen sah. Ein Sturmwind fuhr durch die Baumkronen, schüttelte und beugte sie; der Tagesschein, den die lange Maihelle noch über den Garten gebreitet hatte, verschwand unvermittelt. Und gleich darauf prasselte, unter grellzuckenden Blitzen und gewaltigen Donnerschlägen, ein heftiger Platzregen nieder.

»Bitte, laßt doch die Fenster schließen! bitte, Jonas, iß nicht mehr! Ach, Erik, der Donner!« sagte Klare-Bel, die vor jedem Blitz die Augen schloß.

Erik stand auf, blieb einen Augenblick am Fenster stehen und schaute in den Aufruhr hinaus, dann schloß er es und kehrte zu seiner Frau zurück. Die Gewitterangst war etwas, das sie überkommen hatte, seitdem sie hilflos dalag. Als junge Frau kannte sie dergleichen nicht, und Erik würde es an ihr auch wohl nicht geduldet haben. Jetzt hatte er Geduld damit.

»Wenn man eine Lampe anzünden könnte! Es ist so dunkel geworden auf einmal. Und dann ist der Blitz so furchtbar hell, Erik!«

»Gonne braucht keine Lampe hereinzubringen,« erwiderte er lächelnd und legte seine Hand über ihre Augen; »bist du nun nicht geborgen, Bel?«

Sie nickte dankbar und drückte ihr Gesicht gegen seine Hände.

Es war ein arges Gewitter. Unaufhörlich folgten sich Blitz und Schlag. Auf Augenblicke sah der Garten aus wie unter bengalischer Beleuchtung, und im bläulichen Scheine konnte man die vom Sturm losgerissenen Blätter und Blüten in tollem Wirbel durcheinander fliegen sehen.

Wenn der Donner besonders gellend krachte, fuhr Klare-Bel jedesmal zusammen.

»Ob Ruth wohl schon zu Hause war, ehe es losging?« fragte sie.

»Längst. Sie muß zu Hause gewesen sein, ehe wir uns zu Tisch setzten,« beruhigte er sie, »und der Diener wird sich freuen, daß er sie bei diesem Unwetter nicht zu holen braucht.«

Es währte noch eine ganze Weile, ehe Blitz und Sturm auch nur ein wenig nachließen, und der grobkörnige Regen mit schwächerem Ton auf das Dach niedertrommelte.

»Nun, Bel, jetzt wird es besser,« sagte Erik und nahm seine Hand von ihrem Gesicht. Er öffnete wieder das Fenster, durch das die abgekühlte Abendluft jetzt frisch und gewürzig hereinströmte.

Jonas stand vor dem Fenster auf der regenumsprühten Terrasse und blickte, über deren Brüstung gebeugt, in den verwüsteten Garten hinaus. Ein großer Ulmenast war quer über den Kiesweg gestürzt, die Obstblüte hatte den Aufruhr in der Natur mit dem Leben bezahlen müssen.

»Nun sind sie wahrhaftig davongeflogen, alle mit einemmal, die weißen Blüten,« rief Jonas bedauernd, »so wie Ruth es gesagt hat! wie leid wird es ihr thun. Sie fand sie so schön. Aber dort oben wird es schon wieder blau, Papa.«

»Gott sei Dank!« meinte Klare-Bel, »solche Aufregung und Verwirrung draußen ist schrecklich. Man wird förmlich mit hingerissen.«

»Ja, das ist nichts mehr für dich, meine Arme,« sagte Erik, »es gab aber Zeiten, wo du solche Gewitterstürme und dazu das Brüllen des Meeren aushalten mußtest, ohne daß ich bei dir war.«

»Das war auch entsetzlich, Erik, ganz entsetzlich war es,« versicherte sie zusammenschaudernd, »damals, als du mit den Leuten hinausfuhrst, wenn ein Schiff in Gefahr war. Und das eine Mal, weißt du, wo du ganz allein es warst, der den Niels und die andern dazu beredete. Denn die hatten ja auch Frau und Kind. Aber das hast du immer so gut gekonnt: die Leute bereden. ›Es wird gehen!‹ sagtest du ihnen, und da glaubten sie dir.«

»Du glaubtest mir ja auch, Bel, wenn du allein Zurückbleiben mußtest, und wenn es dir schien, als ginge das nicht.«

»Ja, Erik. Manchmal dachte ich, der Schreck würde mich töten. Aber dann sagtest du so zuversichtlich: ›Wenn ich nach Hause komme, naß und müde, Bel, dann muß ich da doch meine Frau finden und den kleinen Jungen, und beide vergnügt und gesund.‹ Nun, und da mußte es wohl so sein.«

Er schwieg. Vor seinem Blick stand eine Sturmnacht, in welcher er, aus wirklicher Lebensgefahr heimkehrend, seine Frau gefunden hatte, wie sie, das Kind neben sich, mitten in der kleinen Stube auf den Knieen lag und laut betete.

Einen Augenblick lang war er fast bestürzt auf der Schwelle stehen geblieben, denn noch nie hatte er sie beten sehen. Als sie heirateten, waren ihm unter ihren Sachen ein paar Andachtsbücher in die Hände gefallen, und wie sie ihn darin blättern sah, fragte sie ihn: »Glaubst du an das, was darin steht?« Er hatte mit ernsten Augen aufgeblickt und geantwortet: »Nein, Bel.« Seitdem war dieser Gegenstand nur noch ein einziges Mal, nach Jahren, im Gespräche wieder berührt worden, und da war es ihm mit innerem Staunen aufgegangen, daß seine Frau, ohne es auch nur selbst recht zu merken, ihren Glauben gar nicht mehr besaß. Auf seine Frage, wie denn das geschehen sei, hatte sie mit ihrem freundlichen Gleichmut verwundert erwidert: »Ja, Erik, wenn es doch gar nicht so ~ist~, -- was kann es dann noch nützen, daran zu glauben?«

Und als er nun in jener Sturmnacht in seinen hohen Schifferstiefeln und seinem nassen Wollwams hereintrat, da hörte sie auf zu beten und streckte ihm mit einem Freudenschrei beide Arme entgegen. Er hob sie von den Knieen auf und küßte sie. »Thust du ~das~, Bel, wenn ich nicht bei dir bin?« fragte er sie leise.

»Wenn du nicht bei mir bist, Erik!« sagte sie weinend, »denn dann, scheint mir immer, muß ich es thun!«

Damals trug sie sich mit dem zweiten Kinde. Kurz darauf that sie den gefährlichen Sturz, der ihr die Gesundheit kostete, und das Kindchen wurde tot geboren.

Als Gonne mit einer brennenden Lampe hereinkam, fuhr Erik aus seinen Gedanken auf.

»Ich möchte jetzt zu mir hinübergehen,« bemerkte er und küßte seine Frau auf die Stirn, »ich habe noch Schularbeiten für morgen. Sobald du müde wirst, mußt du mich rufen lassen.«

Bei Erik im Zimmer war es schon fast dunkel. Nur von ein paar rosenroten Wölkchen, die sich von der großen Wolkenmasse losgewunden hatten und nun mit heiterm Leuchten selbständig auf einem breiten Stück Himmelsblau herumschwammen, fiel ein schwacher Schein durch die Fenster. Man konnte in ihm den Schreibtisch, den Bücherschrank, das alte lederbezogene Sofa an der Längswand ziemlich deutlich erkennen.

Erik stutzte und blieb auf der Schwelle stehen.

Er hatte einen Augenblick klar zu sehen geglaubt, daß auf dem Ledersessel am Fenster Ruth säße. An Halluzinationen konnte er doch nicht leiden.

Mit einem Gefühl des Aergers über sich selbst schloß er hinter sich die Thür und ergriff von einem Nebentisch einen Leuchter, um Licht zu machen.

Da fuhr er zusammen und setzte den Leuchter wieder hin. Auf dem Sessel saß wirklich jemand.

»Ich bin es!« sagte eine klägliche Stimme.

»Ruth!« rief er laut.

Sie war es. Durchnäßt bis auf die Haut, in Kleidern, von denen das Wasser schwer auf den Fußboden herabtropfte, und die an einer Seite zerrissen niederhingen. Ihre Zähne schlugen hörbar aneinander.

Erik hatte sie in seine Arme gerissen und betastete sie besorgt und erregt, mit liebkosenden Händen, -- Brust und Arme und das verworrene Haar, das so eng und feucht um ihr kaltes Gesichtchen klebte.

»Wann -- wann, -- von wo bist du gekommen? Warst du denn nicht zu Hause?«

»Ich war nicht zu Hause,« sagte sie zaghaft und schmiegte sich frostbebend an ihn; »ich bin vom Stadtbahnhof wieder zurückgefahren. Und hergelaufen. Gerade als es losging. Ich will nicht nach Hause,« fügte sie flehend hinzu, »mich friert so!«

»Mein Liebling, du sollst nicht nach Hause! Du sollst hier bleiben! Aber wie lange mußt du hier schon sitzen? Wie konntest du das nur thun? Und es hat dich doch niemand an der Thür auf der Terrasse läuten hören?«

»Ich habe nicht geläutet. Ich schämte mich. Ich bin hier in das Fenster geklettert. Aber es ging schwer,« gestand sie, und Mund und Augen lachten übermütig zu ihm auf.

»Und dann? Wenn ich nun gar nicht mehr hier hereingetreten wäre?«

»Dann hätte ich die ganze Nacht hier sitzen müssen!« erklärte sie schaudernd und rieb den Kopf an seinem Arm wie eine naß gewordene Katze. Und dann sagte sie ganz leise: »Denn vor den andern konnte ich es nicht sagen. Und doch mußte ich es sagen. Deshalb kam ich ja zurück! Ich mußte sagen: Ich will alles thun, was ich soll.«

Eine Viertelstunde später war Jonas nach dem Bahnhof geschickt worden, um ein Telegramm an Ruths Onkel aufzugeben, daß sie draußen übernachten müsse. Ruth selbst wurde wohlverpackt in Jonas' Bett gelegt, welches Gonne eilig für sie hergerichtet hatte. Dann bekam sie heißen Thee zu trinken und fiel in einen unruhigen Schlummer.

Jonas fühlte sich sehr stolz, als er bei seiner Rückkehr hörte, daß er Ruth das wichtigste Möbel, das der Mensch besitzt, sein Bett, abgetreten habe. Und voll Begeisterung streckte er sich an diesem Abend in Eriks Arbeitsstube auf dem alten Lederdiwan aus, dessen Polsterwerk an Härte und unbegreiflichen Beulen nichts zu wünschen übrig ließ. Auch war Jonas zu aufgeregt, um bald einzuschlafen, und alle Augenblicke guckte er durch die Thürritze und fragte, was denn Ruth jetzt wohl mache.

Sie fieberte heftig und sprach im Halbtraum wild und wirr durcheinander.

»Der Sandkuchen,« hörte Erik sie mehrmals ängstlich sagen, »er drückt mich so. Er ist immer größer und größer geworden. Ich fürchte mich. Er verschlingt mich. Und anfangs war er so weich und klein und so wunderschön zum Kneten!«

Erik wachte bei ihr, bis der Morgen aufstieg.

Sie warf sich ruhelos in den Kissen umher, und immer wieder sprach sie mit sich selbst in abgerissenen Sätzen. Aber wie ihm schien, waren es keine eigentlichen Fieber-Phantasien, sondern sie enthielten einen deutlichen Zusammenhang. Es kam ihm der Gedanke, daß sie vielleicht oft so mit sich selbst spräche, ohne daß ein Mensch es hörte, und daß jetzt das Fieber vielleicht nur den gewaltsamen Anstoß gegeben habe, es unbewußt vor Menschenohren zu thun.

Er konnte ihren Worten entnehmen, daß sie sich fortwährend noch mit dem Gewittergang beschäftigte. Manchmal erwähnte sie diesen in einer Weise, als habe sie ihn gar nicht selbst gemacht, sondern als sei sie gegen ihren Willen des Weges geschoben worden, -- mit Gewalt hinausgetrieben in Sturm und Blitz und Donnerschläge. Sie sah sich auf dem einsamen, dunkeln Weg dahingehen, während Hagel und Wind ihr entgegentosten, und ihre Füße im tiefen, durchweichten Lehmboden stecken blieben.

Und damit vermischte sich dann ein andres Fieberbild: der Versuch vor etwas fortzulaufen, ohne es zu können, wie es wohl im Traume geschieht.

»Ich laufe und laufe, und bleibe immer am Fleck!« klagte sie unruhig, und das Fieber nahm zu, wenn sie daran dachte.

Am nächsten Morgen war Ruth fieberfrei. Als Erik, zu seinem Schulgang fertig angekleidet, zu ihr hereintrat, saß sie aufrecht im Bett, in einem Nachtjäckchen von Klare-Bel, das ihr zu kurz und zu weit war, und blickte ihm mit schüchternen Augen entgegen.

Auf der Bettdecke lagen Blumen verstreut, die Jonas in aller Frühe hereingeschickt hatte. Sogar ein paar fast unversehrte Zweige von seinem Kirschbaum waren dabei. Er hatte sie mit Todesverachtung abgerissen.

»Muß ich nun nach Hause?« fragte Ruth ängstlich.

»Nein, mein Liebling. Du sollst hier doch nicht nur krank liegen, sondern auch gesund umherspringen. Meine Stube wartet ja noch auf dich. Wollten wir nicht zusammen arbeiten?«

»Ja!« sagte sie eifrig und machte eine Anstrengung, wie um aufzustehen, so daß die Blumen von der Decke glitten.

»Aber, mein liebes Kind, doch nicht jetzt im Augenblick. Später!«

»Später!« wiederholte sie gehorsam, indem sie sich zurücklehnte und die Augen schloß.

Erik faßte nach ihrem Handgelenk und prüfte den Puls.

»Wenn ich heute von der Stadt nach Hause komme,« bemerkte er dazwischen, »dann finde ich dich im Garten, im Sonnenschein, und ganz gesund. Nicht wahr?«

»Ja,« sagte sie folgsam, ohne die Augen zu öffnen. Aber auf ihrem Gesicht war ein Ausdruck von Leiden oder Kummer, der ihn beunruhigte.

Er beugte sich zu ihr nieder und strich sanft das Haar aus ihrer Stirn.

»Aber nicht nur gesund, Ruth,« fügte er hinzu, »sondern auch froh! Nicht diesen in sich gekehrten, verschlossenen Ausdruck! Du darfst dich nicht wieder so scheu vor mir zuschließen, mein Kind. Bist du denn nicht mehr gern bei mir? Thut es dir nicht wohl, hierher zu gehören?«

Sie schlug die Augen auf und blickte ihn voll an.

»Es ist, als ob ich ins Meer gestürzt wäre,« sagte sie. --

Erik ging früher als sonst fort, um noch vor Beginn seiner Schulstunden bei Ruths Verwandten vorsprechen zu können. Er traf sie beim ersten Frühstück. Basil ließ ihn erst auf seinen ausdrücklichen Wunsch, etwas zaudernd, in den Speisesaal eintreten, wo die Tante, im Morgenhäubchen, sich noch hinter dem Samowar befand. Sie zeigte sich ein wenig befremdet über den allzu frühen Besuch. Der Onkel, schon im Begriff, wie allmorgendlich, ins Ministerium hinunterzugehen, saß in Militärbeinkleidern und eleganter geschlossener Joppe beim letzten Glase Thee. Er sprang auf und kam Erik mit lebhaften besorgten Fragen nach Ruth entgegen. Erik erzählte, wie sie auf dem Heimweg umgekehrt, ins Gewitter geraten und vor Aufregung krank geworden sei.

»Das kleine Ding!« äußerte der Onkel in zärtlich besorgtem Ton; er warf sich im stillen vor, daß er Ruth eigentlich dazu aufgemuntert habe, »wegzulaufen«. »Wie schlimm muß das für sie gewesen sein! Schon wenn Ruth einmal unerwartet vom Warmen ins Kalte gerät, da schaudert ihr die ganze Haut und sie zittert. Und dann kann sie sich auch so ganz entsetzlich fürchten.«

Liuba kam herein, begrüßte Erik und schenkte sich mit schlafgeröteten Augen Thee ein; sie war in Gesellschaft gewesen und spät aufgeblieben.

»Ja, Courage hat Ruth mal nicht,« bestätigte sie, »als wir ihr einmal eine Raupe auf den Hals setzten, fiel sie in Krämpfe.«

Erik blickte mit bestürztem Gesicht auf.

»Hat sie ~dazu~ Anlage gezeigt?« fragte er langsam.

»Aber nein, sonst niemals!« erwiderte der Onkel ärgerlich, »es ist schon Jahre her. Dreizehn Jahre war sie wohl alt. Es war irgendwo in der Schweiz. Ruth trug ein dünnes Sommerkleid mit bloßem Halse. Es war sehr schlecht von euch, sie so zu erschrecken, Liuba. Du solltest lieber davon still sein.«

»Wir haben uns doch nichts Böses dabei gedacht,« sagte Liuba, »warum saß sie auch immer so ganz versonnen und vertieft herum, so ganz wie ein Stein, der weder sieht noch hört. Es störte das Spiel der andern. Und da, wie nichts sie aufwecken wollte, setzten wir eine Ligusterraupe auf ihre Halskrause. Aber die Raupe kroch in den Halsausschnitt hinein. Ruth schrie nicht einmal auf. Sie fiel um.«

»Die Hauptsache habt ihr vergessen,« bemerkte die Tante, -- »das, was die unartigen Mädchen entschuldigt und Ruths Schreck erklärt. Ruth war nämlich als Kind fest überzeugt davon, daß in den Raupen, Schlangen und allem Gewürm der leibhaftige Böse sitze. Sie steckte überhaupt immer voll von gottlosen Ammengeschichten. Weiß Gott, wo sie die auflas. In solchen Dingen ist Ruth immer so merkwürdig kindisch gewesen, und auch geblieben. Sie hat dasselbe Grauen unvermindert noch heute.«

»Aber es ist ihr seitdem alles aus den Augen geräumt worden, was sie daran erinnern könnte,« sagte der Onkel zu Erik.

»Das hätte es nicht dürfen,« entgegnete dieser bestimmt, aber sein Gesicht war sehr nachdenklich geworden. »Man kann mit Ruth nicht behutsam genug, aber gleichzeitig auch nicht fest genug umgehen, wenn man ihr nützen will.«

Er erhob sich, um Abschied zu nehmen.

Der Onkel schwieg einen Augenblick, zerdrückte stehend seinen Cigarettenrest auf dem Aschenbecher und sagte dann plötzlich herzlich zu Erik: »Wissen Sie, -- ich bin froh, ordentlich froh bin ich, daß die Ruth bei Ihnen ist.«

»Ich wünsche nichts lieber, als daß sie mir bleibt!« entgegnete Erik einfach.

»Ja, sehen Sie,« fuhr der Onkel fort, indem er dicht an ihn herantrat, »ich glaube, gerade bei Ihnen ist das kleine Ding endlich einmal vor die rechte Schmiede gekommen. Nach all ihren Irrfahrten. Und vor die rechte Schmiede, das heißt fast so viel wie: ~nach Hause~.«

»Aber, ich bitte dich,« fiel die Tante, unangenehm berührt, ein, »nach deinen Worten muß jeder denken, Ruth sei hier mißhandelt worden.«

»Ach, wieso denn mißhandelt,« sagte er verdrießlich. »Nein, gut behandelt, natürlich, wie sollte es denn anders sein? Aber wozu sollen wir's leugnen: Sie wissen sich besser um sie zu kümmern, als wir es verstehen. Neulich fühlte ich's schon, heute weiß ich's ganz deutlich. Ich ~freu'~ mich ja auch an ihr, -- ja, das thu' ich, weiß Gott, -- aber im übrigen: das Kind ~hat~ nichts davon. Das ist es nur, was ich meine.«

»Nun ja,« lenkte die Tante ein, »sicherlich müssen wir Ihnen dankbar sein. Aber sprich nur nicht so sündhaft. Es klingt ja geradezu so, als ob du Ruth los sein wolltest. Grüßen Sie das liebe Kind von mir. Und wenn sie erkranken sollte, komme ich ganz bestimmt hinaus und pflege sie.«

Erik versprach, das »liebe Kind« zu grüßen, das er ihr am liebsten nie wiedergegeben hätte. Er ging mit dem Onkel fort und erwog einen Plan, für den er ihn zu gewinnen hoffte. Sie waren beinahe Freunde geworden. --

Als Ruth im Laufe des Vormittags aufstand, sah sie Klare-Bels langen Stuhl schon am steinernen Springbrunnen aufgestellt. Ein Stück gestreiftes Segeltuch, das man zwischen den Obstbäumen angebracht hatte, schützte sie vor der Morgensonne.

Nach dem Gewitter schien sich das Laub ringsum wie durch einen Zauber entfaltet zu haben. Der Garten stand ordentlich grün da, und die letzten Blätter drängten sich aus der Knospe. Ruth ging langsam durch den Garten hin, und mit Entzücken hefteten sich ihre Augen auf die frische, sonnenwarme Schönheit um sie her und auf die kranke Frau, die inmitten derselben ruhte.

»Guten Morgen, Ruth!« rief Klare-Bel ihr entgegen und streckte liebreich die Hand nach ihr aus, »willkommen, mein liebes Kind! Du weißt wohl, wer ich bin? Ich konnte nicht zu dir kommen, als du die Nacht krank dalagst. Ich bin froh, daß du wieder gesund bist, und daß du nun zu mir kommen kannst.«

Ruth ergriff die kleine, weiche Hand, der man es ansehen konnte, wie rund und rosig, mit Grübchen über den Knöcheln, sie gewesen sein mochte. Und, einem raschen Gefühle folgend, beugte sie sich nieder und küßte die Hand. Sie blickte Klare-Bel mit einer Art von Ehrfurcht an, wie den kostbarsten Gegenstand hier im Hause.

»Erik und Jonas sind in der Stadt,« sagte Klare-Bel, »ich liege jetzt ganz allein hier. Willst du mir ein wenig Gesellschaft leisten, Ruth?«

Ruth nickte, noch immer ohne zu sprechen; sie war wie berauscht vom Frühling und von dem starken, frischen Duft, den alles um sie herum ausströmte. Am liebsten hätte sie aufgejauchzt.

»Ich werde hier sitzen bleiben,« erklärte sie und kauerte sich mit emporgezogenen Knieen auf den bemoosten Steinrand des Springbrunnens, aus dessen geborstener Wasserurne über ihr ein langes, dünnes Schlinggewächs sich schlangengleich herunterrankte; »denn hier ist es am allerschönsten in der ganzen Welt!«

»Sie übertreibt alles!« dachte Klare-Bel, sie heimlich betrachtend, fühlte sich aber in diesem Augenblick doch angenehm berührt. »Am Meer ist es jetzt noch viel schöner, Ruth,« sagte sie, »da, wo wir früher gewohnt haben, -- auf der kleinen Insel weit draußen. Bist du schon einmal am Meer gewesen?«

»Ja, mehreremale,« versetzte Ruth, »aber viel lieber wäre ich gerade da gewesen, wo Sie gewohnt haben, -- auf der kleinen Insel. Aber ich wußte damals nichts davon. Nein, ich wußte es nicht.«

Es kam ihr sichtlich ganz wunderbar und eigentlich unbegreiflich vor, daß sie jemals nichts davon gewußt haben sollte. Klare-Bel fand, sie spräche ganz wie ein Kind: etwas so Selbstverständliches mit einem so ernsten und bewegten Gesicht.

»Und Sie wissen alles darüber!« setzte Ruth mit demselben Ausdruck hinzu, »alles, ganz so wie es war. War es wunderschön?«

Klare-Bel war nicht redseliger Natur; sie sprach ebenso wenig, wie Erik viel sprach. Aber sie bekam große Lust, sich mit Ruth zu unterhalten.

»Soll ich dir davon erzählen?« fragte sie und sah sie lächelnd an.

»Ja!« sagte Ruth dringend, und ein Gefühl, mächtiger als nur Neugier, trat in ihren Blick, »aber alles! wie die Menschen waren, und das Leben, und das Haus, und das Meer, und auch die Schulkinder.«

Klare-Bel fand, daß man mit dem Hause anfangen müsse. Und nachdem sie beschrieben, wie dörflich-klein und doch wie wunderbehaglich es gewesen sei, trotz seiner niedrigen Balkendecke und der schmalen Fensterscheiben, die von der Salzluft immer beschlagen waren, -- kam sie auf die Menschen zu sprechen, die dort aus- und eingingen. Viele Menschen waren das, -- ein ganzes Volk schien es Ruth, -- und immer scharte Klare-Bels Erzählung sie um den einen, den sie in den Mittelpunkt stellte, um den einen, der mit ihnen alles teilte und alles that, und den das jüngste Kind und das älteste Weib mit dem gleichen Lächeln grüßten.

Ruths Augen blitzten. Was Klare-Bel erzählte, das glaubte sie wahrzunehmen, zu schauen, mitzuerleben; sie ergänzte unbewußt das Bild bis zur greifbarsten Deutlichkeit, indem sie es mit den Goldfarben übermalte, die Klare-Bel selbst ihr auf die Palette rieb. Und um dieses ganze Bild hörte sie unablässig das gewaltige Meer donnern und schäumen.

Sie roch die Salzluft und fühlte den feinen Meersand unter den Füßen knirschen; mit nachdichtender Schnelligkeit folgte ihre Phantasie den Andeutungen der Frau, die gar nicht wußte, wie liebevoll sie idealisierte, was sie Ruth beschrieb.

Als Klare-Bel geendet hatte, atmete Ruth tief auf mit lebhaft geröteten Wangen.

»O wie herrlich Sie erzählen,« rief sie dankbar; »ich möchte nichts andres thun, als Ihnen den ganzen Tag zuhören. Den ganzen Tag. Ach, das möchte ich auch erleben! Wie schön muß es gewesen sein!«

»Das war es auch,« bestätigte Klare-Bel zufrieden, der es selbst noch nie so schön erschienen war, wie heute während ihrer eigenen Erzählung. Von sich selbst hatte sie bisher noch gar nicht gesprochen, nur von Erik. Aber auf Ruths Ausruf fügte sie mit dem Stolz der Frau, die sich ihr Glück liebend verdient hat, hinzu: »Schön und auch schwer, Ruth. Denn es ist schwer, mit so vielen teilen zu müssen, die alle von demselben Rat und Beistand und Teilnahme wollen und ihn immer in Anspruch nehmen, -- ihn immer fortnehmen. Es ist nicht leicht, man muß bescheiden werden. Das würdest du erst lernen müssen.«

»~Das?~« sagte Ruth verdutzt, »nein, das möchte ich lieber nicht. Das hatte ich mir dabei gar nicht ausgewählt. Aber so unter den Menschen stehen und alles können, als ob man ein Hexenmeister wär' -- das muß herrlich sein. Es muß sein, als ob man plötzlich viele Menschen auf einmal wäre -- und dann auch noch mehr, als sie alle zusammen.«

Klare-Bel schwieg betroffen. Sie fühlte recht wohl die enthusiastische Bewunderung in Ruths Ton heraus, aber sie konnte nicht begreifen, wie dieser Enthusiasmus, weit davon entfernt, dem Bewunderten dienen zu wollen, sich einfach egoistisch an dessen Stelle wünschte.

Ruth vertiefte sich inzwischen ganz in das Bild, das sie sich ausgemalt. Nach einer kurzen Pause hob sie wieder an: »Und das war doch nur ein Dorf. Eine ganz gewöhnliche Insel. Ringsherum Wasser, so daß da alles aufhörte. Es hätte aber etwas noch viel Größeres sein können, nicht wahr? Vielleicht mit noch viel mehr Menschen darauf. Ich weiß nicht recht, wie. Aber ich denke mir: so stark sein, -- und dann etwas Gewaltiges thun dürfen. Es braucht nicht beim Dorf zu bleiben.«

Klare-Bel berührten diese Worte wunderlich. Sie dachte im stillen, das sei es vielleicht so ungefähr gewesen, was ihr Mann einst gewünscht und erhofft habe. Damals, als alles um sie her noch Zukunft und Hoffnung war.

»Es wäre am Ende auch nicht beim Dorf geblieben,« meinte sie und sah Ruth an, »daran waren nur die Verhältnisse schuld. Er hatte früher so große Pläne. Ach, was hatte er alles für Pläne! Aber dann kam das Unglück, daß ich liegen mußte. Und es kamen die Aerzte, die Reisen, die Operationen. Zuletzt kamen die Schulden. Da war es mit den Plänen aus. Das hat alles schrecklich viel Geld gekostet, Ruth. Und ganz umsonst.«

Ruth blickte aus weitgeöffneten Augen auf die Frau, die das so ruhig sagen konnte.

»Ich könnt's nicht überleben!« stieß sie entsetzt wider Willen hervor.

»Ach, mein liebes Kind! Das denkt man, wenn man noch so jung ist wie du. Dann aber lernt man, sich in das Schicksal und seinen Willen fügen. Sogar in das Schwerste: stillzuliegen und nicht mehr mit eigenen Händen sorgen zu dürfen für das Behagen derjenigen, die man liebt. Denn das ist das Allerschwerste, Ruth.«

Es klang so sanft und liebevoll, wie sie das auf Ruths unbesonnenes Wort sagte. Keine einzige Klage hatte sie für sich selbst. Sie beklagte es nur, den andern nicht mehr dienen zu können.

Aber Ruth fand, es sei beinahe gleichgültig, ob man in einem solchen Fall den andern noch dienen konnte. Was sie so entsetzte, war die Vorstellung, durch ein derartiges Unglück die Ursache zu werden, daß ein Andrer, Starker, Gesunder aufhören mußte, ~seiner~ Sache zu dienen.

Es verwirrte sie ganz, daß die sanfte kranke Frau ihr gar nicht leid that. Sie hatte das Gefühl: diese würde ihr schon leid thun, wenn sie nur erst Zeit hätte, an sie zu denken. Aber sie mußte immer an Erik denken. Und sie empfand Mitleid mit ihm, stürmisches Mitleid bis zum Weinen.

Klare-Bel lag gerade ausgestreckt und blickte mit ihren ruhigen blauen Augen in den klaren blauen Himmel hinauf. Sie dachte an das Glück, wie sie es hätte behalten mögen, -- so klar und blau und ruhig, wie der.

»Das wünschte ich dir,« sagte sie zu Ruth, die ganz verstummt war, »einmal so von ganzem Herzen jemand dienen zu dürfen, den du lieb hast. ~Dazu~ gesund zu sein, und schön und gut und klug obendrein! Gleichviel, ob er dann Großes oder Kleines in der Welt vollbringt, -- daran liegt's nicht! Das Lieben und das Dienen ist doch das Schönere. Namentlich für uns Frauen. Es ist viel schöner, als derjenige zu sein, dem es gilt. Das brauchen wir nicht zu beneiden.«

»Ach nein!« rief Ruth lebhaft, »es kann ja gar nicht möglich sein, daß es das Schönere ist. Der, dem's gilt, hat es besser. Sonst hätte Gott es ja schlechter als die Menschen!«

Klare-Bel warf ihr einen erstaunten Blick aus den blauen Augen zu, -- einen tadelnden Blick. Aber sie wußte nicht, was sie darauf erwidern sollte. Man mußte wirklich ziemlich viel Nachsicht haben mit Ruth. Klare-Bel fühlte sich nur sicher, so lange Ruth zuhörte. Sie hörte so hübsch zu. Aber sobald sie sprach, mußte man sich verwundern und eigentlich auch ärgern. Die war sicher mehr für Erik geschaffen als für sie. Er würde wohl aus ihr klug werden. Denn das war ja seine Spezialität.

Inzwischen war Jonas, lustig pfeifend, von der Straßenseite her in den Garten getreten, und man sah ihn, den Schulranzen auf dem Rücken, zwischen den Bäumen im Hause verschwinden. Als er wieder zum Vorschein kam, war der Ranzen abgeworfen, und in der Hand hielt er ein mächtiges Butterbrot, in das er hineinbiß.

Er lief auf seine Mutter zu, küßte sie, streckte Ruth die Hand hin und sagte: »Du, -- Sie -- haben --,« stockte und wurde rot.

»Du!« entschied Ruth ernsthaft und betrachtete ihn.

»Ja, nicht wahr?« meinte er fröhlich und nahm neben ihr aus dem Rande des Springbrunnens Platz, »denn jetzt sind wir ja Hausgenossen. Eigentlich Geschwister. Nicht wahr, Mama? Und Altersgenossen auch. Wie alt bist du denn?«

»In elf Monaten siebzehn,« sagte Ruth.

»Ich bin erst sechzehn,« gestand er betreten, aber dann klärte sich sein Gesicht auf, -- »das heißt jetzt. Aber in elf Monaten längst nicht mehr. Sogar schon eher. Jetzt solltest du ein Stück Butterbrot mit mir essen, denn es ist noch eine gute Stunde, bis wir Mittag bekommen,« fügte er hinzu und brach, im lebhaften Drang sein Brot mit ihr zu teilen, es in zwei Hälften.

»Ich mag nicht essen,« sagte Ruth und lachte über seinen Eifer.

»Dann bist du gewiß noch krank!« behauptete er, »aber das war auch ein rechtes Glück, weißt du, denn sonst wärst du ja gar nicht bei uns geblieben. Es war eine gute Idee von dir, so im Gewitter herumzulaufen. Denk nur! wo du so bequem gleich bei Papa hättest sitzen bleiben können.«

»Ja. Wenn ich sitzen geblieben wäre, wäre ich auch fortgegangen,« bemerkte Ruth tiefsinnig.

Jonas konnte sich diesen Fall nicht ganz klar machen, und so sagte er schnell. »Komm mit mir in das Gehölz, Ruth. Du kennst es noch gar nicht. Da sind so viele Nester. Und mitten hindurch fließt ein kleiner Bach nach dem Wiesengrund zu. Wir können leicht hinüberklettern; der Zaun ist nur niedrig.«

»Nein,« erwiderte sie, »gehe nur hinter das Gehölz. Ich muß jetzt hier bleiben.«

»Was willst du denn hier thun?«

»Ich muß nachdenken.«

»Nachdenken?«

Jonas sah sie etwas verdutzt an; es schien ihm jedoch eine Beschäftigung zu sein, die Respekt verlangte. So stand er seufzend auf und trollte sich ins Haus, denn er wußte nicht recht, wie er sich daran beteiligen könnte.

Ruth merkte nicht, daß er ging. Sie blieb mit emporgezogenen Knieen sitzen, die Arme auf die Kniee, und das runde Kinn auf die geballten Hände gestützt, wie auf zwei Säulen. So blickte sie angestrengt vor sich auf einen einzigen Fleck im Grase, wo eine weiße Gänseblume stand, und dachte mit Hingebung nach, gleich einem indischen Derwisch. Sie wußte ganz genau, wo sie stehen geblieben war, als Jonas kam und sie aufhören mußte.

Klare-Bel lag still und hatte die Augen geschlossen. Die Mittagssonne strahlte warm über den Bäumen, kein Lüftchen bewegte das duftende Laub. Ein paar gelbe Schmetterlinge flatterten naschend um die Frühlingsbeete, und zu Ruths Füßen zirpten die Heimchen laut und eifrig ihr Lied.

Ruth versank tiefer und tiefer in ihren Mittagssonnentraum. Wie in goldenen Lichtwellen wob er sich um die Gestalt, die Klare-Bels Erzählungen vor ihr heraufbeschworen hatten. Ein unklares Verlangen, halb Demut, halb Forderung, bemächtigte sich ihrer, diese Gestalt so lichtvoll, so schattenlos als möglich zu sehen, -- in einem warmen Glanze, der sie unter allen andern Wesen hervorhob. Warum? das wußte Ruth nicht.

Aber das wußte sie: in diesem Licht sahen die wirklichen Menschen, die sie sonst kannte, noch viel störender und sinnloser aus als bisher, -- fast als ob es nur lauter Leiber wären, in denen so gut wie nichts drinsteckte. Und die phantastischen Schattenbilder, die sie sich nach eingebildeten und fremden Menschen so schön entwarf, wie sie wollte, und wieder wegwischte, wann sie wollte, -- die sahen viel schattenhafter aus als bisher, ordentlich dünn waren sie geworden, und so durchsichtig, daß man meinen konnte, es seien nur Irrwische von Gedanken.

Ruth durchwanderte ihre ganze Welt wie der Schöpfer am sechsten Tage, fand aber nur das Chaos wieder. Und mitten darin den einzigen, wenn er wollte, alles beseelenden Menschen, den zu gestalten Phantasie und Wirklichkeit zusammenschmolzen. Es war, als stände er ihr ganz allein gegenüber in dieser einsamen, phantastischen Welt ihrer Träume, -- der ~erste Mensch~ am sechsten Schöpfungstage, unerkannt noch, und ein Wunder. Mit innerm Staunen stand sie still vor ihm, als müsse sie fragen. »Wer bist du? Wie kommst du hierher? Wie darfst du hier herrschen?« Er beschädigte ihre Gedanken so stark, er setzte sie so stark in Erstaunen, daß sie darüber sich selbst aus ihren Gedanken verlor und nur ihn anschaute. Es schien ihr notwendig, daß er etwas Besonderes, Merkwürdiges, ganz außer allem Vergleich Stehendes sei, wenn sie ihn da dulden sollte.

Und wieder erhob sich das unruhige Verlangen in ihr, Glanz auf Glanz, Licht auf Licht auf ihn zu häufen.

Nachdem Ruth lange Zeit stumm dagesessen hatte, richtete sie sich aus ihrer zusammengekauerten Stellung auf und ging langsam an die Gartenpforte. Die Arme über dem Zaun verschränkt, schaute sie die Straße hinab, die Erik entlang kommen mußte. Er kam bald. Sein erster Blick fiel auf ihr Gesicht und blieb aufmerksam und forschend darauf haften. Sie sah ziemlich blaß und schmal aus nach der Fiebernacht, aber der leidende Ausdruck von heute morgen war völlig aus ihren Kinderzügen verschwunden. Ein neuer Ausdruck, offen und verlangend, der Erik wohlgefiel, lag in ihren Augen.

Er nickte ihr mit einem Lächeln zu. Sie sprachen nicht miteinander, nur Ruths Hand schlich sich leise in die seine. Hand in Hand sah Klare-Bel sie auf sich zukommen.

»Wie lange hast du heute in der argen Sonne auf mich warten müssen, meine Arme!« sagte er zu seiner Frau, »nun sollst du auch keinen Augenblick länger daliegen.«

Damit schob er ihren Stuhl in die Nähe der Terrasse, hob sie heraus und nahm die kleingewachsene Gestalt so behutsam in die Arme, wie man ein Kind an der Brust bettet.

»Du allzuleichte Last!« scherzte er und sah heiter und belebt aus.

Klare-Bel lachte vor lauter Vergnügen und hatte die Arme um seinen Nacken geschlungen.

Ruth griff nach einem herabgeglittenen Kissen und folgte ihnen die Stufen hinauf. Am liebsten hätte sie ihnen den ganzen Stuhl nebst Zubehör nachgetragen, um dasselbe zu thun, was Erik that. Das Mitleid, das sie während Klare-Bels Erzählungen mit ihm empfunden hatte, war in nichts verflogen, -- und an dessen Stelle blieb die Bewunderung stehen. Es kam ihr jetzt ganz natürlich vor, daß die kranke Frau sich nicht als Last und Hindernis auf dem Wege des gesunden Mannes fühlte, sondern daß sie lachte und ihre Hände um seinen Nacken schlang.

Als Ruth ihren Platz bei Tisch einnahm, vergaß sie ganz, daß es heute zum erstenmal geschah, und daß sie erst gestern hatte weglaufen wollen. Sie fühlte sich als ein längst hierher gehöriger Hausgenosse, -- zufrieden und ohne weiteres eingereiht unter die übrigen.

»Von deinem Onkel bring' ich dir was mit,« sagte Erik, der sie zu Mittag neben sich gesetzt hatte, »nämlich die Erlaubnis, so lange hier zu bleiben, als du willst. Ich denke, wir antworten ihn vorläufig: den ganzen Sommer. Was meinst du?«

Sie nickte nur und sah glücklich aus. Wenn er aber nicht unablässig auf sie geachtet und ihr selbst vorgelegt hätte, so würde sie lieber keinen Bissen gegessen haben.

Als sie beim Kaffee waren, und die Kinder hinausliefen, blickte Erik seine Frau an und fragte: »Und nun, Bel, wie gefällt sie dir?«

»O Erik! mir gefällt sie gut für dich! Denn sie hat etwas so Unverständliches, finde ich. Das ist gerade was für dich. Was zum Raten.«

»Sie ist ein scheuer Vogel,« sagte er mit einem Lächeln, »und es ist noch nicht gewiß, ob ich sie eingefangen habe. Eine falsche Bewegung, -- und sie fliegt mir fort.«

»Ja, Erik, das denke ich mir nun wieder ungeheuer angreifend. Es macht doch unsicher. Förmlich schwindlich würde es mich machen. Wie ein konfuses Stickmuster.«

»Unsicher? Nein, Bel, im Gegenteil. Man wird sich wieder dessen bewußt, was man vermag -- ~ob~ man's vermag. Man sammelt die Kraft, -- die vergessene, eingerostete. Und so kommt man endlich wieder zur großen Sicherheit des Lebens und zum alten Glauben an sich selbst.«

»Ja, ja, Erik. Wenn nur alles gut geht.«

Er stand auf und legte herzlich seinen Arm um ihre Schultern: »Sorgenmütterchen! nur ein einziges Mal: laß die Sorgen, die grauen! Mir ist froh. Du sollst es noch sehen: an dem Mädel wächst mir mein Meisterstück!«

Sie seufzte und gab ihm im stillen ganz recht. Daß er Ruth zu sich nahm, das war ungefähr so, wie wenn ein Gelehrter eine recht unentzifferbare Handschrift irgendwo ausgräbt, -- meinte sie; an der liest er dann lieber und eifriger herum als am bestgeschriebenen Buch. Es war nun einmal nicht anders: darin steckte sein Talent und sein Beruf.

Erik ging fort; er wollte noch nach dem Bahnhof, um zu veranlassen, daß Ruths Gepäckstücke durch einen Bauernwagen herübergeschafft würden; der Onkel hatte sie bereits herausgeschickt.

Klare-Bel lag und dachte nach. Sie zwang sich dazu, an die Zeit zu denken, die sie sonst immer in ihrer Erinnerung zurückschob. Es war doch schön, daß Erik wieder so froh sein konnte und so voll von sanguinischen Hoffnungen. Das war doch besser und natürlicher für ihn, als diese langen, langen Leidensjahre, in denen nur der ~eine~ Gedanke ihn erfüllte: wie seine Frau wieder gesund zu machen sei.

Ein einziger jahrelanger Kampf, -- ein schmerzensreicher, gräßlicher.

Namenloses hatte Klare-Bel aushalten müssen um seiner Hoffnungszähigkeit willen, die nicht nachließ, nichts unversucht ließ, die noch ans Unmögliche anrannte, und mit unermüdlichem Trotz den alten Kampf immer wieder aufnahm. Es war nicht leicht, denn wegen einer geringen Herzschwäche durfte bei Klare-Bel die Narkose nicht angewendet werden. Aber immer wieder wußte er sie zu neuem Wagnis, neuer Qual zu überreden und mit seinem unbegrenzten Einfluß zu zwingen. Er war in diesem Kampfe zum Arzt geworden; was er früher aus Lust und natürlicher Begabung nebenher betrieben, wurde ihm Beruf. Seine ganze, ungeteilte Kraft warf er hinein: er wollte es nicht glauben, nicht dulden, daß ein einziger blöder und blinder Zufall auf Lebenszeit das Glück verschütten könne.

Und nun, da er's glauben und dulden mußte, war es doch hart, alles das umsonst geopfert zu haben, woran noch seine Hoffnungen gehangen hatten. Und wenn Ruth ihm nur eine davon zurückgab, wollte Klare-Bel sie lieben. Es war ja nicht mehr als eine kleine, späte und unscheinbare Blume für einen ganzen Strauß, den das Leben ihm schuldig geblieben.

Noch nie war das Klare-Bel so klar geworden, wie heute, seit dem Gespräch mit Ruth am Springbrunnen im Garten.

Jonas kam herein und setzte sich an das Fußende ihres Ruhebetts. Er griff nach einem Bund Garn, das Klare-Bel abzuwickeln begonnen hatte, und hielt es ihr auf den Fingern.

»Wird Ruth nun bei uns bleiben, Mama?« fragte er.

»Jawohl. Du hörtest es doch. Freut es dich nicht?«

»Ueber alles freut es mich. Nur werde ich mich jetzt so ganz umsonst anstrengen.«

»Wie meinst du das, mein Kind?«

»Ich meine: Papa wird Ruth ganz gewiß viel lieber haben als mich. Ganz gewiß. Sie ist sehr klug, -- meinst du nicht?«

»Das kann ich unmöglich wissen. Aber was ist das für ein Unsinn, Jonas. Weil Papa dich lieb hat, will er ja, daß du dich mehr anstrengst und besser vorwärts kommst.«

»Ach, Mama, ich strenge mich schon an so sehr, wie ich kann. Ich komme ja auch vorwärts. Aber Papa ist so schwer zufrieden zu stellen. Er ist der strengste Lehrer bei uns. Sie fürchten ihn alle. Aber ich am meisten. Von mir verlangt er am meisten.«

»Darüber solltest du froh sein. -- Mach nur jetzt keine Eifersüchteleien, Jonas; hörst du?«

Da lachte er über das ganze Gesicht, scheinbar völlig unmotiviert, so daß er wirklich einfältig aussah.

»Nein, Mama, das thue ich gewiß nicht. Wenigstens nicht so, wie du es meinst. Aber wenn es Ruth einfallen sollte, -- Papa lieber zu haben als mich -- --«

»Aber Jonas!«

Er ließ das Garn vom Finger gleiten, so daß es fast in Verwirrung geriet.

»Verzeih, Mama. Ich bringe es gleich wieder in Ordnung. -- Weißt du, du hattest eben ganz recht, als du sagtest, ich solle nur froh sein, daß Papa so viel verlangt. Das denkt sich nämlich Ruth angenehmer, als es ist. Sie wird das noch merken. Und ich werde nie etwas Unangenehmes von ihr verlangen.«

»Du bist wirklich ein recht dummer und unnützer Junge!« sagte Klare-Bel ärgerlich und sah sich ihren Sprößling genauer an. Er machte ein ganz treuherziges Gesicht. Das Lachen hatte sich in die Winkel der Augen verkrochen. »Wenn Papa so was hörte. Und

da wunderst du dich noch, wenn Papa Ruth dir vorziehen sollte.«

»Ich wundere mich ja gar nicht, Mama. Das kann ich ihm doch nie im Leben übelnehmen. Wie sollte Ruth ihm denn nicht besser gefallen als ich?«

»Wo steckt Ruth nur eigentlich?«

»Sie ist oben in die Giebelstube gelaufen, wo Gonne noch herumwirtschaftet. Um sich ihre Wohnung selbst herzurichten, sagt sie.«

Als Erik vom Bahnhof zurückkam, und Ruths Kopf oben aus dem offenen Fenster herausschaute, stieg er zu ihr hinauf. Das kleine, nach hinten zu abgeschrägte Gemach war schon in Ordnung. Außer dem heute beschafften Bett und einer großen Holzkiste, die durch zierlich gekrauste und gefaltete Mullvorhänge beinahe das Aussehen einer wirklichen Waschtoilette bekommen hatte, gab es jedoch hier noch nicht viel zu sehen. Ein Geruch von Seife und frisch aufgenommenem Oelanstrich machte sich bemerklich.

Ruth saß auf dem schmalen Fensterbrett, zu dessen Seiten schon kleine weiße Gardinen niederhingen; die Leiter lehnte noch daneben. Ein leichter Wind bewegte die Zweige der großen alten Ulme vor der Terrasse, so daß sie am Fenster auf und nieder schwankten und fast Ruths Gesicht berührten. Man sah von hier oben nur in die Wipfel der Bäume, und das, fand Ruth, sah lustig aus: wie ein grünes rauschendes Gewoge, von dem man sich einbilden konnte, es schwebe in der Luft, ohne Stamm und Wurzel. Wie viele Vögel mochten im Sommer darin nisten! Und unter dem vorspringenden Dach, gleich über dem Fenster, klebten zwei vorjährige Schwalbennester.

Als Erik auf die Schwelle trat und die Einrichtung des Zimmers bemerkte, fing er an zu lachen.

»Es ist wahrhaftig ein richtiger Karzer, wie gemacht für böse Kinder, die eine Strafe abbüßen sollen,« sagte er und blieb im Rahmen der Thür stehen, »oder für Durchgänger, die man mit Gewalt einsperren muß. Meinst du nicht, Ruth?«

»Nein. Es ist sehr schön!« versetzte sie mit Nachdruck und nahm es fast übel, daß er ihre Wohnung verspotten konnte; »es ist nur noch nicht fertig, und das ist das schönste. Wenn ich drin bin, wird es von selbst fertig. Es ist sehr schön. Ganz so, wie ich es haben will.«

»Das ist freilich die Hauptsache, meine kleine Königin,« gab er lächelnd zu und kam zu ihr ans Fenster; »als wir zuerst aus dem Auslande angereist kamen, da sahen die Stuben in unsrer Stadtwohnung auch nicht viel besser aus. Und es gefiel mir auch ganz gut. Man konnte so ganz von vorn und nach eigenem Ermessen anfangen.«

Sie wandte sich halb nach ihm um und sah ihn mit Interesse an.

»Ach ja!« sagte sie, »aber außerdem muß es doch schrecklich schwer gewesen sein, -- da von der kleinen Insel weg -- und hierher; weg vom Meer und von all den vielen Leuten?«

Er hatte seine Hände auf ihre schmächtigen Schultern gelegt und zwang sie mit sanftem Druck nach dem Rücken zu, denn es machte ihm heimlich Sorge, daß sie sich so gern vornüberneigten.

»Warum schwer?« fragte er dabei mit seiner ruhigen Stimme, »hier gibt es ja auch Buben und Mädchen genug zu unterrichten, -- schlimme kleine Mädchen mit ganz schlimmen Aufsätzen, wie du weißt.«

»Ach, -- die!« sagte sie im Tone tiefer Verachtung und zuckte mit den Achseln, »die sind's nicht wert.«

»Auch du?« fragte er zweifelnd und sah sie aufmerksam von der Seite an.

»Ja, auch ich,« meinte sie treuherzig.

»Du bist ja ungeheuer demütig heute,« bemerkte er, »allzu demütig, Ruth. Das ist nicht gut.«

»Warum ist nun das auch wieder nicht gut?« fragte sie zerstreut.

»Weil es nicht aus dir selbst herauskommt, Mädel. Nicht aus deiner Natur. Es ist, wie wenn jemand eine Stellung festhalten wollte, für die er sich verrenken muß. Das sollst du nicht thun.«

Sie erwiderte nichts darauf, vielleicht hörte sie kaum hin. Ihre Gedanken waren auf etwas andres gerichtet, das sie nicht anzubringen wußte. Nach einer kleinen Pause sagte sie leiser: »Sie sehen so froh aus. In den Augen -- und überhaupt. Warum?«

»Weil ich dich wieder habe, mein Kind,« entgegnete er ernst.

»Mich! aber all die andern?«

»Wen denn, Ruth?«

Nun hielt sie es nicht länger aus.

»Ich meine: bloß Buben und Mädchen zu unterrichten, die es gar nicht wert sind, und sonst nichts! Anstatt etwas ganz andres thun zu dürfen, etwas viel, viel Größeres, -- so groß wie ein Meer mit allen Schiffen darauf,« versuchte sie es auseinanderzusetzen und nestelte dabei, ohne es zu merken, erregt an seiner Uhrkette.

Er sah erstaunt auf sie nieder.

»Phantasierst du, Kind? Du sollst dem nicht so nachgeben,« sagte er eindringlich, »was hast du eigentlich zusammengedichtet? Du mußt es klar sagen können. Nun?«

»Es ist ja etwas Wirkliches!« rief sie schüchtern, »es ist gar keine Phantasie. Wir sprachen im Garten darüber, -- am Vormittag.«

»Mit meiner Frau?«

Ruth nickte.

»Sie hat mir erzählt. Von früher und von jetzt. Sie erzählt so wunderschön! Ganz wunderschön erzählt sie.«

»So. Thut sie das? Ader was hat sie dir denn erzählt?« fragte er, und sein Blick war forschend und gespannt.

»Alles. Und da, -- ja, da schien es mir so ganz entsetzlich, -- so ganz unmöglich schien es mir, daß nichts daraus geworden ist. Aus all den großen Plänen nichts geworden,« sagte sie leidenschaftlich, und ihre Finger umklammerten die Uhrkette, als müßte sie irgend etwas zerbrechen, »nichts als eine Schulstube. Und daß es immer so bleiben soll. Es kann ja nicht so bleiben.«

Sie sprach beinahe zornig, und in ihren Augen standen große Thränen.

Erik antwortete nicht gleich. Seine Hand hob sich und strich sanft hin über ihr loses weiches Haar, und als Ruth aufblicken wollte, da glitt die Hand tiefer und legte sich leise über die fragenden Augen. Er schaute über sie weg, hinein in die grünen rauschenden Baumwipfel, und kämpfte eine Erregung nieder. Ihm war seltsam zu Mute. Er wußte, daß das, was Ruth empfand, nicht von seiner Frau kam; weder die leidenschaftliche Auffassung, noch die phantastische Unklarheit des Bedauerten war seiner Frau möglich. Noch nie, seit er sich verheiratet, hatte er zu einem Menschen, hatte ein Mensch zu ihm von den Enttäuschungen seines Lebens gesprochen. Und da stand sie nun, die ihn seit vier Tagen kannte, in Zorn und Gram und Thränen und härmte sich um diese Enttäuschungen, als seien es ihre eigenen.

Als mehrere Minuten in Schweigen verstrichen, bückte Ruth den Kopf tiefer, und ihre Hand sank von seiner Uhrkette.

»Ich will es gewiß nie wieder sagen!« sagte sie leise, abbittend.

Er griff heftig nach ihrer Hand und preßte sie in der seinen zusammen.

»Du sollst mir immer alles sagen, alles, was dich beschäftigt,« versetzte er ruhig, aber seine Stimme klang verändert und gedämpft, »niemals sollst du Gedanken, die dich aufregen, vor mir verbergen, -- und nun gar Kümmernisse, mein Kind, -- solche kindischen und phantastischen Kümmernisse.«

Dann lehnte er sich gegen das Fensterbrett, vom Licht abgekehrt, das Gesicht im Schatten.

»Ich will dir eine Geschichte erzählen, Ruth; soll ich?«

Sie nickte gehorsam, ohne den gesenkten Kopf zu heben; man konnte sehen, daß ihr an dieser Geschichte nicht allzuviel lag, und daß sie sich als Kind behandelt fühlte.

»Es war einmal ein Mann,« begann er, »den gelüstete es sehr, ein großes, weites Feld zu bebauen, -- ein Feld, wohl so groß wie ein Meer. Denn er wußte, der Boden war gut, und nur der Arbeiter gab es noch wenige, -- viel zu wenige. Aber es kam anders, als er es sich gewünscht hatte, und an dem großen Felde durfte er so gut wie gar nicht mitarbeiten. Nur ganz fern, in einem äußersten

Winkel desselben, wies man ihm ein kleines Stückchen Erde an, wo er Kohl pflanzen konnte und Kartoffeln. Nur eben genug, um zu leben.«

Sie hatte längst die Augen mit aufblitzendem Verständnis zu ihm aufgeschlagen. Groß, ungeduldig hingen sie an seinen Lippen. Ihre ganze Seele war in diesen Augen.

»Und da --?« fragte sie atemlos.

»Und da,« fuhr er fort, »fand er eines Tages unter seinen Kohl- und Kartoffelstauden eine fremdartige kleine Pflanze. Von irgendwoher mochte ihr Samenkörnchen in diesen Boden gefallen sein. Es war nur ein unscheinbarer, zarter Trieb, dem man noch nicht ansehen konnte, was darin steckte. Aber vielleicht konnte er sich einmal zum Bäumchen auswachsen. Und wenn das gelang, -- wenn ein guter Gärtner an diesem Bäumchen unablässig seine Dienste that, und wenn das Bäumchen sich willig behandeln und biegen, pfropfen und beschneiden ließ, -- dann, -- ja, dann konnte es am Ende seltnere Früchte tragen, als irgend etwas, was sonst auf dem Feldwinkel wuchs.«

»Bin ich das Bäumchen?« fragte sie naiv und glitt leise vom Fensterbrett.

Er antwortete nicht, aber er zog sie näher an sich, so daß ihr Haar seine Schultern berührte. Auf ihrem Gesicht lag ein Ausdruck, der kein Lächeln war und kein Ernst, und doch wie ein gesteigerter Abglanz von beiden, der einer Ekstase glich. Er erinnerte Erik plötzlich an jenen Aufsatz mit der Ueberschrift: »Seligkeit!« Zum erstenmal erinnerte ihn dieses schmale Kindergesicht mit den beredten Augen und den geschweiften Lippen an die Verse im Schulheft.

»Möchtest du ein solches Bäumchen für den Gärtner werden, Ruth?« fragte er sie mit gesenkter Stimme.

Sie atmete tief auf.

»Noch lieber möchte ich der Gärtner werden,« sagte sie unerwartet, »aber es ist vielleicht fast dasselbe.«

III.

Jeden Morgen, ganz früh, noch ehe das Haus wach wurde, fanden Erik und Ruth sich im Studierzimmer zusammen. Sie standen beide ein paar Stunden zeitiger auf als sonst, um es zu können, und jeden Morgen nahm er mit ihr ihre Arbeit für den Tag durch, der er sie dann allein überließ.

Es war immer dasselbe Bild: Ruth war immer schon da, und stand, ihn erwartend, ins offene Fenster gelehnt. Sie horchte auf die kleinen Buchfinken draußen und zugleich, ob sein Schritt nicht über den Flur käme. Gewöhnlich sah sie ein bißchen blaß und bange aus, denn so übermütig froh sie auch tagsüber vor Erik sein konnte, -- als Lehrer fürchtete sie ihn. Und auch jetzt noch, wenn sie seinen Schritt im Flur vernahm, überfiel sie, wie am allerersten Abend, das Herzklopfen und die alte Schüchternheit.

Es war immer dasselbe: ohne daß sie sich nach ihm umwandte, trat Erik dicht an sie heran, bis ihr Rücken gegen ihn gelehnt war, dann schloß er ihre beiden Hände in den seinen zusammen, so daß sie wie eingefangen war zwischen seinen Armen. Es lag für sie darin nicht nur eine Liebkosung, sondern auch etwas zugleich Beschwichtigendes und Zwingendes, unter dem sie unwillkürlich stillhielt und sich sammelte. Und dann, ohne Zeitverlust oder überleitende Gespräche, nahm er sie sofort nüchtern und ernsthaft vor. So ging der Morgengruß unmerklich in die Morgenarbeit über.

Als Erik heute morgen die Thür zu seinem Zimmer öffnete, blieb er einen Augenblick überrascht stehen. Vor den Fenstern waren die weißlackierten Innenläden geschlossen worden, so daß die graue Regenluft draußen nur durch die Ritzen hereinschauen konnte; ein einzelnes Licht brannte mit trübem Schein auf dem Schreibtisch. Vor demselben saß Ruth, umgeben von Heften und Büchern, und schrieb, ohne auch nur aufzublicken.

Erik sagte nichts. Er schlug einen Laden zurück und öffnete das Fenster, so daß Luft und Licht in breitem Strom eindrangen, dann kam er an den Schreibtisch und blies das Licht aus, während Ruth verwirrt emporfuhr.

Er beugte sich zu ihr nieder, nahm ihr Gesicht zwischen seine Hände und blickte sie aufmerksam an.

»Du hast geweint. Worüber?«

Sie errötete und zauderte einen Augenblick.

»Ich mag nicht dumm sein!« rief sie dann außer sich mit sprühenden Augen.

Er lachte.

»Du bist nicht dumm. Habe ich das gesagt? Wenigstens nicht hoffnungslos. Solange ich dich nicht aufgebe, brauchst du es auch nicht zu thun.«

Er rückte ihren Stuhl vom Tisch ab und nahm ihr die Feder aus der Hand.

»Aber du darfst nicht nachts aufstehen und arbeiten. Nie ohne mein Wissen. Das ist Unfug. Wenn ich abends deine Arbeiten durchgesehen habe, dann sollst du aufhören.«

»Die Sonne hörte auch nicht auf,« sagte Ruth, »sie schien hell fast die ganze Nacht durch. Im Gehölz rief ein Kuckuck; die Drosseln vor meinem Fenster unterhielten sich. Da kam ich leise her.«

Erik griff über ihre Schulter nach dem Heft, in dem sie geschrieben hatte, aber Ruth hielt es zögernd und schüchtern fest. Man konnte ihr ansehen, daß sie in ihrer Erregung beinahe litt.

»Ruhig!« sagte er eindringlich und entfernte ihre Hand vom Heft.

Schweigend las er darin eine Zeit lang, während Ruth mit gefurchter Stirn dasaß, die Hände im Nacken verschränkt und ganz blaß.

Dann legte er ihre Arbeit vor sie hin.

»Das hast du gut gemacht,« bemerkte er, »hat es dir Mühe und Ueberwindung gekostet?«

»Ja,« gestand sie ehrlich, ohne ihre Haltung zu verändern, »aber es schadet nichts.«

»Nein. Es schadet nichts. Siehst du das nun selbst ein? Es konnte nichts helfen, mit dir zu treiben, was dir lieb und leicht ist; durch das, was deinen kleinen phantastischen Kopf am härtesten anmutet, durch das, was ihm am schwersten fällt, gerade da muß er hindurch.«

Er löste ihre im Nacken verschlungenen Hände und behielt sie in den seinen.

»Ich weiß, daß es manchmal ein harter Zwang war,« sagte er, »und du dein eigenes Wesen unterdrücken mußtest; es that weh, nicht wahr? Aber es mußte sein. Und nun, -- nun bekomme ich dich allmählich gerade so, wie ich dich haben will, Mädel. Ist es nicht schön?«

»Wunderschön ist es!« rief sie, mit leuchtenden Augen sich nach ihm zurückwendend, »das denke ich ja immer dabei, wenn es mir schwer fällt! Ich such's zu vergessen und denke mich nur hinein: wie wunderschön muß es sein, jemand, der ganz anders ist, gerade so zurecht zu kriegen, wie man ihn haben will!«

Ein Schatten von Enttäuschung ging durch Eriks Augen.

»Nur daran denkst du dabei, Ruth? Und ich glaubte, dich selbst solle es glücklich machen.«

»Das thut es ja eben!« erklärte sie erstaunt und stand auf.

»Was willst du nun heute morgen thun? Wir wollen in den Garten gehen. Es regnet nicht mehr. Oder meinst du, daß du schlafen könntest?«

Sie schüttelte lachend den Kopf.

»Ich möchte nicht, daß du später allein bleibst, ohne Beschäftigung und Morgenfrische,« sagte Erik; »arbeiten sollst du nicht. Vielleicht solltest du mit mir zur Schule kommen. Noch immer warten die Mädchen auf deinen versprochenen Besuch. Und in ein paar Tagen ist Klassenschluß. Es wird dich ablenken und zerstreuen. Und wenn es dich ermüdet, desto besser.« --

Gonne hatte auf der Terrasse den Frühstückstisch gedeckt, und Klare-Bel lag schon neben demselben in ihrem Stuhl, als Erik, Ruth und Jonas, erst auf wiederholte Rufe, aus dem Garten herankamen. Jonas sah ganz erhitzt aus, und der Strohhut saß ihm im Nacken; in seiner rechten Hand trug er einen hohen Eimer, den er von Gonne erbeutet hatte und jetzt auf die Stufen, die zur Terrasse führten, niedersetzte. Eine wohl zwei Fuß lange, stahlfarbene, bläulich glänzende Schlange wand sich darin.

»O pfui, Jonas!« rief Klare-Bel entsetzt, »wie magst du nur ein so greuliches Tier herbringen! Könnte sie uns nicht alle totbeißen, Erik?«

»Das kann sie nicht. Es ist eine Ringelnatter,« versetzte er lächelnd.

»Aber eine prachtvolle, Mama! ich fand sie hinter dem Gehölz, da wo der kleine Bach sich im Wiesengrund verläuft,« sagte Jonas voll Stolz und Bewunderung; daß er einen solchen Fund that, war ihm ein ganz unerwartetes Landvergnügen, er hatte eigentlich nur auf Raupen gerechnet, und höchstens auf eine Blindschleiche.

Ruth beteiligte sich nicht an der Unterhaltung über die Schlange, die Jonas gar nicht aufhören konnte zu bewundern, während sie Kaffee tranken. Seitdem sie im Garten Jonas mit dem Eimer in der Hand begegnet waren, verhielt Ruth sich ganz still. Sie hatte heimlich gehofft, Klare-Bel würde gegen die Schlange protestieren, aber die erkundigte sich ja nur danach, ob das Tier wohl jemand totbeißen könnte. Und das war an einer solchen Schlange doch wohl das Geringste, fand Ruth.

Jetzt gelang es der Ringelnatter, nach mehreren vergeblichen Versuchen, sich auf dem Boden des Eimers aufzurichten, sie wiegte rhythmisch ihren Oberkörper und guckte mit ihren kleinen klugen schwarzen Augen die Anwesenden an.

Klare-Bel blickte zufällig auf Ruth, deren Glieder ein Zittern durchlief, und die die halbgefüllte Tasse niedersetzte und erblaßte.

»Wirf das Untier fort, aber schnell, Jonas,« sagte seine Mutter rasch, »siehst du denn nicht, daß Ruth sich ängstigt?«

»Nein, lasse sie nur da,« fiel Erik ruhig ein, der Ruth die ganze Zeit über beobachtet hatte, »darauf soll keinerlei Rücksicht genommen werden.«

Dann wandte er sich in leichtem Ton an sie: »Liuba hat mir erzählt, daß du einmal wegen einer ähnlichen Kleinigkeit umgefallen bist. Strafe sie Lügen.«

»Hat Liuba gesagt: wegen einer Kleinigkeit?« fragte Ruth erstaunt. »Es war keine Kleinigkeit. Es war etwas fürchterliches, -- kalt und grausig, -- was so gewaltsam von außen kam, -- so, wie wenn man einen umbringt.«

»Um Gottes willen!« bemerkte Klare-Bel, »was kann denn das nur gewesen sein?«

»Eine kleine Raupe!« entgegnete Erik spottend.

Ruth wollte wahrheitsgemäß verbessern: »Eine große Raupe,« aber sicherer erschien es ihr, nicht noch ausdrücklich zu bestätigen, daß es nur eine Raupe gewesen war.

»Paß mal auf,« rief Jonas, »ich werde das Prachttier zähmen; Ringelnattern sind zutraulich und verständig, man kann sie gern um den Hals winden. Dann spielen wir ›Schlangenbändiger‹. Hast du je schon etwas so Schönes gehört? Ich bin der Schlangenbändiger. Da brauchst du dich gar nicht zu fürchten. Du siehst nur zu und -- und bewunderst mich.«

Erik lachte und griff ihm ins kurzgeschorene Blondhaar.

»Stopf deiner Eitelkeit den losen Mund,« warnte er, »denn schon ist die Zeit ganz nah, wo Ruth sich nicht mehr mit der Zuschauerrolle begnügen wird. Wo sie selbst, freiwillig, aus eigenem Antriebe, an die Schlange herantritt, sie in die Hand nimmt und sich auf den Körper hinaufkriechen läßt.«

Ruth hatte vergeblich versucht, ihn zu unterbrechen.

»Ich! Wann wird das sein?« fragte sie, ganz außer sich vor Erstaunen.

»Wann? vermutlich schon bald.«

»Nein! Nie!« versicherte Ruth, noch ganz fassungslos über seinen Irrtum, »ich würde mich ja immer fürchten.«

»Das würdest du wohl. Aber das ist noch kein Gegengrund. Es kommt vor, daß man stärker ist als die eigene Furcht, und daß man sie totschlägt.«

»Nun, Erik, das ist ein starkes Stück,« sagte Klare-Bel halblaut.

Jonas sah verdutzt aus, daß sein Vater so etwas im voraus wissen konnte, was doch Ruth selbst noch nicht wußte. Aber er begriff, daß Erik ihr etwas Unangenehmes geweissagt hatte, denn sie schauderte unwillkürlich zusammen.

»Weißt du was?« schrie Jonas ihr plötzlich zu, und der rettende Einfall verklärte förmlich sein Gesicht. »Ich weiß einen Ausweg: -- thu's eben nicht! Einfach! denke nur: du brauchst es ja einfach nicht zu thun!«

Er mußte sich von seinen Eltern auslachen lassen, und das Gespräch wandte sich andern Dingen zu.

Ruth saß regungslos da und blickte scheu nach dem Eimer. Wie gebannt, mußte sie den länglichen, schilderbedeckten, züngelnden Kopf ansehen, der sich dort herüberreckte. Es war, als grüße er sie. Es war, als schaue er nur gerade sie an. Nur sie ganz allein. Als sei sie ganz allein mit der Schlange.

Die kleinen runden schwarzen Augen schienen sich mehr und mehr zu erweitern, wie ein grausiger Höllenabgrund, in dem alles Unheimliche sein Spiel trieb. Und hinter dem Kopf mit den Augen hing das ekle, schlüpfrige Gewürm und wand sich ungeduldig. Es war ganz gewiß: die Schlange lauerte schon auf sie.

Sie sah doch wirklich so aus, daß man das Schlimmste von ihr denken konnte.

Ruth und die Ringelnatter maßen sich mit den Blicken.

Ruth errötete langsam, immer dunkler, ohne ein Wort zu sprechen.

Da, als Erik sich vom Frühstückstisch erhob, und Jonas wieder in den Garten laufen wollte, sprang Ruth hastig auf und sagte wild. »Dann lieber gleich!«

Die andern verstanden sie nicht recht, nur Erik, der sie unausgesetzt im Auge behalten hatte, entschlüpfte ein Laut der Ueberraschung.

»Jetzt gleich?« wiederholte er, »nein, mein Kind, das ist weder gut noch notwendig. Es wäre eine ebensolche Uebertreibung wie das mit dem Nachtarbeiten. Und nach dieser Nacht bist du mir jetzt nicht fest genug dazu.«

»Ich bin fest!« versicherte sie fast flehend, »aber warten kann ich nicht auf etwas so Grausiges! Ich kann es nicht so heranschleichen sehen, -- Tag für Tag, -- immer näher, -- immer gewisser; -- mit einer Schlange zusammenwohnen, vor der ich mich fürchte, -- und die mit der ganzen Familie immer intimer wird, -- -- und nur auf mich lauert, -- nein, das kann ich wirklich nicht!«

Erik lachte, sah aber dabei besorgt aus. Dies kam ihm ganz unerwünscht.

»Aber Ruth!« sagte er, »hat dich denn deine Phantasie mit Haut und Haar aufgefressen? Eine solche Kleinkinderangst legt man am sichersten in allmählicher Gewöhnung ab. Mir ist es lieber, wenn es allmählich geschieht. Ueberlege es dir! Denn, wenn du darauf bestehst, gibt es kein Zurückweichen mehr! Dann kein Spielen und Versuchen! Das würde ich nicht dulden. Deiner selbst mußt du sicher sein.«

»Ja!« behauptete Ruth, und die Stirn wurde ihr feucht.

»Willst du es trotzdem? Gut. Dann komm her.«

Erik beobachtete sie mit gespannter Aufmerksamkeit und trat zugleich von hinten an sie heran, damit sie sich mit dem Rücken gegen ihn lehnen mußte, wenn sie etwa »umfiel«.

Sie stand mit herabhängenden Armen da und machte ein entschlossenes, beinahe finsteres Gesicht. Als er sich aber nach dem Eimer bückte, und sie, dicht vor sich, die Schlange in seiner Hand sich winden sah, überfiel sie ein Schwindel.

Unwillkürlich schlossen und ballten sich krampfhaft ihre Hände, denen sie befahl, sich nach dem glatten Wurm auszustrecken; sie machte zuckend die Augen zu, und es fing an, ihr vor den Ohren zu sausen.

Da hörte sie Eriks ruhige Stimme: »Fürchtest du dich sehr?«

Sie nickte fast unmerklich.

»Dann wollen wir es lassen, mein Kind.«

Ruth öffnete erwartungsvoll und groß die Augen.

»Für immer?« fragte sie schnell.

Er mußte lächeln.

»Nein. Nicht für immer,« sagte er ruhig und freundlich, »aber es eilt nicht.«

Sie nahm sich zusammen.

»Dann jetzt gleich!« murmelte sie.

Und sie streckte den Arm aus und nahm ihm die Schlange aus der Hand. Bei der ersten Berührung erschütterte es ihren ganzen Körper wie ein elektrischer Schlag, sie warf den Kopf zurück und drängte sich hilfesuchend enger an Erik. Aber ihre Finger hielten dabei den langen, glatten Schlangenleib fest umspannt, und ohne einen Laut über die erblaßten Lippen zu bringen, sah sie mit weitgeöffneten Augen zu, wie die Ringelnatter sich an ihrem Arm hochstreckte, sich um denselben herumschob und den Kopf mit der feinen gespaltenen Zunge wiegend zur Seite niederhängen ließ.

Der Arm blieb ausgestreckt, als wäre er erstarrt. Und Ruth machte ein Gesicht dazu, als ob sie hingerichtet würde.

»Bravo!« sagte Erik, der seine Hände schützend und ermutigend um sie gelegt hatte, »auch das hast du gut gemacht, Mädel.«

Als er sie aber losließ und mit raschem Griff die Schlange wieder in den Eimer schüttelte, da taumelte Ruth.

»Nein, nein!« rief er heiter, »du mußt nicht denken, daß du jetzt noch ›umfallen‹ darfst. Damit ist es nun nichts mehr.« Und er schob ihr einen Stuhl zu.

Aber Ruth beachtete den Stuhl nicht, sondern ging, ohne aufzusehen, mit unsicheren Schritten an Erik vorbei, quer über die Terrasse und in den Flur hinein. Dort, so weit von ihm entfernt wie möglich, setzte sie sich in eine Ecke, hinter den Mantelständer, versteckte ihr Gesicht in den Mänteln, die dort hingen, und fing an zu weinen.

Erik sah ihr verwundert zu.

»Aber Ruth, du Narr!« rief er, und mußte doch lachen, »nun solltest du froh sein, und sogar stolz. Was kann es nützen, hinterdrein zu weinen?«

Sie guckte hinter dem Mantelständer hervor und blickte ihn vorwurfsvoll an.

»Ich thue mir so leid!« sagte sie und weinte weiter.

Jonas, der die ganze Zeit mit offenem Munde dagestanden, aber auf einen Wink seiner Mutter seine steigende Verwunderung für sich behalten hatte, sah auf diese Worte hin den Vater ebenfalls sehr vorwurfsvoll an. Er lief in den Flur, um Ruth zu trösten.

Eine Stunde später fuhr Ruth aber dennoch mit ihm und Erik zur Stadt.

Die Mädchen in der Schule warteten schon lange auf ihren Besuch. Es interessierte sie außerordentlich, daß Ruth jetzt bei Erik im Hause lebte, und in jeder Stunde erkundigten sie sich nach ihr bei Erik. Sie fanden, alles sei plötzlich so nüchtern geworden. Nur eine kleine Partei, freilich die beste, vermißte Ruth nicht. Das waren die Musterschülerinnen, die sich jetzt vor ihren Ausgelassenheiten sicher fühlten und durch keine argen Einfälle mehr in Versuchung geführt wurden. Aber die Stimmung blieb flau, und als es nun, so kurz vor den Ferien, zu regnen anfing, da verdüsterten sich die Gesichter auch der Fleißigsten.

So gab es doch eine gewaltige Freude, als heute, in der Freistunde, Ruth wieder auf dem Schulhof erschien, mit einem großen Regenschirm, unter dem ihr Gesicht vergnügt hervorschaute. Alle umringten sie, und der Lärm wurde so schlimm, daß im Hinterhause die Leute aus den Fenstern herabschauten, um zu sehen, was es gäbe, und warum die Schulvögel noch lauter zwitscherten als sonst.

Ruth war von ihnen die einzige Stille. Als sie so mitten unter ihnen stand, von allen bedrängt, da kam es ihr vor, wie wenn sie aus einer Weltferne zu ihnen zurückgekehrt sei, und sie wurde fast schüchtern. All das Viele, was sie zu erzählen hatte, all das Viele, worauf jene begierig waren, schmolz zu einem bloßen Blick und Lächeln zusammen, und es blieb nichts, als auf ihrem Gesicht der Ausdruck von Kinderglück, der an ihrer Statt erzählte.

Die Schülerinnen schoben sich an der Hauswand aneinander, wo das überragende Dach sie vor dem schwachen Sommerregen schützte, und wie damals, als Erik aus dem Klassenfenster auf sie niederblickte, fand Ruth ihren Platz wieder auf dem umgestülpten Wasserfaß.

Sie erschien den Mädchen verändert, ohne daß diese sagen konnten, wodurch. Denn wie ein Junge im Blusenkittel sah sie noch immer unter ihnen aus, und einen Zopf hatte sie ja auch noch nicht bekommen. Daß sie nicht sprach, entging ihnen vollständig; der in ihnen selbst aufgespeicherte Mitteilungsstoff brannte auf den Zungen, und, anstatt dessen, was sie von ihr erfahren wollten, erfuhr Ruth binnen weniger Minuten das Schicksal einer jeden einzelnen, von damals bis heute, nebst dem ganzen Gang der »öffentlichen« Angelegenheiten.

Das größte Ereignis stellten sie ihr in Person vor. Das war eine Braut. Eine wirkliche Braut aus ihrer Klasse. Ein großes, blondes Mädchen von frauenhafter Gestalt, mit ruhigen, freundlichen Gesichtszügen. Als Legitimation wurde ihr ein Ring von der linken Hand gestreift und seine Inschrift triumphierend vorgezeigt, -- der glatte goldene Traureif fiel Ruth in den Schoß.

Die Braut wehrte sich nur schwach dagegen, so als Gemeingut behandelt zu werden. Sie war begreiflicherweise mit ihren Gedanken längst aus der Schule heraus und fühlte sich mit deren Insassen nur noch durch das unendliche Interesse verbunden, welches ihr, ihrem Liebsten, und ihrem Glück wahrhaft glühend entgegengetragen wurde. Denn mit ihr betrachtete sich sozusagen die ganze Klasse als mitverlobt und an den Mann gebracht.

»Er ist dunkelhaarig!« erklärte das kleine blonde Gretchen, die besonders zärtlich an Ruth hing, »ach, Ruth, ein solcher, wirklicher Bräutigam bleibt doch das Allerhöchste. Denke dir nur, was man als Braut alles zu erzählen hat! Wenn wir so zusammensitzen, und sie spricht von ~ihm~ und dem Leben und der Ehe und der Zukunft, dann meint man, daß man in einer Stunde mehr erfährt als in all den Schuljahren mit ihrem Kram.«

»Wieso?« sagte Ruth, »sie weiß ja selbst noch nichts davon.«

Gretchen schwieg etwas betroffen.

»Nun, du bist auch nicht wenig prosaisch geworden!« fiel eine andre ein und lachte, »sie lieben sich ja doch! Findest du denn das nicht wunderschön?«

»Doch!« sagte Ruth und betrachtete nachdenklich den schmalen Goldreif in ihrer Hand; »vielleicht ist es wunderschön.« Dann gab sie ihn der Braut mit einem vollen Blick zurück und fügte hinzu: »Aber das Wunderschöne daran läßt sich ja doch nicht erzählen. Nicht wahr?«

Die Angeredete errötete etwas und sah Ruth erfreut an. Sie fühlte sich zum erstenmal zu dem beglückwünscht, was sie ganz für sich allein besaß, als Braut, -- was sie mit den andern nicht gemein haben konnte. »Es wäre eigentlich schöner gewesen, nicht so viel und so ausführlich mit allen darüber zu sprechen,« dachte sie plötzlich, mit Scham und Stolz. Und während sie den Ring überstreifte und Ruth anblickte, konnte sie dem Gedanken nicht wehren: »Diese hier ist gewiß die nächste Braut.«

»Ja, Ruth, du hast recht: zum Erleben mag es schmecken, zum Erzählen ist es fade!« rief die hübsche dunkle Wjera dazwischen, die schon immer zu den Kecken gehört hatte und sich jetzt aus allen Kräften gegen das Uebergewicht der »Brautschaft« in der Klasse sträubte, »was hattest du immer für herrliche Geschichten und Abenteuer für uns auf Lager! Und jetzt: der reine Hausfrauenzettel! Ich bin die einzige, die noch dem ›Edlen, Unglücklichen‹ nachsteigt.«

»Ist der noch da?« fragte Ruth.

»Ja, stell dir nur vor,« klatschte eine an Ruths Ohr, »sie macht förmliche Straßenbekanntschaften. Es hat schon einen Verweis gegeben.«

»Laß dir nichts in die Ohren blasen, Ruth,« unterbrach die Geschmähte sie, »es ist ja alles deine Schuld und dein Vermächtnis! Warum bist du auch fortgeblieben mit deinen schönen Freistundengeschichten?«

Ruth hatte ihren Kopf gegen die Hausmauer gelehnt und sah schweigend in den verregneten Hof. Gerade vor ihr erhob sich ein hoher Schornstein, dessen Rauchsäulen jahraus, jahrein die Mauern schwärzten und ihren Ruß auf den Schulhof niederstäubten. Gegenüber sperrte die mächtige gelbe Wand des Hinterhauses jede Aussicht ab. Die Luft war schwül; sie hatte es draußen im blühenden Juni gar nicht bemerkt.

»Wie ein Gefängnis!« dachte Ruth und sagte laut: »Das mit den Geschichten war ja nur ein Notbehelf. Phantastereien.«

»Wieso ein Notbehelf?«

»Würdest du uns keine mehr erzählen?«

Sie schüttelte den Kopf.

»Nein. Keine Phantasiegeschichten mehr. Nie mehr. Aber wenn man vor einer großen Mauer sitzt, dann malt man sich natürlich aus, was es hinter der Mauer gibt. Und wir wußten nichts, als daß es dahinter Männer gibt. Und da malten wir sie uns mit lauter Männern aus. Ihr wolltet es ja so.«

»Nun, und was? Was gibt es sonst noch dahinter?«

»Weißt du jetzt etwas davon, was es da gibt?«

»O!« sagte Ruth nur, aber ihre Augen öffneten sich groß und strahlten alle an, wie zwei unergründlich verheißungsvolle Glücksgeheimnisse, »dahinter gibt es das Leben.«

In ihrem Blick und Ausdruck lag etwas dermaßen Aufstachelndes, die Neugier und das Verlangen Aufreizendes, daß in diesem Augenblick den meisten selbst der »Bräutigam« schon etwas schal und abgestanden erschien. In den Gesichtern prägte es sich deutlich aus, daß ein neuer Hunger sich geltend machte.

»Wie kommt man denn über die Mauer?« fragte die unternehmende Wjera.

Ruth lachte.

»Man klettert eben hinüber,« sagte sie und lachte noch immer, »und dann geht man geradeaus, und noch rechts und nach links, ringsherum und nach allen Seiten. Bis man alt ist.«

»Nehmt euch in acht!« rief eine von den Musterschülerinnen warnend, »seht ihr denn nicht, wie sie euch foppt? Gerade so machte sie es immer mit euch. Sie spielt und phantasiert, und dann lacht sie uns aus, weil wir's ernst nehmen.«

»Nehmt's nur für Ernst!« sagte Ruth und gab sich vergebliche Mühe, den Schalk zu zügeln, der ihr im Nacken saß.

»Da sollen wir wohl zu Herrn Matthieux gehen und ihn bitten, uns auch über die Mauer zu helfen?«

»Das könnt ihr ja thun.«

»Der hätte wohl gerade Lust und Zeit dazu!«

»Die hat er gewiß,« versicherte Ruth; »und Lust hat er auch. Er hat alles, außer den Menschen, die dazu gehören.«

Sie sahen sich mit unsicheren und lächelnden Blicken untereinander an. Und dann auf Ruth, die gleichmütig dasaß, wie das verkörperte Behagen.

Die Spannung wuchs. Dies hier schien ihnen ihre schönste Geschichte zu sein.

»Sage mal: ist es auch gewiß, daß es dahinter angenehm ist? Hast du da auch gewiß nie etwas Unangenehmes vorgefunden?« fragte eine von ihnen vorsichtig.

»Nie!« behauptete Ruth, und es blitzte über ihr Gesicht, als ihr beiläufig einfiel, daß ihre Augen seit gestern noch nicht trocken geworden waren.

Die dünnstimmige Klassenglocke fing an zu bimmeln, und die Mädchen verließen den Platz am Brunnen.

»Du könntest Herrn Matthieux ja mal für uns fragen,« meinte die hübsche Wjera, »das kostet nichts.«

»Warum?« entgegnete Ruth; »es ist eure Sache. Laßt es euch nur was kosten.«

In aufgeregtem Meinungsaustausch drängten sie dem Hause zu. Darüber blieb es unbeachtet, daß Ruth ihnen nicht folgte. Ueber der Spannung, die sie hervorgerufen, war sie selbst vergessen worden. Als die Mädchen sich dann nach ihr umsahen, um einen gemeinsamen Heimweg zu verabreden, war Ruth verschwunden. Das letzte, was sie noch von ihr vernahmen, war ein Gelächter.

Erik brauchte an diesem Vormittag nicht ganz so viele Stunden zu geben wie sonst, denn mehrere Privatschulen hatten schon Ferien gemacht. So kam er bereits früh in seine Stadtwohnung hinauf, wo Ruth ihn erwarten sollte. Noch war nichts von ihr zu erblicken. Erik erledigte, was es hier noch zu thun gab, und kleidete sich um, froh, der heißen Uniform zu entrinnen. Als Ruth sich dann immer noch nicht melden wollte, öffnete er etwas beunruhigt die Thür zum Wohnzimmer und schaute hinein.

Da lag sie und schlief.

Sie hatte ihre kleinen Schuhe ausgezogen und unter einen Stuhl gestellt. Dann hatte sie sich, mit emporgezogenen Füßen, auf dem weißen Leinwandbezug des Sofas zusammengekauert. Den Kopf gegen das Seitenpolster gedrückt, schlummerte sie, mit ernstem Gesicht und schlafgeröteten Wangen, fest und eifrig, wie ein Kind.

Die Müdigkeit mußte sie beim Warten überfallen haben.

Aus dem grauen Regenhimmel stahlen sich durch die niedergelassenen Fenstervorhänge einzelne Strahlenbündel, in denen der Staub in breiten Wellen flimmerte und zitterte, und huschten über Ruths Gesicht. Ein leises Lächeln glitt mit den Sonnenstrahlen über dasselbe hin und blieb auf den Lippen stehen, wie im Traum. Dann, als die Sonne zudringlicher wurde, zog sie ein paarmal Stirn und Nase kraus, und endlich mußte sie heftig niesen.

Das Lachen breitete sich über ihr ganzes Gesicht. Lachend wachte sie auf und hörte Erik lachen.

»Ist es Morgen?« fragte sie verwundert und setzte sich auf.

»Nein. Es ist Mittag. Warum bist du denn den Mädchen so rasch weggelaufen? Sie fragten noch nach dir,« sagte er.

Ruth rieb sich die Augen.

»Ach so, die Mädchen. Jetzt weiß ich schon,« versicherte sie; »ja, mit den Mädchen ist es nichts. Glaub's nicht. Aber mir ist eingefallen: wenn man keine lebendigen Menschen aufbringen kann, -- dann gäb's am Ende auch noch ein andres Mittel.«

»Mädel! Schüttle den Schlaf ab. Träumst du denn noch?«

»Nein, nein. Kein Traum,« sagte sie eifrig, glitt mit den Füßen vom Sofa herunter, stützte die Arme auf den staubigen Tisch davor und drückte das Kinn auf die geballten Hände; »ich habe es mir nämlich so gedacht: wenn man zu den Menschen sprechen will, -- in sie hineinwirken, -- an ihnen was Großes schaffen, -- und man findet nicht recht die richtigen Menschen, die gut dazu passen würden, dann muß man es ~so~ machen: man muß sich etwas ausdenken, was man ihnen vor Augen stellt, -- so recht überzeugend und gewaltig vor Augen, bis sie Lust kriegen. Kann man das nicht? Warum nicht? Zu den Menschen vom Allerschönsten reden und nicht müde werden, -- bis sie Lust kriegen.«

Sie sprach rasch und belebt, mit wachen, glänzenden Augen, sichtlich bemüht, ihm etwas deutlich zu machen, das sie da, wie einen Traum, mitten aus ihrem Schlaf hervorgeholt zu haben schien.

»Wer soll das thun?« fragte er langsam, von ihrem Gesichtsausdruck wie gebannt, und trat heran an den Tisch.

»~Sie~ sollen es!« rief sie hell, »wer denn sonst? Sie haben mir immer gesagt: mit den Phantastereien ist es nichts, aber das Leben ist schön und weit. Ich glaub's ja! Ader nun weiß ich, wozu die Phantasiegeschichten gut sind, -- denn zu etwas sind die auch gut. Dazu, daß man sich ausdenken kann, was noch am Leben fehlt, und es hinzuthun. Am Leben und an den Menschen. Nicht wahr?«

Während sie sprach, ging Erik im Zimmer auf und ab. Ihm schien, als lausche er auf den kindlichen Ausdruck dessen, was er nur künstlich in sich selbst zurückgedrängt hatte. Es kam wieder und redete mit Kinderstimme zu ihm. Eine Reihe noch unklarer Pläne blitzte ihm durch den Kopf. Alte und neue durcheinander. Sie hatten immer nach Gestaltung verlangt. Und er, durch die Verhältnisse enttäuscht, hatte versucht, sie von sich abzuschieben, -- zu vergessen. Im vergangenen Winter hatte er sich in einen förmlichen Gesellschaftsrausch gestürzt, um sie zu vergessen.

Ruth saß und folgte ihm mit den Augen.

»Jetzt denkt er sich gewiß was aus!« dachte sie.

Mehrere Minuten vergingen in Schweigen. Beide merkten nichts davon, daß die Luft im Zimmer dick und staubig war, und ungezählte Mücken umherschwirrten.

Dann blieb Erik stehen, nickte zu ihr hinüber und sagte heiter: »Danke dir, Mädel. Erinnerst du dich, daß du mir etwas schenken wolltest, was ich eigentlich nie bekommen habe? Nun hast du mir aus deinen Phantasiegeschichten heraus doch etwas geschenkt. Zur guten Stunde.«

Sie sprang vom Sofa und kam auf ihren Strümpfen lautlos zu ihm.

»Ja!« sagte sie froh, »Sie wollten sie mir aus dem Kopf herausnehmen und alle für sich behalten. In den Kopf sollte nur lauter Vernünftiges hinein. Sie sagten damals: ›Nun sind alle deine Geschichten mein Eigentum, und ich kann mit ihnen machen, was ich will.‹ Und nun werden Sie etwas Schöneres damit machen, als ich's gekonnt habe.«

Sie hob den Kopf mit einem Ausdruck ungeduldiger Spannung und Erwartung, und dann fügte sie bittend hinzu: »Aber ich muß zuhören dürfen, wenn Sie sich was ausdenken! Darf ich zuhören? Werden Sie es mir erzählen?«

Erik blickte auf sie nieder. So kindhaft kam sie ihm vor, als sie so in Strümpfen neben ihm stand. Da reichte sie ihm noch nicht bis zur Schulter.

Wie heute morgen am Schreibtisch beugte er sich zu ihr, nahm ihr Gesicht in seine Hände und sah hinein in zwei strahlende, glückliche, bittende Kinderaugen.

»Wir werden es uns zusammen ausdenken!« sagte er. --

Klare-Bel hatte inzwischen Besuch gehabt. Als Erik und Ruth nach Hause kamen, stand eine Equipage vor der Gartenpforte. Der Kutscher wendete den leichten Wagen mit englischem Gespann und ließ die Pferde sich langsam, im Schritt, abkühlen.

Warwara Michailowna saß bei Klare-Bel in deren kleinem, behaglichem Gemach neben der Wohnstube. Sie war von ihrem erst kürzlich bezogenen Landhause, das etwa eine Stunde entfernt lag, herübergekommen.

Es waren meistens nicht nur konventionelle Besuche, die sie der kranken Frau machte. Sie kam gern, wie sie auch gern empfangen wurde: Sie empfand es wohlthuend an Klare-Bel, daß man deutlich fühlte: hier lag eine, der es wirkliches Vergnügen machte, einmal im Plauderton wieder etwas von der Welt draußen, von den Menschen und der Gesellschaft zu hören. Konnte sie auch nie wieder in das gesellige Treiben zurückgelangen, so kannte sie dergleichen doch recht wohl aus den ersten, beglückenden Jahren ihrer Ehe und sah es noch immer ein wenig im Glanze dieser Zeit. Und da war es nun eigentümlich: wenn man zu so einer sprach, dann ließ man unwillkürlich den schlechtesten Klatsch zu Hause.

Klare-Bel selbst erzählte zwar niemals viel. Aber Warwara wußte, daß es auch andern Bekannten gegenüber nicht geschah. Sie wußte: dies hier war wirklich eine Frau, die mit niemand intim zu sein vermochte, als mit ihrem Mann.

Was Warwara über Ruth und deren Anwesenheit im Hause erfuhr, fesselte sie im höchsten Grade und erregte sie beinahe. Als aber nun Ruth ins Zimmer trat, war sie enttäuscht.

Sie hatte unwillkürlich etwas Auffallendes erwartet.

Vielleicht einen wilden, interessanten Jungen in Mädchenkostüm, vielleicht auch umgekehrt ein rührendes, liebliches Kind, das sich schüchtern zurückzog, -- jedenfalls etwas ganz Eigenartiges. Nicht ein blasses, wohlerzogenes Ding, das sich für Warwaras im Salon geübten Blick von andern so jungen Mädchen durch nichts unterschied, als höchstens durch das geradezu Abgeschliffene, Formsichere und Unbefangene ihres Wesens einer Fremden gegenüber.

Nicht minder schnell war Ruth mit Warwara fertig: sie nahm diese ganz als eine von vielen und gab auch sich selbst so, wie eine unter den vielen, aus denen die Gesellschaft besteht.

Warwara zog sie ein wenig ins Gespräch und fragte, wo sie erzogen worden sei.

»Ich war an verschiedenen Orten,« sagte Ruth, »aber erzogen bin ich noch nicht.«

Man wußte nicht, war es bescheiden oder übermütig gemeint?

»Wenn die nicht durchtrieben ist!« dachte Warwara bei sich und musterte sie schärfer.

Bald trat Erik dazu, eine heitere Unterhaltung in Gang bringend. Warwara erzählte vom Rückgang einer Verlobung, deren Anzeige erst kürzlich auch hier eingelaufen war. Ein sensationeller Rückgang, denn die Braut hatte sich während der kurzen Verlobungszeit ganz eilig in einen andern verliebt.

Erik, der es nicht über sich vermochte, die humoristische Seite dieser Sachlage unbeachtet zu lassen, lachte laut.

Warwara sah sich nach Ruth um. Diese war hinausgegangen.

»Zufällig? oder ein Kunstgriff, um bei diesem Gespräch nicht hinausgeschickt zu werden?« fragte sie sich, »oder ist sie wirklich so kindlich, daß sie das gar nicht interessiert?«

Nachdem Erik über den betrübten Mienen der beiden Frauen wieder ernst geworden war, sagte er: »Ja, die armen Frauen! Wenn sie sich binden, haben sie allen Grund zu beten: Lieber Gott, hilf, daß ich eine gute Frau werde. Denn ihr einziger Schutz gegen sich selbst liegt in der That im rein gefühlsmäßigen Fortdauern ihrer Liebe, -- in der eigentlichen Gefühlstreue. Sie können natürlich auch aus Pflichtstrenge festhalten, aber das ist dann ein verkümmertes Leben.«

»Sie meinen, der Mann bedarf eines solchen Gebetes nicht,« bemerkte Warwara, ohne ihre Ironie zu verbergen.

Er sah sie ganz unbefangen an. »Nein,« sagte er; »ich glaube, der Mann ist in diesem Punkt, wie in so vielen andern auch, durch seine Natur besser geschützt. Nicht gegen die Untreue der Sinne. Nicht gegen den Wechsel des Liebesgefühls. Aber gegen das bewußte innere Loslassen desjenigen Wesens, an das er sich gebunden, -- nein: ~das er an sich gebunden~ hat. Das ist's!«

»Das ist originell. Sie vindizieren da dem Manne eine Kraft des Pflichtbewußtseins, einen Edelmut des Mitleids, den ~wir~, -- die Frauen, -- nicht --«

»Ach nein, empören Sie sich nur nicht. Kein Pflichtbewußtsein: nur ein Glücksbewußtsein mehr, als ihr es habt. Keinen mitleidigen Edelmut: nur einen begehrlichen Hochmut, den ihr nicht besitzt. Der Mann, der für immer ein Weib an sich und auf sich nimmt, genießt neben dem Liebesglück noch ein andres, spezifisch männliches Glück: er legt seine Hand bewußt auf dieses ganze ihm zugehörige Dasein und sagt dazu: ›Mein‹. Ihm bedeutet sein Glück durch das Weib dreierlei: lieben mögen, -- verantworten wollen, -- herrschen dürfen.«

Warwara schüttelte sich.

»Gott erhalte Ihnen Ihre Arroganz!« sagte sie; »mir jedoch ist wahrlich die Vorstellung lieber, nach welcher die Frau des Mannes Königin ist.«

»Sie sehen, -- ich sage noch mehr: sein Königreich,« versetzte er lächelnd, »daher gibt sie ihn eher preis, als er sie. Für sie gibt es eben ihm gegenüber Aufstand, Empörung, Revolution, -- was alles ganz heroisch aussehen und sehr verführerisch wirken kann. Für den Mann hingegen wäre untreues Preisgeben seines eigensten Reiches etwas, was ihm wider die Scham geht.«

Warwara lachte ihm ins Gesicht.

»Und das sind Sie, der für alle möglichen modernen Entwickelungskämpfe, und auch für die der Frauen, so gern eintritt!« rief sie; »es ist eine schauderhafte Inkonsequenz und ein Selbstbetrug obendrein! Denn wenn Sie sich nun in eine solche entwickelte Zukunftsfrau verliebten, die nicht mehr so mittelalterlich denkt, und sie ~nicht unterkriegten~?«

»Das würde ich doch!« sagte Erik. »Sonst würde ich mich vielleicht für sie begeistern, sie bewundern, fördern, als meinen Kampfgenossen achten, -- aber lieben, -- wie sollte ich das? So wenig, als wenn ich ein Weib, oder sie ein geschlechtsloses Wesen wäre. Ich kann mir vorstellen, daß der Mann jede Herrschsucht vollständig ablegt um einer Sache willen, die er über sich stellt. In der Liebe -- nie! Und ein Weib, das diesem Instinkt nicht entgegenkommt, -- wirkt nicht als Weib.«

»Und dieser Widerspruch sollte in der Natur selbst liegen? Nein, nur in eurem jahrhundertelang großgenährten Dünkel,« versetzte Warwara entrüstet und wandte sich zu Klare-Bel: »Was sagen Sie nur zu einem solchen Mann? Wir sollten uns für alle Zukunft unter den Mann stellen, wenn wir lieben?«

Klare-Bel antwortete etwas unsicher: »Ich glaube, das thun wir, nicht weil wir unter ihm stehen. Sondern weil wir glücklich sein wollen.«

Alle drei fingen an zu lachen. Warwara erhob sich, um nach Hause zu fahren.

»Nun sollt' ich hiervon eigentlich genug haben,« bemerkte sie gut gelaunt zu Erik, »aber von meiner kleinen Nichte in der Mädchenschule erfuhr ich, daß diesmal Sie bei dem feierlichen Schulschluß die übliche große Rede halten werden. Da komme ich hin. Damit Sie doch wissen: Eine sitzt da und verspottet Sie. Und hübsch klingen wird es sicher. Ich habe nämlich schon immer Ihre Toaste in Gesellschaften so gern gehabt.«

Erik mußte lachen.

»Sie sollten mich nicht so gewaltsam daran erinnern, daß unsre schönsten Reden für Toaste genommen werden,« versetzte er, »und daß fast die einzigen aufmerksamen Zuhörer, die wir außer den Schulkindern auftreiben können, die gelangweilten schönen Frauen unsrer oberflächlichen Gesellschaft sind.«

»Liebste, jetzt sind Sie Zeugin, daß ich mich zu rächen habe,« sagte Warwara gekränkt zu Klare-Bel; »ich möchte nur wissen, ob's ihm nicht weh thäte, wenn die schönen Frauen alle wegblieben. Ich glaube, dieser Barbar würde dann ~Sie~ auf den Rücken nehmen und zur Zuhörerschaft unter seine Schulkinder setzen, die ihn alle fürchten wie das Feuer.«

»Das wird wohl nie geschehen,« meinte Klare-Bel etwas betrübt.

»Doch! doch! Kein Mensch kann in die Zukunft sehen. Wir werden jetzt, auf Grund einer Konsultation mit dem Professor, eine Behandlung meiner Frau durchführen, die Wunder verspricht,« sagte Erik zu Warwara und geleitete sie an ihren Wagen.

Jonas war später nach Hause gekommen, als Erik mit Ruth, und kam seltsamerweise erst zum Vorschein, als der Besuch fortgefahren war, und man sich schon zu Tisch setzte.

Die Zwischenzeit hatte er im hintersten Winkel des Gartens unter den tropfenden Bäumen verbracht, im Kampf mit einem großen Entschluß. Seine Ringelnatter war mit ihm, sie hing ihm melancholisch um den Hals, als wisse sie schon, daß ihr etwas sehr Unangenehmes bevorstehe. Noch einmal hatte er sie liebkosend in die Arme genommen, sie gestreichelt und zärtlich an sich gedrückt, noch einmal in ihrem kostbaren Besitze geschwelgt. Dann hatte er sie totgeschlagen.

Um es zu thun, mußte er sich Mut einsprechen und sein Herz verhärten. Er mußte sich vorstellen, daß er wie ein neuer Herkules sei, der die Hesione von einem Meerungeheuer erlöst, oder noch lieber wie Perseus, der sich seine Andromeda erobert. Aber diese Vorstellung verfing nicht recht. Seine arme Ringelnatter sah gar nicht aus wie ein Meerungeheuer; Ruth verkannte sie nur. Das Tier blickte ihn mit seinen schwarzen Aeuglein so beweglich an, und er hatte es so lieb.

Da ging ihm ein altes Märchen tröstend durch den Sinn, von einer Schlange mit einem Goldkrönlein auf dem Kopf; wer die totschlug, dem verwandelte sie sich in eine liebreizende Prinzessin. Er wußte nicht mehr, ob es sich genau so verhielt, aber es gefiel ihm. Und seine Prinzessin saß und wartete gewiß schon darauf.

Nachdem Jonas den Mord vollbracht hatte, wandte er sich mit rotem Gesicht ins Haus. Es war ein ganz ungeheures Opfer, fand er, was sie da beide Ruth gebracht hatten, er und die Ringelnatter. Denn die Schlange blieb nun tot, und er hatte sich über sie fast ebenso gefreut, wie über ein Reitpferd.

Und nun sprach Ruth bei Tisch immer von den albernen Schulmädchen, die er nicht leiden konnte. Es ärgerte ihn, daß sie heute in die Freistunde gelaufen war, denn bisher besaß sie an ihm ihren einzigen Spielgefährten, und in diesem Punkte verstand Jonas keinen Spaß.

Noch saßen sie beim Mittag, als ein Eilbote kam und ein Telegramm für Erik überbrachte.

Erik erbrach es und überflog den Inhalt, dann schob er seinen Teller zurück und trat mit dem Papier ans Fenster. Man sah ihm an, daß es eine freudige und ihn bewegende Nachricht war, die er erhalten.

»Fast ein ganzer Brief! An der Grenze aufgegeben,« sagte er; »denke dir, Bel, mein alter Freund Bernhard Römer ist hierher unterwegs. Siebzehn Jahre haben wir uns nicht gesehen. Oder noch länger? Damals waren wir beide noch Studenten! Erinnerst du dich seiner?«

»O ja, Erik! Wie sollte ich den vergessen! Denn mit ihm war es ja, daß du immer noch so große Zukunftspläne machtest. Ihr wolltet alles am liebsten auf den Kopf stellen. Ja, so jung wart ihr damals. Was ist Römer denn eigentlich geworden?«

»Er ist Professor der Medizin an der Heidelberger Universität. Schrieb mir noch manchmal in frühern Jahren.«

Ruth hatte aufgehört zu essen und sah mit großen Augen zu Erik hinüber. Bei dem Wechsel in seinem Mienenspiel und bei Klare-Bels Worten war es Ruth, als stiege plötzlich eine ganze, fremde und ferne Vergangenheit zwischen ihnen auf. Eine Vergangenheit, bei der sie nicht zugegen gewesen war. Ueberhaupt noch nicht auf der Welt! Es schien ihr ganz unmöglich.

»Wird er hier herauskommen?« fragte sie leise.

»Das wird er leider nicht. Er reist nur durch. Sein Ziel ist Moskau. Dort ist irgend eine Aerzteversammlung. Morgen früh am Bahnhof werde ich Näheres erfahren. Ob er seine Frau wohl mitgebracht hat?«

»Zu einer Aerzteversammlung?« bezweifelte Klare-Bel.

»Warum nicht? Ich glaube, sie sind in ihrem geistigen Leben eng verwachsen. Römer heiratete sehr jung, die Frau machte seine ganze Sturm- und Drangperiode noch mit durch. Das gab ihrer ganzen Ehe den Charakter.«

»Haben sie keine Kinder?« fragte Klare-Bel, die dieser Punkt besonders zu interessieren pflegte.

»Ich glaube nicht.«

»Keine Kinder?« wiederholte Klare-Bel im Tone des Bedauerns. Nichts war ihr an ihrem Leiden so hart erschienen, wie der Umstand, daß sie nicht wieder Mutter werden konnte; »das ist doch eine traurige Ehe, so zu zweien.«

»Soviel ich mich erinnere, haben sie nicht immer zu zweien gelebt. Sie hatten wiederholt ein junges Mädchen bei sich, das an der Universität studierte.«

»An der Universität studierte? Können junge Mädchen das?« erkundigte sich Ruth erstaunt.

Erik blickte sie mit einem Lächeln an.

»Jawohl. Solche junge Mädchen wie du,« sagte er; »es steht dem ja nichts im Wege, daß du eines der nächsten Hauskinder bei Römers wirst. Hast du Lust dazu?«

Er sagte es scherzend, aber der Blick, mit dem sie ihm antwortete, war so ernst, daß er ihm im Gedächtnis blieb.

Erik setzte sich an den Tisch zurück und plauderte mit seiner Frau von alten Zeiten. Jonas fand, nun könnte Ruth mit ihm hinausgehen, aber sie blieb sitzen und hörte zu.

Draußen hatte es angefangen, stärker zu regnen; Jonas lehnte in der Hausthür an der Terrasse und schaute prüfend hinaus. Als Ruth endlich vom Mittagstisch aufstand und in den Flur trat, bemerkte er: »Wenn wir doch wenigstens bei Regenwetter ›Mann und Frau‹ spielen wollten. Das paßt so gut fürs Haus. Denn wenn die Sonne scheint, thust du es doch nicht. Und dann ist es auch etwas, was du bei deinen albernen Mädchen nun einmal nicht haben kannst.«

»O doch!« versicherte Ruth und schwang sich auf das Geländer der schmalen Holztreppe, die nach ihrem Giebelstübchen hinaufführte, »das haben wir im Schulhof oft genug miteinander gespielt.«

»Das muß aber eine schöne Wirtschaft gewesen sein, ohne einen wirklichen Jungen!« meinte Jonas verächtlich. »Und ich möchte doch so viel lieber dein Mann sein, als der Mann in all den Räubergeschichten, bei denen ich mich immer so anstrengen muß.«

»Aber ich möchte nicht deine Frau sein,« sagte sie kaltherzig und saß und schaukelte mit den Füßen, »und dann wäre das auch noch viel anstrengender für dich. Sei doch froh, daß du bei alledem jedesmal die Hauptperson und der Held bist.«

»Nein, das bist du eben immer!« warf er ihr mißmutig vor.

»Nein, Jonas, das ist bestimmt nicht wahr. Du bist es ganz allein. Warst du nicht erst gestern der Egmont? Und neulich --«

»Ja, im Anfang!« unterbrach er sie gereizt; »aber wenn du mir alles immer erst vorsagst und womöglich auch noch vormachst, dann bin ich es ja gar nicht in Wirklichkeit, sondern nur du.«

»Ich kann doch nichts dafür, wenn du dumm bist.«

Jonas schwieg gekränkt. Wenn sie wüßte, wem sie das sagte; -- wenn sie wüßte, daß er freiwillig darauf verzichtet hatte, ihr seine Ueberlegenheit zu zeigen, sie in Furcht zu versetzen, sie zum Bitten und Schmeicheln zu bewegen! Denn, hätten sie

»Schlangenbändiger« gespielt, da wäre er doch wohl der Herr gewesen. Und sie war so dumm, ihm zu glauben, die Schlange sei wirklich entschlüpft.

Jonas brannte die Zunge, Ruth von seinem Opfer zu erzählen. Aber er fand, das verbiete ihm sein Mannesstolz. Lieber noch wollte er sich die Zunge abbeißen, wenn die Schwatzlust zu groß wurde.

»War ich Egmont, so hättest du mein Klärchen sein müssen,« sagte er; »warst du es etwa?«

»Nein, natürlich nicht. Dazu kam ich ja gar nicht. Denn allein hättest du ihn doch nie herausgebracht. Und er ist doch das Wichtigste, wie du dir denken kannst. Das Klärchen kann man streichen.«

»Ich habe aber keine Lust, mich zu deinem Hampelmann herzugeben! Sei meine Frau!« schrie er ärgerlich und stampfte mit dem Fuß auf.

Ruth war vom Geländer herabgeglitten. Sie stellte sich ans niedrige Flurfenster, an dem der Regen herunter rieselte, und drückte ihr Gesicht platt gegen das Scheibenglas, so daß es sich satyrhaft verzog. Wenn Jonas wütend wurde, dann überschlug sich jedesmal seine Stimme: sie schwankte immer zwischen zu hoch und zu tief. Das brachte Ruth immer zum Lachen.

Da riß Jonas seine Mütze vom Mantelständer und stürzte hinaus.

»Lauf nur zu deinen albernen Mädchen!« rief er grimmig, »ich bin ein Junge!«

Am Ende war Ruth gar nicht das Ideal einer Frau, wie er sie brauchte. Andromeda hatte sich bereit erklärt, ihrem Erretter als Sklavin durch alle Länder zu folgen. Ruth würde so etwas nie thun, es würde ihr gar nicht einfallen, -- davon war er fest überzeugt.

Von der Terrasse aus steckte Jonas seinen Kopf durch das offene Fenster des Wohnzimmers und fragte, ob er noch bis zum Abendthee einen Kameraden aufsuchen dürfe.

Klare-Bel, die neben dem abgeräumten Tisch lag und in Lenneps Novellen las, blickte bei seinen Worten verwundert aus.

»Es ist nur gut, daß er noch an so was denkt,« bemerkte sie, als sein Kopf vom Fenster verschwunden war, »denn jetzt denkt er Tag und Nacht nur noch an das Mädchen, Erik.«

»Strohfeuer!« versetzte dieser.

Er stand und schaute verträumt hinaus. Seine Gedanken weilten noch in der Vergangenheit. Seine Frau nahm den morgenden Tag nur als eine willkommene Zerstreuung, und darüber freute sie sich für ihn. Ihm war es mehr als das.

»Findest du, es schadet nichts?« fragte Klare-Bel besorgt: »aber du meintest doch selbst, Jonas sei flüchtig und zerstreut im Lernen geworden.«

»Das ist er wohl ein wenig, aber was ihm an Schulweisheit vielleicht dadurch abgeht, erhält er tausendfach wieder in glücklicher Anregung, die seine geistigen Kräfte belebt und aufschüttelt. Das ersetzt ihm keine Schule.«

»Er ist freilich noch wie ein Kind. Aber Jonas ist anhänglich. Wenn er nun sein Herz so ganz an sie hängt --?«

»Dann laß ihm diese Erinnerung, Ruth begegnet zu sein. Er kann es an nichts Besseres hängen, Bel.«

Sie schwieg darauf. Das holländische Novellenbuch entglitt ihren Händen. Sie faltete sie im Schoß.

»Wie hoch er sie stellt!« dachte sie im geheimen erschrocken.

Es war ein stiller Tag, der nächste. Weil Erik nicht nach Hause kam. Wie ausgestorben schien das Haus, weil man seinen Schritt und seine Stimme darin nicht hörte.

Er würde wohl erst mit dem letzten Nachtzug heimkommen, meinte Bel. Nachts ließ er sie gewiß nicht gern auf dem Lande allein.

Jonas schlich übler Laune im Hause umher. Nach dem gestrigen Streit fühlte er einen heftigen Drang nach einer ausgiebigen Versöhnung nebst darauf folgendem unzertrennlichen Beisammensein. Aber dafür war Ruth heute nicht zu haben. Den Streit hatte sie rein vergessen. Und auf alle seine Vorschläge, etwas Gemeinsames zu unternehmen, entgegnete sie nur ihr wohlbekanntes stereotypes: »Ich muß nachdenken.«

Und Jonas wußte schon, daß sie dann für ihn so gut wie verloren war.

Ruth dachte immerfort, unablässig über ein und dasselbe nach. Sie folgte in Gedanken Erik in die Stadt, an den Eisenbahnzug, der ihm den Freund bringen mußte, und versuchte, sich in das Wiedersehen hineinzuversetzen.

Als Klare-Bel ihm am Morgen beim Weggehen zurief: »Adieu, Erik, amüsiere dich gut!« da hatte Ruth beinahe betroffen aufgeblickt. Es kam ihr vor, als habe Erik etwas so Ernstes und Herzbewegendes vor. Selbst sein Gesicht schien ihr seit gestern verändert. Unter allem, hinter allem, was er in gewohnter Weise sprach oder that, fühlte Ruth es heraus, wie eine ganze Welt von aufgestörten Erinnerungen unaufhörlich in ihm raunte und redete. Keine Erinnerungen aber, die ~amüsieren~, -- sondern solche, die gewaltsam zurückzerren in eine Vergangenheit, von der die Gegenwart verdunkelt wird.

Auf dem Garten lag heute freundlicher Sonnenschein. Klare-Bels Stuhl war auf die Terrasse geschoben worden; unten konnte sie nicht bleiben, weil Erik fehlte, um sie wieder heraufzutragen. Ein warmer Sommerduft stieg von draußen auf; Flieder und Goldregen waren am Verblühen, und auf den Beeten öffneten sich die roten Rosen. Baumwipfel und Büsche drängten sich jetzt so dicht ineinander, daß es fast schon zu viel Laub und Schatten ums Haus gab. Der Sommer barg es ganz in seinem warmen Dunkel, und von der Straße gesehen nahm sich der Garten jetzt aus wie ein großer grüner Farbenklecks.

Als der Abendthee auf der Terrasse getrunken wurde, fiel es Klare-Bel doch auf, daß Ruth wie geistesabwesend dabei saß.

»Es ist doch, als könnte sie es gar nicht mehr ertragen, daß Erik sich mit andern Menschen beschäftigt als mit ihr; am liebsten würde sie ihm keine Zerstreuung mehr gönnen, diese arge kleine Egoistin,« dachte sie und fragte laut: »Aber, Kind, fehlt dir etwas? was machst du nur für wunderliche Augen? Ich glaube gar, am liebsten wärst du mit Erik dort?«

Ruth fing mit feinem Ohr den nicht ganz liebreichen Ton auf und sah sie schüchtern an.

»Ich versuche es, dort zu sein!« sagte sie zum unaussprechlichen Erstaunen Klare-Bels.

Diese zog sich nach dem Abendthee bald in ihr kleines Gemach zurück, um sich zeitig zur Ruhe zu begeben, denn sie fühlte sich ein wenig leidend. Vielleicht griff die neue Behandlung sie an, die Erik seit kurzer Zeit mit ihr vornahm, und die er ihr auf viele Monate hinaus in Aussicht gestellt hatte. Er fing wirklich schon an, wieder neue Hoffnung zu schöpfen.

Gonne entfernte sich, nachdem sie ihre Frau sorgsam gebettet, und Klare-Bel lag in ihrem stillen Zimmer allein, umgeben von all den zierlichen und saubern Sächelchen, die sie bei sich aufzustellen liebte.

Sie lag und lächelte über sich selbst. War es nicht seit kurzem, als ob auch sie, ganz leise -- leise, heimlich, die neue Hoffnung hätschele? Ein klein wenig nur. Die Hoffnung, doch noch einmal wieder gesund zu werden, Erik entgegengehen zu können auf ihren zwei gesunden Füßen.

Es war ja gewiß nichts damit. Ein bloßer Wahn. Aber wenn er trog, dann würde Erik sie schon darüber hinwegtragen, wie über die vielen, vielen frühern Enttäuschungen auch. Denn das hatte er gethan, -- nicht gerade mit übermäßigem Bemitleiden und Schonen, aber mit seiner unaufhörlichen Gegenwart, mit seiner beständigen energischen Einwirkung auf sie. Und manchmal, da überkam sie ganz deutlich das Gefühl: es war gut so, denn er brauchte das; nur in diesem Bemühen überwand er seine eigenen Enttäuschungen. Seine starke Beeinflussung andrer schien es zu sein, durch die er immer wieder selbst zur alten Sicherheit zurückkehrte. So oft konnte sie es mit Verwunderung beobachten im täglichen Leben unter den Menschen seiner frühern Umgebung, wie belebend es auf ihn wirkte, daß sie von ihm Kraft und Belebung erwarteten. Das Alleinsein vertrug Erik wirklich schlecht.

Die Zeit rückte vor, und immer noch lag Klare-Bel wach und träumte mit offenen Augen. Durch das geöffnete Fenster strich weich und feucht die Luft, ganze Schwärme von kleinen Mücken mit sich tragend; von fernher verklang leise das Lied der letzten Landarbeiter, die von nächtlicher Arbeit heimkehrten. Mit hellen Sonnenaugen schaute die Nacht ins Zimmer herein.

Klare-Bel kamen ketzerische und sogar übermütige Gedanken, so daß sie über sich selbst erstaunen mußte. »Wer ist nun stark,« dachte sie, »wenn der Starke wieder der Schwachen bedarf?« Sie war sicherlich ein schwaches Wesen, froh, wenn Erik sie bei der Hand nehmen und führen wollte. Er aber, brauchte er denn nicht jemand um sich, den er führen konnte, um selber froh und des Weges sicher zu bleiben? Brauchte Erik also nicht sie, wie sie ihn?

Klare-Bel lächelte in der Einsamkeit der hellen Nacht, und inbrünstig streckte ihre Sehnsucht sich ihm entgegen. --

Wie sie es vorausgesehen, befand sich Erik erst Stunden später auf dem Heimweg. Er hatte mit vielen andern dem Freunde das Geleit bis zum Moskauer Bahnhof gegeben, und dann blieb man noch eine Weile zusammen, -- ein ganzer Haufen von Menschen, von Fremden und Bekannten, mit denen der Abend in angeregter Geselligkeit verbracht wurde. Erik ließ sich nicht mehr die Zeit, zu Hause vorzufahren, um sich umzukleiden; er erreichte eben noch den letzten Nachtzug und fuhr aufs Land hinaus.

Der lange Gang von der Station aus that ihm nach den verflossenen Stunden und Eindrücken wohl; die freie Nachtluft erfrischte ihn. Kein Lufthauch bewegte sich; am fast taglichten Himmel stand blaß und glanzlos der Vollmond; einzelne Wolken ballten sich aufeinander, und von Zeit zu Zeit sprühte ein feiner Regen nieder.

Als er am Hause ankam, das unter den regungslosen Bäumen in der Nachthelle dalag, wich langsam die noch erregte Stimmung einem Gefühl ruhiger Freude, wieder daheim und bei den Seinen zu sein. Bei ~den~ Seinen! Auch Ruth gehörte jetzt dazu. Gehörte ihm zu.

Er stieg leise die Stufen zur Terrasse hinauf und warf einen Blick auf die Giebelstube, wo sie jetzt schlief und träumte. Da, als er fast geräuschlos die Hausthür aufgeschlossen hatte, knarrte die schmale Holztreppe, die vom Flur nach oben führte, unter einem leichten Fuß. Völlig angekleidet, nur das Haar ein wenig wirr um den Kopf, erschien Ruth auf dem untersten Treppenabsatz.

»Aber, Ruth, was fällt dir ein? Wie konntest du aufbleiben? Schnell ins Bett!« sagte er.

Er schalt, doch klang es sehr herzlich. Empfand er doch ihr liebes Gesicht wie einen Willkommgruß.

»War es schön?« fragte sie entgegen und blickte ihn mit großen überwachen Augen an, »sollte ich denn dabei schlafen? Nein, das konnte ich nicht! denn ich war auch da, -- immer mit da. War es schön?«

Er faßte nach der sich ihm entgegenstreckenden Hand und hielt sie fest. Alle Eindrücke des Tages, alle Erinnerungen, die von ihnen aufgewühlt worden, verflogen; er hatte den ganzen Menschenstrom hinter sich gelassen und war nur noch ganz allein mit ihr.

Was bedeutete ihm alle Anregung, ja, was aller so ersehnte Beifall oder Erfolg, nach dem er im Leben gegeizt und gerungen, gegenüber dem zarten Lob, wie es aus Ruths kindlicher, gläubiger Hingebung an ihn redete? Wie schal und brutal erschien ihm daneben alles, was von einer Menge ausging und sich laut äußerte. Nur wessen Sinne zu stumpf geworden für so feinen Duft, der mochte nach schärfern Würzen suchen.

Dieser Gedanke flog Erik durch den Kopf und darüber vergaß er zu antworten.

Er sah gut aus im Gesellschaftsanzug, den weiten Mantel lose umgeworfen, regenbesprüht, und darüber das belebte Gesicht. Wie sie so einander gegenüberstanden in der schweigenden Nacht, während die ganze Welt um sie her im Schlummer lag, erschienen sie beide wie gesättigt mit Leben; und etwas Verwandtes schien aus beider Ausdruck zu sprechen, -- verwandt über Alter und Geschlecht hinaus, -- ein Lebenverlangendes, Lebenforderndes. Es war dasselbe, was Erik so verwandt berührt und ergriffen hatte, als er Ruth zuerst im Schulhof sah, mit dem Uebermut in den Augen und den erhobenen Armen.

Sie standen und schwiegen, und um sie her träumte die magische Helle, in der Abend und Morgen unmerklich ineinanderschmolzen.

»Hätte ich nicht fortgehen sollen, Ruth?« fragte er unwillkürlich und blickte sie mit einem Lächeln an.

»Doch! aber mich mitnehmen!« entgegnete sie, und im Klang ihrer Stimme verriet sich die ganze Sehnsucht und Selbstentrückung, in der sie den Tag über umhergegangen war. Erik verstand sie nicht ganz, er nahm die nachträgliche Bitte kindischer und tatsächlicher, als Ruth sie meinte, aber Blick, Ton und Haltung drückten es so kindlich aus, daß sie sich in seiner Abwesenheit wie verloren gefühlt hatte, daß eine tiefe Rührung über ihn kam.

Ihm schien, Ruth sah wie verzaubert aus, -- anders, lieblicher als sonst.

Im Hause blieb es ganz still, und beide sprachen mit gesenkter Stimme. Nur durch die offen gebliebene Hausthür zog es ganz leise wie ein geheimnisvolles Raunen und Rauschen, -- ein Flüstern, das draußen durch das niedrige Gebüsch ging, -- die erste Ankündigung des neuen Tages.

»Es ist Zeit!« sagte Erik aufschreckend, »lege dich schlafen. Gute Nacht! Guten Morgen. Liebling!«

Und mit einer raschen Bewegung zog er sie an sich, -- fest, so daß sie an seiner Brust lag, und küßte sie auf den Mund.

Als er sie ebenso rasch wieder losließ, hatte Ruth seine Hand ergriffen und drückte ihre warmen Lippen darauf.

Dann flog sie geschwind die schmalen Stufen zu ihrer Giebelstube hinauf.

Erik öffnete die Mittelthür im Flur, die in das Zimmer von Jonas führte. Er mußte hindurchgehen, um sein dahinter gelegenes Schlafzimmer zu erreichen. Dabei wachte Jonas auf.

»Na, Papa, war es schön?« fragte auch der und drehte sich schlaftrunken auf die andre Seite; »hat es denn auch Champagner gegeben?«

Damit schlief er weiter.

Erik stieß ein Fenster auf und blickte in die lichte Ferne hinaus. Ein farbloses, blasses, gleichmäßiges Grau breitete sich in der Stube aus, und der dämmernde Morgen fing an, sie mit herber Kälte zu erfüllen.

Das leise Raunen und Rauschen schlich nicht mehr flüsternd am Boden hin, es hatte sich höher erhoben. Es bewegte die Zweige der wilden Akazien, die dicht vor dem Fenster standen, und dann schwoll es machtvoll an, bis es in majestätischem Brausen die alten Wipfel durchklang, die vorhin lautlos gegen den hellen Nachthimmel starrten.

Wie ein Morgenchoral klang es, und -- ganz leise, -- versuchend, wie im Halbschlafe noch, fiel hie und da ein kleiner froher Vogellaut ein. Und bald darauf, gleich einem Aufjauchzen, ein lang gezogener unermüdlicher Buchfinkentriller.

Erik hatte sich zur Ruhe gelegt, aber mit wachen, lauschenden Sinnen nahm er das Nahen des Tages auf, und es kam ihm vor wie eine geeignete Begleitung zu seinen Gedanken, die noch an Ruth hingen. Denn auch über ihnen lag eine zarte und halbverhüllte Stimmung, eine Morgentraumstimmung, so schien ihm.

Noch nie hatte ihn die Empfindung so gepackt wie heute, daß sie ja unwiderruflich zu einander gehörten, daß sie im Grunde gleichgeartet, gleichen Wesens seien. Und nun erst meinte er ihre Bitte zu verstehen: »Mich mitnehmen!« Was er war, das wollte auch sie sein, denn nur in ihm erfaßte und ahnte sie sich selbst. Der gleiche Lebensdrang schlummerte stark und freudig in ihnen beiden. Nur daß in ihr aus unbewußtem, unberührtem Naturgrunde hervorbrach, was in ihm bewußter Entschluß, Verstand und Wille gewesen. Und daß in ihr mit reiner Flamme brannte, was in ihm die Berührung mit dem Leben mit Schlacken und Asche vermengt hatte.

Und über diesen unklaren Gedanken fing Erik an zu schwärmen.

Der erste Jubel der Vögel draußen legte sich, und der Morgenwind schwieg still. Wieder ragten die alten Bäume regungslos gegen den Himmel, durch dessen Blau zerrissene weiße Wolken schwammen. In einem breiten Goldstrom flutete das Sonnenlicht durch das Gemach.

Hinter Eriks geschlossenen Augenlidern malte es lächelnd rosige Farben. Im Sonnenschein war er eingeschlafen.

Er erwachte viel später als sonst und besann sich nicht gleich, weder auf den gestrigen Tag, noch auf die Nachtstunde. Irgend ein Traum, ein wunderbarer, von dessen Vorgängen er aber nichts mehr wußte, hielt ihn noch fest in Bann. Und offenbar aus diesem Traum heraus kam ihm zwingend die seltsame Frage: »Ist sie schön? Ich weiß es nicht; ich glaube eher: nein. Aber sie sieht aus wie -- Ruth. Es ist ja Ruth.«

Und ihm schien, es könne nur ~eine~ solche geben.

Er fühlte eine Mischung von Glück und schmerzlicher Beklommenheit.

Und blitzähnlich wurde er vollständig wach.

Wie ein Schicksal, groß und schwer, stand vor ihm die Erkenntnis seiner Liebe.

Noch nie hatte er über sein Gefühl für Ruth nachgedacht. Vielleicht, weil es überhaupt wenig seiner Natur entsprach, über sich nachzudenken. Vielleicht aber auch, weil dieses Gefühl einem leidenschaftlichen Interesse am Menschen, nicht am Weibe, entsprungen war.

Plötzlich war das alles anders geworden. --

Auf der Terrasse saßen sie schon lange und warteten am Frühstückstisch auf Erik, als er endlich zu ihnen heraustrat. Klare-Bel bemerkte augenblicklich etwas Verändertes, Verschlossenes in seinem Gesicht, und sie bewies es, indem sie keine Frage an ihn richtete und von Gleichgültigem zu reden begann.

Erik jedoch erzählte unaufgefordert manches vom Zusammensein mit dem Freunde. Die Frau war wirklich auch dabei gewesen; sie war eine Deutschrussin und besaß Verwandte bei Moskau.

Sie hatte Erik außerordentlich gut gefallen. Heiter, gütig, praktisch, -- ein kluger und reifer Mensch, sagte er von ihr.

Klare-Bel hörte nur mit halbem Ohre zu. Sie fühlte sich sonderbar beunruhigt und fand im stillen, daß Erik nach der gestrigen Zerstreuung reichlich überwacht und angegriffen aussähe.

Um so frischer und heller sah Ruth aus. »Wie angesteckt von der Morgensonne,« dachte Erik, während sein Seitenblick sie streifte. Dabei konnte er ihr ansehen, wie sie nur mit Mühe einen Witz darüber unterdrückte, daß er verschlafen habe. Sie hatte nicht verschlafen. Sie hatte den ganzen Frühmorgen im Garten umhergetollt.

Mit der gemeinsamen Arbeit wurde es heute nun nichts. Hastiger als sonst stand Erik auf, um zu gehen. Die Zeit drängte, und Jonas war schon fort.

Erik konnte es kaum erwarten, daß das Haus weit hinter ihm lag, und er wieder mit sich selbst allein blieb. Aber dennoch war ihm weder zum Träumen noch zum Grübeln zu Mute. Nur nach ~einem~ verlangte es ihn dringend und ungeduldig, als hinge das Leben davon ab: voll und klar ins Auge zu fassen, was seit wenigen Stunden wie sein Schicksal vor ihm stand. Nur nach ~einem~ verlangte ihn: davor stillzustehen und den Blick darauf ruhen zu lassen, fest und forschend, wie auf einem fremden Antlitz.

Darüber entschwand alles andre, was ihn hätte beschäftigen und beunruhigen können, völlig aus seinem Gesichtsfeld. An allem, was bisher sein Schicksal ausgemacht und zwingend sein Leben bestimmt hatte, an allen innern und äußern Verhältnissen, in denen er lebte, sah er vorbei, -- ganz gerade, ganz unverwandt auf den ~einen~ Punkt, ohne nach rechts oder links zu schauen. Für etwas andres blieb kein Blick, kein Raum, es blieb nur eine dunkle, trotzige Nebenempfindung: über ~Hindernisse~, und wären es Menschen, geht's hinweg. --

Ehe Erik sich mit Klare-Bel verlobte, hatte sie ihm einmal eine Photographie geschenkt, auf der sie sich im Kreise ihrer ganzen Familie befand. Er steckte das Bild in einen Rahmen und legte zwischen Rahmen und Glas ein Blatt Papier, in das er eine nur Bels Gestalt entsprechende Oeffnung ausgeschnitten hatte: so war er mit ihr allein. Ihre Sippe deckte er zu, weil sie ihm nicht gefiel.

Erik war es sich nur halb bewußt, daß er es jetzt ebenso machte: mit feiner eigenen Familie, mit den Menschen und Pflichten seiner täglichen Umgebung, ja, mit der gesamten Welt, die er in seinen Gedanken weglöschte, bis nichts übrig blieb als eine unermeßliche leere Weite, eine Welteinsamkeit, in der nur Ruths Bild vor ihm stand.

Sie und er, allein miteinander, und Auge in Auge.

Aber je länger er auf sie hinschaute, desto stiller wurde sein Blick. Was alle Hindernisse und Schranken in ihm wie außer ihm nicht an sein Bewußtsein heranbringen konnten, das ging von dem fröhlichen Kinderbilde selbst aus. Alles harte und leidenschaftliche Fordern in ihm wurde still.

Was liebte er denn an ihr, wenn nicht eben dieses Kindhafte, in dem noch, geheimnisvoll und verheißungsvoll, die ganze Fülle der Möglichkeiten ruhte, -- dieses Keimende, Werdende, Zukünftige, das noch auf lange hinaus der schützenden Hülle bedurfte, -- den zarten, kostbaren Stoff, nach dem seine Hand sich nur herrisch ausgestreckt, weil sie allein ihm die edelste Form geben wollte?

Ihm fiel das Gleichnis vom Gärtner und seinem Bäumchen ein, das er Ruth einmal erzählt hatte. Es enthielt eine Wahrheit, es enthielt seine Liebe. Unsäglich liebte er in ihr seine Gärtnerkunst und seine Gärtnerhoffnungen.

Je länger Erik sich aber so in das ihm vorschwebende Bild vertiefte, um so weniger klärte sich ihm sein eigenes Gefühl. Er sprach zu sich selbst nur noch mit geringer Ehrlichkeit. Unwiderstehlich erhob sich aus dem leidenschaftlichen Begehren der Hang zu idealisieren. Allmählich büßten in seiner Phantasie er wie Ruth viel von ihrer Wirklichkeitsfarbe ein, und immer höher ging der Schwung der Gedanken.

Während Erik glaubte, es sei der Erzieher und Menschengestalter in ihm, der in reiner Hingebung an einem Frauenbildnis meißele und dichte, damit es einst Wirklichkeit werde, schwelgte und berauschte sich der Liebende an Ruths unähnlichem Idealporträt. --

Ruth hatte inzwischen den Vormittag in einer Weise verbracht, die diesen hochfliegenden Vorstellungen nur wenig entsprach.

Anfangs überlegte sie ein Weilchen, ob sie die Absicht hege, ganz für sich allein fleißig zu sein. Nein, die hegte sie entschieden nicht. Am besten hätte es ihr gepaßt, jetzt Jonas da zu haben, aber der saß in der Schule und lernte, der Aermste. So entschloß sie sich denn, zu Gonne in die Küche hinunterzugehen. Denn lieber noch wollte sie mit den Händen thätig sein als mit den Gedanken, meinte sie, und irgendwie lebhaft sich bethätigen mußte sie durchaus. War ihr doch froh, so vogelfroh, so gar nicht zum Stillsitzen und zum »Nachdenken«. Und dann war es auch ganz unterhaltend, mit Gonnes Eimern am Brunnen zu plantschen.

Gonne litt es glücklicherweise gut, wenn Ruth ihr so unerbeten mitten in die Arbeit sprang. Da sie nichts von der hierzulande üblichen Devotion besaß, so betrachtete sie es als eine Auszeichnung für Ruth, daß sie sich deren Hilfe gefallen ließ. Und Ruth nahm es auch nicht anders, und zum entsprechenden Dank sang sie ihr mit ihrer weichen ungeschulten Stimme russische Volkslieder zur Arbeit, und Gonne hörte tiefernst zu.

Erik fand bei seiner Heimkehr Ruth mit aufgeschürztem Rock und zurückgestreiften Aermeln singend und seelenvergnügt am Brunnen. Bei diesem unerwarteten Anblick zerflatterte plötzlich das meiste von dem, was er sich zusammengesonnen und zurechtgelegt hatte; die verklärte Gestalt seiner Phantasie, um derentwillen er die wirkliche Ruth am tiefsten zu lieben glaubte, war wie versunken. Eine stürmische Zärtlichkeit erfüllte ihn, ein heißes Verlangen, sie an sich zu ziehen, die schlanken wasserübersprühten Arme unter seiner Hand zu fühlen, die lachenden Lippen zu küssen und das stets verwirrte Haar und den feinen von der Sonne schwach gebräunten Hals.

Im Begriff an der Terrasse vorüber zum Brunnen zu gehen, machte Erik plötzlich Halt, kehrte um und ging in sein Zimmer.

Dort, auf dem Schreibtisch, lagen noch, unordentlich, Ruths Hefte und Bücher umher, die heute morgen umsonst auf ihn gewartet hatten. Erik setzte sich davor nieder und beugte den Kopf auf seine Hände. Das Blut hämmerte ihm in den Schläfen, und er drückte die Zähne gegeneinander. -- -- --

Mußte Ruth fort?

Er zwang sich, den Gedanken zu Ende zu denken. Ihn überschlich eine Ermattung, eine bleischwere Müdigkeit, die alles klare Denken umschleierte.

Halb mechanisch blickte er über die Hefte hin, die aufgeschlagen dalagen; ohne zu lesen, folgte er den einzelnen Buchstaben, als enthielten sie eine erlösende Antwort. Es war eine rasche, in den Grundstrichen harte Schrift, deren Züge alle fest zusammenhingen. Noch keine ausgeschriebenen Rundungen, aber auch kein überflüssiger Schnörkel.

Ihm fiel wie von ungefähr auf: in Ruths Handschrift lag im Grunde eine fremde Ruth. Nichts von ihrer Phantasie, -- ihrem Ueberströmen. Etwas merkwürdig Logisches.

Seine Blicke und Gedanken blieben darauf haften.

Lag nicht vielleicht auch in ihr selbst noch eine ihm fremde Ruth? Die noch nicht erwacht war, die er noch nicht kannte?

Da lachten ihre Augen durch das Fenster. Ruths Kopf erschien zwischen den krausen Ranken und Blättern des wilden Hopfens, der am Fensterkreuz emporkletterte.

»Soll ich arbeiten?« fragte sie.

»Nein. Wir wollen auch Ferien machen. Wenigstens für heute,« sagte er und stand auf, »weißt du, was es für eine Ueberraschung gab, -- in der letzten Stunde vor den Ferien, in der Mädchenschule? Sie erhoben sich alle und trugen feierlich eine Bitte vor. Was es war, ließ sich nicht leicht herausbringen. Sie wußten es selbst nicht genau. Sie wollten dasselbe, was du gewollt hast, sagten sie. Sie wüßten es nur nicht zu bewerkstelligen.«

Von Ruth kam nur ein Gelächter. Er hatte es schon in der Schule um sich zu hören geglaubt. Ganz deutlich empfand er aus dem unerwarteten »Massenerfolg« den übermütigen Einfluß einer einzelnen heraus. Aber gerade dies hatte ihn heute aus seiner zerstreuten Gleichgültigkeit gerissen, ihn mit Wärme und Freude erfüllt. Aus dem Bilde der ganzen Klasse, aus der Gesamtphysiognomie all dieser braunen und blonden Mädchenköpfe, schaute ihm, wie aus einem Vexierspiegel, Ruths Gesicht entgegen: mit einem Schalkslächeln um den Mund, aber auch mit unbegrenzter Hingebung in den Augen. Ganz so, wie sie jetzt eben zwischen den Hopfenranken dastand.

»Aber nun wird Ernst damit gemacht,« bemerkte er und lehnte sich ans Fenster; »im Herbst, wenn alle wieder zusammenkommen. Vielleicht in Form von allgemeinen Kursen bei mir zu Hause. Vielleicht bei Beteiligung Erwachsener. Ich weiß noch nicht, wie.«

Sie sah ihn voll Interesse an.

»Das ist gut!« sagte sie eifrig und nickte, »je mehr, desto besser. Aber alle werden nicht kommen dürfen, und manche werden bald wieder fortbleiben. Daß die Braut da ist, nimmt vielen die Lust zu so etwas fort.«

»Die Braut?«

»Ja. Denn da denken sie nun, so schön könnten sie es jetzt bald alle kriegen. Und dann hat ja all das andre keinen rechten Zweck mehr, meinen sie. Denn sie finden: Braut sein, das sei doch das Allerhöchste. Darüber haben wir uns vorgestern im Schulhof unterhalten.«

Er blickte auf sie.

»So. Und was hast denn du dazu gemeint? Hast du auch gefunden, daß es das Allerhöchste sei, und daß dann all das andre keinen rechten Zweck mehr hat?«

»Ich? Das kann ich ja gar nicht wissen. Wie soll ich wissen, wie es dann ist? Aber ich brauche es doch auch gar nicht zu wissen. Denn ich kann niemals Braut werden,« sagte Ruth.

Das Wort erschütterte ihn in seiner nervösen Erregung. Er war so betroffen, daß er nicht gleich antworten konnte. Dann entgegnete er: »Wie kommst du auf diesen wunderlichen Gedanken? Wo hast du diesen Einfall her? Du bist ein Kind, das nichts davon voraussehen kann, wie sein zukünftiges Leben sich gestalten mag. Und deine Phantasie soll nicht damit spielen. Du sollst nicht damit spielen!« wiederholte er mit plötzlichem, unmotiviertem Zorn. »Sage mir, wie du darauf gekommen bist.«

»Es ist von selbst gekommen,« sagte sie einfach, »ich habe nicht damit gespielt. Es ist gekommen, weil ich wußte: um Braut zu werden, muß man einen lieb haben. Und das kann ich ja nicht mehr. So lieb kann ich in der ganzen Welt nie mehr jemand haben.«

»~Wie~ lieb, Ruth?«

Seine Stimme klang gedämpft und heiser.

Sie sah ihn an mit ihrem offenen naiven Kinderblick. Nie noch, meinte er, eine solche Unschuld und Treuherzigkeit in einem Menschenblick gesehen zu haben.

»So lieb wie Sie,« sagte Ruth.

Erik machte eine kurze Bewegung und, niederblickend, schob er die Hopfenranken zur Seite, die sich überall festnestelten und anklebten. Die linke Hand, die in der Seitentasche seiner Joppe lag, ballte sich zur Faust.

Ruth betrachtete ihn unverwandt, aber sie verstand nicht den Ausdruck, der über sein Gesicht ging.

Da, wie Erik, fast furchtsam, aufschaute und die fragenden Augen vor sich sah, durchzitterte es ihn. Ihm kam es vor, wie wenn dieser eine Blick und Augenblick über ihn entscheide.

Er beugte sich etwas vor, ergriff Ruths Hände und bedeckte damit seine Augen.

»Weißt du, Mädel,« sagte er halblaut, »wenn du groß bist, -- denn jetzt bist du doch nur erst ein kleines Mädel, -- aber wenn du längst eigene und reife Vorstellungen gewonnen hast über alle diese Dinge, und viele andre noch, -- dann -- ~dann~ sollst du noch einmal zu mir kommen und mir sagen können: daß du mich lieb behalten hast. Und daß du von mir -- ~von mir~ dein Bestes hast. Dein Eigenleben und deine Entwickelung. Deinen Glauben an deinen Selbstwert und den Glauben an den Wert der Menschen. Wer du dann bist, Ruth, das wissen wir beide nicht; wer ich dann bin, das weiß ich ja wohl: ein alter Mann. Aber ein alter Mann, der dafür gelebt hat, daß du, Mädel, ihm bleiben darfst, was du ihm heute bist: sein Stolz, sein Werk, sein Kind und seine höchste Hoffnung.«

Und er ließ ihre Hände los und verließ das Zimmer.

Ruth stand noch draußen am Fenster. Sie hatte die Arme aufgestützt und blickte ihm regungslos mit ernstem Gesichte nach.

An einem der nächsten Tage, um die Mittagsstunde, füllte eine bunte Menschenmenge den großen Mädchenschulsaal. Eltern und Angehörige der Kinder, eine Flut von Neugierigen aus den obern Gesellschaftsschichten und viele, die Erik reden hören wollten, von dem die Mädchen zu Hause so viel erzählten.

Er stand auf der Tribüne im Hintergrunde des Saales und sprach zu ihnen und ihren Kindern; er erwähnte den Vorschlag, den seine Klasse ihm gemacht, die Gemeinsamkeit des Lebens und Arbeitens über die Schule hinaus zu erstrecken, und knüpfte daran seinen Lieblingsgedanken von der Notwendigkeit einer reichern Weiterentwickelung für die Frau, als die Gegenwart sie ihr außerhalb der Schuljahre gewähre. Ueber die Möglichkeit, eine lebensvollere, geisteskräftigere Zukunft heraufzuführen, sprach er ihnen, und über die Zukunft der Frau, die, erst geahnt und nur halbenthüllt, noch vor ihr liege, von der sie aber Besitz ergreifen könne in allem, was ihr Wesen der innern Entfaltung und Vollendung näher bringe.

Und während er sprach, dachte er an Ruth, der er nicht erlaubt hatte, mitzukommen; denn im Grunde war sie es ja, von der er redete, zu der er redete. Sie war es ja, die in ihm die Lust wiedererweckt hatte, zu den Menschen zu reden, und die Menschen für ihn suchte, wie man für einen Armen Brot sucht, damit er seinen Hunger stille. Und was er seinen Menschen gab, entnahm er ihr: denn das Höchste, was er von ihr erhoffte, das Schönste, was er sich in ihr träumte, legte er seinem Zukunftsbild unter, und dann erhob und verklärte er es zu allgemeinen Formen.

Es war, wie wenn er eine überlebensgroße Gestalt vor den gebannten Menschenaugen aufrichtete, in der durch diese Größe die individuellen Züge unerkennbar wurden. Zu groß sicherlich, für das wirkliche Leben, aber von einer Fülle und Wärme der Farben, die unwillkürlich mit fortriß und sich dem weiblichen Teil unter den Zuhörern gewaltig einprägte.

So stand Erik und hielt eine Art von Selbstverteidigung seiner Liebe, und die tiefe Bewegung, die in ihm war, verlieh einem jeden seiner Worte eine eigentümliche Wucht.

Unter der Menge im Zuschauerraum befand sich auch Warwara, wie sie es ihm vorhergesagt. Sie blickte voll Interesse auf ihn. Ihr schien, als sähe sie vor ihren Augen entfesselt und entfaltet, was sie, mit ihrem feinen Instinkt, immer schon dunkel und undeutlich geahnt, wenn sie mit Erik zusammen gewesen: daß er Gewalt über Menschenleben besaß, und daß er in Hunger und Sehnsucht nach ihnen lebte. Es war also das, was sie zu gleicher Zeit so seltsam an ihm anzog und von ihm abstieß, -- das, was sie koketter erscheinen ließ, als sie war. Ihr fiel die Scene in seiner Stadtwohnung ein. Ja, ein Heiliger war Erik wohl sicher nicht. Aber selbst damals hatte sie mit Schrecken empfunden, wie suchend und sehnend und ungeduldig er aus das Innerste ging. Auf das, worin sie ihn enttäuscht hätte. Und das ließ ihre Eitelkeit nicht zu.

Als sie damals aus seiner Stadtwohnung nach Hause fuhr, hatte sich ihr fortwährend ein ganz abscheulicher Vergleich aufgedrängt. Sie konnte denselben nicht verscheuchen. Immer sah sie ein Weib vor sich, das falsche Brüste angelegt hat und sich deshalb vor der Berührung des Mannes, den ihre Gestalt fesselt, hüten muß. Hatte ihre Koketterie nicht ganz ähnliche Gründe? Sie fürchtete die geistige und seelische Entblößung. Und die Arbeit an sich selbst.

Es war aber wirklich ein abscheulicher Vergleich. Und zum größten Erstaunen ihrer Nachbarin errötete Warwara mitten im Vortrag.

Nach dem Schluß desselben, im Treppenhause, wo Warwara beiseite trat, um nicht in die hinausdrängende Menge zu geraten, bemerkte Erik sie und kam auf sie zu. Seine Augen leuchteten so. Warwara war blaß.

»Nun?« fragte er lächelnd und ganz in seinem alten, leichten Ton ihr gegenüber, »fand der ›Toast‹ Gnade vor ihren Augen? Vielleicht war es wirklich einer.«

»Wenn es einer war, so könnte ich wohl auf ~die~ eifersüchtig -- nein, aber neidisch sein, deren Wohl Sie da ausgebracht haben,« versetzte sie, ebenfalls in ihrem gewöhnlichen Scherzton, aber ihr Gesicht blieb ernst; »~unser~ Wohl ist's nicht. Ich begreife jetzt, daß Sie anderswohin gehören wollen, als unter uns Gesellschaftsgelichter.«

»Aber, Warwara Michailowna!« sagte er, von ihrem Ausdruck frappiert, »warum nehmen Sie sich nicht aus?«

Sie schüttelte den Kopf.

»Aus Selbsterkenntnis. Ich hab' Sie heut verloren,« entgegnete sie und gab ihm die Hand, »also adieu, -- nicht nur für heute. Ich verzichte auf Sie. Ich entlasse Sie. -- Aber nun hören Sie: es ist doch der Schulrock, und nicht der Gesellschaftsrock, der Ihnen am besten steht.«

Er sah ihr nach, wie sie langsam die breite Treppe hinunterstieg. Aber als sie seinen Augen entschwunden war, vergaß er auch schon wieder, was ihm, durch den Scherz hindurch, heute an ihrem Wesen so aufgefallen war.

Und sein Blick glitt von ihr fort über die andern hin, die ihr folgten, über jung und alt, und vertiefte sich in die Mienen der einzelnen mit dem Interesse, das der wechselnde Ausdruck in den verschiedenen Menschengesichtern stets in ihm hervorrief.

Ja, nun begannen die Ferien, und die langen, nicht enden wollenden Sonnentage. Da würden seine Gedanken erst recht hierher wandern, in die Schule. Einen andern Wirkungskreis gab es wohl nie mehr für ihn, -- einen breitern. Er wollte auch keinen in diesem Augenblick. Sein Ehrgeiz schwieg still. Zu Kindern reden lernen wollte er, und die Großen zu Kindern machen, bis auch sie empfänglich wurden, gleich denen, die da noch wachsen.

Mit diesen Gedanken verließ Erik das Schulgebäude.

Er war ungeduldig, heimzukommen: er sah eine Bank im Garten, hinten am kleinen Gehölz, unter den überhängenden Birkenzweigen, und Ruth saß darauf, und lauschte, während er ihr von allem erzählte, was »er sich ausgedacht«. Zusammen wollten sie's sich ja ausdenken, hatte er ihr versprochen.

Daheim sein bedeutete jetzt nicht mehr bloß die Stille und das Behagen, aus denen seine unbefriedigte Thatkraft ruhelos und vergeblich in die Weite gestrebt hatte. Daheim umfing ihn gerade seine liebste Arbeit und Aufgabe, -- daheim fiel jetzt Innen und Außen, Ruhen und Wirken, Träumen und Schaffen in ~eins~ zusammen. In Ruth war etwas, das machte sein ganzes Wesen produktiv, erregte und vertiefte alle seine Kräfte, so daß leise von ihnen abglitt, was dem äußern Ehrgeiz angehört.

Als Erik die Gartenpforte öffnete, sah er auf dem Rasen, zwischen den Bäumen, ums Gehölz herum, eine wilde Jagd. Er sah Ruth, Jonas -- und noch einen. Einen mittelgroßen, etwas untersetzten Mann mit kurzem dunkeln Vollbart und Brille. Der jagte sich mit Ruth, und haschte vergeblich nach ihr. Seine Stimme klang scherzend und lachend herüber.

Es war Bernhard Römer.

Nun wurde er Eriks ansichtig und kam heran.

»Auf einen Tag und eine Nacht, wenn's recht ist!« rief er, ein wenig außer Atem, und fuhr sich mit dem Taschentuch über das kurzgeschorene dichte braune Haar; »-- und die Ruth nehme ich gleich mit fort, -- das heißt, wenn ich sie hasche. Dann soll ich sie kriegen, haben wir ausgemacht,« fügte er hinzu, während sie sich die Hände schüttelten, »das ist ja ein reizendes Ding. Sieht aber noch aus wie ein Kind. Vierzehnjährig.«

»Sie ist zart,« sagte Erik und stieg mit ihm die Terrasse hinauf.

»Zart? Muskulatur wie eine stählerne Feder. -- Es ist ungerecht, daß du sie hast. Wir brauchen ein Hauskind. Ihr habt ja den Jungen.«

»Bist du schon so schnell zurückgereist? Und deine Frau?« fragte Erik, ihn unterbrechend, und bot ihm einen Stuhl neben Klare-Bel, die auf der Terrasse lag und lächelnd dem lustigen Treiben zugesehen hatte.

»Ich mußte zurück. Und meine Frau? Ja, die wollte noch nicht zurück. Die Frauen sind heutzutage entsetzlich selbständig. Sei froh, daß Bel dir nicht fortlaufen kann. -- Meine Frau, die reist also herum und besichtigt Suppenanstalten.«

»Suppenanstalten?«

»Na ja. Und besucht auch noch den verrückten Grafen in Jasnaja Poljana. Für so etwas interessiert sie sich nun einmal. Von Rechts wegen sollte ich wohl meine hochwohllöbliche Professur aufgeben und ein russischer Bauer werden, der das Feld pflügt. Aber ein so edler Mann und Ehemann bin ich nun doch nicht.«

»Ich finde: sehr,« bemerkte Klare-Bel staunend, »da Sie Ihrer Frau alles das erlauben.«

»Erlauben?« Bernhard Römer lachte herzlich und setzte sich zu ihr. »Meine liebe gnädige Frau, ich will es Ihnen nur gestehen: ich habe gar nichts zu erlauben. Wissen Sie warum? Ich bewundere nämlich ein wenig meine unartige Frau. Bei uns zu Hause hat sie auch so etwas wie Suppenanstalten eingerichtet. Natürlich nur sehr im kleinen, -- sagen wir lieber: im winzigen. -- Aber nun will ich dir etwas sagen, mein lieber Erik: wir haben einst so im größten, im allergrößten, herrliche Pläne gemacht von Vervollkommnung des Lebens und der Menschen, -- aber meine Frau, die führt sie im kleinwinzigen aus. Nur sie. Das ist die Art, wie sie sich meine

Pläne zu Herzen genommen hat, nachdem ich wohlbestallter und -- wohlbeengter Professor geworden bin. Daß sie nur so wenig kann, hält sie von nichts zurück. Das Leben ist Frauenhand und Frauenarbeit -- mutige. Wir sind Stümper dagegen.«

»Deine Frau ist sehr außergewöhnlich,« bemerkte Erik, »ich bin froh, sie kennen gelernt zu haben. Aber entbehrst du sie denn nicht jetzt zu sehr im Hause? Wie lange bleibt sie noch fort?«

»Bis zu den Ferien. Den deutschen Universitätsferien. Entbehren? Ja, -- doch in der Arbeitszeit, da behelfe ich mich schon mit der Wirtschafterin und schlecht bereitetem Kaffee. Denke mir halt dabei: 's ist Arbeitzeit, Wochentag. Aber in den Ferien, -- ~meinen Ferien~, -- da muß ich Sonntag haben. Da muß ich -- muß ich meine Frau um mich haben.«

Klare-Bel sah ihn erfreut an. Sie freute sich über seine herzlichen Worte. Freute sich, ihn wiederzusehen. Kaum konnte sie's glauben, daß er selbst es war: der bartlose Jüngling mit dem braunen Lockenkopf, -- sanfter als Erik, stiller, ein schwärmerischer Utopist mit einem kleinen Stich ins Phlegma und in den deutschen Michel.

Und während Erik ins Haus ging, vertieften sie sich von neuem in die alten Erinnerungen, wie sie es schon heute morgen miteinander gethan. Und beide wurden warm beim Heraufbeschwören der Jugend und empfanden beide mit uneingestandener Wehmut, daß die Jugend Vergangenheit war.

Erik störte sie nicht. Er stand in seinem Zimmer. In erregter Stimmung.

Ruth mit Römer, -- nicht mit ihm: er konnte das Bild nicht loswerden.

Des Freundes Leben daheim stand ihm klar vor Augen. Ein seltenes Heim, -- das seltenste: eine vollglückliche Ehe. Neben dem Mann die gleichaltrige Frau, in der, wie ein Stückchen seiner Jugend, das nicht sterben wollte, die Frische weiterlebte, die ihn vor dem Vertrocknen in Professorenweisheit und zufriedener Sattheit bewahrte. Daher seine ewigfrische Liebe zu ihr, daher für alles, was sie plante, das offene Herz und die offene Hand.

Dort würde Ruth haben, was ihr not that: in körperlicher, geistiger, praktischer Beziehung. Und indem sie ~ihn~ verlor, eine mütterliche Freundin gewinnen, der er sie blind anvertrauen konnte.

Irgend etwas raunte Erik zu: »Gib sie hin. Dort wäre die selbstlosere Liebe. Schütze sie vor dir selbst.«

Seine Augen verfinsterten sich, und um seinen Mund erschien eine harte Linie.

Nun ja, er gestand es sich ein: daß er selbstlos Ruth dienen wollte, das war nur, um sie zu behalten. Er hatte außer ihr nichts zu verlieren, was ihn ganz erfüllte. Er kämpfte um das Schönste und um das Letzte, -- das fühlte er. Und um das Höchste: um sich selbst.

Man sagt oft: erst der Zusammenbruch des ganzen persönlichen Glückes führe manchen zur wahren, menschlichen Größe, lehre ihn erst, wahrhaft thatkräftig den andern zu dienen, auf andre zu wirken.

Gewiß gab es solche milden Menschen in der Welt. Aber galt es von ihm? Konnte er je zu ihnen gehören? Laut schrie es in ihm: Nein! Nein!

Seine Kraft und sein Glücksverlangen wollten sich nicht trennen. Miteinander verwachsen waren sie von der Wurzel an. Glück brauchte er, um Mensch zu bleiben. Viel Glück, um gut zu bleiben. Er mußte es zu sich zwingen in irgend einer Form, -- und um jeden Preis.

Um jeden? Gab es nichts, was ihn veranlassen konnte, einst selbst die Axt an die Wurzel zu legen?

Bels Glück? Nein! Aber Ruths Glück.

Er versuchte, gewaltsam, den Gedanken fortzustoßen. Er setzte sich an den Schreibtisch und versuchte, ein paar Aufzeichnungen auszuführen, die er sich unterwegs für seine Winterpläne entworfen. Er versuchte, sich dabei die Mienen einzelner zu vergegenwärtigen, die er an der Treppe, im Vorbeigehen, studiert, und in denen er den Ausdruck der Freude und der Anregung gelesen hatte.

Aber die Gedanken verschwammen, und die Gesichter verblaßten. Er sah nur noch ein Chaos fremder, gleichgültiger Physiognomien, -- ohne Ausdruck, ohne Freude, ohne Blick.

Unschöne, an denen sein Auge vorüberglitt, -- hübsche, aus denen es teilnahmslos haften blieb.

IV.

Kurz und glühend, wie immer, war der russische Hochsommer vorübergeflogen, und früh, mitten im August, nistete sich leise der Herbst im Garten ein und verlöschte mit seinen langen dunkeln Abenden die Sonne. Der Rasen sah fahl und versengt aus, und längs den Kieswegen sammelten sich die ersten dürren Blätter.

Gerade da, wo Klare-Bel in ihrem Stuhl am Rande des kleinen Gehölzes lag, konnte sie an den Birkenzweigen über sich in einen breiten goldgelben Fleck hineinschauen, der täglich ein wenig zunahm. Und von Zeit zu Zeit sank eines der entfärbten Blätter, drehte sich in der Luft ein paarmal herum und flatterte zu ihr nieder.

Gleich daneben stand ein Tisch, roh aus ungeschälten Baumästen gezimmert, und zwei Bänke mit Rückenlehnen aus einem groben Flechtwerk von Weidenzweigen. Da saßen Erik und Ruth schon den halben Tag und arbeiteten.

Klare-Bel konnte nicht begreifen, wie sie das nur so ununterbrochen aushielten; manchmal schienen es ihr allerdings nur Unterhaltungen und Gespräche zu sein, die sie führten, aber sie wußte, wie ernst sie es damit nahmen, und daß Erik mitunter die Nacht aufblieb, um seinen Unterricht vorzubereiten.

Gern lag sie so und lauschte darauf; nicht auf die Worte, aber auf die Stimmen. Denn darüber täuschte sie sich nicht: nur in solchen Stunden noch klang Eriks Stimme gerade so froh wie früher. Und da war es wirklich gut, daß er sein Zimmer jetzt förmlich mied und mit Ruth immer in ihrer Nähe saß, wo sie ihn hören konnte.

Oft dachte sie dabei mit heimlichen Sorgen und Zweifeln an den ersten Tag im Juni zurück, den Erik mit Bernhard Römer und dessen Frau in der Stadt verbracht hatte. Seit dem darauffolgenden Morgen blieb er verändert. Und mit diesem Tage mußte es zusammenhängen. Aber den wahren Grund suchte sie in der fernsten Vergangenheit: namentlich seitdem sie den gemeinsamen Jugendfreund selbst wiedergesehen.

Denn seitdem begriff sie ganz gut, daß Erik vielleicht noch im stillen den alten Erinnerungen nachgehen mochte. Kehrten doch sogar ihre eigenen Gedanken häufiger als je dorthin zurück, wohin es keine Rückkehr gibt.

Die Jugend ersteht nicht wieder auf.

Wenn es doch eine Freude gäbe, -- dachte sie ganz heimlich bei sich, -- eine große, gewaltige Freude, die sie einmal über Eriks Leben bringen könnte, so daß er alles darüber vergäße! Aber sie besaß nichts, -- sie hatte immer nur so dagelegen, mit leeren Händen, und Opfer gekostet.

Vor wenigen Tagen brachte Erik unerwartet den Professor heraus, den er manchmal bei ihrer Behandlung hinzuzog. Sie war auf ihr Bett gelegt worden, und dann hatte Erik die in Angst und Schmerz Zitternde ganz fest in seinen Armen gehalten, bis qualvolle Minuten überstanden waren. Er selbst war ganz blaß. Aber der Professor wollte wiederkommen.

»Muß es sein, Erik?« fragte sie zagend.

»Es muß sein. Eine Aenderung ist da,« antwortete er ausweichend.

Aenderung! vielleicht Genesung!

Ja, nur ~eine~ große, gewaltige Freude konnte es noch geben: wenn sie selbst auferstand von ihrem Lager und zu ihm trat aus eigenen Füßen, -- da mußte er wohl wieder froh werden.

Und sehnsüchtig schaute Klare-Bel in die durchsonnten goldgrünen Zweige, von denen sich langsam die Blätter lösten. Und ihre Gedanken verträumten sich.

Als die Strahlen der Nachmittagssonne schräger fielen, und die Schatten der Bäume anfingen, sich zu dehnen und zu strecken, verstummten die beiden am Tisch, und Ruth stand auf.

Da erschien Klare-Bel jedesmal von neuem ganz eigentümlich bei diesem Unterricht, daß immer Ruth es war, die seinen Schluß angeben sollte. Erik wollte es so; nur diese selbst konnte genau wissen, wann ihre volle Frische und Empfänglichkeit nachließ. Er seinerseits konnte nur seine ganze und ungeteilte Kraft in das hineinlegen, was er ihr gab, -- und das that er. Er sammelte alle

Kräfte des Willens und des Geistes und konzentrierte sie auf einen einzigen Punkt: er hielt Ruth wie ein Fürstenkind, das man nur mit dem Auserlesensten beschenkt.

Er blickte sie an, wie sie, sonnengebräunt und mit vornübergewehtem Haar, neben ihm stand, in einer richtigen russischen Bauernbluse von grobem, ungebleichtem Leinen, mit roter Stickerei auf den Achselstücken und Oberärmeln, -- fast wie ein Kind aus dem Volk. Aber sein Fürstenkind war sie doch.

Er hatte ein Heft herangezogen, ohne Absicht es durchzusehen; nur mechanisch glitten seine Augen über die Zeilen hin. Doch Ruth blieb neben ihm stehen, und nun beugte sie sich über ihn, um hineinzublicken. Von Sekunde zu Sekunde wurde Erik nervöser. Und plötzlich, wegen eines geringfügigen Versehens, das er fand, herrschte er sie so heftig an, daß Klare-Bel erschrocken aufsah.

Ruth zog Schultern und Augbrauen hoch und schüttelte entrüstet den Kopf.

»Es ist nicht zu glauben. Wie kann man nur so kopflos sein, -- nicht wahr? Geradezu verdummt muß man schon dazu sein!« setzte sie mit unverhohlener Selbstverachtung seine Vorwürfe fort.

Erik war verblüfft und mußte über sie lachen.

Aber es berührte ihn wunderlich. Noch vor ein paar Monaten hätte etwas derartiges sie scheu gemacht, -- sie ~ver~scheucht. Jetzt weinte sie nicht mehr darüber, daß er sie ein dummes Kind nannte. Sie lachte. Lachte sich aus. -- Ihre Augen sahen ihn so spottend an. Wen verspottete sie eigentlich? Sich selbst, -- daran war kein Zweifel. Sich selbst nahm sie als einen fremden Gegenstand, den sie nur noch von Erik aus beurteilte; sie empfand, dachte und handelte nur noch wie aus seinem Wesen heraus.

Was war diese Selbstentrückung, dieses Uebermaß von Selbstvergessen im Grunde? war das Liebe? war es das, worauf er, halbbewußt und wider seinen Willen, -- wartete?

Klare-Bel hatte mitgelacht.

»Es wird dir noch sonderbar vorkommen,« sagte sie, »wenn du mit dem Herbst so viele Lerngenossen bei Erik bekommst. Wenn du mit ihnen alles teilen mußt. Wirst du nicht eifersüchtig sein, wenn nun eines von den Mädchen mehr kann als du?«

»Warum nicht?« fragte Ruth, und der Schalk ging durch ihre Augen, »dann wollen wir die eine lieber haben als mich. Wir haben Raum für viele da. Je mehr es sind, desto besser.«

Erik blickte auf. Am Ende würde sie wirklich eine dritte im Bunde mit Begeisterung empfangen? Aber wenn sie so spitzbübisch aussah, konnte niemand wissen, was sie bei sich dachte.

Er erhob sich und schob den Stuhl seiner Frau dem Hause zu, um sie vor Sonnenuntergang hereinzutragen. Jonas kam ihnen entgegen; den ganzen Nachmittag hatte er sich draußen auf den gemähten Wiesen herumgetrieben, aber immer paßte er den Augenblick richtig ab, wo er Ruth in Beschlag nehmen konnte.

Als Erik wieder aus dem Hause trat, sah er Ruth mit Jonas unter den Birken auf und ab gehen. Sie hielten sich lose umschlungen und stießen sich gegenseitig an den grasbewachsenen Wegrand, wo der Frühherbst das welke Laub angehäuft hatte. Es machte ihnen offenbar lebhaftes Vergnügen, mit den Füßen durch die Blätter hindurchzuraschelnd.

Jonas hatte Ruths Hand gefaßt, die auf seiner Schulter lag, und von Zeit zu Zeit neigte er den Kopf seitwärts und fuhr mit ihrer Hand liebkosend über seine eigene Wange.

»Jonas!« rief Erik den Knaben laut an.

Der schrak auf bei dem Ton.

»Was soll ich?« fragte er und kam betreten näher.

»An deine Ferienarbeiten sollst du!« sagte Erik, und schämte sich vor sich selbst.

Ruth folgte Jonas ins Haus.

Erik war im Garten stehen geblieben und sah den beiden nach.

Da war es wieder, -- dies Kindhafte, Kindische, dieses Unausgewachsene und sonderbar Unreife, über das er in Ruths Wesen nicht hinwegkam. Es nahm nicht ab, es nahm zu, -- es steckte ganz tief irgendwo, im Kerne ihrer Natur. Geistig hatte sie sich rasch und stark entwickelt, wie junges Laub in warmem Mairegen. Aber es war, als ob nun erst auch alle kindlichen Elemente sich entwickelten und zu immer vollerer Auslebung drängten, -- und daneben andere, beinahe männliche, die er in ihr bis dahin nur geahnt. So schnell gewöhnte sie sich daran, ihre Gedanken zu logischer Schärfe zu formen und ihnen eine energische Richtung auf das Erkennen zu geben, als habe sie nie in der Phantastik der Träume gelebt. Sichtlich hatte das Unentwirrbare, Unklare und Wildschweifende ihres Denkens nur mit den phantastischen Stoffen selbst zusammengehangen und fiel mit diesen von ihr ab.

Erik ging langsam in das Haus zurück, wo Jonas im Wohnzimmer mit resignierter Miene über seinen Büchern saß und zu lernen schien; aber im stillen grübelte er darüber nach, wie er Ruth dem Vater am besten abspenstig machen könnte, um sie mehr für sich zu haben. Morgen war ein Sonntag, da konnte man viel unternehmen; in diesen Ferienmonaten wurde schon früh gegessen, und so bekam man einen reichlich langen Nachmittag und Abend heraus. Aber Jonas fand es ungerecht, daß auf sechs Wochentage nur ein Sonntag fiel, und daß der Vater sich gerade die Wochentage genommen hatte.

Ruth saß nicht mit im Wohnzimmer. Sie mußte in ihre kleine Giebelstube hinauf gegangen sein.

Erik trat wieder in den Flur zurück und horchte, ob sich oben nichts rege.

Und dann stand er auch schon gleich darauf am Fuß der schmalen Holztreppe.

Wie ein Dieb erschien er sich selbst, als er da, in der Halbdämmerung, auf dem untersten Treppenabsatz zögerte.

Nur langsam nahm er die ersten Stufen, dann rasch die nächsten.

Wie lange, lange war er nicht mit Ruth allein gewesen, -- ganz allein. -- --

Oben klopfte er kurz und laut an. Ruth antwortete mit heller Stimme. Sie stand vor dem geöffneten Wandschrank, in dem sich ihre Sachen befanden, und kramte darin.

Außer einem Tisch und Stuhl am Fenster enthielt das kleine Gemach nicht viel mehr als am ersten Tage. Aber das Fensterbrett war mit Blumen gefüllt, mit gewöhnlichen Sommerblumen, wie die Straßenhändler sie auf einem Kopfbrett vorübertrugen, und darunter standen, am Boden, Töpfe mit Ablegern aus dem Garten. Und die Tapetenwand war bedeckt mit Bleistiftzeichnungen, die einen breiten Tintenrand als Rahmen empfangen hatten. Sie rührten alle von Jonas Hand her und stellten alle irgend einen Winkel des Gartens oder des Hauses dar.

Erik sah auf den Tisch nieder, auf dem Nähzeug und Papiere unordentlich durcheinander lagen.

Es fiel Ruth nicht ein, zu fragen, weshalb er heraufgekommen sei, aber in der leichten Verlegenheit, die er selbst empfand, suchte er nach einem Wort und zog eines der Papiere unter dem Nähzeug hervor.

»Schreibst du hier Verse?« fragte er überrascht.

Sie wurde dunkelrot.

»Nicht mehr so oft,« antwortete sie fast bestürzt, »und ich will ja auch gar nicht! Aber manchmal, wenn -- manchmal muß ich es noch thun.«

»So Verborgenes thun. Verborgen vor mir. Und ich habe geglaubt, daß kein Gedanke unausgesprochen, den ich nicht kenne, durch deinen Kopf geht.«

Sie machte ein so schüchternes Gesicht wie in alten Zeiten.

»Nicht verborgen,« sagte sie leise, »es sind nur eben keine Gedanken. Und aussprechen kann man sie auch nicht. Und die kommen nun und drängen sich, und dann muß man Verse schreiben.«

Erik lachte.

»O weh, die armen Verse!« bemerkte er, »also einen solchen stillen Winkel hast du dir noch in deinem Kopf referiert, während es aussieht, als ob du die schönste Ordnung gemacht hättest. Die ist wohl nur in den Staatsstuben, auf der Oberfläche. Dahinter liegt eine wunderschöne, unergründliche Rumpelkammer. Was sollen wir mit der machen?«

Sie sah ihn ganz ernsthaft an.

»Was Sie wollen,« versetzte sie treuherzig.

»Würdest du denn fraglos thun, was ich will? Auch im geheimsten, was du für dich treibst? Auch im Verborgensten deiner Rumpelkammer? Immer?«

»Immer.«

Er nahm ihren Kopf zwischen seine Hände.

»Und wenn ich sie dir nun ausräumen wollte? und wenn es zufällig gerade dein liebster Winkel wäre? und wenn es nun, irgend wann einmal, vielleicht keine bloße Rumpelkammer mehr wäre, sondern dein glückliches geistiges Zu Hause? würdest du dann auch noch ebenso antworten: ›Was Sie wollen‹?«

»Ja!« sagte sie einfach.

Erik machte eine Gebärde, wie wenn er sie in seine Arme ziehen wollte, dann aber ließ er sie frei, trat zurück und ans Fenster, neben welchem, an der Seitenwand, ein kleiner Bücherbort hing.

Ein paar Minuten vergingen.

Ruth sah ihm zu, wie er anscheinend die Titel der Bücher studierte, die sich in der langsam zunehmenden Dämmerung nicht mehr erkennen ließen. Aber Erik wußte ungefähr, was alles sich hier auf das sonderbarste einträchtig zusammengefunden hatte. Eine lateinische Grammatik aus Jonas' Nachlaß und die Märchenwelt von Tausend und eine Nacht, eine Auswahl aus Platos Werken in deutscher Uebersetzung und ein zerrissener Band alter russischem Volkserzählungen, Ueberwegs »System der Logik« und die französische Uebersetzung des Don Quixote mit den Illustrationen von Doré, und so fort.

»Warum haben Sie nie ein Buch geschrieben?« fragte Ruth plötzlich vom Fenster her.

»Weil ich es nie gekonnt habe. Bücher zu schreiben verstehe ich nicht, Ruth. Und mir schien wohl auch immer: Bücher sind tot, nur das gesprochene Wort lebt. Und ich fürchte, du wirst es auch nie können, nie verstehen, mein armes Mädel.«

»Ich? Ich will auch nicht. Ich möchte etwas andres.«

»Was möchtest du denn?«

»Ein Märchen erzählen. Ein einziges. Eines, in dem alles drin ist. Aber nicht mit Worten.«

»Das würdest du ja auch schreiben oder sprechen, malen oder meißeln müssen, wenn du es mitteilen willst.«

»Es muß noch auf bessere Weise gehen,« meinte Ruth.

»Nicht, wenn es für alle sein soll. Sonst kann man es auch wohl einem lieben Menschen an den Augen ablesen.«

»Das ist schon besser,« sagte sie und lehnte ihren Kopf gegen das Fensterkreuz zurück.

Kurze Zeit schwiegen beide.

Die Dämmerung sank tiefer. Ueber den Steinfliesen der Terrasse unter ihnen blinkte es hell auf, im Wohnzimmer wurde die Lampe angezündet.

Um den Wipfel der alten Ulme vor dem Fenster spielten die Fledermäuse. Lautlos huschten sie unter dem Dachfirst hervor und flatterten hinter Ruths Rücken hin und her im Zickzack.

Erik stand mit einemmal im Halbdunkel dicht neben ihr. Er hob die Hände und strich leise über ihr Haar hin, so daß sie sich in den weichen, lockigen Wellen verloren, und dann blieben sie auf ihren Schultern liegen, und er beugte sich tief über Ruth.

»Sage mir das nicht mehr, -- was du vorhin sagtest: daß du immer und fraglos thun würdest, was ich will,« bemerkte er mit gesenkter Stimme, »du sollst mir nicht in jedem Fall und blind folgen. -- Ich könnte ja auch ein Unrecht von dir wollen. -- Hast du daran nicht gedacht?«

Sie legte sich weit in seinen Arm zurück und schüttelte den Kopf.

Er umfaßte sie fester.

»Und wenn es doch so wäre?« fragte er fast heftig, »was würdest du thun?«

Nun erst blickte Ruth auf und sah ihn lange und ruhig an. Sie schien sich den Fall ernsthaft zu überlegen.

»Unrecht thun!« sagte sie dann laut.

Erik fuhr zusammen. Er murmelte etwas, was sie nicht verstand. Sie lachte aber über das ganze Gesicht.

»Für mich ist immer ~das~ das Rechte, was Sie wollen, -- niemals ein Unrechtes. Besser weiß ich es nicht. Ich brauche es aber auch nicht besser zu wissen.«

»Mein armes Kind,« sagte er leise.

Sie richtete sich in seinem Arm hoch. Ein lauschender Ausdruck kam in ihr Gesicht.

»Wer? ich? Warum sagen Sie das?« fragte sie mit veränderter Stimme und machte sich langsam frei. »Was ist das? Warum sagen Sie mir das alles? Ich bin kein armes Kind. Ich bin ja ~Ihr~ Kind!«

Und als er nicht gleich antwortete, faßte sie ihn plötzlich an beiden Armen und schüttelte dieselben mit leidenschaftlicher Kraft. »Bin ich es denn nicht?« fragte sie wild. »Worum soll ich nicht mehr thun, was Sie wollen? Bin ich denn nicht Ihr Kind? Nicht mehr?! Dann wäre es besser, tot zu sein.«

»Ruth!« rief er erschüttert.

Sie suchte sich zu fassen. Ihre Hände sanken von seinen Armen und schlangen sich ineinander. Dann hob sie den Kopf.

»Ich will alles thun, -- alles! Recht oder Unrecht, Gutes und Böses, -- alles! Ich will gehorsam sein bis in den Tod. Stellen Sie mich auf die Probe. Aber gehorchen muß ich Ihnen dürfen, -- Ihr Kind sein dürfen, -- zu Ihnen sagen dürfen: ich will thun, was Sie wollen. Immer! Immer! Das muß ich -- muß ich dürfen. -- -- Darf ich?«

Unwillkürlich hob sie ein wenig die gefalteten Hände. Eine Gebärde unsäglicher Demut. Aber ihr Gesicht sah dabei fast finster aus, und ihre Stimme klang wie Metall. Und nun ein ganz weicher, kindlicher Ton: »-- Darf ich?«

Erik wurde zu Mute, als schaue er plötzlich, erst in diesen vorüberblitzenden Sekunden, mit weitem Blick hinein in die verhüllte Tiefe, aus der allein Ruths Liebe geboren werden konnte. Zum erstenmal hinein in das Geheimnis ihres Wesens, -- hinein in die stumme Einsamkeit und Sehnsucht vieler, vieler Jahre, aus der mit rückhaltloser Gewalt die langgehemmte, lang aufgestaute Inbrunst hervorgebrochen war, als er in ihr Leben trat. Ihn lieben dürfen, das hieß: endlich -- endlich ~Kind sein dürfen~, gehorchen, sich hingeben, sich weggeben, auf den Knieen noch. Es hieß sammeln und ausstürzen dürfen die ganze leidenschaftliche Zärtlichkeit des Kindes, das noch keine Kindheit gehabt. Und das doch gerade dessen -- nur dessen bedurfte.

Ruths Augen blitzten ihn durch die Dämmerung an.

»Bin ich noch immer arm, -- ein armes Kind?« schienen sie ihn unverwandt zu fragen.

»Du bist nicht arm, -- mein Kind bist du, -- und darfst gehorchen, -- mir folgen, -- du sollst es immer dürfen,« sagte er heiser.

Und er öffnete die Thür nach der Treppe, über der hell das Lampenlicht aus dem Flurraum heraufschien. --

Diesen Abend zog sich Erik schon gleich nach dem Thee in sein Arbeitszimmer zurück. Klare-Bel merkte recht wohl, daß er wieder die halbe Nacht aufblieb. Obgleich doch am andern Tag der Unterricht ausfiel.

Den nächsten Morgen fragte Erik am Frühstückstisch, ob Briefe in die Stadt mitzunehmen seien.

»Willst du zur Stadt fahren? gerade heute? am Sonntag?« fragte seine Frau erstaunt.

»Ja. Ich muß selbst zwei Briefe, die dringend sind, besorgen und einen notwendigen Besuch machen,« versetzte er.

Die beiden Briefe sah Klare-Bel auf dem Nebentisch liegen. Der eine an Römer nach Heidelberg, der andere an dessen Frau nach Moskau. Beide doppelt frankiert.

Sie wagte nicht, ihn zu fragen, was er denn an Frau Römer so viel zu schreiben habe? Er machte ein so ablehnendes, verschlossenes Gesicht. Aber als er fortgegangen war, sann Klare-Bel den ganzen Vormittag traurig und besorgt diesem Gesicht nach.

Dies Wortkarge, Verschlossene kannte sie als ein schlimmes Zeichen. Erik war offen und mitteilsam, wenn er froh war; wenn er schwieg, so litt er. Und gerade dann hätte Klare-Bel am liebsten alles mit ihm geteilt. Dem Glücklichen, Frohen gegenüber fühlte sie sich leicht ein wenig gedrückt, ein wenig überflüssig. Dagegen erschienen ihr immer Leiden und Kummer als die geeignetsten Zugänge, die wohl auch sie zu Eriks Innerem hätte finden müssen, -- um ihm nahe zu kommen, um ihm notwendig zu werden. Aber gerade wenn er litt, wurde er am unzugänglichsten, -- wurde er stets abweisend, bis zur Schroffheit. Nur in seinen frohen Stunden erschloß er sich ihr.

So war es also wohl nichts für sie: weder mit der Freude, die sie ihm so gern bringen wollte, -- noch auch mit dem Kummer, den sie mit ihm getragen hätte. --

Inzwischen befand sich Erik in der Stadt bei Ruths Verwandten. Ganz gegen seine Vermutung fand er auch die Tante vor, die soeben von Wiesbaden zurückgekehrt war, um, nach kurzem Aufenthalt, zu den Ihrigen nach Livland zu reisen, wohin ihr Mann sie begleiten sollte.

»Vor Anbruch des Winters kommen wir von dort nicht mehr heim,« sagte der Onkel zu Erik, den er auf das herzlichste wieder begrüßt und erst nach längeren, zwanglosem Gespräch zu zweien in das Empfangszimmer zu seiner Frau geführt hatte. »Aber alles, was Sie mir da erzählt haben, eilt ja auch nicht von heute auf morgen, denke ich mir. Wenn Sie Ihre Absicht ausführen, Ruth ins Ausland zu senden, so ließe sich dabei der Zeitpunkt unsrer Rückkehr ein wenig mit berücksichtigen, nicht wahr?«

»Nein!« entgegnete Erik, »das, was ich von Ihnen erbitten wollte, war eben dies: mir auch hierin vollständig freie Hand zu lassen. Und für Ruth an dem Reiseanschluß festzuhalten, den ich im Auge habe. Auch wenn das ihre Abreise unberechenbar beeilen sollte. Ich weiß, daß ich Ihnen damit viel zumute. Aber wenn Sie Vertrauen zu mir haben, dann lassen Sie mich noch einmal über Ruth entscheiden, so unbedingt wie damals, als ich sie Ihnen fortnahm.«

»Ich weiß keinen Menschen aus der weiten Welt, zu dem ich mehr Vertrauen fassen könnte, als zu Ihnen,« versetzte Ruths Onkel, dem bei Eriks sonderbar bestimmtem Ton die Gemütlichkeit schwand, »und was Ruth betrifft, so habe ich von allem Anfang an das Gefühl gehabt, als ob selbst so nahe Verwandte wie wir, Ihnen ein Recht auf die Kleine abtreten müßten. Wenn Sie also so fest glauben, daß es gut an ihr gehandelt ist, handeln Sie so! Ich meinerseits will, -- wenn ich sie nicht wiedersehe, -- ich will Weihnachten einen kurzen Urlaub nehmen und unsre kleine Studentin in Heidelberg besuchen.«

»Aber ich bitte dich! nenne es doch wenigstens nicht gleich beim ärgsten Namen!« fiel die Tante ein, der die Nachgiebigkeit ihres Mannes unverantwortlich vorkam. »Ruth soll doch nicht wirklich studieren? Ich meine, mit einem Studentenplaid und kurzen Haaren, wie es hier geschieht? Bei uns in den Ostseeprovinzen wäre so etwas rein undenkbar.«

»Einstweilen soll sie lernen,« antwortete Erik etwas ablehnend, »das Weitere wollen wir ruhig ihr selbst und der Zeit überlassen.«

Sie sah ihn prüfend und mißbilligend an. Wie konnte man so etwas der »Zeit« überlassen? Hätte er noch gesagt »der Vorsehung«. Wenn er für das Frauenstudium eintrat, dann war er auch ganz sicherlich ein Atheist. Und solchen Leuten war doch wohl alles zuzutrauen.

»Ich sehe mit Verwunderung, daß mein Mann sehr sorglos darüber denkt,« bemerkte sie, als Erik schon aufstand, um sich zu verabschieden, »aber um so mehr muß ich ein Wort hinzufügen. Du sprichst so ruhig von Recht abtreten, Louis! Aber ~ein~ Recht kannst du doch nie und nimmer abtreten. Ich meine das Recht der moralischen Verantwortlichkeit. Das mag ja eine altmodische Ansicht sein. Aber ich möchte doch wissen, wie Herr Matthieux darüber denkt.«

Erik sah ihr ernst und ruhig in die kampflustig auf ihn gerichteten Augen. Zum erstenmal gefiel sie ihm. Eben die Kampflust gefiel ihm. Obwohl der Onkel Ruth lieb hatte, war sie doch ein besserer Wächter als er.

»Wenn ich Sie recht verstehe,« sagte er, »so fürchten Sie, daß ich mit meinem Recht an Ruth nicht zugleich auch alle Pflichten ihr gegenüber übernehmen würde. Wenn es etwas gibt, was Sie von dieser Furcht befreien kann, so nennen Sie es nur.«

Der Onkel sah fast verlegen aus, aber sie beachtete es nicht.

»Ich antworte Ihnen als gläubige Frau,« entgegnete sie, die stolz war auf baltische Ueberzeugungstreue, »mir bedeutet moralische Verantwortlichkeit: schuld sein wollen an einem Menschen, -- schuld an dem, was an seinem innern Menschen geschieht. Nicht zulassen, daß er Schaden daran nimmt. Wie sollte man das ohne Gott, ohne religiösen Glauben auf sich nehmen können? Wenn Sie nun Ruth fortgeben, -- können Sie eine solche Pflicht in diesem Sinne übernehmen?«

Ueber Eriks Züge ging ein Ausdruck, den sie nicht zu deuten wußte, der sie aber wider ihren Willen ergriff.

»Nun verstehen wir uns,« sagte er mit unterdrückter Bewegung, »denn eben das soll mein Recht sein: ich will schuld sein an diesem Kinde!«

Sie fand, es klang arroganter als je. Es war nichts, das ihre religiösen Bedenken beruhigen konnte. Aber ihr war dennoch, als habe er »Gott« gesagt. --

Erik ging dem Bahnhof zu. Fast kein Mensch außer ihm in den leeren Straßen; auch die letzten, die den Sommer in der heißen, ungesunden Sumpfluft der Stadt zubringen mußten, entrannen ihr am Sonntag. Nur hier und da taumelte ein Betrunkener aus der offenstehenden Thür einer Kellerschenke, oder rasselte eine vereinzelte Droschke holpernd über das schadhafte Holzpflaster, das stellenweise noch weit aufgerissen dalag und darauf wartete, daß seine alljährlichen Löcher in schöner Mosaikarbeit zugestopft würden.

Verlorene Glockenklänge, die letzten von einer der zahllosen Kirchen, zitterten über die ausgestorbenen Straßen hin, wie Grabgeläute über einer Totenstadt.

Erik ging langsam, müden Schrittes heimwärts.

»Nicht zulassen, daß sie Schaden nimmt,« wiederholte er die eben gehörten Worte. Ja, genau das wollte er doch. Noch war die Umpflanzung in einen neuen Boden möglich, wenn er seinen kleinen Baum behutsam, mit allen feinsten Würzelchen, dort eingrub. Nur so konnte er jetzt seine Gärtnerdienste an ihm thun, damit derselbe nicht Schaden nehme an seiner Entwickelung, die noch in hart und fest geschlossenen Knospen vor sich ging, -- undurchsichtig von allen Seiten.

Denn manchmal, da wachte etwas Gewaltthätiges in ihm auf, -- im pflegenden Gärtner die verbrecherische Ungeduld des Knaben, der sich am Frühling vergreift und die Knospen zerstören möchte, um zu sehen, ob eine rote oder eine weiße Blüte in ihnen schläft.

Aber er fiel sich selbst in die gewaltthätige Hand; er selbst riß Ruth sich aus der Hand.

Verdirbt denn ein Vater sein Kind, ein Mann sein Weib, ein Künstler sein Werk?

Und ihm schien: seine Liebe zu Ruth sei alles dieses.

Zu Hause hatten sie mit dem Essen auf ihn gewartet; als er kam, wurde es einsilbig eingenommen. Klare-Bels Hoffnung, Erik werde erzählen, bei wem er den Besuch gemacht, erfüllte sich nicht.

Er wußte wohl, daß er nun davon sprechen mußte. Mit ihr und mit Ruth. Es war ihm das Schwerste.

Das dachte er, als er dann endlich am Fenster seines Arbeitszimmers stand und wartend in den Hintergarten hinausblickte, wo Ruth sich mit Jonas erging: »Nur nicht sprechen, -- nur nicht grübeln, -- handeln! Sie aus den Arm setzen und forttragen. Handeln! Wer es wortlos dürfte!«

Und nun ging Jonas ins Haus.

Erik stieg zu Ruth in den Garten hinunter.

Sie saß auf ihrem Lieblingsplatz, dem Steinrand des Springbrunnens. Dort saß sie mit gebücktem Kopf und stocherte mit einem trockenen Ast im Grase.

Wie sie ihn kommen sah, warf sie ihren Zweig fort und lief ihm entgegen. Er hatte sie kaum begrüßt bei Tisch, zum verspäteten Essen, und nun schlich sich ihre Hand in die seine.

Ohne recht zu bemerken, was er that, steckte er sie mitsamt der seinen in die Seitentasche seiner Joppe.

Ruth lachte darüber und blickte zu ihm auf, aber als sie den ernsten, beinahe strengen Ausdruck seines Gesichtes sah, verstummte sie ebenso plötzlich.

Sie gingen einige Schritte dem kleinen Gehölz zu.

»Heute war ich bei deinen Verwandten, Ruth,« sagte Erik, »sie waren beide da. Ich wollte sie einmal etwas auf das hin ausfragen, was wir in den letzten Monaten schon öfters miteinander besprochen haben. Weißt du nicht? Ich meine daraufhin, ob du nicht einmal im Auslande tüchtig weiterlernen könntest.«

Sie sah ihn erwartungsvoll an. Dies da interessierte sie sehr und ein wenig beunruhigte es sie auch. Denn es handelte sich doch eigentlich erst um ein ganz allgemein gehaltenes, unbestimmtes Zukunftsbild, -- nicht um etwas, was schon erwogen und besprochen werden mußte.

»Nun? und was meinten sie darauf?« fragte Ruth gespannt, als er schwieg.

»Sie haben nichts dagegen einzuwenden, Ruth. Nichts Ernstliches. Da ist es denn Bernhard Römer gewesen, an den wir dabei gedacht haben. Dort wüßte ich dich im richtigen Hause geborgen. Es wäre fast so, als wenn ich selbst bei dir bleiben konnte.«

Ihre Hand, die er noch umfaßt hielt, erkaltete in der seinen.

»Ja, -- aber -- das ist ja noch so lange hin!« meinte Ruth ganz langsam, und dann immer schneller, in wachsender Unruhe: »Es ist doch noch lange hin? Sehr lange? Ich soll doch nicht -- bald fortgehen? ~Von hier~ -- -- fortgehen!«

Er umschloß ihre Hand fester und ging auf die Bänke zu, die unter den Birkenbäumen standen.

»Komm zu mir,« sagte er sanft, »setze dich zu mir her, mein Liebling, und laß uns ruhig darüber sprechen. Ganz ruhig, -- hörst du?«

Sie folgte ihm schweigend, aber ihre Augen hingen unverwandt, mit tausend aufgestörten bangen Fragen, an seinem ernsten Gesicht.

»Sieh, Kind,« fuhr Erik fort, »wenn wir hier, während unsrer gemeinsamen Arbeit, an deine Zukunft dachten, dann schwebte sie dir wie ein erwünschtes, lockendes Bild vor. Ich wollte, daß du dich später weiter entwickelst, und du wolltest es auch. Ich dachte oft bei mir, wenn ich dir zusah: manches von dem, was ich selbst einst erstrebt, könntest, in andrer Form, du einst verwirklichen. Aber was so, als Zukunftsmöglichkeit, in der Ferne stand, wird doch näher rücken müssen, bis es unwiderrufliche Wirklichkeit und Gegenwart geworden ist. Und ich wünsche, daß du diesem Gedanken jetzt nahe trittst, mein Kind.«

»-- -- Wie nahe -- -- ist es denn?« fragte Ruth mißtrauisch, aber kaum war es ihr entschlüpft, als sie ihre Hand aus der seinen riß und ihre beiden Hände flach gegen die Ohren preßte.

»Nicht!« murmelte sie undeutlich, »ich will es nicht wissen! bitte, nicht! bitte, bitte, nicht weitersprechen.«

Einen Augenblick schloß er die Augen.

Dann faßte er sanft nach ihren Händen und zwang dieselben zu sich nieder.

»Es hilft nichts, mein Kind,« sagte er fest, »es hilft nichts, sich vor etwas Unwiderruflichem zu verschließen. Gerade hiervon werden wir weitersprechen. Denn, je mehr du noch davor zurückscheust, desto dringender, desto eher muß es geschehen.«

Ruth war sehr blaß geworden.

Ein unbestimmtes Grauen stieg dunkel in ihr auf. Vor etwas, was sie noch nicht fassen, nicht deutlich begreifen konnte, was aber vor ihr empordämmerte, -- unerwartet, unversehens, aus dem Nichts, -- schattenhaft, gleich einem Riesengespenst.

»Ich kann nicht!« stieß sie hervor. »Es kann ja so nicht sein! Ich will nicht, daß es so ist. Ich kann nicht!«

Er beugte sich zu ihr und suchte ihren Blick.

»Wirklich nicht?« fragte er ruhig; »auch nicht, wenn du weißt: ich will es? Auch nicht, wenn ich selbst es bin, der dich bei der Hand nimmt, dich vor etwas hinstellt, das dir schwer fällt, damit du lernst, es herankommen zu sehen, ohne davor fortzulaufen?«

Sie schmiegte sich an ihn und versteckte den Kopf an seiner Schulter.

»Ich fürchte mich,« sagte sie, wie ein Kind im Dunkeln, »-- irgend etwas Schreckliches ist da, -- seit gestern ist es da, -- und kommt heran, immer näher, -- ganz dicht heran, -- ganz nahe. Wie ein Ungeheuer, das sich um mich ringelt. -- Ist es etwas Schreckliches -- --?«

»Nicht das, was du gestern fürchtetest,« sagte er leise, »-- nur das, was du gestern selbst wolltest, selbst fordertest. Weißt du nicht, was du mir versprachst? die Probe stellen. Wenn ich es nun thue, Ruth, -- ziehst du dein Versprechen zurück?«

»Nein!« entgegnete sie rasch und richtete sich auf. Dagegen gab es keine Auflehnung. Nur Gehorsam.

»Worin besteht die Probe?« fragte sie entschlossen, »was soll ich thun?«

Er antwortete nicht gleich. Er hatte die Brauen zusammengezogen, und seine Zähne gruben sich in die Lippe, als litte er körperlichen Schmerz.

Ein paar Augenblicke verharrten sie schweigend bei einander.

Ein kühler Luftzug strich durch die Bäume und warf ein rundliches gelbes Birkenblatt nach dem andern ihnen in den Schoß. Mühsam schien die Sonne durch breite weiße Wolkenmassen in den Garten, und aus den Vogelnestern ringsum unterbrach hin und wieder ein kleiner, satter Ton die Stille um sie.

Da antwortete Erik mit einer Stimme, die fast rauh klang: »Du sollst dich in einer großen Sache ebenso tapfer erweisen, wie du dich einmal in einer kleinen erwiesen hast. Du sollst thun, was du schon einmal thatest, als dir das langsame Herankommen, -- Näherkommen von etwas Gefürchtetem bevorstand. Es war damals, als Jonas uns die Schlange ins Haus brachte. Sie flößte dir solchen Schrecken ein. Weißt du nicht mehr, was für ein Mittel deine eigene Tapferkeit dagegen fand?«

»Nein!« sagte sie stutzend und blickte auf, »was war das für ein Mittel?«

»Du sagtest: ›Dann lieber -- gleich!‹«

Ruth sprang jäh von der Bank auf und machte eine wilde Bewegung gegen ihn hin, als ob sie ihn noch rechtzeitig an etwas hindern wollte.

Dann, ohne einen Laut der Erwiderung, brach sie vor ihm in die Kniee, in das welke Augustlaub, das zu seinen Füßen lag.

»Ruth!« murmelte er angstvoll und breitete seine Arme um sie, »mein Kind! mein Liebling! hörst du mich?«

Aber sie hörte nicht mehr. Ihr Kopf fiel zurück. Sie hatte das Bewußtsein verloren.

Inzwischen kam Jonas in den Garten gelaufen, der vom Fenster aus beobachtet hatte, wie der Vater mit Ruth in das kleine Gehölz hineingegangen war.

Wie versteinert stand er still, als er jetzt Erik zwischen den Bäumen hervortreten sah und Ruth mit geschlossenen Augen regungslos in seinen Armen. Ihre rechte Hand hatte der Vater um seinen Nacken gelegt, die linke hing schlaff herunter.

»Geh voraus!« gebot Erik dem Knaben, »ohne Lärm. Halte mir die Thüren offen. Ich muß Ruth auf ihr Bett tragen.«

Jonas blieb jegliche Frage in der Kehle stecken; er rannte voraus, nicht ohne sich fortwährend nach dem Vater umzuschauen, und ins Haus hinein. Dort lief er, ohne die Mutter oder Gonne zu alarmieren, die Holztreppe zu Ruths Giebelstube hinauf. Als Erik mit Ruth in den Armen oben ankam, stand Jonas wartend an der weitgeöffneten Thür, durch welche man das schmale weiße Bett mit den zurückgeschlagenen Decken sehen konnte.

Jonas blickte dem Vater ängstlich bittend ins Gesicht; er wäre so gern mit hineingegangen, um bei Ruth zu bleiben. Aber Erik ging schweigend an ihm vorbei und zog die Thür hinter sich zu.

Dieser Augenblick prägte sich ihm mit merkwürdiger Gewalt ein: wie der Vater, Ruth an der Brust, so stumm an ihm vorüberschritt, während ~er~ zurückbleiben mußte.

Im Blick und Ausdruck des Vaters empfand er etwas Außerordentliches, einen starren, wortlosen Ernst, -- so, wie wenn Ruth schon so gut wie tot sei.

Jonas überlief es kalt.

Er klammerte sich an den Thürgriff und lauschte mit zurückgehaltenem Atem. Anfangs unterschied er nichts. Dann hörte er Eriks Stimme, halblaut, kurz, sehr bestimmt im Ton. Sie wiederholte sich. Darauf eine Pause, -- und plötzlich ein Klagelaut drinnen, ein einziger Laut, aber so schmerzlich, daß den Knaben Entsetzen faßte.

Was that man mit Ruth, mit seiner lieben Ruth? Was that der Vater ihr an? Etwas Furchtbares mußte es sein. Etwas Furchtbares mußte heute im kleinen Gehölz vor sich gegangen sein.

Und er durfte die Thür nicht aufstoßen, er wagte es nicht. Aber eine rasche, wilde Empfindung, wie plötzlicher Haß, loderte unverstanden in ihm auf: daß er ein Knabe war, und der Vater ein Mann! Daß er nicht eindringen durfte mit gleichem Recht, -- mit Gewalt!

Aber ebenso rasch erlosch sie wieder. Ruth konnte nichts geschehen, wenn sie bei seinem Vater war.

Jonas schlich sich hinunter, in das kleine Zimmer von Klare-Bel neben der Wohnstube. Er konnte nicht allein sein.

Dort setzte er sich am Eingang auf die äußerste Kante eines Stuhles und brach in Thränen aus.

»Ruth ist halbtot, Mama!« sagte er außer sich, »ach Mama, sie stirbt! Die Augen hat sie schon zugemacht. Und Papa, -- ich weiß nicht, was Papa thut, aber ganz bestimmt thut er ihr weh. Sie darf aber nicht sterben! Vorhin war sie ja noch so vergnügt und raschelte mit mir durch die Blätter im Garten!«

Klare-Bel war nach diesem Bericht nicht weniger erschrocken als er selbst, und mit ängstlicher Spannung warteten sie darauf, ob Erik nicht bald herunterkäme. Aber es dauerte noch geraume Zeit, bis er kam.

»Um Gottes willen, was ist denn mit Ruth geschehen?« rief sie ihm in großer Unruhe entgegen.

»Sei nur ruhig; es war eine Ohnmacht,« versetzte Erik und gab Jonas einen Wink, hinauszugehen. Dann trat er an seine Frau heran und sagte: »Ich mußte Ruth eine Mitteilung machen, auf die sie nicht genügend vorbereitet war. Jetzt mußt auch du es erfahren: Ruth geht schon in diesen Tagen fort. Nach Heidelberg, zu Römer ins Haus.«

Klare-Bel erhob sich ein wenig auf ihren Kissen und sah ihn voll tiefen Staunens an.

»Ist das dein Ernst? Du gibst Ruth aus der Hand? Aber was willst du denn ohne Ruth machen? Kannst du sie denn entbehren?«

»Das muß ich doch können, Bel.«

Im beginnenden Zwielicht vermochte sie nicht seine Züge genau zu erforschen. Aber dieselben kamen ihr vor wie aus Stein gehauen. Und diesen Ausdruck kannte sie.

»Erik!« sagte sie ängstlich, »thu nur nichts so gewaltsam. Du siehst ja, daß es sie krank macht. -- Warum siehst du so hart aus, Erik?«

»Hart?« Er fuhr sich mit der Hand über die Stirn; »für mein Aussehen kann ich nicht. Aber ängstige dich um nichts. Ruth wird morgen gesund sein, und auch gefaßt. Für ihre Haltung stehe ich ein. Aber sei gut und freundlich zu ihr. Ich muß auf ein bis zwei Tage verreisen.«

»Verreisen? Du reisest fort, Erik? Wohin?«

»Nach Moskau.«

»Zu Frau Römer?« fragte sie lebhaft.

»Ja. Ihr soll Ruth sich anschließen. Und sie wird sich wahrscheinlich hier nicht mehr aufhalten. Ich muß daher alles mit ihr verabreden und besprechen. Mündlich.«

Klare-Bel schwieg. Es wurde dämmerig im Zimmer, und draußen im Flurraum hörte man Jonas unruhig auf und ab gehen.

Da, ganz leise, fühlte Erik seine Hand von Klare-Bel erfaßt.

»Erik!« flüsterte sie, »-- laß mich dich bitten: lasse sie noch ein Weilchen bei uns. -- -- -- Auch ich werde sie ja vermissen, Erik!«

»Du -- -- -- Bel?«

»Ja. Denn sie hat dich so glücklich gemacht.«

Er zog ihre Hand an sich, und an den Mund und küßte sie voll Scham und Ehrfurcht.

»Ich danke dir für diese Bitte. Ich danke dir, Bel. Aber es kann nicht sein.« --

Er zog sich zurück, um Ruths Onkel die definitive Entscheidung mitzuteilen. Dann packte er eine Handtasche, und eine Stunde später war er fort. Er reiste noch mit dem Nachtzuge nach Moskau ab.

In dieser Nacht lag Klare-Bel viel wach und dachte an Ruth und an Erik. Sie hatte bestimmt geglaubt, Ruth werde bis zum Spätherbst bei ihnen im Haus und dann, vom Hause ihres Onkels aus, nach wie vor in engster Verbindung mit ihnen bleiben. Wie oft hatten sie darüber gescherzt, ob sie dann, später, mit Jonas zusammen auf die Universität abgehen solle? Erik hatte kein Wort davon gesagt, daß seine Absichten wohl von Anfang an andre waren. Ganz plötzlich kam er jetzt mit ihnen heraus.

Aber Klare-Bel fiel es gewiß nicht ein, Kritik an dieser Handlungsweise zu üben. Da er es so wollte, mußte es so wohl gut sein. Gut für Ruth. Er liebte sie so sehr, er konnte nur ihr Bestes dabei im Auge haben. Auch dabei, daß es so unerwartet über sie kam.

Aber gern wäre sie jetzt zu Ruth hinaufgegangen und hatte sie geliebkost und getröstet. Sie nahm sich vor, es den nächsten Tag zu thun. Zum erstenmal fühlte sie eine echt mütterliche Zärtlichkeit für Ruth, -- nicht nur das indirekte Interesse, das durch Erik hindurchging und alles auf ihn bezog. --

Der Morgen war herbstlich und grau, die Terrasse noch feucht von den kalten Nebeln der Nacht. Man mußte das Frühstück im Wohnzimmer einnehmen. Ruth fand sich zur gewöhnlichen Zeit dort ein; sie war blaß und ernst, aber gesund, wie Erik es gesagt hatte, und ganz gefaßt und still.

Als sie, noch vor Jonas, hereinkam, streckte Klare-Bel ihr die Arme entgegen: »Komm zu mir,« sagte sie liebevoll, »sei nicht traurig, denke nicht an die Abreise. Noch bist du hier!«

Ruth sah auf, ohne daß sich eine Miene in ihrem stillen Gesicht verändert hätte, und schüttelte den Kopf.

»Ich bin schon fort!« entgegnete sie.

Diese Antwort ergriff Klare-Bel sehr. Ihr schien, es lag etwas Schmerzlicheres darin, als in Klagen und Thränen, -- etwas, das die bloße Ankündigung der Trennung schon mit ganzer Wucht als Trennung empfand und nicht mehr davon los konnte.

Sie fühlte heißes Mitleid in sich aufsteigen. Und jetzt kam Erik ihr doch hart vor. Wie konnte er nur wollen, daß Ruth so von Haus zu Haus, von Hand zu Hand ging. Unwillkürlich suchte sie nach Worten, die wahrhaft trösten könnten. Gab es keine solchen? In ihrer Ratlosigkeit griff sie nach dem Höchsten, das sie gekannt hatte.

»Wir wissen alle nicht, wo wir bleiben, und was mit uns geschieht,« sagte sie zögernd, »wir wissen es nie. Es steht in Gottes Hand. Aber wir sind auch nie allein, wo wir auch hingehen. Gott ist allgegenwärtig.«

Ruth lächelte flüchtig.

»Ja,« versetzte sie traurig, »was kann es helfen, daß Gott allgegenwärtig ist, wenn die Menschen es doch nicht sind? die Menschen, von denen wir fortgehen.«

Klare-Bel schwieg peinlich berührt. Sie gab es auf, Ruth trösten zu wollen. Wenn diese so etwas sagte, klang es kindisch und vermessen zugleich. Wer mochte darauf antworten?

Ueber Eriks Abwesenheit äußerte Ruth kein Wort; obgleich er ihr nicht davon gesprochen hatte, wunderte sie sich doch nicht darüber, ihn nicht zu sehen. Es mußte wohl so sein: war doch alles in Auflösung begriffen.

Jonas erfuhr nichts von der bevorstehenden Trennung. Niemand teilte es ihm mit. Er hörte nur, daß Ruth wieder gesund sei, aber das glaubte er nicht. Wie konnte sie gesund sein, wenn sie doch so ganz verwandelt war seit gestern. Und nicht nur Ruth, alles schien ihm wie verwandelt.

Gern hätte er sie gebeten, ihm zu sagen, was gestern geschehen sei, aber sie ging den ganzen Tag mit so in sich gekehrtem, fremdem Blick an ihm vorbei, daß er es nicht herausbrachte. So begnügte er sich damit, so oft er nur konnte, neben ihr zu sitzen, den Arm um ihre Stuhllehne gelegt, und von Zeit zu Zeit behutsam und zärtlich ihre Hand zu streicheln. Manchmal duckte er sich auch und küßte ihre Hand, ohne daß Ruth es beachtete.

Daß Erik nicht zu Hause war, verstärkte in Jonas noch die Empfindung, daß er über Ruth zu wachen habe, wie ein getreuer Wächter. Am liebsten hätte er sie mit Leib und Leben verteidigt, aus Todesgefahr errettet, -- wenn er nur gewußt hätte, wovor und vor wem.

Spät abends, als sie längst in ihre kleine Stube hinaufgestiegen war, patrouillierte Jonas noch unermüdlich im Garten vor ihrem Fenster auf und ab, und es that ihm leid, daß so absolut nichts passieren wollte. Endlich verfügte er sich mit einem krampfhaften Gähnen in sein Bett, aber er schlief unruhig und erwachte bald wieder.

Da sah er deutlich im Garten vor der Terrasse Ruths Fensterkreuz auf einem hellen Lichtfleck abgezeichnet: bei ihr mußte jetzt, gegen Morgengrauen, noch Licht brennen.

War sie krank? unglücklich?

Er hielt es im Bett nicht aus. Im Nu war er in seinen Kleidern und kletterte geräuschlos aus dem Fenster. Vor der Terrasse stand die alte Ulme; sie besaß einen bequemen Sattel, von dem aus zwei mächtige Aeste sich gabelten. Wie eine Katze glitt Jonas am bemoosten, von den starken Niederschlägen der Nacht schlüpfrig gewordenen Stamm hinauf.

Verlangend blickte er in den gelblichen Kerzenschein, der aus der Giebelstube fiel.

Ruth saß auf dem Bett. Vollständig angekleidet, so wie sie hinaufgestiegen war, saß sie noch da; die Arme vor sich hingestreckt, die Hände auf den Knieen gefaltet, kehrte sie Jonas fast voll ihr Gesicht zu. Den Kopf ein wenig erhoben, schaute sie weit hinweg über die dunkeln Wipfel des Gartens.

Sie schaute so geheimnisvoll, wie in eine unendliche, verklärte Ferne. Und um die festgeschlossenen Lippen lag ein stiller Ausdruck, -- lag Ergebung.

Jonas starrte auf sie hin mit weitgeöffneten Augen. Er war so im Bann des ~einen~ Bildes, daß er gar nicht mit Bewußtsein wahrnahm, was das flackernde Licht auf dem Tisch sonst noch beleuchtete. Er sah nicht, daß der Tisch selbst abgeräumt war, die Stühle zusammengeschoben, -- nicht, daß auf ihnen ein offener, halbgefüllter Koffer stand, und daß die Wände, ohne den Schmuck seiner Bleistiftsskizzen, kahl und leer auf Ruth niederblickten.

Er sah nur sie, seine lustige Ruth, wie in dem Bilde einer betenden Heiligen, und alles, was in dem gestrigen Erlebnis seine schwerfällige Knabenphantasie in mächtige Schwingungen versetzt hatte, gewann erneute Gewalt über ihn. Ruth selbst wurde zu etwas Geheimnisvollem und Leidendem für ihn; aus der fröhlichen Spielgefährtin zu einem Wesen, das seine Schwärmerei wachrief.

In Gedanken hörte er wieder den leisen Klagelaut von gestern; er sah sie auf dem Bett daliegen, den Vater über sie gebeugt, -- und sein Herz schlug beklommen. Er vermochte die Augen nicht vom Fenster abzuwenden.

Die Nacht war kalt; vom Rasen unter ihm stieg der Nebel auf. Schmal und blaß hing die kleine Mondsichel am östlichen Himmel, und aus dem Gehölz klang verschlafen ein Rabenkrächzen.

Jonas fror; er schob die Hände unter seine dünne Sommerjacke und drückte sich dichter gegen die breiten Aeste, deren Feuchtigkeit ihn allmählich durchdrang. Dabei fiel ihm der eine seiner roten Pantoffeln klatschend aus die Terrasse nieder.

Er zog den nackten Fuß unter sich und überlegte ärgerlich, ob er hinuntersteigen solle, den verlorenen Schuh zu holen. Da bewegte Ruth sich. Das Geräusch draußen hatte sie aus ihrer Traumversunkenheit geweckt.

Sie stand langsam auf und löste ihre Bluse von den Schultern.

Ein Arm hob sich heraus und, unter dem von keinem Schnürleib bedeckten Hemde, die zarte Wölbung der Brust.

Einen Augenblick stand sie mit gesenktem Kopfe still. Dann hob sie die entblößten Arme hoch über sich, stürzte vor ihrem Bett auf die Kniee und warf sich mit ausgebreiteten Armen darüber hin, den Oberkörper langgestreckt, in den Kissen vergraben. So blieb

sie regungslos liegen.

Jonas verharrte unbeweglich und hielt den Atem an. Er hatte den Schuh, er hatte die Kälte vergessen.

Vor seinen Augen flimmerte es.

Weit vorgebeugt, die Finger hineingekrallt in die belaubten Zweige, um nicht zu fallen, starrte er mit klopfenden Schläfen nach dem Bett.

Ueber ihm glomm langsam der Morgen herauf. --

* * * * *

Als Gonne früh morgens, beim Fegen der Terrasse, den Pantoffel auflas, war Jonas längst frostbebend in sein Bett gehinkt, halb bewußtlos vor Kälte und Erregung. Er gab sich den nächsten Tag große Mühe, ein starkes Unwohlsein zu verbergen, konnte aber vor Heiserkeit kaum sprechen, und seine Augen glänzten im Fieber. Auf Klare-Bels besorgtes Drängen und Fragen bekannte er, die Nacht im Garten gesessen zu haben.

Nach dem Essen warf er sich angekleidet auf sein Bett.

Um diese Zeit kehrte Erik nach Hause zurück. Klare-Bel erwartete ihn erst mit Einbruch der Nacht. Aber er hatte auch von Moskau den Nachtzug benutzt.

Ruth stand in seinem Arbeitszimmer, bemüht, ihre Papiere und Hefte unter den seinen herauszusuchen, um sie einzupacken. Was war nun seines, -- was ihres? Der ganze Inhalt ihrer Studien in Niederschriften von seiner Hand, -- der ganze Inhalt seiner Pläne und Arbeiten für den Winter, seiner Gedanken und Vorträge wiedergegeben, niedergeschrieben von ihrer Hand.

Da vernahm sie unerwartet im Flur einen raschen, festen Schritt.

Die Thür von Eriks Zimmer in den Flur flog auf, und Ruth an seine Brust.

Sie hatte über Zweck und Dauer seiner Reise nicht nachgedacht. Von der einen Gewißheit hypnotisiert, daß sie fort mußte, nahm sie alles passiv hin.

Um so mächtiger jedoch wirkte der plötzliche Anblick Eriks jetzt auf sie. In diesem einen Augenblick vergaß sie alles, -- in diesem einen Augenblick siegte die Gewalt der Gegenwart über jeden Kummer, der bevorstand, -- leugnete ihn, vernichtete ihn, -- in diesem Augenblick wurde alles, -- alles gut.

Sie vermochte nichts zu denken, als daß er da war. Und daß sie bei ihm war.

Fest, -- fest schlangen sich ihre Arme um seinen Nacken, fest barg sich an seiner Schulter ihr Gesicht.

So stehen bleiben, -- für immer so stehen bleiben, festgewurzelt für immer an dieser Stelle, hineingeschmiegt in die weiten, weichen Falten des geöffneten Reisemantels, -- nichts fühlen, nichts vernehmen, als den starken, dumpfen Herzschlag, der ihr entgegenpochte, -- für das ganze Leben nichts -- nichts mehr.

Sie wechselten kein Wort.

Aus Eriks Hand war die Reisetasche auf den Boden geglitten; stumm hielt er Ruth an der Brust, schwer atmend und den Kopf niedergebeugt auf ihr Haar.

Und plötzlich gruben sich seine Hände hart in ihre Schultern, um ihre Hüften, und umschlossen sie mit so gewaltthätigem Griff, daß es wie Schmerz und Ersticken über sie kam, -- als müsse er sie nun zerbrechen. Zerbrechen unter seinen Händen und an seiner Brust, -- sterben, -- nicht fortgehen, -- dachte sie, und es überflutete sie mit einem jauchzenden Glücksgefühl, wie sie es nie gekannt.

Erik sah sie lächeln.

Er verlor die Besinnung.

»Wahnsinn!« schoß es ihm wie Feuer durch den Kopf, »Wahnsinn! Wahnsinn, sich zu lassen, wenn man sich liebt.«

Eine Sekunde lang, -- dann ließ er sie so jäh los, daß sie zurücktaumelte. --

»Erik!« rief Klare-Bels Stimme durch das Nebenzimmer, »Erik, bist du wieder da?«

Er hing den Mantel an den Ständer, dann öffnete er die Thür zu der Wohnstube, in der sie lag.

»Denke nur, Erik, Jonas ist inzwischen krank geworden, -- so schwer erkältet, -- hoffentlich ist es nicht schlimm. Er hat -- -- aber was ist dir?«

Er stand da wie ein Betäubter, das Blut in den Augen.

»Nichts. Ein Schwindel,« murmelte er, setzte sich an den Tisch und stützte den Kopf auf die Handflächen.

»Das ist diese übertriebene Eile!« klagte sie besorgt, »-- daß es mit solcher Windeseile vor sich gehen soll. Wann ist es denn nun, daß sie reist, Erik?«

»Morgen, -- um Mittag,« sagte er leise.

»Mein Gott, so schnell ist es aber doch rein unmöglich! Denke doch nur, was es für eine solche Abreise alles zu ordnen und zu überlegen gibt. Ruth braucht doch gewiß noch manches, was für sie beschafft werden muß.«

»Es kann alles in Heidelberg beschafft werden.«

»Nun ja, Erik. Aber wenn du wüßtest, wie tief es ihr geht. Wie blaß und elend sie ausgesehen hat, gestern und heute. Sie ist doch nur zart.«

»Hör auf!« sagte er zwischen den Zähnen.

»Ach, Erik, ich widerspreche dir ja nicht! Das thue ich ja niemals! Sie thut mir nur so leid. So allein ist sie, und so liebebedürftig. Und nun: von Haus zu Haus, von Hand zu Hand. Und wenn sie nun erkrankt, --«

»Hör auf!« unterbrach er sie außer sich und sprang auf, und warf den Stuhl zurück, daß er zu Boden schmetterte, »hör auf, Bel! Es ist genug! Ich will es so!«

Damit verließ er das Zimmer.

Mit erschrockenen Augen sah sie ihm nach. Erik war fast immer sanft gegen sie, obschon -- oder vielleicht weil -- ihr Wille gegen den seinen nie recht in Betracht kam. In so heftigem Ausbruch hatte sie ihn lange nicht mehr gesehen, -- wohl seit ihrem Krankenlager nicht mehr. Kranke sind gute Lehrmeister!

Nur in den ersten Jahren ihrer Ehe. Da war ihm der rasche Zorn noch nicht verraucht, da ward er leicht heftig, wenn seine Frau nicht ganz dem entsprach, was er erwartet, was er mit ihr gewollt hatte.

Seltsam: damals erschreckte es sie nicht, -- nein, mehr noch, so wunderlich es auch sein mochte: sie liebte diesen Zorn. So deutlich fühlte sie, daß Eriks Liebe damit verknüpft war. Gegen einen ihm gleichgültigen Menschen konnte er nie heftig werden. Mit dem Interesse an einem Menschen wuchs in dieser herrischen Natur das Verlangen, ihn zu formen, zu gestalten, nach seinem Willen umzuprägen. Liebe und Härte fielen zusammen.

Klare-Bel hatte ein russisches Geschichtenbuch gesehen, da befanden sich auf dem dazu gehörigen Titelbilde zwei Bauersfrauen: die eine, im roten Sarafan, auf die ihr Eheliebster mit einem Weidenprügel dreinschlug, lachte über das ganze Gesicht; die zweite, im blauen Sarafan, saß daneben am Weg auf einem Stein, sah neidisch zu und weinte sich die Augen aus, indes ihr Liebster mit einer andern spazieren ging.

Das war gewiß eine dumme Geschichte. Aber diese beiden Bauersfrauen konnte Klare-Bel gut verstehen.

Niemals sollte sein Zorn sie schrecken: nur, daß er mit seinem Zorn seiner Liebe vergäße. --

Der Tag schlich langsam zu Ende. Es war so still im Hause, als ob keiner darin anwesend sei. Erik hatte lange bei Jonas gesessen, ihn genau angesehen, alles Notwendige veranlaßt und den heftig Widerstrebenden gezwungen, sich ganz zu Bett zu legen. Es handelte sich um eine starke Halsentzündung mit beträchtlichem Fieber.

Ruth stand auf dem Flur, gegen das Treppengeländer gelehnt. Sie wußte selbst nicht, warum sie dort stand. Wahrscheinlich weil alle Thüren sich in den Flur öffneten. Und aus einer der Thüren mußte doch endlich Erik kommen. Und wenn er kam, mußte er doch zu ihr treten. Sich nach ihr umwenden. Er mußte doch einsehen, daß es unmöglich war, so fremd aneinander vorüberzugehen, wie er es heute abend that.

Sie wollte so wenig: nur seinen Blick auf sich gerichtet sehen wollte sie, -- nur seine Hand fühlen, einen Augenblick lang.

Seitdem Erik sie an sich gerissen, und von sich gestoßen hatte, war eine ratlose Verzweiflung über Ruth gekommen. Die äußere Trennung, die nahm sie ja hin, wie etwas Furchtbares, aber Unabwendbares, weil er es so forderte. Aber daß er sie ganz plötzlich auch innerlich von sich losriß, das konnte sie nicht ertragen. Ihn den Blick absichtlich fortwenden zu sehen, -- ohne ein Wort der Liebe für sie, ihn wie einen Fremden dastehen zu sehen, -- das konnte sie ganz gewiß nicht ertragen.

Zur Schlafenszeit trat Erik aus dem Wohnzimmer heraus. Als er Ruth an der Treppe bemerkte, sagte er ihr gute Nacht. Sie machte eine Bewegung auf ihn zu, ihre Augen schauten dunkel und vorwurfsvoll zu ihm auf. Aber er sah ihr nicht in die Augen. Er gab ihr nur flüchtig die Hand. Dann ging er an ihr vorüber, zu Jonas hinein.

Bald darauf siegte die Uebermüdung über ihn; wider Erwarten fiel er in einen schweren Schlummer. Aber aufregende und häßliche Träume erfüllten seinen Schlaf, furchtbare Träume, die seinen Körper mit kaltem Schweiß bedeckten.

Er sah Ruth vor sich, gealtert, verwelkt, mit gefurchten Zügen und gekniffenen Lippen, mit Lippen, wie sie eine leere, liebeleere Jugend gibt; er sah sie in einem lächerlichen Bilde, wie in einer Theaterposse, als tugendsame hysterische alte Jungfer, mit der unerfüllten Sehnsucht nach Zärtlichkeit im erloschenen Blick. Und da, als er in der Angst des Traumes gewaltsam seine Augen von der Fratze wandte, -- fort, einem andern Ruthbilde zu, -- da wandelte es sich vor ihm -- zu nackter, entblößter Schönheit. Nackt sah er Ruth, -- und schamlos, fremden Männern preisgegeben, -- einen weißen Körper, der nicht der ihre war, ein lachendes Antlitz, das nicht das ihre war, -- und doch wußte er: es sei Ruth.

Er erwachte mit einem stöhnenden Laut. Und noch aus dem Traume heraus hörte er küssen und lachen.

Aber das leise Stöhnen wiederholte sich, als habe es ein Echo an den Wänden des Zimmers gefunden, und ein unterdrücktes Weinen schlug an Eriks Ohr.

Er richtete sich auf und lauschte.

Das Weinen kam aus Jonas' Bett, welches neben der offenen Verbindungsthür beider Stuben stand. Man konnte deutlich hören, wie er es in den Kissen zu ersticken suchte.

Erik ermunterte sich völlig. Er machte Licht und näherte sich Jonas' Bett. Als dieser ihn kommen hörte, verkroch er sich nur tiefer in seine Decken.

»Hast du Schmerzen?« hörte er den Vater fragen, »bist du kränker geworden?«

»Ich bin nicht krank!« murmelte Jonas, »es ist unnütz, mich mit Gewalt im Bette zu halten. Ich weiß doch alles! Ich weiß jetzt alles! Es hat nichts genützt, es vor mir zu verheimlichen! Und was ich noch nicht wußte, habe ich gehört! Ich habe gehorcht und habe es gehört!«

Erik schwieg einen Augenblick betroffen.

»Du sprichst im Fieber,« sagte er dann, »was weißt du denn, was hast du gehört?«

»Daß sie fortgeht! Daß sie morgen fortgeht!«

Und er wühlte sich schluchzend in seine Kissen.

Erik tastete nach seinem Gesicht und legte ihm die Hand besorgt an die trocken brennende Stirn. Aber Jonas stieß seine Hand zurück.

»Nein!« sagte er fast keuchend, -- »du willst es ja, -- du bist es ja -- schuld, daß sie fortgeht. Vor dir schützen muß ich Ruth, -- schützen, denn was weißt du, -- wie ihr zu Mute ist. Du weißt nicht, hast nicht gesehen, -- wie sie daliegt die Nächte, -- halb ausgekleidet, an ihrem Bett, -- wie gestern.«

Erik preßte die fieberglühende Hand in der seinen zusammen, so daß Jonas die Zähne mit Gewalt aufeinanderbiß, um den Schmerz zu beherrschen.

»Was hast du -- gestern -- gesehen?« fragte Erik mit heiserer Stimme.

Jonas setzte sich auf.

»Sie kniete vor ihrem Bett,« sagte er traurig, »vielleicht weinte sie, -- oder betete, -- so geheimnisvolle Augen hatte sie, -- und ich habe mit ihr gewacht, -- ganze Nacht, heimlich, oben, in der alten Ulme vor der Terrasse.«

Erik sprach kein Wort.

Aber nach einer langen Pause hob er die Hand, und leise strich er Jonas über Stirn und Haar hin. Diesmal wurde die Hand nicht zurückgestoßen. Die sanfte, liebkosende Bewegung des Vaters, der ihn so selten liebkoste, empfand Jonas als ein wortloses Verstehen und Mitfühlen, das ihn um die letzte Fassung brachte.

Und plötzlich warf er die Arme um den Nacken des Vaters. Und wie ein unaufhaltsamer Strom, fieberheiß, halbverständlich, brachen die Worte aus ihm hervor, überstürzten sich und verklangen in einem Stammeln: »Papa, lieber Papa, hilf mir! Ich kann es nicht aushalten, daß sie fortgeht! Ich war böse auf dich, -- nimm's nicht übel, -- hilf mir! halte sie, Papa! sie bleibt da, wenn du es willst. Früher war ich mal eifersüchtig auf Ruth, ich glaubte, daß du sie mehr liebst als mich. Aber es schadet nichts, wie sehr du sie auch liebst, Papa! Denn ich liebe sie ja auch viel mehr als dich! Mehr als dich! Mehr als alles auf der Welt!«

Erik löste leise die Hände von seinem Nacken und hielt sie fest.

»Nimm dich zusammen!« sagte er halblaut, aber mit der eindringlichen Stimme, der Jonas unbedingt zu folgen gewöhnt war, »du darfst nicht hier liegen und dich so haltlos gehen lassen. Selbst nicht im Fieber. Nimm dich zusammen.«

Fast mechanisch versuchte Jonas zu gehorchen. Er atmete mühsam.

Erik hatte sich auf die Kante des Bettes gesetzt, ohne seine Hände los zu lassen.

»Lege dich nieder. Ganz ruhig. Unterdrücke die Unruhe. Komm, mein Junge! strammer! Und nun höre mich: ich will dir helfen, wenn du mir folgst, aber anders als du denkst. Von Ruth mußt du dich jetzt trennen. Wir alle müssen es. Denn morgen schon reist sie fort, und bis dahin wirst du nicht aufstehen dürfen.«

Jonas fuhr empor.

»Papa! das muß ich! ich springe aus dem Bett! Ihr haltet mich nicht! Ich muß Ruth küssen, -- ich muß sie küssen, -- wenn sie geht!«

»Mit einem kranken, entzündeten Hals und Fieber wirst du Ruth nicht küssen wollen, hoffe ich,« unterbrach ihn Erik in einem Ton, der jede Widerrede abschnitt; »und du wirst es nicht nur unterlassen, sondern auch alles thun, was ich von dir verlange. Dich vollkommen beherrschen, wenn sie von dir Abschied nimmt. Mit keinem Wort, keiner Heftigkeit, keinem einzigen klagenden Ton es ihr noch erschweren. Alle Aufregung mit festem Willen niederzwingen. Das alles wirst du thun. Ich muß mich unbedingt auf dich verlassen können, wenn ich sie zu dir hereinführen soll. -- Kann ich es?«

»Ja!« stieß Jonas hervor, während ihm die Lippen noch zitterten. Er konnte nicht an gegen diesen Willen, der den seinen in Bann hielt.

»Gut. Und nun will ich dir einen helfenden Trost geben für deinen ersten großen Schmerz,« sagte Erik mit so weicher Stimme, daß es Jonas war, als spräche er mit den Lauten seiner Mutter zu ihm, »wenn Ruth von dir gegangen ist, blicke nicht zurück auf sie, sondern vorwärts in dein Leben; sorge dafür, daß du dich tüchtig entwickelst, arbeite daran, daß du bald ein ganzer Mann wirst, -- damit du ihr einst ein ganzer Freund sein kannst, wenn sie deiner bedarf. So kommst du, in allem was du thust, zu ihr zurück, -- ihr nahe. Dulde es nicht, daß sie dich so ganz überflügelt und dich einst weit -- weit hinter sich zurückläßt! Jetzt kannst du zeigen, was du wert bist, -- und ob du's wert warst, Ruth gehabt zu haben.«

Jonas lag ganz still und lauschte.

»Ja!« sagte er begeistert, »das will ich! ach, Papa, das will ich!«

Und er hob den Kopf und küßte den Vater. Erik hielt seinen Kopf einen Augenblick lang an sich.

»Wir werden ~nie mehr~ hiervon miteinander sprechen,« sagte er leise, -- »nie mehr. Aber vergiß es nicht. Zwinge deine Gedanken auf die Arbeit, auf das, was vor dir liegt. Suche dich mit mehr Festigkeit zu beherrschen. Ich werde darauf achten und dir nichts durchgehen lassen. Streng mit dir sein müssen, mein Junge. Mache es mir nicht schwer.«

»Papa,« versetzte Jonas so zutraulich, wie er sonst nur mit Klare-Bel zu sprechen verstand, »ich will mich nie wieder vor dir fürchten. Sei so streng du willst gegen mich. Du hilfst mir ja damit, nicht wahr? Tüchtig zu werden. So fest und tüchtig wie kein andrer. Ausstechen muß ich jeden andern! Hilf mir schnell, ein ganzer Mann zu werden! -- Ein Mann für -- für -- ich meine: ein Freund für Ruth.«

Am liebsten hätte er sich im Bett aufgesetzt und geplaudert; Erik mußte ihm das Sprechen verbieten und das Zimmer verlassen. Nun schwieg er; er lag zufrieden im Bett und dachte angestrengt an die Zukunft.

Erik war außer stande, sich wieder schlafen zu legen; er kleidete sich vollständig an. Er fühlte sich frei; wie erfrischt von einem langen, gesunden Schlaf, wie gekühlt und gestählt durch ein erquickendes Bad. Die ganze schwüle Beklommenheit vom Nachmittag und Abend, die noch auf seinen Träumen gelastet hatte, war verflogen. In der Einwirkung auf einen andern, dessen Unruhe er bezwang, dessen innerste, widerstrebende Gedanken er bestimmte, -- im kurzen Kampf mit dem Knaben, der zugleich sich gegen ihn auflehnte und ihm vertraute, hatte er sich selbst zurückgefunden. Seine Kraft geweckt und gesammelt. Er wußte recht wohl, wie es damit stand: wenn er sich am schwächsten fühlte, dann erstarkte er an der Kunst, andre in überlegener Behandlung zur Stärke zu veranlassen; an der gehobenen und mutigen Stimmung, die er von ihnen forderte und in ihnen hervorrief, -- an seinen eigenen überzeugten, überredenden Worten kletterte er selbst zu neuem Mute, neuer Zuversicht empor, wie an einer langen Leiter, die sich manchmal mitten aus seiner eigenen Verzagtheit erhob, aber bis ans Unbegrenzte zu reichen schien, -- bis an ein unbegrenztes Selbstvertrauen.

Viele tausend solcher Leitern, festgehalten von den Händen einer Menschenmenge, die ihn umdrängte, die an ihn glaubte, die auf ihn angewiesen war, -- und er hätte einen Himmel auf Erden erstiegen.

Nur kein Zusammenbrechen der festesten dieser Stützen! denn Stützen waren es, -- wie sehr auch er selbst als der Stützende dabei erschien. Niemand ist absolut stark.

Erik wußte recht wohl, wo seine Gefahr lag, wo auch in ihm der Schwächling steckte: da, wo er sich allein überlassen blieb.

Draußen herrschte noch dunkle Nacht. Es schlug drei Uhr.

Erik litt es nicht im engen, warmen Zimmer. Er öffnete leise die Hausthür und trat hinaus.

Die Finsternis war so dicht, daß er nur langsam der Tiefe des Gartens zugehen konnte. Er empfand den aufsteigenden Nebel, ohne ihn zu sehen. Das knisternde Rauschen der Birkenwipfel belehrte ihn über die Nähe des kleinen Gehölzes. Darüber glänzte am verhängten Himmel hie und da ein verlorener Stern. Das letzte Mondviertel, der schmale, blasse Vorläufer der Morgenröte, war noch nicht sichtbar.

Unweit der Bänke am Gehölz blieb Erik lauschend stehen. Er vernahm absolut nichts als das leise Rauschen der Blätter. Aber er fühlte, daß er nicht allein sei.

»Ruth!« murmelte er unwillkürlich.

»Ja! was soll ich?« fragte sie schüchtern.

Mit einem Schritt stand er neben der Bank; er tastete nach ihr.

»Was du sollst?! Im Bett sein!«

Er riß seine Joppe von den Schultern und warf sie ihr um.

»Was thust du hier mitten in der Nacht? Weißt du nicht, daß Jonas sich in dieser gefährlichen, kalten Feuchtigkeit das Fieber geholt hat?«

»Ja, ich weiß es. Aber mir schadet das nichts,« versetzte sie zaghaft, »das Fieber thut so gut; ich kenne es gut: da liegt man im Traum und hört auf zu denken. Und da dachte ich, ich könnte es auch so gut haben.«

Jetzt fühlte sie seine Hand, die sich fest um ihr Handgelenk legte.

»Was sagst du da?« fragte er ganz langsam, »du ~suchtest~ das Fieber?«

»Nein! nein!« rief sie flehentlich, »ich will es ja nur ein wenig, -- ein klein wenig nur, -- nicht so, daß es die Abreise hindern sollte! Ganz gewiß nicht!«

Ein Laut brach von seinen Lippen, wie wenn er verwundet würde. Sie konnte hören, wie seine Zähne leise übereinanderknirschten.

Er beugte sich über sie.

»Und das -- das glaubtest du zu dürfen,« sagte er matt.

»Ja, ich durfte es; denn ich will ja thun, was ich versprochen habe. Bin nicht ungehorsam. Nur so ganz allein bin ich. Niemand, der nur ein bißchen hilft. Da sollte das Fieber mir helfen. Ich darf thun, was ich will, -- wenn es nichts aufschiebt,« versetzte sie finster.

»So. Und wenn du nur rechtzeitig fortgekommen bist, meinst du, -- dann könntest du thun, was du willst? Auch vielleicht dich irgendwo hinsetzen und krank werden, wenn dir das ›hilft‹? Du irrst dich, mein Kind. Ich lasse dich nicht los, indem ich dich fortlasse. Und aus der Ferne sollst du mir doppelt gehorchen. Dein Versprechen geht auf dein ganzes Leben. Du bist mein. -- Bist du es?«

»Ja!« rief sie inbrünstig.

»Steh auf und geh hinauf.«

»Ich kann es nicht so, -- ich muß erst wissen, -- wann reise ich?«

»Ich werde es dir morgen sagen. Heute nacht nicht. Du sollst dich hinlegen und zu schlafen versuchen. An nichts denken als daran, daß du schlafen sollst. Wirst du es?«

Sie war schon aufgestanden.

»Ja!« murmelte sie, »morgen! Ich muß morgen fragen, was ich will.«

»Das sollst du.«

Er gab ihr die Hand.

»Geh voraus. Gehe nur. Ich folge schon. Warte im Hause nicht auf mich.«

»Gute Nacht!« sagte sie gehorsam und ging.

»Mein Liebling! gute Nacht!« rief er ihr nach.

Und im Klang seiner Stimme lagen alle die Liebkosungen, nach denen sie den ganzen Tag, die ganze Nacht gehungert hatte.

»Verzeih mir! Liebling,« sagte er reuig vor sich hin, während er ihr langsam folgte. Allein gelassen hatte er sie, allein stehen lassen in dem Augenblick, wo sie seine ganze Kraft und Liebe erwartete und ihrer bedurfte. Weil er sich selbst nicht traute, nicht vertraute, -- aus Furcht vor seinen Sinnen, -- und vor diesem unwissenden Kindersinn, der ihm mit einem Lächeln entgegenkam.

Das war feige gewesen. Nicht durfte er aus solchen feigen Gründen in letzter Stunde seine Hand zurückziehen, nach der sie sehnsüchtig und gläubig griff, als nach der Hand des einzigen Menschen, den für sie die Erde trug. Nicht überlegen, nicht geizen, nicht einschränken das, was er ihr gab, und wonach es sie mit einer Inbrunst verlangte, -- mit einer Zärtlichkeit, wie sie auf der ganzen Welt nur das einsame, das nie geliebkoste Kind kennt.

Aus einer unendlichen Fülle heraus sollte noch einmal seine Liebe sie umhüllen, sie umgeben, weich und schützend wie Mutterliebe, -- aus einer so reichen, so kraftsichern Fülle heraus, daß er sich aller Bedenken entschlagen konnte, -- daß er sein Liebstes nur noch wie auf starken Armen hob und trug, -- es einem schlummernden Kinde gleich in einem letzten Traum hinübertrug in die fremde, die kältere Welt. --

Der Hausflur war schwach erhellt von dem Licht, das an der offenen Thür zu Eriks Zimmer stand. Ruth hing die Joppe über den Thürgriff, und ohne sich nach Erik umzusehen stieg sie hinauf.

Er löschte das im Luftzuge flackernde, tropfende Licht und warf sich ausgestreckt auf den Lederdiwan in seinem Arbeitszimmer, froh des Dunkels, der Einsamkeit.

Seit der Stunde seiner Rückkunft gestern verlangte ihn unbewußt nach dieser Stille und Einsamkeit.

In dem Augenblick, wo er gestern aus dem Flur zu seiner Frau hineintrat, in dem Augenblick, wo Ruth an seiner Brust lag, und Bels Stimme ihn rief, war etwas Sonderbares in ihm vorgegangen. Sie rief: »Erik, bist du wieder da?« -- Aber ihn durchgellte es wie: »Erik, gehst du fort von mir?«

Und als er sie wiedersah, sie daliegen sah in dem Zimmer, das er so gut kannte, genau so wie zwei Tage vorher, da kam es ihm vor, als läge eine lange, lange -- jahrelange Reise dazwischen, während der er seine Frau nicht gesehen, nicht mit sich genommen, -- ja, vergessen hatte. Es war fast wie ein Moment der Geistesstörung gewesen.

Und die Erregung, in der alle seine Nerven noch zitterten, ließ keine Selbstbesinnung zu.

Aber jetzt -- jetzt stellte er sich wieder dahin, auf die nämliche Stelle, Bel gegenüber und ihrer fragenden Stimme, und jetzt antwortete er ihr: »Es ist eine lange, lange Reise gewesen. Ich ~habe~ dich nicht wiedergesehen all diese Zeit hindurch, -- dahin nicht mehr gesehen, wo du bist: dich vergessen.

Nicht zufällig, nicht unabsichtlich, nicht im Rausch des Augenblicks. Nein, bewußt und gewollt. Mit allen Sinnen und Gedanken wollte ich nur ~einen~ Punkt vor Augen haben, ihn durchschauen, durchdringen, -- in eine verhüllte Zukunft schauen und dringen. Unbeirrt von allem, was hindert und bindet. Frei, wie einer, der alles hinter sich geworfen hat, und dasteht wie ein Bettler oder wie ein König, wollte ich meine Hände aufheben zu meinem Glück.

Dann -- einst -- ist es an der Zeit, zurückzukehren zu den Fragen und Forderungen, den Pflichten und Fesseln des täglichen Lebens, um sich mit ihnen auseinanderzusetzen. Zu dir zurückzukehren. Zum Kampf. Zum Kampf um mein Glück.«

Erik hatte die letzten Worte fast laut gemurmelt: »Kampf -- -- -- Glück.«

Er öffnete, wie erwachend, die Augen.

Es war hell um ihn. Die Nacht vorbei. Glutrot stand der Himmel, wie in Flammen.

Hinter dem Gehölz ging die Sonne auf. Purpurn, strahlenlos wie ein ungeheurer Mond leuchtete sie durch den Morgennebel. Und purpurner Glanz auf den Fenstern, auf dem Fußboden.

Noch war im Hause niemand zu hören. Nur die Schwarzdrosseln schwatzten vor dem nahegelegenen Küchenfenster und unterhielten sich darüber, ob Gonne ihnen wohl bald, beim Zubereiten des ersten Frühstücks, ein paar Krumen zuwerfen werde?

Erik stand auf, stand still angesichts der Morgenherrlichkeit.

Er hatte Bel geliebt, -- so sehr, wie, nach seiner Meinung, der Mann bisher das Weib überhaupt lieben kann: nicht nur mit der Habgier der Sinne, nicht nur zu einem flüchtigen Liebesbündnis, das zufällig »Ehe« hieß, sondern zu einem wirklichen Lebensbündnis, das kein Staat, kein Priester, das nur der eigene, bewußte Wille besiegelt. Es war gewesen, wie er damals, im scherzenden Gespräche über die Ehe, zu Warwara gesagt: kein Pflichtbewußtsein, sondern das dauernde Glücksbewußtsein, seinem Weibe, auch nach dem Schwinden der Sinnenliebe, alles in allem zu sein. Daran hatten weder Krankenlager noch Altern, weder Lebensenttäuschungen noch Liebesversuchungen jemals das Geringste zu ändern vermocht.

Wenn er ihr je untreu geworden in einer heißen Aufwallung des begehrlichen Blutes, -- oder auch in einem bittern Rückblick auf die zerstörten, für sie hingegebenen Hoffnungen seiner Jugend, dann lehnte er sich gegen sich selbst auf mit Kraft und Härte. Niemals hätte er es doch zugegeben, daß irgend eine Gewalt stärker über ihn werden könne als sein Wille, seine Bürgschaft.

Und nun, wenn er alles sammelte, was er an Scham und Selbstvertrauen, an Stolz und Herzensgüte besaß, -- wenn er das alles sammelte und zusammenraffte, war es nicht genug, um Bel, die Wehrlose, gegen einen Kampf mit ihm zu schützen? Oder, wenn es denn in der Zukunft zu einem solchen Kampfe kam, gab es in seinem vergangenen Leben nichts, was stark genug, heilig genug, barmherzig genug war, um für Bel einzutreten und gegen ihn selbst zu siegen?

Erik schaute geradeaus, hinein in das rote Flammenmeer am Himmel. Er wollte, -- er mußte ehrlich sein.

Und er sagte sich: »Nein.« -- -- --

* * * * *

Auf der Terrasse wurde der Morgentisch gedeckt. Eriks Platz am Tisch blieb aber heute leer. Ganz früh hatte er sich Thee auf sein Zimmer bestellt, dann ging er zu Jonas hinein, um nach ihm zu sehen.

Gleich nach dem Frühstück ließ er Ruth zu sich bitten.

Als sie kam, streckte er die Hand nach ihr aus.

»Du schlechtes Mädel. Bist du gesund geblieben? Laß mich sehen.«

Sie nickte und trat zu ihm an den alten Ledersessel am Fenster.

Aufmerksam betrachtete er sie. Ihre Augen waren dunkel umschattet. Aber sie blickten sicher, -- fest. Es fiel ihm auf. Sie blickten beinahe kalt.

Er strich ihr das Haar aus dem blassen Gesicht zurück.

»Weißt du auch noch, daß hier dein alter Platz ist? Hier am Stuhl. Wo du zuerst herkamst. Wir haben ihn wohl fast vergessen, draußen im Garten und -- bei den andern. Monatelang. Aber der heutige Morgen gehört uns allein. Uns zusammen. Und den wolltest du krank zubringen.«

Sie antwortete nicht.

Ganz leise nur beugte sie gegen ihn den Kopf vor, so daß seine Hand durch die Haarwellen hindurchglitt, und schwieg still.

»Du bist ein dummes Kind,« sagte er, »sonst hättest du gewußt: wenn ich etwas von dir verlange, so sollst du es klar und still thun. Niemals in einem Fieberrausch. In keinem Sinn. Ich weiß, es ist tausendmal schwerer. Aber niemals sollst du es dir erleichtern. Durch nichts. Nur war ich dieses Mal selbst nicht ohne Schuld, Ruth. Ich selbst war wie krank, -- nicht wie ich sein sollte. Siehst du, nun beichte ich es dir auch. -- -- -- Ist es nun gut?«

Sie blickte ihn unverwandt an. Dann schüttelte sie den Kopf.

»Eins fehlt noch,« sagte sie.

Ihm kam ein Lächeln.

»Noch etwas? Was denn, mein anspruchsvolles Fürstenkind?«

»Darf ich nicht anspruchsvoll sein?«

»Das darfst du. Halte deine Hände offen, Liebling, und laß dich beschenken.«

Da glitt sie am Sessel nieder, auf ihren alten Platz zu seinen Knieen, und hob ihr Gesicht auf zu ihm, -- Trotz in den Augen.

»Ich meine kein Geschenk. Ein Recht.«

Erik stutzte.

Er schaute forschend in ihre Augen, mit dem fest auf ihn gerichteten rätselhaften Blick.

»Nimm dir dein Recht, Ruth,« sagte er einfach.

Sie flüsterte kaum hörbar: »Daß ich erfahre, ~warum~. Das plötzliche Fortmüssen, -- -- -- ~warum~?«

Er legte ihr die Hand über die Augen.

Eine lange Pause entstand.

»Du hattest vorhin ganz recht: eins fehlt noch,« antwortete er dann, »zwischen uns fehlt ~eins~. Weißt du, was es ist? Daß zwischen dir und mir ein zu großes Stück Menschenleben liegt, -- daß wir im Alter so weit voneinander entfernt sind. Denke nur: du und noch einmal du, das gibt immer noch nicht: ich. Auf eine so große Entfernung hin ist es bisweilen schwer, manches

miteinander zu teilen, -- mitzuteilen. Aber nun sieh das Wunder: dieser Mangel, diese Lücke und Leere zwischen dir und mir, -- ~sie~ eint uns gerade. Nur sie macht, daß ich dich leiten und dir befehlen kann. Sie macht, daß du da so vertrauensvoll knieen kannst, wie eben jetzt, und mit deinen trotzigen Augen zu mir aufschauen. Sie macht, daß ich den Weg besser kenne als du. Denn ich habe den halben Weg schon zurückgelegt. -- Oder könntest du das missen? möchtest du lieber, ich stände neben dir, von gleichem Wuchs wie du? noch suchend, irrend, eines Wegweisers bedürftig, wie du?«

»Nein!« sagte sie lebhaft, »das wäre wie zwei Kinder im Walde.«

»Dann nimm es hin, daß ich dir nicht antworte.«

Sie erwiderte nichts, aber er fühlte, wie ihr Herz wild zu schlagen begann. Sie gab nicht passiv nach, wie bis gestern noch. -- Sie war gestern irre geworden. --

Mit letzter Kraft mochte sie sich gegen ihn zusammengerafft, -- sich eingeredet haben, ihm gegenüber noch Kraft zu besitzen: Selbständigkeit. Im arglosen Schlummer erschüttert, mochten ihre Gefühle in Gärung gekommen sein, -- mochte eine Welt von unverstandenen Empfindungen in ihr ringen.

Die feine, ruhige, gerade Linie, in der sie sich vor Eriks Augen so kindlich weiter entwickelt hatte, wurde ihm undeutlich, wurde unruhig, -- sie schien sich zu biegen, -- eine Wendung zu machen: eine Wendung zu ihm hin -- oder von ihm fort.

Ueber Erik kam eine Spannung, die alle seine seelischen Fähigkeiten aufs äußerste schärfte, sein ganzes Wesen erwartungsvoll spannte, und jegliche sinnliche Erregung vollkommen niederhielt.

Er legte seinen Arm um Ruth und bog mit der Hand ihren Kopf zurück. Ihre Lippen zitterten.

»Sieh mir in die Augen, du Trotzkopf!« sagte er, »was hat sich da in dir geregt? Brich den letzten Trotz, -- denn es war einer. Laß mich ihn brechen. Es schadet nichts, wenn es einen Augenblick schmerzt. Gib nach, laß es geschehen. Wirf dein Recht von dir, mache dich rechtlos. Um Kinderrecht zu haben: um folgen zu dürfen, ohne zu fragen. Um zu gehen, ohne ein Warum.«

»Wann -- gehen?« fragte sie undeutlich.

Er drückte ihren Kopf an sich.

»Heute,« sagte er mit bedeckter Stimme, »jetzt. Jetzt gleich. Nein, nicht zusammenschrecken. Sei mein mutiges Kind. Wir haben nur noch diese Stunde, Ruth. Dann bringe ich dich in die Stadt. Zum Zuge, der ins Ausland fährt. Frau Römer wartet auf uns.«

Sie hatte sich in seine Arme geworfen. Sie umfaßte ihn so fest, als solle nichts sie von da wegreißen. Doch wußte er: sie widerstrebte nicht länger. Sie gab nach, willenlos.

Aber es war vielleicht nur die Angst des Abschiedes. Der Schreck davor, der sie überfiel. Gestern war sie doch irre geworden an ihm, -- und morgen? -- -- da besaß er keine Macht mehr über sie. Wußte nicht mehr, was in ihr vorging.

Er sagte sehr sanft: »Du gehst nicht fort, weil ich dir weh thun will, sondern weil ich dich lieb habe. So lieb, daß ich dir weh thun ~kann~. Gib dich dieser Liebe, Ruth, -- ohne Rückhalt, ohne Zweifel, -- gib dich ganz. Denke täglich, daß ich es zu dir sage, -- des Morgens mit deinem Erwachen, des Abends mit deinem Einschlummern: ~Ich hab' dich lieb.~«

Sie sah auf, ohne von ihm zu lassen, -- mit grenzenlosem Dank in den Augen sah sie auf. Ein kaum merkliches Lächeln spielte ihr um den Mund, -- ein wenig zaghaft noch.

»Da gehe ich ja nicht fort, -- da nehme ich Sie ja mit,« sagte sie, fast schelmisch.

Das Glück brach aus ihren Augen, -- ja, der Schalk.

Es berauschte ihn. Aber anders als gestern. Wohl hielt er sie im Arm, wohl kniete sie an seiner Brust, aber nicht seine Sinne wurden berauscht. Etwas unendlich viel Feineres, eine Wollust so fein, wie sie sich durch keine Sinne vermittelt, erfüllte ihn mit kraftvollem Genügen. Er konnte Ruth nicht unbedingter zu eigen nehmen, nicht stärker sich aneignen als in diesem Augenblick, wo er sie von sich löste, wo sie auf sein Geheiß von ihm ging, weil sie ihm lieb war.

Einigung und Trennung, selbstloses Verzichten und selbstsüchtiges Eingreifen, Schützen und Vergewaltigen, Dienen und Herrschen verschlangen sich ununterscheidbar in einem einzigen Gefühlsknoten, in einem einzigen Augenblick berauschenden

Erlebens.

»Ist es nun nicht gut, daß du mir gehorchen und vertrauen mußt? daß wir ~nicht~ sind wie ›zwei Kinder im Wald‹, die sich verlaufen? Für die es schlimm wäre, wollte eines das andre aus den Augen verlieren, -- verlassen. Mir kommst du aus den Augen, und doch nie von der Hand. Ich bin mit dir wie jemand, den du nicht neben dir stehen siehst, und doch um dich weißt -- über dir walten, wo du auch gehst und stehst. Wie jemand, den du nicht fragen kannst, und der zu manchem schweigt, -- der aber doch alles weiß, was dir not thut und gut thut wie --«

»Wie Gott,« sagte Ruth keck.

Das Wort lief wie ein Schauder über ihn hin.

Aus Gespensterfurcht?

Nein. Aber wohl, weil er ahnte, was mit diesem Wort in ihr selbst aufwachen mochte, an unbewußtem, ungeheurem Fordern und Bewundern und Erwarten.

Sie sagte es, gar nicht in Ekstase. Wie etwas Selbstverständliches. Wie ein Kind einen Kuß gibt.

Aber er ahnte: nie, noch nie war sie der Liebe, der vollen Liebe, so nah wie in diesem kindlichsten Bekenntnis, -- dem vermessensten.

Nein, keine Gespensterfurcht! vor nichts.

Und er küßte sie aufs Haar.

»Nicht wie Gott, Ruth. Und doch für dich: wie dein Gott.« --

Im Wohnzimmer war Klare-Bel damit beschäftigt, Ruths Koffer zu schließen und ihr eine kleine Reisetasche zu füllen. Gonne half, das Letzte zu ordnen und zu besorgen. Am Gartengitter draußen stand ein leichtes Fuhrwerk, eine ländliche »Karfaschka«, welche das Gepäck aufnehmen sollte. Erik wollte mit Ruth zu Fuß zum Bahnhof gehen.

Als das Gepäck aufgeladen wurde, kam er mit ihr aus seinem Arbeitszimmer heraus. Klare-Bel blickte erstaunt auf. Weder er noch Ruth machten ein trauriges Gesicht. Und doch wußte sie: erst jetzt, dort im Zimmer, hatte er es Ruth mitgeteilt.

»Wie er das nur zu stande gebracht hat? Er kann doch alles, was er will!« dachte sie bewundernd.

Das kleine Fuhrwerk rasselte davon, auf dem holperigen Landweg in beständiger Gefahr, eines seiner wackelnden Räder zu verlieren. Erik scherzte darüber, und Ruth harte ihre Schelmengrübchen in den Wangen.

Es war eine Heiterkeit, wie wenn an einem großen stummen, dunkeln Gewässer ein Sonnenrand aufblitzt und die Oberfläche mit glitzernden Perlen überblitzt.

Nur Gonne stand in der Küche und weinte mit einem mürrischen, verschämten Gesicht.

Einige Minuten lang konnte Ruth noch bei Jonas im Zimmer verweilen. Dann trat sie reisefertig, die graue Wollmütze auf dem Kopf, heraus.

Jonas horchte angestrengt. Er hörte sie über den Flur gehen, -- den letzten, grüßenden Zuruf seiner Mutter, -- die Thüren gingen, -- -- dann eine Minute der Pause, -- -- und nun fiel, mit einem schwachen Knarren, die Gartenpforte ins Schloß. -- -- --

Langsam, totenstill schlichen die Stunden hin, eine um die andre. Am frühen Nachmittag kehrte Erik aus der Stadt zurück.

Aber es blieb so still wie zuvor.

Jonas hielt es nicht länger im Bett aus; er stand auf, und seinen kalten Umschlag um den Hals, einen dicken Wollstrumpf darüber gebunden, stahl er sich auf seinen roten Pantoffeln in das Zimmer des Vaters.

Der Vater war nicht da.

Jonas setzte sich an den großen Schreibtisch. Er mußte machen, daß er fertig wurde, ehe der Vater ihn hier überraschte.

Und seine Feder kratzte über das Papier.

Er schrieb an Ruth:

»Süße, liebe Ruth!

Ich habe mich in Papas Zimmer hingesetzt an den Tisch, an dem du arbeitetest.

So ungeheuer gern wär' ich zum Bahnhof mitgegangen! Weinen wollte ich aber nicht, ich biß ins Kissen. Als aber in der Ferne der Zug lospfiff (vielleicht war es gar nicht dein Zug), da habe ich trotzdem ein bißchen geweint. Ich dachte: nun fährt sie fort.

Papa hat mir aber einen guten Rat gegeben. Ich will dir noch nicht sagen, was für einen. Ich will ihn lieber erst befolgen. Und solange ich ihn befolgen muß, was ziemlich lange dauern kann, werde ich dir nicht schreiben. Aber dann schreibe ich dir, daß du meine Frau werden mußt. Im Spiel hast du es niemals sein wollen, und das hat mich manchmal so schwer gekränkt. Aber das war dumm von mir. Denn erst muß ich ein ganzer Mann für dich geworden sein.

Darüber habe ich Papa noch nichts zu sagen gewagt.

Jetzt muß ich schließen. Aber ich mußte es dir gleich schreiben, damit du es weißt. Vergiß mich nur nicht, wenn du dort einen andern Jungen findest. Am Ende sogar einen fertigen Studenten? Dann würde ich mich ja hier so ganz umsonst anstrengen.

Aber vielleicht findest du keinen.

Ich küsse dich mit tausend Küssen.

Dein Freund, (dein zukünftiger Mann,) Jonas.

+Pst. Scr.+: Ich weiß nicht, wo Papa jetzt ist, ich bin heimlich auf. Sonst würde er dich sicher grüßen lassen.«

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Erik war oben in der leeren kleinen Giebelstube.

Er stand am Fenster und weinte.

V.

Unflüggem Vöglein gleich, dem bangt, Wo's flatternd eine Zuflucht fände, So bin ich, flüchtend nur, gelangt, Ein armes Kind, in deine Hände.

Kam scheinbar wohl in trotz'gem Sinn, -- Doch nur von Einsamkeit getrieben, und kniete schweigend bei dir hin, und wollte nichts, als Etwas lieben.

Und wollte nichts, als, kurze Zeit, Gleich einem Kind mich wieder wissen, Nichts, als ein wenig Zärtlichkeit Ganz scheu, von ferne, mitgenießen.

Nichts, als von kindlich tiefer Qual Auf einen Augenblick nur rasten, Nichts, als die junge Brust einmal In heißer Hingebung entlasten.

Wie ward mir wohl, da ich dich fand, Als müßte jeder Wunsch sich stillen, Seitdem du mich, mit sanfter Hand, Geborgen ganz in deinem Willen.

Als würde plötzlich alles klar, Als müßten alle Wirren weichen, Seit über das verwehte Haar Mir deine lieben Hände streichen.

Bis daß ein jeder Schmerz hinfort Versank vor zaubermächt'gem Troste, Seit, mit dem ersten Liebeswort, Dein Blick mich zwang und mich liebkoste;

Bis ganz die Welt um uns versank, -- Und nichts von allem mehr geblieben, Als nur ein grenzenloser Dank, -- Und nur ein grenzenloses Lieben.

Ruth hatte das nicht gedichtet. Erik hatte es gedichtet. Aber Ruth hatte es gestammelt. Ungezähltemal. Vielleicht auch in ungezählten Versen.

Er wußte es nicht. Aber oben in der Giebelstube, unter fortgeworfenen Papieren und verwelkten Blumen, hatte das durchgerissene Blatt mit den gestammelten Versen gelegen.

Und seitdem dichtete er diese Verse, er sah vor sich hin und dichtete an ihnen.

Ruth hatte sie nicht gedichtet. Erik hatte es gethan.

Aber so, -- so in jedem Worte würde sie sie gedichtet haben, -- ein wenig später, -- im Rückblick.

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Sie saßen alle zusammen.

Klare-Bel im Hintergrunde der Wohnstube, in einem großen, bequemen Lehnstuhl. Jonas am Eßtisch: er hatte die Lampe dicht herangerückt, um besser sehen zu können, was er in sein Schulheft schrieb. Erik am Kamin, in welchem mächtige Holzkloben brannten; von Zeit zu Zeit bückte er sich und warf aus einem blankgeputzten Kohlenbehälter, der mit Tannenzapfen gefüllt war, ein paar von den braunen, herzigen Zapfen in die Glut.

Das Zimmer hatte ein ganz winterliches Aussehen bekommen. An Stelle der leichten Sommergardinen schwere, schützende Fenstervorhänge, am Kamin zwei Sessel aus der Stadtwohnung, unter denen ein mächtiger Bär seine Tatzen vorstreckte.

Schon im Anfang des russischen März, noch ehe der Winter zu Ende ging, war dieses Jahr die Uebersiedelung vor sich gegangen. Klare-Bels wegen. Hinter ihr lag der Leidensweg eines halben Jahres, der sie langsam zur Genesung führte.

In der Ecke lehnten zwei starke Stöcke mit Krückgriffen. An diesen Stöcken mußte sie täglich einige Schritte thun. »Laufen lernen,« wie Jonas lachend sagte, der ihr am liebsten die Stöcke ersetzte. Und diese Schritte sollte sie in frischer Luft thun.

Sie saßen alle zusammen und schwiegen zusammen. Klare-Bel saß in halb liegender Stellung und sann vor sich hin; die Handarbeit, die sie vorgehabt, entglitt ihren Händen. Sie fühlte sich müde von ihren wenigen Schritten.

Jonas, der war wie verrannt in seine Arbeit. Mit den schmalen Schultern, lang aufgeschossen, ein wenig weichen, blonden Flaum an Kinn und Lippe, bückte er sich über die Bücher. Der Sicherheit halber hatte er auch noch in jedes Ohr einen Finger gesteckt. Das war unnötig.

Und Erik blickte in die Glut -- --

»Bis ganz die Welt um uns versank --«

Gonne war es, die endlich die Stille unterbrach. Sie brachte den Abendthee herein. Klare-Bel ließ sich hinter den Samowar rücken: ihre täglich neu genossene Freude, wenigstens in solchen kleinen Dingen wieder Hausfrau zu sein.

»Heute warst du gewiß froh, Erik, ein so langer Brief von Ruth,« bemerkte sie dabei, »man muß sagen: sie schreibt treulich, -- regelmäßig. Aber manchmal einen Zettel, manchmal ein Buch!«

»Ich möchte wissen, warum du ihr noch nie geschrieben hast, Jonas?« fragte der Vater, »sie will oft von dir wissen.«

Jonas wurde sehr rot.

»Wovon soll man sich denn schreiben? Ich habe genug zu thun,« murmelte er über seinem Theeglas.

»Für so junge Menschen ist das Briefeschreiben auch nichts,« meinte Klare-Bel, »Ruth ist doch sicherlich begabt, nicht wahr? Und sind ihre Briefe nicht ganz entsetzlich nüchtern, Erik?«

»Nun ja. Wenn sie nicht etwas zu erzählen oder zu beschreiben hat.«

»Beschreiben? was denn? wie ein Berg aussieht, oder was für Wetter es ist, -- ein Schneetreiben im Winter, kann sie das nicht seitenlang erzählen? Aber ich finde, dabei erfährt man recht wenig von ihr selbst.«

Erik schwieg. Er fand es auch. Dies Entzücken an der Schilderung, selbst des geringsten, die Hingebung in der Wiedergabe dessen, was sie umgab, und was unmittelbar von ihr aufgenommen wurde, -- das alles lag neben einer spröden Wortkargheit, wo es ihre Gefühle betraf. Es war nicht Verschlossenheit, -- es war Haß gegen das Wort, das ungenügende. Schlechte Verse kritzeln, singen, stammeln, die Augen aufheben, -- ehe er das nicht wiedergesehen, nicht wiedergehört, war Ruth für ihn wie begraben.

Und wieder schwiegen sie.

Der Theetisch wurde abgeräumt. Nur eine Fruchtschale mit Aepfeln blieb darauf stehen. Jonas machte Miene, seine Bücher und Hefte wieder auszubreiten.

Erik hinderte ihn daran.

»Genug!« sagte er, »es ist ganz unmöglich, daß du mit deinen Schularbeiten noch nicht fertig sein solltest.«

»Ich bin es ja auch, Papa. Aber ich wollte jetzt abends noch Russisch treiben. Einer von den Jungens hilft mir in der Freistunde darin.«

»Ich sehe nicht ein, zu welchem Zweck? Schon im Herbst gehst du ins Ausland. Du wirst ja nicht hier studieren. Wozu also?«

»Es ist sehr nützlich, Papa. In Deutschland kann man jetzt mit russischen Stunden Geld verdienen.«

Erik war unangenehm berührt. »Geld? Mit Stundengeben? Ueberlaß mir das doch.«

»Erlaube es mir, bitte. Thue ich nicht genug für die Schule?«

»Ja, aber du bist ein entsetzlicher Stubenhocker geworden, Jonas! Bleibst mir zu schmalbrüstig, mein Junge. Flaum am Kinn, aber keine Kraft in den Knochen. Nicht genug.«

»Gesundheit ist der Güter höchstes nicht,« behauptete Jonas mit einem Ernst, der ihm drollig genug stand.

»Aber der Uebel größtes ist die Schuld, sie verscherzt zu haben,« ergänzte Erik und fuhr ihm liebkosend über den Kopf; »wenn du öfters mit solchen Citaten kommst, dann werde ich dich noch ganz von den leidigen Büchern fortnehmen. Zu einem Bauern in die Lehre.«

Damit ging er hinüber in sein Arbeitszimmer.

Ein Stoß Schulhefte mit blauen Deckeln lag schon bereit. Auch allerlei andres, das drängte.

Ihn drängte es nicht. Er schob es zurück.

Darunter lagen Ruths alte Hefte, auch neue Arbeiten; sie schickte sie ihm alle. Ihren Studiengang leitete er vollkommen. Aber alles das war immer noch nicht »Ruth«.

Er nahm eine Mappe vom Schreibtisch, in der sämtliche Briefe aus Heidelberg lagen, vom vorigen August bis zum heutigen April.

Anfangs lauter Briefe von Frau Römer. Ruth konnte nicht schreiben, sie lag im Fieber. Ein schleichendes Fieber, fürchteten sie. Erik war zur Abreise vollständig fertig gewesen, er depeschierte bereits seine Ankunft.

Da traf ein Telegramm ein, das ihn zurückhielt. Drei Tage später ein kurzer Brief von Frau Römer:

»Ihre Anwesenheit ist nicht erwünscht. Die Trennung würde dasselbe noch einmal ergeben. Ruth muß es lernen, ohne Sie zu leben. Daher dürfen Sie unter keinen Umständen herkommen. Mein Mann meint es als Arzt, ich meine es aber auch -- als Frau. Ich habe Ruth lieb wie mein Kind; wollen Sie mir helfen, wie eine Mutter über ihr zu wachen, so entfernen Sie auf immer aus Ihren Briefen alles, -- auch das Geringste, was Sehnsucht wecken könnte.«

Nach einer Woche schrieb Frau Römer:

»Mit unsrer Ruth geht es besser. Aber gestern hat sie uns sehr erschreckt. In ihrem Zimmer steht mein Lehnsessel, mit braunem Leder bezogen; sie wollte ihn durchaus haben, als sie ihn bei mir sah, und sagte dabei bedauernd: ›Wie schade, daß er nicht grün ist!‹

Diesen Sessel hatte sie gestern nacht mitten ins Zimmer, ihrem Bett gegenüber, gerückt. Als mein Mann noch einmal leise hereintrat, um nach ihr zu sehen, sieht er im Schein der kleinen Nachtlampe Ruth aufrecht im Bett, -- den Oberkörper weit vorgebeugt, die Augen starr auf den Sessel geheftet, das Gesicht verzückt.

Als sie meinen Mann sah, fiel sie in die Kissen zurück. ›Ach, -- nun ist er fort!‹ sagte sie traurig. Sie war in einer halben Ohnmacht, am ganzen Körper kalt.

Wir haben den Lehnstuhl aus ihrem Zimmer entfernen müssen. Mit den andern Stühlen ›geht es nicht‹, versichert sie.

In aufrichtiger Freundschaft

Irene Römer.«

Bald darauf kam der erste, noch mit Bleistift aus dem Bett gekritzelte Zettel von Ruth selbst. Wenige Zeilen nur, darunter ein Postskriptum:

»Ich glaube, daß die Menschen zaubern könnten, wenn sie wollten.«

In der Mappe befand sich neben diesem kleinen Zettel ein Schreiben von Eriks Hand, -- ein vollständiges Briefkonzept, welches anfing:

»Mein Herzenskind!

Außer den bekannten zehn Geboten gibt es noch ein elftes, speziell für Dich: ›Du sollst nicht zaubern.‹

In ururalten Zeiten nahmen die Menschen, wenn ihre Götter die Wünsche einzelner nicht erfüllten, mitunter ihre Zuflucht zu fremden und bösen Geistern, die sich durch Zauberkunst und Zauberformeln beschwören ließen. Das mögen die Menschen aus zweierlei Ursachen gethan haben: aus Kleinmut oder Hochmut; aus dem mangelnden Glauben, daß im Willen ihrer Götter auch wirklich eine weise, gute Macht über ihnen waltet, -- oder aus dem Trotz, der es müde geworden ist, zu gehorchen und zu vertrauen.

Du machst es doch nicht ebenso, -- gleichviel aus welchem dieser beiden Gründe? Nimmst Dir doch nicht hinter dem Rücken und aus eigener Machtvollkommenheit, was Dir vorenthalten bleiben soll? Rufst doch nicht, wie damals, in der letzten Nacht, einen fremden, bösen Geist, das Fieber, um Dir zu helfen und Dich in eine Wirklichkeit zu entführen, die keine ist?

Du sollst nicht zaubern. Sollst Dich an die Wirklichkeit hingeben, die um Dich ist, -- ganz, voll Glauben und voll Vertrauen, daß Du in ihr zu Hause bist --«

Hier brach das Briefkonzept ab; die nächsten Zeilen waren ausgestrichen, -- wiederholt, und wieder ausgestrichen. Sie waren ihm sichtlich schwer von der Hand gegangen.

Aber die Konzepte mehrten sich; hinter jedem Briefe Ruths folgte eines; Erik blätterte sie ungeduldig beiseite: ~daß~ sie da lagen, das besagte genug.

Sein Blick verweilte nur länger, wenn er wieder auf die feine, charakteristische Handschrift Frau Römers traf. Er konnte das Gefühl nie ganz los werden, als ob er mit ihr -- oder sie mit ihm? -- in einem geheimen, unbewußten Kampf stände; und doch erquickten ihn diese Briefe. Wenn sie wider Wissen und Willen ein Feind war, so war's ein herrlicher. Einer, wie man ihn sich wünschen soll, um sich mit ihm zu messen.

Um diese Frau wehte es wie helle, reine Luft, -- man mußte sich wohl darin fühlen. Und jedes ihrer Worte ein so klarer Ausdruck dessen, was sie warm empfand. Während man las, glaubte man ihre Stimme zu vernehmen: eine heitere, entschlossene Stimme.

Schon wollte Erik die Mappe schließen und an ihren frühern Platz legen, als ihm noch ein Brief Ruths in die Augen fiel. Vor vielen Wochen geschrieben und durchaus nicht gefühlsmäßigern Inhaltes als die übrigen, -- auch, gleich den übrigen, ohne Anrede und ohne andern Abschluß als »Ruth«. Aber auf der letzten Seite, da hatte sie sich verschrieben: da stand einmal »Du«, anstatt »Sie«.

Sie hatte den kleinen Verräter energisch ausgestrichen und das ihm beigefügte Zeitwort umkonjugiert. Aber am Rande der Seite war's treuherzig bekannt: »Ich habe ›Du‹ gesagt, ich wollte aber ›Sie‹ sagen.«

Erik schaute nie in die Mappe hinein, ohne an dieser Stelle hängen zu bleiben, -- und er schaute oft hinein.

Diese eine Silbe war ihr einziger wirklicher Gruß an ihn. Mündlich würde sie sich schwerlich je versprochen haben. Sie bedurfte dessen nicht. Sie ~hatte~ »Du« zu ihm gesagt, an jedem Tage, in jeder Stunde fast, mit Blick und Ton und Miene. Jetzt erst ward es zum verständlichen Wortlaut, unwiderstehlich: ein Ersatz für alle wortlose Nähe.

Erik schob die Briefe von sich; er wollte arbeiten. Arbeiten, -- nur nicht dieses unnatürliche, vollständig entnervende Hinleben in Gefühlen und Gedanken, -- dieses unsichere Tasten ins Blaue, in die Ferne, mit dem Verzicht darauf, zu handeln. Wie leicht war dagegen selbst die Trennungszeit für ihn gewesen: innerste, angespannteste Aktivität bis zur letzten Sekunde, aufs höchste gesammelte und gesteigerte Kraft: für Ruth.

Nun der Rückschlag. Nachlassen, -- gehen lassen. Es machte ihn fast krank.

Und er arbeitete Stunde um Stunde, bis eines der blauen Schulhefte nach dem andern mit den notwendigen roten Tintenstrichen durchsetzt war.

Dann erst lehnte er sich müde in seinen Stuhl zurück. Und wieder las er, mit immer neuen Kommentierungen, an der einzigen Silbe »Du«. --

Der nächste Tag brachte draußen die erste echte Frühlingsstimmung. Ein tiefblauer Sonnenhimmel strahlte über den kahlen Bäumen. Noch zog sich am Rande der Kieswege, schmal und vergraut, eine durchlöcherte Schneekruste hin, aber aus dem toten Gras hoben sich schon frisch die saftgrünen Hälmchen, und an den Birkenzweigen hingen seit Wochen, geduldig wartend, längliche braune Knospenzipfel. Der Wiesengrund hinter dem Garten stand ganz unter Wasser und spiegelte blinkend Himmel und Sonne wieder; vereinzelte zersplitterte Eisschollen trieben darin umher.

Erik hatte, wie jetzt fast immer, den ganzen Tag in der Stadt zu thun; neben seinem Schulunterricht noch den freiwillig erteilten, den er, mit sich daran anschließenden Vorträgen, in diesem Winter durchführte: teils in seiner Stadtwohnung unter Beteiligung Erwachsener, teils in einem leerstehenden Klassenzimmer der Mädchenschule.

Diejenigen, die sich hier einfanden, gehörten ebenfalls der Schule nicht mehr an, oder doch fast nicht mehr. Man konnte es den Gesprächen entnehmen, mit denen sie ihn meistens erwarteten. Es wurde nicht mehr von Phantasieereignissen gesprochen, sondern von Bällen und Gesellschaften und von Anbetern, die wohl nicht mehr in der bloßen Einbildung existierten. Von Schulangelegenheiten niemals, wenn nicht etwas ganz Sensationelles vorfiel, wie heute morgen, wo ein kleines Mädchen beim Frühgebet im großen Schulsaal umgefallen und liegen geblieben war, -- ein Fall von Epilepsie. Es hieß, das bloße Ansehen wirke ansteckend, nichtsdestoweniger hatten die meisten, wie gebannt, auf die Zuckende hingestarrt, welche, Schaum an den Lippen, vor ihnen lag.

Mitten in das Gespräch darüber kam, als die Späteste, und mit einem unterdrückten Gähnen, die hübsche Wjera mit den kecken dunkeln Augen. Sie war seit der Zeit ihrer Backfischstreiche noch hübscher geworden.

»Bist du auch wieder da?« rief Eriks fleißigste Schülerin sie an, »ich möchte wissen, wozu? Ob es dir wohl angenehm ist, daß er immer nur Spott für dich hat?«

»Und Lob für dich; da ziehe ich mein Teil vor,« erwiderte sie mit Ueberzeugung; »laß ihn nur spotten, das thut ihm gut, er ist bei schlechter Laune. Glaubst du, daß dein Fleiß ihn beglückt, mein geliebtes Gänschen?«

»Mehr als fleißig sein kann niemand,« bemerkte eine, die in Erwartung des Kommenden auf dem Fensterbrett saß und häkelte.

Wjera lachte boshaft: »Nun, er könnte noch allerlei andres schmerzlich vermissen, -- zum Beispiel Verstand. -- -- Lieber Gott, was kann es nützen, sich so anzustrengen?«

»Warum bleibst du denn nicht weg? Du wolltest ja haben, was Ruth hatte, -- du am meisten.«

Wjera saß nachlässig hingegossen, die Arme längs der Banklehne ausgestreckt, und schielte seitwärts in den kleinen Handspiegel, den jemand in der Nähe des Fensters angebracht hatte, und der immer umstanden war.

»Ich glaube nicht daran, daß er mit uns so ist wie mit Ruth,« murmelte sie; »es wäre der reine Betrug. Entweder hat Ruth uns gefoppt, -- oder wir sind -- dumm. Glaubt ihr etwa, Ruth meinte ~das~, als sie so außer sich vor Entzücken sagten ›O -- -- dahinter gibt es das ganze Leben?‹ Wir stehen noch ~vor~ der Mauer, -- wie eine Hammelherde.«

»Na, so geh doch hinüber.«

»Ich werd' auch,« versetzte Wjera kurz, -- »noch heute. Wollt ihr? Mit ~einem~ Satz! Aber daß ihr nicht schreit! Ihr könnt ja nachspringen.«

Im Nu drängten sie sich um sie, brennend vor Neugier.

»Was wirst du thun?!«

Sie erwiderte nichts. Sie hob nur das Gesicht ihnen entgegen und spitzte den Mund ein wenig.

»Ein Kuß?!«

Sie schrieen jetzt schon.

Da trat Erik herein. Er bemerkte, daß sie zerstreut waren, beachtete es aber nicht. Wjera las vielleicht ganz richtig in seinen Augen: »Wie eine Hammelherde.« Er vermißte Ruth unter ihnen, nicht weil er sie liebte; er vermißte sie, weil sie ihn fortwährend angeregt, fortwährend seine Geistesgegenwart verlangt hatte. Für sie mußte er auf der Höhe seiner selbst stehen, um niemals fehlzugreifen.

Das war hier unnütz.

Nach kurzer Zeit erhob sich Wjera und ging, ein Blatt Rapier in der Hand, auf Erik zu.

»Sollte es möglich sein?« fragte er sarkastisch, indem er annahm, sie wolle ihm eine Arbeit vorlegen, »es wäre das erste Mal.«

Sie stieg die beiden Stufen zum Katheder hinauf und beugte sich zu ihm, -- so tief, daß er aufsah. Bei dieser Bewegung seines Kopfes berührten sich fast die beiden Gesichter.

Da durchgellte ein Schrei die Klasse, einstimmig. Sie hatten's nicht aushalten können.

Aber gleich darauf folgte ein zweiter, ganz anders im Ton: Wjera war, kaum daß der Schrei erscholl, hintenübergestürzt.

Erik selbst gingen Ursache und Wirkung durcheinander, ob der erste Schrei vorherging, ob er folgte, -- ob sie sich niedergebeugt, weil sie im Stürzen war. -- Er hatte auch vom Fall im Schulsaal gehört, und jetzt ergriff die Erinnerung daran die Mädchen mit kopflosem Entsetzen.

Die meisten sprangen auf, einige sprangen im plötzlichen Schreck auf die Bänke, -- auf das Fensterbrett.

Erik brach sich Bahn. Er hatte die wie leblos Daliegende auf seine Arme gehoben und trug sie hinaus.

Als er raschen Schrittes den Gang entlang dem nächsten leeren Zimmer zuging, kam Leben in sie. Der ganze weiche, geschmeidige Körper bewegte sich, als strebe er, erzitternd, sich an ihn zu schmiegen; ihr Atem flog; wie um sich zu halten, schlang sie den Arm um seinen Nacken, und jetzt -- jetzt fühlte sie deutlich, wie es ihn heiß überlief.

Blitzschnell, eh' er's nur gewahr wurde, hatte sie ihren Mund auf seine Lippen gedrückt.

Aber in der nächsten Sekunde fand sie sich schon auf ihre Füße gestellt -- hart, so plötzlich, daß sie fast zusammengestürzt wäre. Eine sinnlose Wut überfiel ihn. Wie ein Bild stand vor ihm der Augenblick, wo er Ruth, wie ein lebloses Kind, in seinen Armen auf ihr Bett getragen.

Er ergriff die verblüffte Spitzbübin beinahe brutal beim Handgelenk und zwang sie die wenigen Schritte bis an die hohe Flügelthür, die den Hallengang gegen das Treppenhaus hin abschloß. Er stieß die Thür auf.

»Hinaus. Ohne Wiederkehr,« sagte er kurz.

Sie errötete und erblaßte. Sie ging nur langsam hinunter, Stufe für Stufe, und hielt sich am Geländer. Was würden die andern in der Klasse wohl denken, wenn sie nie wieder kam? Daß er ihr über die Mauer geholfen habe? Ja, gründlich. Mit einem Satz.

Und das Schlimmste: sie hatte eine gehörige Beule weg, gerade vorn an der Stirn. --

Erik gab sich Mühe, bei der Rückkehr in seine Klasse, der Stimmung Herr zu werden, die ihn peinigte und niederschlug. Er hatte sich jedesmal gewundert, den bildhübschen Nichtsnutz mit unbegreiflicher Hartnäckigkeit noch auf ihrem Platz dasitzen zu sehen,

und dennoch fest entschlossen, nichts zu lernen. Er hatte sich auch ein wenig gefreut. Weil sie ein kluges Ding war, voll Mutterwitz und Phantasie. Er wußte jetzt, von was für einer Art von Phantasie.

Aber lag es nicht an ihm? War es nicht an ihm, allen diesen jungen Menschen unausweichlich die Richtung zu geben? Auswüchse auszuschneiden, Fehlendes zu ergänzen, Schlummerndes zu wecken? Er hatte sich seiner Aufgabe wohl mit seinem Willen hingegeben, aber nicht mit seinem Herzen. Und kein noch so guter Wille vermochte sein mächtigstes Erziehungsmittel zu ersetzen: das war die Frische und Fülle der Stimmung, deren immer bereites Interesse sich auch noch in das Geringste eingrub, suchend, lockend, verständnistief. Und er bedurfte dessen ganz besonders. Denn seine Vorzüge wie seine Schwächen als Lehrer bestanden darin, daß er seine Persönlichkeit und seinen Unterricht nicht zu trennen wußte; gelang es ihm nicht, sich selbst zu geben, so mißlang ihm alles. --

Am Thorweg des Schulgebäudes wartete Jonas auf den Vater. Sie fuhren zusammen nach Hause aufs Land.

Im Eisenbahnwagen sagte Jonas: »Mama spricht jetzt immer davon, daß sie bald verreisen muß. Sie kann doch nicht so früh im Jahr ins Bad reisen?«

»Ich weiß noch nicht. Vielleicht wird es wünschenswert sein. In Deutschland ist es ja nicht mehr so früh im Jahr. Dagegen spricht nur, daß ich sie jetzt noch nicht selbst hinbringen kann. Das müßtest du dann thun, Jonas. Und sie würde Gonne mitnehmen.«

»Wenn ich Medizin studieren werde,« bemerkte Jonas nach einer Pause, »dann wird es mir immer vor Augen stehen, das Wunderbare, daß es mit Mama besser geworden ist. Ich denke mir: Arzt zu sein, und ein einziger solcher Fall, -- das muß auf alle Lebenszeit einen glücklichen Menschen machen.«

»Du bist ein guter Kerl, Jonas. -- Ich hätte übrigens nicht gedacht, daß du speziell ›Medizin‹ wählen würdest. Ich dachte: Naturwissenschaften.«

»Ja, ich selbst auch, -- früher. Am liebsten Zoologie. Aber es ist eine so ungewisse Zukunft damit. Ein Arzt findet überall sein Brot.«

»Das ist richtig. Aber das allein Ausschlaggebende dürfte es nicht sein. Es kam immer noch auf die Stärke der besondern Neigung und Befähigung an. Wenigstens für dich. Das andre war dann meine Sache.«

»Ich möchte aber so früh als es geht unabhängig werden, Papa. Selbständig.«

»Ist es dir so unangenehm, dich von mir abhängig zu wissen, mein Junge? Es ist nur dein gutes Recht. Noch lange. Ich will nicht, daß dir deine Studien durch irgend etwas verkürzt oder eingeschränkt werden.«

Den Rest der Fahrt schwiegen sie. Jeder blickte, in seine eigenen Gedanken vertieft, zu einem andern Fenster hinaus.

Zu Hause, über dem Garten, dunkelte es schon. Aus dem Wohnzimmer blinkte Licht. Der späte Mittag, der jetzt in den Abend fiel, wartete auf sie.

Erik legte beim Eintreten eine Handvoll blaßblauer Fliederzweige auf den Tisch. Er hatte sie in einer Hülle von Seidenpapier mitgebracht.

»Aber, Erik!« sagte Klare-Bel vorwurfsvoll, während sie doch vor Freude errötete, »etwas so Kostbares und Ueberflüssiges! Im russischen April!«

»Ueberflüssig?« Er ordnete die langen Stiele geschickt in einem geschliffenen Kelchglas. »Der Frühling ist doch nicht überflüssig. Und ich meinte: in einem Landhause müßte er wenigstens drinnen sein, wenn er schon nicht draußen ist.«

Ihre Augen füllten sich langsam mit Thränen; sie schlug sie nieder, damit er es nicht sähe. Der Frühling ~war~ ja drinnen eingekehrt, ~ihr~ Frühling, auf den sie gewartet hatte, wie auf eine Lebenserneuerung gerade für Erik. Aber dieser Frühling war blumenlos und frostig geblieben.

Nein, das war ungerecht. Ungerecht gegen ihn, dem sie ihre Genesung dankte: abbittend blickte sie Erik verstohlen an. Aber ~das~ mußte sie ja sehen: er ertrug kaum die Trennung, -- die Trennung von Ruth. Solange Bel ihn glücklich gesehen, war sie arglos und sorglos geblieben. Jetzt aber lag es auf ihr, bei Tag und bei Nacht.

»Hast du Ruths gestrigen Brief schon beantwortet?« fragte sie nach einer Pause.

»Ja. Noch nicht völlig beendet,« erwiderte er.

Sie zog den Flieder zu sich heran und vergrub ihr Gesicht in den duftenden Dolden.

»Da war doch, -- ist der junge Russe noch immer da, den sie so gern haben?«

»Jurii? Ja. In den jetzt angehenden Ferien sollte er sogar, glaub' ich, eine kurze Zeit bei ihnen wohnen, -- draußen am Schloßberg. Sie wollten allerlei zusammen unternehmen. Römer hält viel von ihm.«

Eine kleine Pause entstand.

»Wie alt ist er eigentlich, Erik?«

»Ungefähr zweiundzwanzig Jahre, glaub' ich.«

»Und gänzlich unabhängig, nicht wahr? Es handelt sich für ihn nicht um ein Brotstudium?«

»Nein.«

Erik blickte auf, ein flüchtiges Lächeln um den Mund. Auf den jungen Russen eifersüchtig, -- nein, das war er unter keinen Umständen.

»Eine echt weibliche Kombination, Bel. Du dachtest schon an Brautkranz und Schleier, nicht wahr? Aber dafür, daß Ruth rasch mit ihm vertraut geworden ist, liegt ein andrer Grund vor: er ist ihr nicht fremd. Er kennt ihren Onkel hier. Hat einmal früher mit seinen Eltern dort verkehrt, -- mit ihr gespielt, als sie acht und dreizehn Jahre alt waren.«

Sie lehnte den Kopf zurück.

»Es ist nichts,« dachte sie, »es kann nicht sein. Sonst müßte -- ~müßte~ er eifersüchtig sein. Trotz seinem starken Selbstvertrauen. Jugend sucht Jugend.«

Nach einiger Zeit sagte sie bittend: »Erik! Du mußt nicht böse sein. Ich habe einen so großen Wunsch.«

»Einen so schlimmen, Bel? Nun, heraus mit ihm.«

»Ich wünsche so sehnlich, -- ich möchte so sehr gern, nur ein einziges Mal, -- lesen, was du an Ruth schreibst.«

Er antwortete nicht. Er stand auf und ging aus dem Zimmer. Gleich darauf kehrte er zurück, den fast beendeten Brief in der Hand.

»Du kannst es jedesmal lesen, Bel, wenn du willst.«

Ihre Augen strahlten ihn so dankbar und beglückt an, daß er den Blick nicht aushielt. Er sah hinweg.

Es war ihm eine Pein, sie dasitzen zu sehen, -- lesen zu sehen. Am liebsten wäre er hinausgegangen.

Er trat an das Fenster und schaute in die Dunkelheit.

Aber das Fensterglas höhnte ihn. Was es wiedergab, war noch einmal das Zimmer, mit der Lampe auf dem Tisch, den zarten Fliederzweigen und der lesenden Frau im Lehnstuhl.

Klare-Bel ließ den Brief sinken. Sie sah betroffen aus.

»Wie seltsam, Erik,« sagte sie, »-- ich kann mir gar nicht vorstellen, daß du so an Ruth schreibst.«

»Ich glaube ihr nicht anders zu schreiben, als ich zu ihr gesprochen habe,« entgegnete er.

»Es mag ja sein. Aber dann kam wohl noch allerlei hinzu, was nur im Mündlichen liegt. Dein ganzes Wesen kam hinzu. Du bist ja so jung und frisch im Wesen, Erik.«

»Nun, -- und?«

Er wandte sich um. Gewiß fand Ruth seine Briefe ebenso »entsetzlich nüchtern,« wie er die ihren. Nur aus einem andern Grunde: sie konnte nicht ihr Inneres aussprechen, -- und er durfte nicht.

»Ja, -- nun, -- ich weiß nicht, wie ich es beschreiben soll, Erik. Aber in dem Brief da bist du wie ein ehrwürdiger alter Mann, mit langem weißem Bart und Haar, -- ungefähr so, wie die Kinder sich den lieben Gott vorstehen.«

Es durchzuckte ihn. Er mußte an Ruths Wort denken: »Wie Gott.«

Eine Fülle widerstreitender Empfindungen wühlte es in ihm auf. Was für ihn wie für Ruth diesen Briefwechsel nüchtern machte, -- im lebhaftesten Plauderton noch kalt und stumm, -- das mochten wohl zwei ganz entgegengesetzte Gefühle beim Lesen der Briefe sein.

Für ihn war's ein Abzug am Vollen, Menschlichen ihrer Persönlichkeit, ihres innersten Wesens, das in Worten nur seine Oberfläche zu zeigen vermochte. Für ~sie~ war's vielleicht ein Zusatz zu seiner menschlichen Persönlichkeit, eine ~Verklärung~ derselben: er hatte ihr ja auch mündlich sein innerstes Wesen verschweigen müssen, und gerade das idealisierte sie sich nun vielleicht aus seinen geschriebenen Worten, -- »ungefähr so, wie die Kinder sich den lieben Gott vorstellen.«

Daher war ihm auch nie von selbst das Bedenken gekommen, sie könne an seinen Briefen ebensoviel auszusetzen haben, wie er an den ihren. Denn er hatte gefühlt: in seinen Briefen ergriff sie seine Hand und ging an derselben vertrauensvoll ihren Weg. Gehorsam -- froh. Denn sie litt doch nicht? Nein, das that sie gewiß nicht.

Man hatte sie dort mit einem Leben umgeben, das sie unausgesetzt anregen, bereichern, entwickeln mußte, -- sie beglücken und sie erfüllen. Und mit ihrer unbegrenzten Empfänglichkeit stand sie mitten in diesem Leben, -- wie mit weit ausgebreiteten Armen.

Nein, sie -- sie litt nicht.

Auch Klare-Bel war verstummt. Wieder hing jeder seinen eigenen Gedanken nach, und wieder wurde es heute ein schweigsames Abendessen. Wie sie da zu dreien bei einander saßen, eng zusammen, in herzlicher Neigung verbunden, blieben sie doch einander so weltenfern entrückt, daß keiner von ihnen teil hatte an der stummen Welt des andern.

Als nach dem Essen Erik sein Zimmer nicht wieder verließ, setzte Jonas, ohne Schularbeiten, sich zur Mutter.

»Wenn Papa nicht da ist, muß ich ihn ersetzen,« versicherte er, »kann ich dir nicht schon bald fast dasselbe sein wie Papa? Einen guten Kopf größer als du bin ich doch schon, meine kleine Mama.«

Sie sah ihn mit einem tiefen, stillen Blick an, den er nicht verstand. Dann streckte sie ihm über den Tisch ihre Hand hin.

»Mein lieber Junge. Ja, mir kannst du bald -- viel sein. Wirst du es auch nicht vergessen, später, über all dem Studieren? Du mußt mir viel -- viel Freude machen, Jonas.«

»Ich werde dir ganz ungeheuer viel Freude machen, Mama,« erklärte er treuherzig, »das werde ich ganz bestimmt. Denn ich werde etwas ganz Ausgezeichnetes werden. Das muß ich.«

»Freust du dich sehr auf das ungebundene, neue Leben draußen?«

»Auf draußen, -- ja. Aber das mit dem ungebundenen Leben finde ich gar nicht so schön. Ich finde es viel schöner so, wie Papa es gehabt hat.«

»Wie denn, mein Kind?«

»Nun, doch so ganz gebunden, Mama. Mit dir zusammen. Das kann ich mir nämlich so wunderschön ausmalen. Fast als ob --. Eine Studentenstube, -- ganz klein braucht sie ja nur für den Anfang zu sein, und an den Wänden Bücher, und auf dem Tisch eine Kochmaschine zum Selbstkochen. In der Ecke ein schönes Skelett und am Fenster viele Blumen. Da sitzt die Frau mit dem Nähzeug. Und bei den Büchern, da sitze ich, -- ich meine: sitzt Papa.«

»Ganz so war es wohl nicht. Nicht so eng. Für Blumen und Kochmaschinen und Nähzeug schwärmte Papa nicht sehr. Und wenn er bei den Büchern war, dann mußte er in seinem Zimmer allein sein. Da warst nur du bei mir. In einer kleinen Wiege.«

»Eine kleine Wiege?«

Jonas wurde ziemlich rot. An dieses Stück der Zimmereinrichtung hatte er noch gar nicht gedacht. Er sagte etwas befangen: »Nun ja. Aber wenn du auch nur nebenan gesessen hast, so war es doch ~das~, was ihn fleißig machte. Und eben das denke ich mir so herrlich beim Studieren, wenn man's für jemand thut, den man so über alles lieb hat.«

»Das sage du Papa lieber nicht. Das würde ihm vielleicht mißfallen. So hat er es mit seinen Studien und Plänen wohl nie gemeint. Er war so ganz anders, als du bist, Jonas. Aber unendlich gut und klug war er. Und als er anfangen mußte, sich ums Brot zu plagen, und es mich grämte, da lachte er mich so herzlich aus und sagte: ›Laß gut sein, Bel, ich hab' ein Mittel, ein Zaubermittel, um frisch zu bleiben, -- mag es noch so viel Plage geben, -- frisch für meine Ziele: das Mittel bist du, Bel‹. Ja, so sagte er.«

Jonas schwieg. Er wollte den Vater nicht vor seiner Mutter herabsetzen, aber in diesem Punkte fühlte er sich ihm weit überlegen.

»Man kann noch tausendmal mehr lieben!« dachte er im stillen.

Klare-Bels Gedanken aber träumten sich, schmerzlich und beglückt, in die Zeit ihrer Studentenehe zurück. Sie sah alles vor sich, als habe sie es eben erst verlassen, und durchwanderte jeden Winkel, der ihr Glück beherbergt hatte. Sie sah auch die Stube, wo er über seinen Arbeiten saß, und sie ihn leise, -- ganz leise mußte es sein, -- umsorgte. Aber gerade dieses Bild verwischte sich ihr, wurde undeutlich wie vor Thränen. An Eriks Stelle saß ein andrer, -- saß Jonas; -- und immer wieder, mit einem dumpfen Zukunftsgrauen, erblickte sie sich allein, -- allein mit dem Sohn.

Die Nacht lag Klare-Bel wach, und als sie gegen Morgen einschlummern wollte, schreckte der Gedanke sie auf, als müsse sie über irgend etwas angestrengt und mit Schmerzen nachgrübeln.

Am folgenden Tage fielen die Schulstunden aus; irgend einer der zahlreichen griechischen Kirchenheiligen wurde gefeiert. Erik setzte sich am Vormittag mit einigen Büchern und Papieren ins Wohnzimmer, wo, in der Nähe des Kaminfeuers, ein Schreibtisch für ihn improvisiert worden war. Draußen stöberte ein ganz feines Schneewetter aus ein paar finstern Wolken, hinter deren blau-schwarzem Rande die Aprilsonne neckend bereits wieder hervorlachte. Hell und dunkel glitt es über das Zimmer hin.

Klare-Bels Augen hingen mit einem wehmütigen Ausdruck am Arbeitenden. Heute morgen wollte sie ihn fragen. Sie hielt es nicht länger aus. Wie hatte sie nur denken können, seine Briefe würden ihn ihr verraten? Denn Ruth war ja noch so ganz unbewußt gewesen. Zu ihr konnte er nicht offen sprechen. Daher gerade der auffallend zurückhaltende Ton. Vor ihr verbarg er sich -- befangen und mühsam.

»Wo steckt Jonas eigentlich?« fragte Erik, über seine Ausarbeitungen gebeugt.

»Jonas ist nun doch wieder zur Stadt gefahren. Er wollte so gern seinen Freund besuchen.«

»Hoffentlich doch nicht, um wieder zu arbeiten, -- mit dem Freunde?«

»Vielleicht. Laß ihn, Erik. Ist er nicht ausgezeichnet geworden?«

»Ja. Höchstens zu ausgezeichnet. Er hat viel vor sich gebracht, das muß man dem Jungen lassen. Sowohl was seine Fähigkeiten wie seine Ausdauer betrifft, hat er meine Erwartungen im letzten Halbjahr weit übertroffen.«

»Nicht nur das. Er ist dabei so verständig geworden. Ihm steckt kein Unsinn im Kopf. Keine Kindereien.«

»Ja. Gerade das mißfällt mir. Dafür ist er zu jung. Wenn er nur nicht eng wird. Mit siebzehn Jahren muß man nicht Philister sein.«

»Ach, Erik, wenn er nur brav wird.«

»Das kann er immer noch. Zunächst soll sein Temperament heraus! Heidelberg wird ihm gut thun, denke ich, und Römers Einfluß. Man muß sorgen, daß er sich frei bewegen kann. Weder Zeit noch Geld darf ihm knapp zugemessen werden.«

»Wie gut er ist!« dachte Klare-Bel, »ja, in solchen Dingen ist er immer unendlich gut gewesen. Würde sich plagen für den Jungen, damit der lernen kann, zu genießen.«

Mehrere Minuten vergingen in Schweigen. Eriks Gedanken liefen voraus, dem Herbst entgegen, wo Jonas nach Heidelberg abging. Allerspätestens dann mußte er Ruth wiedersehen, sie sprechen. Vielleicht aber schon früher. Wenn Klare-Bel so ins Bad reiste, daß er sie mit Beginn der Sommerferien in Deutschland abholen konnte.

»Erik!« sagte eine Stimme neben ihm.

Er sah zerstreut auf. Seine Frau stand am Schreibtisch -- ohne ihre stützenden beiden Stöcke. Sie hatte sich selbständig erhoben und war durch das ganze Zimmer zu ihm hingegangen, -- allein.

Sie hatte es heimlich geübt, mehrere Tage.

Erik vermochte nicht gleich aus seinen Gedanken herauszukommen. Er blickte sie nur fragend an, ohne zu beachten, was ihn überraschen sollte.

Er bemerkte es nicht.

Auf Klare-Bels Lippen erstarb ein Lächeln.

»Ich wollte dir nur zeigen, was ich kann,« sagte sie, mit einer gewaltsamen Anstrengung, es unbefangen zu sagen.

Aber es mißlang. Sie erblaßte. Und plötzlich schwankte sie und glitt dem erschrocken Aufspringenden in den Arm.

Er führte sie langsam zu ihrem Lehnstuhl, besorgt, über sie gebeugt. Jetzt war er ganz bei ihr.

»Ist dir besser?« fragte er herzlich und zog sich einen der niedrigen Polstersessel vom Kamin heran, »die Selbständigkeit bekommt dir schlecht, meine arme Bel.«

Sie sah den Scherzenden mit einem langen, stillen Blick an.

»Ich muß sie doch lernen, Erik!« entgegnete sie doppelsinnig.

Sie lehnte den Kopf müde zurück und schloß die Augen. Und so, mit geschlossenen Augen, während er ihre Hand festhielt und leise streichelte, sagte sie: »Siehst du, -- ach, Erik, es war ja gewiß recht kindisch. Aber siehst du, -- hierauf hab' ich mich ja schon so lange gefreut. Auf deine Freude, -- wenn ich einmal so zu dir käme, -- ohne Stütze, auf eigenen Füßen. Es war so kindisch. Aber nun ist mir aller Mut abhanden gekommen, dich zu fragen, Erik.«

»Wonach wolltest du mich fragen, Bel?« Er sprach mit gepreßter Stimme, gedämpft, wie immer, wenn er eine Erregung niederhielt.

»Ja, Erik, ich dachte: wenn du dich nun so freutest, und mich in die Arme schlössest, -- nicht wie jetzt, weil ich fiel, sondern weil ich stand, aufrecht neben dir stand, -- dann wollte ich dich fragen, -- ganz leise wollte ich dich fragen, -- ach, Erik! ich kann es nicht mehr.«

Er faßte ihre beiden Hände in die seinen und blickte durchdringend, mit gespanntester Aufmerksamkeit in das erblaßte Gesicht mit den fest geschlossenen Augen. Sein Herz schlug hart gegen die Brust.

»Ich will es dir sagen, Bel!« erwiderte er fest, ohne den Blick von ihr zu lassen, »wenn es dich gequält hat, dann muß es sein. Hast du den Mut, es zu hören? Willst du es?«

Sie schlug ihre Augen auf, -- hilflos, thränengeblendet, -- hilflos wie ein gestelltes Wild vor dem Schuß.

»Erik!« stieß sie flüsternd heraus, und das Entsetzen vor seiner Antwort vergrößerte ihre Augen, »-- Erik, liebst du sie?«

Da beugte er den Kopf tief nieder auf ihre Hände.

»Ja, Bel,« sagte er laut.

In demselben Augenblick durchflutete ein so breiter Sonnenstrom das ganze Zimmer, daß Klare-Bels Lider sich unwillkürlich davor schlossen, in einem abergläubischen Erschrecken, wie wenn der Himmel selbst Zeugnis ablegen wollte für Eriks Liebe. Blau lachte es herab, und wie ein blitzendes Goldnetz von Tauperlen blinkten die rasch zerronnenen Schneefederchen über dem Garten. So warm spielten die hellen Sonnenstrahlen über den Fliederstrauß am Fenster hin, als sei er draußen vom Strauch geschnitten.

»Dunkel,« bat Klare-Bel leise, »-- ich möchte auf mein Bett, -- mach's dunkel.«

Er hob sie aus dem Stuhl und legte sie in ihrem anstoßenden kleinen Gemach auf ihr Bett, hinter welchem er die Fenstervorhänge aus den Klammern löste und zuzog.

Sie suchte nach seiner Hand.

»Die Briefe, Erik, -- wie du ihr geschrieben hast, -- war es lauter Verstellung? Oder hast du ihr -- hast du nicht auch anders geschrieben? Niemals?«

»Ich habe ihr auch anders geschrieben, Bel. Ganz anders. Jedes einzige Mal, daß ein solcher Brief an sie abging. Aber es war nur für mich allein. Sie hat's nie gelesen.«

»Du hast es nicht abgeschickt? -- Hast du diese Briefe noch, Erik?«

»Nein. Ich habe sie jedesmal, sobald sie geschrieben waren, vernichtet.«

»Wozu hast du es dann nur gethan, Erik?«

»Es half mir.«

Fast hätte er hinzugefügt: »Ich liebe sie ja, Bel! Ich liebe sie! Ich mußte zu ihr sprechen.«

Nach einer Weile ließ Klare-Bel seine Hand los und sagte leise: »Und ich hatte keine Ahnung, -- nein, keine Ahnung hatte ich, daß du sie um deswillen von dir gabst. Nun erst weiß ich es.«

Er richtete sich betroffen auf. Mißverstand sie ihn jetzt nicht? Meinte sie nicht, er habe Ruth von sich gegeben um ihretwillen? um Herr zu werden seiner Liebe?

Mußte er ihr die letzte, die tödlichste Kränkung zufügen: »Nicht an dich habe ich dabei gedacht.«

Ja, einmal mußte auch das sein. Aber mußte es heute sein? Alles heute? Litt sie nicht genug, -- maßlos?

Er vermochte es nicht.

Da Klare-Bel nicht mehr zu ihm sprach, trat er von ihrem Bett zurück, an die offene Thür des Wohnzimmers.

Gräßlich war es, einen Wehrlosen niederzuschlagen mit der Faust. Das Mitleid überfiel ihn mit nie gekannter mitleidsloser Macht, -- mit einem nie gekannten wehen, elenden Gefühl umkrallte es ihn.

Das Kaminfeuer knatterte hoch auf unter kurzen Windstößen; der Himmel hatte sich längst wieder verfinstert. Von neuem stäubte ein feiner Schneeschauer um das Fenster, -- dasselbe Aprilspiel wie zuvor.

Erik warf gedankenlos eine Handvoll Tannenzapfen in die rote Glut, und ein schwacher Duft, den er liebte wie keinen andern, -- ein Duft nach Wald und Weihnachten verbreitete sich in der Stube. Unwillkürlich dachte man sich den kahlen, kalten Garten im Winterfrost und einen geputzten Christbaum in der Zimmerecke.

Weihnachten, -- -- -- auch in diesem Winter hatten sie den Baum geschmückt und sich um ihn geschart, aber zum erstenmal hatten sie sich wie drei arme Erwachsene gefühlt, die am Fest der Kinder leer ausgehen. Erik, der zu beschenken wußte, wie nur ein Knecht Ruprecht, und sich zu freuen, wie nur ein Kind, war karg, -- war wortkarg geblieben.

Es kam ihm selbst sonderbar vor, daß sich sein Mitleid an lauter solche kleinen, kleinlichen Rückerinnerungen heftete.

Langsam begann er im Zimmer auf und ab zu gehen.

Nicht daß sie jetzt dalag und litt, -- aber daß sie so lange -- lange umsonst auf seine Freude gewartet hatte, in seinen Zügen nach Freude gespäht, all diese Monate hindurch, -- das erschütterte ihn so tief. Genesen war sie, -- wie ein strahlender Weihnachtsbaum hätte das mitten unter ihnen stehen sollen zu jeglicher Stunde, lichterblitzend, mit tausend neuen kleinen Freuden geschmückt. Und sie hatten sich nicht wie frohe Kinder darum geschart -- --.

Klare-Bel lag noch immer und schwieg. Er mochte nicht zu ihr hineingehen, er mochte nicht fortgehen. Noch immer ging er auf und ab, wie ein Verurteilter.

Endlich kam Jonas. Die Stufen zur Terrasse sprang er herauf und hielt schon am Fenster zwei Briefe in der Hand hoch. Beim Eintreten in das Wohnzimmer warf er sie auf den Eßtisch.

»Wo ist denn Mama? Mehr war nicht in der Stadtwohnung im Briefkasten. Zwei an dich.«

»Mama ist nicht ganz wohl. Sie liegt auf ihrem Bett.«

Während Jonas ans Bett trat, leise, auf den Fußspitzen, griff Erik nach den Briefen. Der eine von Frau Römer, der andre von Warwara. Ohne zu wissen, warum, erbrach er Warwaras kurzes Billet zuerst: die Bitte, morgen bei ihr zu speisen; sie bäte um

Nachrichten über Bels jetziges Befinden und wünsche auch, ihm eine Mitteilung zu machen; in etwa einer Woche verreise sie bereits ins Ausland.

Erik setzte sich an das Fenster und öffnete Frau Römers Brief. Ein längerer als sonst. Acht Seiten.

»Lieber Freund!

Heute schreibe ich in einer besondern Angelegenheit, die unsre Ruth betrifft. Aber erschrecken Sie nicht, denn erstens ist es nichts zum Erschrecken, und dann ist es auch noch keine Wirklichkeit, sondern vorläufig nur eine Möglichkeit.

Sie erraten wohl, daß es sich um Jurii handelt. Ich wußte wohl von seiner jugendlichen Schwärmerei für Ruth, ohne sie besonders zu beachten. Dergleichen ist am Ende kein Unglück für einen jungen Menschen. Jetzt aber glaube ich, daß er Ruth ernsthaft liebt, und daß er im Begriff steht, um sie zu werben. Dies ist nun von geringem Interesse für Sie, es sei denn, daß Ruth ihn wiederliebt. Dafür habe ich keinerlei stichhaltigen Beweise. Aber das Wunderliche ist, daß man nie ganz ergründen kann, was in Ruth vergeht, und wie sie in ihrem innersten Herzen denkt. Nie sah ich einen Menschen, der offener, nie einen, der verborgener gewesen wäre als sie. Offen: bewußt; verschlossen: unbewußt. Es ist, als führe sie, noch hinter allem andern, was sichtbar wird, ein geheimes Eigenleben für sich, von dem sie selbst nicht recht weiß, aus dem aber dennoch alle entscheidenden Gefühle und Gedanken bei ihr kommen. So könnte sie recht gut einmal sich selbst zur Ueberraschung handeln, -- ihrer ganzen klaren, frischen, heitern Unbefangenheit zur Ueberraschung, -- und gerade damit ihr eigentlichstes Selbst erst zum Ausdruck bringen. --

Aber nun zu Jurii. Ich kann über ihn nur Gutes, ja Vortreffliches mitteilen. Ich kann es nur in die Worte fassen: hätt' ich eine Tochter, -- mir sollt's recht sein. Er ist brav, sympathisch, sehr begabt, ernst in der Richtung seines Wesens und seiner Interessen. Gänzlich unverdorben. Dazu kerngesund und ein bildhübscher Junge. Das ist viel auf einmal. Ueber Familie und Verhältnisse wurde Ihnen selbst schon das Beste bekannt. Seine große Jugend ist kein Fehler, da Ruth denselben mit ihm teilt, und da die Zeit ihn so gründlich heilt.

Aber glauben Sie, bitte, trotzdem nicht, daß meine Wünsche Ruth vorauslaufen, -- auf Kupplerfüßen laufen. Ich wünschte nur, Sie rechtzeitig vorzubereiten, damit Sie überlegen, wie Sie sich zur Sache stellen wollen. Denn gegen Ihren Willen, -- nein, auch nur ohne Ihren vollen Willen, -- würde ja wohl Ruth nie etwas thun --«

Erik las nicht weiter.

Er überflog die nächsten Seiten: sie handelten nicht mehr hiervon.

Ruths Schweigsamkeit, -- war sie doch gewollt, bewußt? Abkehr von ihm, eine stille Wandlung?

Er glaubte seinen eigenen erwachenden Zweifeln nicht. Aber sie kamen wieder. Hell und dunkel, Licht und Schatten glitt es über seine Gedanken hin, wie draußen.

»Aprilwetter, -- in mir! um einen Knaben!« murmelte er im Zorn über sich; »in Angst um eine Aprillaune, -- in Angst, in den April geschickt worden zu sein!«

Er war so zornig, so ungerecht als möglich, gegen sie, gegen sich selbst.

Beim Heraustreten aus dem Zimmer der Mutter sah Jonas den Vater über die Terrasse in das Schneegestöber hinausgehen.

Und Klare-Bel wollte ruhen, wollte allein sein.

So schlich er sich in seine Stube.

Als Erik nach ein paar Stunden nach Hause kam, bemerkte Gonne gegen ihn, die Frau habe sich zur Ruhe begeben, sie sei krank.

Erik ging zu ihr.

Sie saß aufrecht im Bett; auf dem Tischchen daneben lagen Bücher. Im Nachtjäckchen, ihre kleine Haube auf dem, wie zur Nacht, glatt zurückgestrichenen blonden Haar, sah sie ihm verwirrt und angstvoll entgegen. Als fürchte sie sich vor ihm. Als schäme sie sich vor ihm.

Er ertrug es nicht. Er beugte sich über sie, das Gesicht auf ihren Händen, und küßte diese.

»Bel, -- Bel, -- verzeihe mir.«

Sie gab sich Mühe zu lächeln; es war ein merkwürdiges, schwaches, kleines Lächeln, das dabei herauskam. Und nun wurde sie dunkelrot.

»Ach, Erik, -- nicht so. Es ist mir zu -- es ist mir so ungewohnt. Schrecklich ist es mir. Sprich nicht so zu mir.«

Er setzte sich neben sie, auf den Stuhl an ihrem Bett.

»Lasest du, Bel?« fragte er zerstreut, gepeinigt.

»Ja, Erik. Du mußt nicht böse darüber sein. Es sind so alte Bücher, -- die alten, weißt du? Aber neulich fand ich einmal etwas, und das machte mich so glücklich. Das suchte ich mir heute auf. Es ist so schön zu lesen, Erik.«

Sie sprach rasch, befangen, wie ein verlegenes Mädchen.

Er blickte nieder auf die Bücher. Ein goldenes Kreuz auf dem einen. Und das andere. P. A. de Génestets »Laiengedichte«, -- diese echt holländischen Lieder, in denen Trotz und Glaube, Trost und Zweifel sich seltsam genug mischen.

»Ich hatte sie so völlig vergessen, alle beide. Weiß selbst nicht, wie nur. -- Wie gut, daß so etwas dableibt, ob man es auch vergißt. Sie waren so verkramt, und ganz staubig, als ich sie neulich fand. -- Willst du mir die ›Laiengedichte‹ herreichen, Erik? Ein Lesezeichen liegt drin.«

Er schlug das Buch auf und reichte es ihr. Das Lesezeichen fiel dabei heraus.

»Höre nur, -- Erik, -- nur einige Verse, magst du? Auch du mußt es schön finden. Es heißt ›+Peinzensmoede+‹. Es sollte wohl heißen: ›Ich glaube, Herr, hilf meinem Unglauben‹.«

Und sie las mit ihrer sanften Stimme:

»Wo -- wo sind die Priester, Die dich erklärten? In Rätseln wandelt Der Mensch auf Erden. Geheimnis -- das Leben, Geheimnis -- der Tod, Die Schöpfung, sie predigt Keinen liebreichen Gott. Natur nur umgibt dich, Die nicht auf dich hört, Gleichviel ob sie wohlthut Oder ob sie zerstört.

Und doch, -- nisten Zweifel Mir auch in der Brust, -- An dich, meinen Vater, Glaub' ich unbewußt. Nicht weil deine Schöpfung Dein Lieben enthüllt, -- Nein! nein! nur trotz allem, Dem Zweifel entquillt! Trotz jeglichem Rätsel, Trotz jeglicher Not, Trotz Angst und Verderben, Trotz Schmerzen und Tod!

Ich schmachte, vom Schicksal Zu Tode getroffen, Meine Hoffnung ist Wehmut, Meine Wehmut ist Hoffen. Ich ~will's~ -- ~will~ es glauben, Daß ich deine Hand Im Leben wohl spürte, Nur sie nicht erkannt; -- ~Will's~ glauben, was Kirche und Priester mich lehrten: Daß niemand umsonst dich Gesucht hat auf Erden.«[1]

[1] Frei nach dem Holländischen.

Sie saß da und las, den Kopf mit dem weißen Nachthäubchen andächtig gesenkt, die Hände auf der Bettdecke gefaltet. Die Röte der Befangenheit, der verlegene Ausdruck wichen langsam von ihrem Gesicht; rührend und vertrauensvoll sah sie aus, wie ein Kind, das seiner Mutter ein Gebet nachspricht.

Und so nackt legte sie auch jetzt noch ihre Seele -- in all ihrer Hilflosigkeit und zagenden Hoffnung, vor ihn hin, -- ohne jeden falschen Stolz. Sie kannte es nicht anders.

Erik hielt noch immer das Lesezeichen in der Hand und betrachtete es geistesabwesend. Ein recht unpassendes hatte sich da ins Buch hinein verirrt: ein nackter Amor mit einem großen Rosenbouquet.

Während er aber stumm darauf hinschaute, sprach er in Gedanken zu Klare-Bel, unterbrach sie im Lesen, nahm ihr das Buch aus der Hand. Er war ganz eingenommen von diesem wortlosen Zwiegespräch: »Dieser Titel gehört sicher nicht über deinen Glauben und deine Zweifel, Bel; ›+Peinzensmoede+‹ bedeutet ja: des Sinnens, des Grübelns müde. Wann hättest du das gekannt? Ein vom Zufall der Erziehung lässig dir übergeworfenes Kleid, -- ein durch einen Zufall deiner Ehe lässig von dir abgeglittenes Kleid: das war in deinem Leben der Glaube.«

Und in Gedanken hörte er Klare-Bel: »Woran soll ich denn aber noch glauben, Erik? An dich? Doch nicht an dich? Von wo einen Halt nehmen? Du warst mein Halt. Ach, der hält nicht! Er biegt sich unter meiner Hand hinweg, und läßt mich stürzen. Soll ich mir selbst ein Leid anthun? Dich ermorden? ~Sie~ vergiften? Ich bin keiner von den Menschen, über denen die Leidenschaften vernichtend zusammenschlagen. Bin ich dadurch nicht nur hilfloser? Meine tiefste Verzweiflung heißt Hilflosigkeit; -- das Tasten nach einer Stütze: mein letzter klarer Gedanke. Warum verwehrst du es mir?«

»Weil ich diese Stütze hasse, -- diesen Halt, der mich ersetzen soll. Nein, weil ich mich dessen schäme, -- daß er mich ersetzen muß. Weil ich kein Mitleid mehr mit dir habe, -- nur noch Zorn und Haß und Scham vor mir selbst.« -- -- -- -- -- -- -- -- -- -- -- --

Klare-Bel schaute von ihrem Buch auf, unsicher gemacht durch sein Schweigen.

»Ist es nun nicht schön, Erik?« fragte sie leise, beinahe bittend, »-- mich macht es glücklich.«

»Dann ist es schön, Bel!« sagte er sanft. --

Aber seine Stimmung war nicht sanft. Den ganzen Abend schlug er sich mit einer ihm fremden Pein herum. Schon am Vormittag, -- als er seine Frau nicht sofort über ihr Mißverständnis aufklärte, sondern sich edler nehmen ließ, als er war, -- und jetzt wieder, wo seine Lippen anders redeten, als seine beschämten, zornigen Gedanken, -- hatte er gegen seine innerste Natur gehandelt, sich passiv verhalten, die Dinge gehen lassen. Nicht aus einer Weichlichkeit des Mitleids, -- aus gerechter Ueberzeugung: ob es ihm sympathisch oder widerwärtig war, durfte nicht in Betracht kommen gegenüber dem, was Klare-Bel durch ihn erleiden mußte.

Er hatte sich unausweichlich in die Lage gebracht, gegen seine eigenste Natur handeln zu müssen.

Den nächsten Tag bedurfte Erik einer gewaltsamen Willensanstrengung, um seine Gedanken von allem loszureißen, was ihn quälte, und auf seine Arbeit zu richten. Bald sah er Bel als Betschwester vor sich, bald Ruth als Braut; Hohn und Erbitterung erfüllten ihn. In beiden Fällen war er der entthronte König.

»Einen neuen Gott die eine, -- einen neuen Mann die andre, -- es ist fast dasselbe!« dachte er und erschrak selbst vor der Häßlichkeit seiner Gedanken.

In einer Pause zwischen seinen Schulstunden, während welcher er in der Stadtwohnung vorsprach, zog er Frau Römers Brief aus seinem Taschenbuch. Er hatte ihn nicht einmal ganz gelesen, -- nur durchflogen, -- und jetzt kam ihm das Gefühl: es müsse wohl thun, diese Frau reden zu hören, bei ihr Ruhe zu finden vor all dem Häßlichen, was in einem Menschen aufgewühlt werden kann.

Und er las weiter.

»Es ist ja nicht notwendig, daß Ruth sich schon so jung bindet. Vielleicht wird sie sich erst viel später verheiraten, -- vielleicht nie. Nun sehen Sie, dies wäre nicht wünschenswert. Ich weiß nicht, wie Sie darüber denken. Ich spreche als glückliche Frau naturgemäß für die Ehe. Aber ich habe gut reden: ohne meinen Mann wäre ich wohl ein nichtsnutziges Ding geblieben, -- mit etwas Interesse für Tand und einer großen Leere im Herzen. Ich glaube, Sie legen einen Hauptwert auf Ruths geistige Entwickelung. Ich auch. Aber dazu verhält sich ein frühes gleiches Liebesleben nicht als Gegensatz, sondern als die einzige gesunde, natürliche Grundlage auch des Geistesstrebens im Weibe. Nicht nur damit Sie Gehilfin des Mannes sei. Häufig langt es ja gar nicht zu mehr. Wo es aber langt, -- desto besser. Von meinem Mann glaube ich bestimmt, daß er mich im Ergreifen eines jeden Berufes unterstützt hätte, zu dem eine entsprechend große Befähigung vorhanden war. Nicht aus reiner Selbstlosigkeit natürlich. Liebe ist nicht selbstlos. Wohl aber, um den ganzen frischen Duft, die ganze Fülle und Freude um sich zu haben, die nur derjenige Mensch auf seine Umgebung ausstrahlt, der voll erblüht. Und daß zwei Blüten bei einander stehen wollen: das bedeutet ja wohl ›Ehe ‹ --.«

Erik sprang auf und warf den Brief auf den Tisch. Etwas ganz andres, als er gesucht, hatte er darin gefunden, -- etwas ganz Unerwartetes: einen unbewußten Vorwurf.

Seine Ehe mit Bel, das waren keine zwei selbständigen Blüten, die zusammenstanden: das war eine Blüte, die einen Tautropfen aufgesogen, der unvorsichtig in ihren Kelch gefallen war.

So würde es wohl Frau Römer ausdrücken.

Römers standen eben von vornherein anders zu einander. Sie bewunderten sich gegenseitig, -- eigentlich war es rührend. Man konnte nicht recht darüber lächeln: man mußte diese beiden Menschen achten.

Bel konnte aber nicht mit Frau Römer verglichen werden. Als er sie fand, ein Jahr älter als er selbst, sinnbethörend schön, bereits fertig mit ihrer kurzen Entwickelung, -- ein in gewisser Weise viel fertigerer Mensch als er, -- was hätte er da wohl andres thun können, als dürstend in sich aufzusaugen, was, nach Selbstuntergang sehnsüchtig, sich ihm darbot?

Aber wenn man einen schwächern Menschen so absolut in seinen Besitz nimmt, so fühlt man die furchtbare Verpflichtung: ihn nicht wieder von sich zu lösen. Man stellt sich für das ganze Leben in einen Kampf hinein zwischen Scham und Mitleid, bei jedem leisesten Versuch, sich dieser Verpflichtung zu entziehen.

Wahrscheinlich würde das Frau Römers Meinung sein. -- Auch -- Ruths Meinung? Ruth grübelte nicht über solche Fragen. Aber was täglich, stündlich auf sie wirkte, sie beeinflussen mußte, mächtiger als alle Worte, alle Grübeleien, -- das war Frau Römers Ehe. Eine heilig gehaltene, glückliche Ehe.

Sobald sein Unterricht ihn freiließ, ging Erik zu Warwara. Mehr, als er es sich selbst gestehen wollte, war es ihm recht, jetzt noch nicht nach Hause zu fahren.

Als Erik gemeldet wurde, entfernte sich eine lange, hagere Engländerin, Warwaras Gesellschafterin, aus dem Zimmer.

»Sie sehen ganz besonders ernst aus,« bemerkte er bei der Begrüßung zu Warwara, »es ist Ihnen inzwischen doch nichts Unangenehmes passiert?«

Sie mußte hell auflachen.

»Etwas passiert, -- ja. Aber man zählt es nicht zum Unangenehmen.«

»-- Verlobt?! -- war das die Mitteilung?! -- Mit wem?«

Sie setzte sich in ihre Plauderecke. »Gleichviel, mit wem. Ein Ihnen ganz Fremder. Im Auslande. Sie werden es auf einer schön gestochenen Verlobungskarte lesen.«

»Und darf ich Ihnen Glück dazu wünschen, Warwara?«

»Wie meinen Sie das?«

»Ich meine natürlich, ob Sie das Geringste für den Mann fühlen, den Sie heiraten wollen.«

»Daran zweifeln Sie?«

Er schwieg.

»Ich will es Ihnen sagen. Dazu rief ich Sie ja her. Ich hab' ihn gern. Sehr gern. Aber mir wird nicht heiß und kalt, wenn ich an ihn denke.«

»Und das scheint Ihnen zu genügen. Es genügt nicht, Warwara.«

»So will ich Ihnen noch mehr eingestehen. Was ich in der Ehe suche, -- das Glück, das ich suche, -- ist nicht der Mann.«

»Sondern?«

Sie stand auf und trat an ihren Blumentisch, mit dessen Pflanzen sie sich zu schaffen machte.

»Das Kind.«

Erik schwieg überrascht.

Nach einer kurzen Pause sagte sie: »Es ist ein sehr vertrautes Geständnis. Aber ich bin mit Ihnen sehr vertraut, -- mehr, als Sie wissen. Hab' Sie oft so im stillen bei mir selbst um allerlei Rat gefragt. Sie zum Beichtvater und Seelsorger gehabt. Wir hätten öfter, als wir gethan, ernste Dinge miteinander teilen sollen.«

»Das hätte mich sehr froh gemacht, Warwara. Schon das, was Sie da sagen, macht mich froh. Ich bedurfte gerade dessen.«

»Nun, sehen Sie, das ist gut. So will ich's auch ruhig bekennen. Daß ich wirklich nur ein ganz armes Weltkind bin, voll von allerlei Tand und Plunder. Und daß ich gern mehr sein möchte. Vielleicht dank Ihnen, -- dank den stillen Unterhaltungen, die ich da

mitunter mit Ihnen geführt habe. Und so will ich mir denn nun den einzigen Erzieher und Meister ersehnen und erwünschen, der aus mir noch das Beste machen kann, -- das Beste, was in mir ist.«

»Das alles erwarten Sie von einem Kinde?«

»Von der Mutterschaft -- ja. Von der Mutterliebe. Dem Mutterglück. Der Mutterpflicht. -- Und dann,« sie wandte sich lebhaft zu ihm, »irgend wann einmal, wenn ich wirklich so glücklich sein soll, dann gebe ich mein Kind in Ihre Hand, damit Sie es zu einem tüchtigen Menschen heranziehen helfen, Sie Menschenlehrer.«

»Hätten Sie ~das~ Vertrauen zu mir? Ein so festes? Einen ganz festen Glauben an mich? Ich danke Ihnen, Warwara.«

»Ja. Ich traue Ihnen und Ihrer Kraft unendlich viel zu. Unter der einen Bedingung: daß Sie Ihre Aufgabe sehr lieben.«

»Mit andern Worten, keine Kraft zur Pflichttreue.«

»Das weiß ich nicht. Ich glaube nur, trotz allem, daß Sie im Grunde Gemütsmensch sind. Und das heißt doch nur: sehr lieben können, -- Menschen oder Ideen, -- und da, wo man sehr liebt, sich rückhaltlos verschenken können. Hingegen all das andre, was Sie bisweilen mit solchem Selbstvertrauen zu behaupten pflegen, -- all die Sicherheit und Unfehlbarkeit außerhalb dieser leitenden und entscheidenden Gefühle, -- nein, -- daran glaub' ich auch für Sie nicht.«

»Sie sind eine große Philosophin geworden,« bemerkte er halblaut.

»Wie? Sie geben's mir zu?« fragte sie überrascht, »welch ein fremder, guter Geist der Nachgiebigkeit ist denn nur über Sie gekommen? Aber es ist wahr, warum sollten auch Sie es nicht einmal fühlen, wie abhängig wir alle vom Glück sind, -- wir armen Weltkinder alle? Vom fruchtbaren Erdfleckchen, auf dem auch für uns noch ein ganzes Glück, eine ganze Liebe, -- und dadurch allein! -- auch eine ganze Pflicht und Heiligkeit wachsen kann.«

»Und wenn wir dies Erdfleckchen, gerade dies, nicht bebauen dürfen?«

»Dann verdorren wir, -- oder verschleudern uns. Wenigstens ich. Und Sie auch.«

Ein Diener erschien in der Portierenthür und bat zur Tafel.

Warwara stand auf.

»Geben Sie mir den Arm. So ernst? Ich habe Sie doch nicht verletzt?«

»Nein. Sie haben ganz recht. Hatten recht, als Sie einmal vor langer -- sehr langer Zeit zu mir sagten: ›Wir haben eine gemeinsame Versuchung.‹ Es erkennen, heißt hart werden, -- gegen alles, was uns hindert, uns fruchtbar auszuleben.« --

Auf dem Lande saßen Klare-Bel und Jonas nebeneinander bei Tisch. Jonas fand: einander gegenüber, das sei zu feierlich. Es machte ihm Spaß, dabei die Mutter zu bedienen und ihr vorzulegen, von allem das Beste. Er war bemüht, sie zu unterhalten.

Klare-Bel hörte nicht recht hin; ihre Blicke hingen an einem Brief, den Jonas mitgebracht hatte. Er war erst nach Eriks Anwesenheit in der Stadtwohnung dort eingelaufen.

Von Ruth. Ganz außer der Zeit. Klare-Bel konnte eine schwache, thörichte Hoffnung nicht unterdrücken, die mitten in Jonas' harmloses Geplauder hineinredete.

Als Erik, bald nach dem Abendthee, zu Hause eintraf, bemerkte er sofort den Brief, der für ihn bereit lag. Sein Blick streifte Jonas, -- flüchtig nur, -- aber Jonas stand sofort auf, um hinauszugehen. Der Vater wußte doch ganz gut, wie schwer ihm das fiel, -- aber er sollte ihm nicht noch einmal, wie in jener Nacht vor Ruths Abreise, Mangel an Selbstbeherrschung vorwerfen. Jonas gehorchte ihm jetzt immer blind, -- auf den Wink; denn schickte er ihn auch aus dem Zimmer: er führte ihn ja doch den Weg zu Ruth.

Klare-Bels Augen hingen mit unaussprechlicher Spannung an Erik, während er den Brief erbrach. Eine einzige Sekunde, -- die Seite umgerissen, -- eine zweite, blitzschnell, -- und er ballte das Papier in der Hand.

Er war grau im Gesicht.

»Erik! was ist es? -- etwas Schlimmes, -- für dich Schlimmes, -- Erik!«

Sie entsetzte sich vor dem veränderten Ausdruck in seinen Zügen.

Er entfaltete das Papier wieder, nur die Hand ballte er. Vor seinen Gedanken schwirrten vier Worte: »Ich habe ihn lieb«, und, am Schluß, etwas wie »den Kuß gab ich ihm«, -- mehr hatte er nicht gelesen. Er biß die Zähne aufeinander.

Das zu lesen, jetzt, vor den Augen seiner Frau.

Er las es, aufrecht stehend, hell beleuchtet, vor der Lampe.

»Am Schloßberg. Dienstag.

Ich soll Ihnen von Jurii schreiben, sagt Frau Römer. Ob ich ihn lieb habe. Ich habe ihn lieb. Und ich soll alles so erzählen, wie es gewesen ist. Es ist so gewesen: Um den Schloßberg stürmte und regnete es. Ich durfte nicht in die Stadt hinuntergehen, weil ich mit Husten zu Bett gelegen hatte. Ich ging aber doch hin, um mir ein Buch für meine Arbeit zu holen. Unten fand ich Jurii, und er brachte mich nach Hause. Wir gingen unter einem Schirm und mußten uns gut zusammendrücken. Es war aber sehr glatt, und Jurii mußte immer nur achtgeben, daß ich mit den Galoschen nicht ins Rutschen kam. Da sagte Jurii zu mir: ›Ich liebe Sie. Ich liebe Sie so sehr. Werden Sie, bitte, meine Frau.‹ Das sagte er aber russisch, und darüber fing ich an zu lachen, denn wir sprechen ja immer deutsch. Da sagte er noch: ›Ich weiß jetzt, daß Sie mich nicht wiederlieben. Dann gibt es kein Glück mehr auf der Welt. Sterben möcht' ich.‹ Darüber, daß er sterben wollte, wurde ich ganz traurig, und er wurde es auch. Wir achteten nicht mehr auf den Schirm und auf die Galoschen, ich verlor einen, und der Regen lief uns in den Rücken. Frau Römer schalt sehr, als wir pudelnaß ankamen, steckte mich ins Bett und kochte heißen Thee auf. Ich lag und weinte, denn ich wußte nicht, wie ich es anfangen sollte, damit wir wieder vergnügt sein könnten. An derselben Wand stand aber im Nebenzimmer ein Diwan, und da lag jemand und that dasselbe. Frau Römer kam herein, und horchte, ob nebenan auch jemand weinte und lächelte etwas und sagte, wir wären rechte Kinder. Darauf setzte sie sich an mein Bett und streichelte mein Haar zurück (das thut sie gerade so wie Sie) und fragte: ob ich Jurii denn nicht ein wenig lieb hätte. Ich sagte: ›Ja.‹ Da sagte sie: ›Ich meine es anders. Denke einmal nach, was dir das Schönste auf der ganzen Welt ist? gehört Jurii dazu?‹ Ich dachte nach und sagte, das Schönste auf der ganzen Welt sei ja, daß ich Ihr Kind sei. Darauf sagte sie: ›Vielleicht jetzt noch. Aber kannst du dir denn nicht denken, daß es später noch viel, viel schöner wäre, einem andern zuliebe Braut zu sein?‹ Das konnte ich mir nicht denken. Da fragte sie nichts mehr. Sie küßte mich und ging fort.

Heute ist Jurii fortgereist. Er will nicht mehr hier studieren. Ich stand gerade bei meinen vielen Schneeglöckchentöpfchen, die ich im Februar unten in der Gärtnerei gepflanzt habe. Ich schnitt die aufgeblühten ab für Frau Römers Glas, damit sie wieder gut sein sollte. Da kam Jurii in mein Zimmer. Er wollte die Blumen haben und einen Kuß. Er sah so blaß und verweint aus. Ich gab ihm die Blumen. Und den Kuß gab ich ihm auch.

So ist es gewesen.

Ruth.«

Klare-Bel hatte ihre Augen vom Lesenden abgewendet. Sein Gesicht verriet alles, was im Brief stand. Allzu deutlich verriet es, daß sein Schreck umsonst gewesen war.

Erik in dieser Abhängigkeit zu sehen von dem, was Ruth that oder unterließ, -- das war gräßlich. Das wollte sie nicht sehen.

Sie hatte gemeint, das Schwerste sei über sie gekommen: gestern. Aber nicht, es zu wissen, war das Schwerste, -- nein, es mit wissenden Augen zu beobachten, täglich, stündlich, es bestätigt zu finden in solchen kleinen Vorgängen. Dieses Lieben und Schwanken mit anzusehen, -- das war schwerer. Nicht nur schwerer, -- unmöglich war es.

Und dann, -- wenn Ruth einen andern abwies, -- dann liebte wohl auch sie Erik. Und wenn sie ihn liebte -- dann erst war er für Bel verloren. Auf sein Glück konnte er vielleicht verzichten -- für Bel; auf Ruths Glück nie. Nicht, wenn er sie wirklich liebte. Wo die stärkere Liebe blüht, da wächst auch das stärkere Pflichtgefühl: da sorgt man nur noch um das Glück des andern.

So empfand Klare-Bel.

Am nächsten Tage fehlte sie beim Morgenfrühstück. Gonne hatte es ihr auf ihr Zimmer bringen müssen.

Erik suchte sie sofort auf. Er war schon in aller Frühe aufgestanden und hatte, nach mehreren vergeblichen Versuchen, Ruth geschrieben. Aber diesmal gelang es ihm schlecht, -- ein gequälter Ton klang durch.

Klare-Bel lag im Morgenrock auf ihrem früheren Ruhestuhl, eine Felldecke über den Knieen. Sie sah nicht krank aus. Vielmehr klar und gesammelt.

»Du bist doch nicht leidend?« fragte er dennoch, mit ehrlicher Sorge.

»Ich bin nicht leidend, Erik. Aber ich mußte dich bei mir haben. Allein -- ganz allein, -- ohne Jonas.«

Und sie umfaßte seine Hand mit ihren beiden Händen.

»Um dich zu bitten: laß mich jetzt abreisen! Jetzt schon. Es sollte ja doch bald sein. Laß es jetzt sein!«

Er schwieg einen Augenblick. Diese Bitte war beredt.

»Wenn du es durchaus willst, Bel. Dann soll es beeilt werden. Ich will alle Sorge dafür tragen. Ich bin jetzt gebunden. Aber Jonas soll dich hinbringen.«

»Ach nein, Erik! Laß mich allein hin. Nicht mit Jonas. Gonne genügt. Ich bitte dich so sehr darum. Mit Jonas bin ich nicht allein. Er hat so feine Augen. Vor ihm will ich nicht --«

Sie brach ab; aber der einzige Stolz, den sie besaß, ihr Mutterstolz, schrie in ihr: »Vor ihm will ich mich nicht in meiner Schwäche zeigen, in meinem Elend!«

»Nun gut. Auch das. Dann soll er dich nur bis über die Grenze bringen. Darauf bestehe ich, Bel.«

»Ich danke dir. Und nun muß ich dir noch das andre sagen, Erik.«

»Was denn?«

Er schritt unruhig ein paarmal durchs Zimmer und lehnte sich ans Fenster. Sie sprach so klar und so ruhig bewußt. Er kannte seine Bel vollkommen, -- jede leiseste Regung in ihr kannte er, -- und beeinflußte er. Und nun ging von ihrem Wesen ein ihm Unbekanntes, ihm Entrücktes aus, -- etwas Fremdes. Er fühlte es, ohne es sich noch erklären zu können, wie einen Druck auf die Nerven. Ein ganz seltsames Gefühl: als sei noch ein Dritter im Zimmer.

»Ich will es nur lieber schnell heraussagen, Erik. Das andre ist, daß auch du verreisen sollst, -- so bald als möglich. Nicht erst zum Sommer, um mich abzuholen. Bald, -- eher, -- in den Ostertagen. Wo du zwei Wochen Zeit hast. Um sie wiederzusehen. Um dich zu überzeugen, ob wohl auch sie -- --. Ganz gewiß, das mußt du thun. Denn sonst bist du zeitlebens unglücklich, Erik. Und das -- siehst du -- das könnt' ich ja nicht aushalten.«

Die Röte war ihm übers Gesicht geschossen. Dunkelrot bis über die Stirn. Er warf den Kopf zurück gegen das Fensterglas.

Das war es: eine neue Stütze besaß sie, die sie selbständig gehen und handeln lehrte! Einen neuen Herrn: schon handelte sie auf sein Geheiß!

Wie hatte er nur an Kampf denken können -- mit Bel! Kampf? Nein, ausrauben, ausplündern wollte er sie! Aber sie ließ es nicht zu: sie beschenkte ihren Räuber, -- freiwillig, überreich beschenkte sie ihn: »Nimm, du Armer, vom Glück Abhängiger, -- ich kann's entbehren, bin die Stärkere, -- ich kann entsagen, -- du -- nicht.«

Und glühend brannte in ihm die Scham empor, -- glühende Scham, -- und Auflehnung als einzige Antwort: »Tausendmal lieber ein Räuber als ein Beschenkter!«

Klare-Bel sah den Schweigenden, Wortlosen nicht an. So ganz ergriffen und benommen war sie von dem Schweren, das sie vorhatte, daß ihre Blicke ihn nicht suchten, nicht befragten, wie sonst wohl.

»Heut nacht lag ich immer und dachte: wenn es anders möglich wäre! Aber das ist es ja: es ist nicht möglich. Du kannst nicht aufhören, an sie zu denken, und ich, -- wie sollte ich, -- wie sollte ich nicht anfangen, sie zu hassen? Und so versündigen wir uns aneinander, Erik. Das soll nicht sein. Es ist immer alles schön gewesen zwischen uns. Es kann traurig werden, -- sterbenstraurig. Aber nicht häßlich. Das soll es nicht. Ich ertrüg's nicht.«

Ein halber Laut entfuhr ihm. Sie, -- was wußte sie wohl von »Haß«. Von Häßlichem. Nein, nichts! Es erfüllte ihn mit einem fast andächtigen Staunen: in ihr wurden die Gedanken nicht häßlich, nicht bitter und ungerecht, im Kampf und Zweifel, im Aufruhr und

Schwanken der Seele. Sie dachte nichts Häßliches.

»Und nun hab' ich auch verstanden, -- heut nacht, -- warum ich gesund geworden bin,« sagte Bel leiser, als er noch immer schwieg, »und warum wir doch dessen nicht froh werden konnten. Nicht froh, obgleich ich auf meinen Füßen stehen und gehen konnte. Gott sprach darin zu mir: ›Geh!‹«

»Bel!« stieß er gequält heraus. Diese religiöse Exaltation war ihm entsetzlich. Aber Klare-Bel sagte ruhig, beinahe freundlich: »Ja, Erik. Und ich gehe. Gott selbst wollte es so. Er wollte es. Aber Jonas mußt du mir später lassen. Bei mir lassen. Jonas gehört mir mehr als dir.«

Höchstes und Alltägliches ging durcheinander. Erik fand: nun redete sie von der Trennung und Scheidung wie von einem Hausumzug; »dies ist mehr mein, -- dies mehr dein.«

Er trat an ihr Bett.

»Höre mich jetzt an, Bel. Du fassest keinen Entschluß -- über nichts, -- ehe ich jetzt zu dir gesprochen habe. Offen. Offener als bisher. Denn du weißt nicht alles.«

»Ach, Erik, -- sage nichts! Es ist schrecklich, es zu hören! -- Nichts, -- nein! Nur eines -- hätt' ich von dir erbeten!«

Er ergriff die Hände, die sie gegen ihn vorstreckte, und hielt sie sanft fest.

»Es ~muß~ sein, Bel. Du mußt mich hören.«

»Warte noch. Bitte, nicht! Erik, -- sage mir nur erst: -- hast du -- ihr schon geschrieben?«

»Ja,« versetzte er erstaunt.

»Ich meine -- den ~andern~ Brief?«

»Ja, -- auch den andern.«

»Und du hast ihn vernichtet. Nicht wahr, -- das hast du doch?«

In diesem Augenblick wußte er es selbst nicht. Unwillkürlich griff er an die Tasche seiner Joppe. Es knisterte leise unter seinen Fingern.

»Erik! -- das ist das Einzige, -- was ich von dir erbitten wollte.«

Seine Hand krampfte sich zusammen um das dünne, zerknitterte Papier, -- wieder stieg eine Blutwelle ihm ins Gesicht, -- wieder die Röte der Scham, einer feinen, empfindlichen Scham. Nein, -- nur das nicht! Das konnte er nicht! Vor Bels Augen das Innerste, Geheimste bloßlegen, -- sein Heiligstes und sein Unheiligstes, -- den Aufruhr der wildesten Stunde, -- die Andacht der stillsten --.

Aber nur einen Augenblick lang zauderte er so. Sie hatte recht, -- tausendmal hatte sie ein Recht darauf! Und was sie daraus erfuhr, war, was sie erfahren mußte, -- sich zu erfahren scheute. Und wenn es mehr war, als sein Bekenntnis hätte aussprechen können, -- wenn er selbst es war, mit allem, was in ihm tobte, gärte, schluchzte, kämpfte, mit allem Häßlichen auch, und dem Aufschrei nach Glück, -- dann war es gut so.

Vor seinen Worten scheute sie sich, -- vor der endgültigen Klarheit: und in dieses Dunkel griff sie verlangend, -- vermessen. Wer ergründet wohl einer Frauenseele Furcht und Neugier!

Er reichte ihr das zerdrückte Blatt, -- zusammengeballt war es zu einer Kugel.

»Du hast es gewollt.«

Dann verließ er sie.

Nebenan im Wohnzimmer stand der Frühstückstisch noch unabgeräumt. Jonas hatte vergeblich auf den Vater gewartet und zur Schule gehen müssen.

Erik blieb in der Mitte der Stube stehen und starrte ins Leere.

»Nicht entsagen!« war sein einziger deutlicher Gedanke. »Nicht entsagen! nicht in der Versuchung des Mitleids, -- nicht in der schlimmern: der Versuchung der Scham.«

Ihm war, als handle es sich gar nicht um einen einzelnen Menschen, noch weniger um ein Weib, -- nein, um alles, was Mensch hieß, was ihm Mensch sein konnte, -- um alles, was er überhaupt berühren konnte, schaffend, wirkend, liebend, -- um sein eigenes Menschsein.

Es konzentrierte sich alles in diesen zwei kindlichen, gläubigen Augen, die auf ihn warteten und zu ihm emporschauten.

Entsagen hieß: in die Wüste gehen, -- nicht nur mit seiner Liebe, -- auch mit seiner Thatkraft, -- mit seiner Kraft überhaupt, -- ins Unfruchtbare, in die tote Einsamkeit.

Gab es eine Kraft auch für die Wüste? Die in solcher Einsamkeit standhielt? Ja, in ihr vielleicht erst erstand? Die nicht mehr eines andern bedurfte, um stark und schön zu bleiben, -- keiner Augen, die da glaubten, und warteten, und an sie appellierten?

Ja vielleicht! für Reflexionsmenschen, die sich selber über die Schulter gucken, sich in sich selbst bespiegeln, -- spottend oder genießend! Oder für Gefühlsmenschen, die in ihren eigenen Erregungen sentimental zu schwelgen und zu schwimmen wissen, -- auch sie ihr eigenes Publikum!

Aber nicht für solche, die in sich selber unteilbar eins sind und daher auch hilflos in sich selber, -- wenn sie sich nicht dadurch helfen können, daß sie handeln, aus sich heraus wirken, -- und sich selbst erkennen, wiedergespiegelt im Auge eines andern.

Aber Bel? Warum konnte sie entsagen? sie, die weder in Reflexionen noch in Gefühlen schwelgte, sie, die vielmehr naiv und schüchtern war und keineswegs ihr eigenes Publikum? Aber so ging es auch: mit dem großen suggerierten Zuschauer, -- mit dem da oben, der alles sah. Auch sie hatte ihren Spiegel, für den sie sich schön erhalten mußte, -- das Gottesauge, den blauen Himmelsspiegel!

Ein schwacher Laut, wie ein Stammeln oder Stöhnen, drang aus Klare-Bels kleinem Nebengemach. Es war, als wolle sie Erik in seinen bittern Gedanken unterbrechen, -- widerlegen.

Er trat zur offenen Thür.

Bel hatte den Brief von sich geworfen, weit fort, auf den unteren Rand der Felldecke. Sie lag da, das Antlitz glutrot, in den Händen vergraben.

»Lieber Gott!« betete sie, »großer, barmherziger Gott, der du im Himmel bist, und in die Herzen der Menschen hineinsiehst, nimm mir meine Liebe aus meinem Herzen!« --

* * * * *

Warwara war sehr überrascht, als sie am nächsten Tage Erik auf der Straße traf und von der bereits jetzt bevorstehenden Abreise seiner Frau hörte. Sie redete auf das lebhafteste zu, noch eine einzige Woche zu warten und Klare-Bel dann mit ihr zusammen hinausreisen zu lassen. Aber es fruchtete nichts. Schon den folgenden Morgen konnte sie der Fortfahrenden, der sie baldigen Besuch im Bade versprach, einen mächtigen Rosenstrauß in das Waggonfenster stecken. Warwara war außer Erik die einzige, die Mutter und Sohn das Geleit gab, und sie fand, daß die Gatten sich nicht ganz unbefangen gegeneinander verhielten.

Nach Abfahrt des Zuges verabschiedete Erik sich nur kurz und hastig von ihr. Sehr nachdenklich fuhr sie nach Hause.

Ihre klugen Gedanken mißverstanden ihn vollkommen. Sie glaubte ihn eigentlich als Mann in seinem eigenen Heim befriedigt, aber als Mensch in seinem Wirkungskreise unbefriedigt. Und wenn sie, scherzend oder ernst, von »Versuchungen« für ihn sprach, so meinte sie damit gelegentliche Versuche, die hungernde Thatkraft durch Näschereien und Tändeleien zu betäuben. War jetzt so etwas im Spiel? Jetzt, wo Erik so völlig zurückgezogen lebte, -- schon seit einem Jahr? Wo er ganz aus der glänzenden, leichtlebigen Welt der Gesellschaft verschwunden war, die ihn einst fesselte, und die er gefesselt hatte? War eine Frau im Spiel? --

Wenige Tage später, an einem Sonntag vormittag, wollte Warwara eine notwendige Besichtigung ihres Landhauses zum Anlaß nehmen, um bei Erik vorzusprechen und zu erfahren, ob Jonas mit guten Nachrichten von der Grenze heimgekommen sei.

Beim Einsteigen in die erste Klasse des finnländischen Zuges erstaunte sie darüber, sich nicht allein zu finden. In der Ecke ihr gegenüber saß eine ganz junge Dame und blickte mit großen, erwartungsvollen Augen zum Fenster hinaus.

Warwara betrachtete sie mit flüchtigem Interesse. Wie immer, fielen ihr zuerst und hauptsächlich lauter einzelne Aeußerlichkeiten auf.

Ein zarter, geschmeidiger Wuchs; das eng anliegende dunkelblaue Tuchkleid mit offenem Jackenteil, auf tiefrotem englischen Flanell abgefüttert, zeigte nur hoch am Halse einen kleinen weißen Linnenstreifen. Ein schmaler Fuß guckte, in ungeduldiger Bewegung, unter dem Rock hervor. Aschblondes Haar, von einer starken Schildpattnadel im Knoten zusammengehalten, drängte sich um Stirn und Schläfen in seinem Gelock aus einem weichen Barett von dunkelblauem Sammet hervor.

In Warwara stieg eine unbestimmte Erinnerung auf, sie wußte nicht, an wen. Eine junge Engländerin? So eindringlich blickte sie auf ihr Gegenüber, daß dasselbe sich ein wenig befremdet nach ihr umwandte.

Ein paar Sekunden lang erwiderte das junge Mädchen fest und forschend ihren Blick. Dann grüßte sie mit einem schwachen Lächeln.

Das Lächeln half Warwara plötzlich auf die Spur.

»Ruth!« entfuhr es ihr. Sie verbesserte sich sofort, lachend: »Verzeihen Sie nur. Die Zudringlichkeit erst und jetzt. Aber ich suchte und suchte, und was ich fand, war, was mir im Gedächtnis geblieben: Ihr Vorname.«

»Es genügt ja vollkommen,« sagte Ruth. »Ich nehme an, wir haben Einen Weg?«

»Nein!« versetzte Warwara mit raschem Takt, denn sie wollte nicht stören, »ich fahre nur zu einer Besichtigung meines reparaturbedürftigen Landhauses hinaus. Aber unsre Freunde erwarten Sie?«

Ruth errötete und schüttelte den Kopf.

»Nein; ich bin sehr -- ganz unerwartet von Heidelberg abgereist,« entgegnete sie mit auffallender Befangenheit.

Warwara durchzuckte blitzähnlich ein Verdacht. »Das ist sie, -- die ›Versuchung‹,« dachte sie, »sehr jung, aber ich argwöhnte schon damals hinter ihren geübten Formen: sehr durchtrieben.«

»Da wird es Ihnen leid thun, eine Lücke zu finden,« bemerkte sie laut, »denn Sie wissen wohl noch gar nicht, daß Sie Klare-Bel nicht treffen? Sie ist schon abgereist.«

»Nein!« rief Ruth betroffen, »das konnte ich ja noch nicht wissen! Es hat doch keinen schlimmen Grund? Ja, das thut mir leid!«

Sie sah so ehrlich aus mit ihren ungeduldig fragenden Augen, daß Warwara sich schämte. »Sie wußte wirklich nichts davon; es war nicht verabredet; was bin ich für ein häßlicher Mensch!« sagte sie sich, und wandte sich in herzlichem Tone zu Ruth: »Nein, kein schlimmer Grund. Klare-Bel ist so gesund, wie man es nie hat erwarten dürfen, und nun geht es stetig bergauf. Im Anfang des Winters hat sie freilich noch viel aushalten müssen. Einmal sagte sie zu mir in trübem Scherz: ›Erik muß mich mit Gewalt dazu zwingen, gesund werden zu wollen.‹ Eine Operation hat er selbst gemacht, weil die Aerzte es nicht wollten -- ohne Betäubung. ~Der~ Mann hat Eisen im Blut. Aber es hat ihn gehörig geschüttelt. Ich hab' ihn ein paarmal gesehen: blaß wie ein Tuch.«

Ruth lauschte stumm, ihre Hände verschlangen sich in ihrem Schoß, die Lippen öffneten sich halb, die Augen sagten immer nur: »Mehr!« Als Warwara schwieg, atmete sie tief auf.

»Das schrieb er nicht, daß er selbst, -- -- daß er ihr eigentlich selbst die Gesundheit wiedergegeben hat. Aber so mußte es sein! Er kann alles, was er will! Und das wollte er ~so~ aus voller Seele, daß sie wieder gesund und glücklich sein sollte. Er hat dafür gelebt. Wie grenzenlos froh müssen sie jetzt sein! Nun, wo er alles zum Guten geleitet hat! Nun, wo es ist, wie ~er~ will: ~wo sie glücklich~ ist.«

Sie sprach hingerissen; ihre Augen blitzten.

Warwara betrachtete sie nachdenklich. Sie kam ihr gar nicht mehr, wie damals, so formell abgeschliffen und gewandt vor, sondern im Gegenteil wie ein Wesen, an dem alles Beseelung und nichts mehr Form ist. Eine Seele, bis zum Rande gefüllt mit Hingebung und Gläubigkeit, -- -- und Liebe? Dann konnte sie nicht mit so kindlicher Unbefangenheit und Freude sprechen. Keine Liebe? Dann konnte sie nicht mit diesem Blick und diesem Ton sprechen.

Der Zug hielt. Sie stiegen aus.

Warwara bequemte sich dazu, eines der kleinen rasselnden Fuhrwerke zu benutzen, die am Stationsgebäude bereit standen, und deren Kutscher sie sofort umschrieen. Ruth hatte einen andern Weg. So trennten sie sich.

Warwara sah sich im Fortfahren noch wiederholt nach ihr um.

»Es ist etwas an ihr, das nicht in das Leben gehört, -- Poesie. Poesie im Konflikt mit dem Leben, -- was ergibt das wohl?« dachte sie; -- »es ist, wie wenn man die erste Seite eines Romans aufgeschlagen hätte: -- o pfui, nein! -- oder: die letzte eines Märchens.«

Ruth ging langsam hin, zwischen den kahlen Birken am Wegrande; nicht in Hast, ein paar Minuten früher anzukommen. Mit einem lauschenden Gesichtsausdruck atmete sie den Frühling um sich her ein, als ob er in tausend Blüten um sie stände. Noch war er nicht da, man sah ihn nicht, -- und doch war er da, in der Luft, in alles erfüllender unsichtbarer Gegenwart. Man hörte ihn; in einzelnen feinen kleinen Singstimmen sang er von den blattlosen Zweigen.

Der Himmel hatte sich schwach bedeckt, die Sonne schien nur in verhaltenem Glanze nieder, -- Ton, Licht, Farbe wirkten gedämpft, verhüllt, und wie eine Verheißung.

Und nun stand Ruth am alten Lattenzaun mit der knarrenden Gitterpforte. Sie öffnete, durchschritt den Garten und stieg, zaudernd, leise, ein paar Stufen zur Terrasse hinauf.

Vorsichtig vornübergebeugt spähte sie von der Seite her in das breite Fenster des Wohnzimmers, ob jemand darin anwesend sei.

Der Tisch war zum zweiten Frühstück gedeckt; hinter den Tellern mit kaltem Fisch und fleischgefülltem Gebäck dampfte der Samowar.

Jonas saß allein am Kamin. Er hielt eine lange Bratengabel in der Hand, an deren Zinken ein Brotscheibchen klebte, und ließ dasselbe an der roten Holzglut rösten. Wie er so dasaß, einen Arm nachlässig um die Stuhllehne geschlungen, in wartender Haltung, den Kopf mit den etwas zu fest geschlossenen Lippen hell vom Feuer bestrahlt, erinnerte er stark an Erik.

Das Scheibchen geriet zu nah an die Flammen; es glitt plötzlich von der Gabel und fiel hinein.

Jonas sah verdutzt aus. Er wandte sich um, und spießte ein neues auf; diesmal gelang es besser.

Dann spülte er einen Theetopf kunstgerecht mit heißem Wasser aus und machte einen Aufguß. Dabei kamen seine Finger ungeschickt genug unter den geöffneten Hahn des Samowars, und ein siedender Strahl verbrühte ihm die Hand.

Jonas machte den Mund weit auf und fing an auf einem Bein im Zimmer zu tanzen.

Vom Fenster erklang helles Gelächter.

Er blieb stehen, wie wenn ein Blitz von der Zimmerdecke vor ihm niedergefahren wäre. Mit einem ungläubigen Ausdruck, als trauten sie sich selbst nicht, richteten sich seine Augen nach dem Fenster.

Er streckte die Hände aus nach dem Bilde hinter der geschlossenen Scheibe, das ihn auslachte, und das wie Ruth aussah; er wußte nicht, ob er Ruth träumte, oder ob er Ruth sah.

Aber im nächsten Augenblick schon hatte er das Fenster aufgerissen, daß es dabei fast in Splitter schlug, und heraus streckten sich die Hände nach dem lachenden Kopf und hielten ihn fest.

»Aber, Jonas! laß mich nur erst zur Thür hineinkommen!«

»Nein, -- nicht!« murmelte er, als könne sie ihm doch noch wieder wie ein Traumbild plötzlich entschwinden, »nicht abwenden, ich laß dich nicht! Zum Fenster herein! Es muß gehen. Setz den Fuß auf die Rampe, -- ganz fest, -- hörst du? Ich hebe dich.«

Sie sah ihn an: das da sagte er nun ganz so wie Erik.

Das Klettern hatte sie noch nicht verlernt. Mit einem Satz stand sie im Zimmer.

Er ließ sie los. Er trat zurück. Nun, wo sie da vor ihm stand, nicht mehr hinter einer geschlossenen Scheibe, sanken ihm die Arme. Eine grenzenlose Befangenheit überkam ihn plötzlich.

»Wie ist es nur möglich, daß du da bist, -- von wo bist du nur gekommen?« Er starrte sie an, als sei er überzeugt, daß sie vom Himmel gefallen sei.

»Mit dem Blitzzug. Gestern abend. -- Und -- dein Papa?«

»Er müßte hier sein. Aber jetzt vergißt er die Zeit. Stundenlange Gänge macht er, allein, -- seit Mamas Abreise.«

»O Jonas, -- daß Mama gesund geworden ist, -- nicht wahr? Ist es nicht wie ein Wunder, -- immer noch?«

»Ja. Und jetzt werde ich auch Arzt. Weißt du es? Für den Fall, daß du später einmal krank wirst.«

Sie hatte sich an den Kamin gesetzt und betrachtete ihn mit freudigen, übermütigen Augen.

»Hoffentlich werde ich später einmal krank. -- -- Wie ist es dir nur ergangen, Jonas? Du schriebst nie.«

Er sah rot und verwirrt aus.

»Nie? Mir? Ja, ich mußte doch, -- ich dachte ja, -- -- Du! willst du nicht eine Tasse Thee haben?«

»Nein, danke,« sagte sie lachend; »aber die Hauptsache ist: bald kommst du nach Heidelberg, nicht wahr? Wie herrlich, Jonas. Da studieren wir zusammen.«

»Ja,« versetzte er tiefatmend, »-- endlich: -- bald! endlich! endlich zusammen! Ja, -- siehst du: lang wär's so nicht mehr gegangen. -- -- Hab' gelebt wie im Grabe,« fuhr er mit plötzlich ausbrechender Heftigkeit fort, »-- muß in deiner Nähe sein, Ruth. -- Bei dir. Ja, -- du! -- ich liebe ja nur dich. Nur dich lieb' ich, -- -- nimm mir's nicht übel, -- aber ich lieb' dich wirklich. Kann ja nichts, hab' nichts, bin nichts, -- muß mich eben erst durchbeißen, -- aber bei dir sein will ich wenigstens, -- jedem die Faust zeigen, der's auch will, -- der dir nahe kommen will! Jedem! Hüten soll er sich! Niederschlagen jeden -- --«

»Jonas! Du rasest!«

Sie war aufgesprungen, blaß vor Schreck.

Er kam zu sich, versuchte zu lächeln, einzulenken, -- und plötzlich stürzte er vor ihr in die Kniee, das Gesicht in den Falten ihres Kleides.

»Ach, Ruth! sei nicht böse! Du weißt nicht, -- es war ja so schrecklich für mich, -- all die Zeit, -- so stumm in mich hineingewürgt, alles. Sieh mich an, sei nicht böse! Nie wieder, -- es kommt nie wieder, bis --: Ich weiß, -- ich darf noch nicht. Aber einmal, -- ~einmal~ mußt' ich, -- ich wär' erstickt sonst. Ach, liebe Ruth! Ich bin ja so grenzenlos unglücklich, bis -- bis du mein -- mein -- geworden bist!«

»Jonas!« flüsterte sie, »-- Jonas, ich bitte dich, -- steh auf, -- laß mich los, -- du bist wahnsinnig, Jonas! Das kann ja nicht --«

Er klammerte sich an ihrem Tuchrock fest, den sie aus seinen Fingern losen wollte, -- er umklammerte ihre Hand, ihre Hüfte.

»Es kann nicht?!« schrie er fast drohend, und als sie sich mit einer unerwarteten Bewegung freiwand, vergrub er wie besinnungslos seine Zähne in ihren Handrücken.

Dunkel drang das Blut vor.

Sie hatte den Kopf zurückgeworfen und schwieg.

Er stand langsam auf, zur Besinnung gekommen. Er küßte ihre Hand.

»Verzeih mir!« sagte er leise und brach hilflos in Thränen aus, »Ruth -- hast du mich denn gar nicht lieb? Nicht ein kleines bißchen? Was -- was sind wir uns denn? was -- in Zukunft?«

Sie faßte ihn an beide Schultern; -- angstvoll und liebevoll sah sie ihm ins verstörte Gesicht.

»Jonas! Jetzt, -- und in Zukunft, -- und immer, -- ~Geschwister~!«

Er nahm ihre Hände von seinen Schultern, ging langsam die wenigen Schritte bis zur Thür, öffnete sie, -- und stürzte hinaus, über die Terrasse, die Stufen hinab, und verschwand im Garten.

Totenstill wurde es plötzlich im Hause. Nur die Funken knisterten und lohten hell auf im Kamin.

Ruth lehnte am Tisch und blickte nieder auf die Blutstropfen auf ihrer Hand. Langsam errötete sie, immer tiefer, bis ihr das ganze Gesicht in Flammen stand.

Was that sie hier, -- allein, -- im Hause, -- ein Eindringling, -- der Jonas hinausgetrieben?

Die Thür war weit offen geblieben. Als sagte sie: »Geh wieder!«

Ruth sah sich um. Nein, niemand sagte es. Auch Klare-Bel nicht. Nur ihr großer Stuhl stand da, mit einem hohen Schemel davor, -- leer. -- -- --

Als kurze Zeit darauf Erik die Gartenpforte öffnete, saß in der Tiefe des Gartens, den die kahlen Bäume weithin überschauen ließen, Ruth auf der Bank unter den überhängenden Birken.

Erik blieb stehen, blickte schärfer hin, und kam langsam näher. Sie bewegte sich nicht. Wie hingezaubert von seiner Sehnsucht, in den grauen Frühling hinein, so daß sie ~da~, -- in unsicheren Umrissen, -- dann immer lebenswärmer, -- immer beseelter vor seinen Augen, kein blasses Gedankenbild mehr: Wirklichkeit. Weich hob der blonde Kopf sich ab von den weißlichen Birkenstämmen und dem Gehölz dahinter, das die Sonne matt durchdrang, in einem Schattenspiel von rosigvioletten Farben.

Ruth überfiel es wie eine Schwäche, lähmend, je näher Erik ihr kam, je näher die Wirklichkeit sie umfing, die unsäglich ersehnte. »Zu Hause! jetzt erst zu Hause!« dachte sie wie im Traum, und ihre Hände hoben sich ihm entgegen.

Dieses seltsam Stille, dieses Unfähige zu jedem Ausbruch, jeder lauten Bewegung, hielt auch Erik davon zurück, -- als fürchte er zu verscheuchen, was er endlich wieder so beredt, so wortlos beredt und überzeugend vor sich sah: Blick, Ausdruck, Gebärde.

Ueber Ruths Kopf saß in der Birke ein Rotkehlchen, schaukelte sich auf schwankendem Zweig und sang hell.

Wie Erik vor der Bank stand, flatterte es erschrocken auf und flog davon.

Er hatte Ruths Hände ergriffen, er hielt sie fest in den seinen, er zog ihre Hände fest an sich.

»Lieb' -- Liebling!« murmelte er, den Blick auf ihrem Gesicht.

»Ich, -- -- der Brief, -- er machte mir angst,« sagte sie matt, »etwas Fremdes, -- Zweifel war darin. Ich mußte fort.«

Er hörte nur ihre Stimme; er mußte sie wieder hören.

»Mit dem Rotkehlchen -- hergeflogen?« fragte er.

Sie sah ihn an, -- etwas zaghaft, etwas schelmisch; »Durchgebrannt,« sagte sie.

Er setzte sich neben sie, ohne ihre Hände aus den seinen zu lassen.

»Von Römers?!«

»Ich mußte. Sie ließen mich nicht. Römer half mir. Aber sie -- sie blieb unerbittlich. Wie entsetzt war sie. ›Nur jetzt nicht!‹ sagte sie immer. Da brannte ich durch. Noch bei Nacht, -- heimlich. Telegraphierte unterwegs. Ich mußte kommen. -- Durfte ich?«

Sie fragte es schüchtern, um seine nachträgliche Erlaubnis bange, wie ein Kind. Vor Frau Römer hatte sie bittend auf den Knieen gelegen, -- aber das sagte sie nicht.

Er nahm ihr das mützenartige Barett ab und strich ihr das Haar aus dem Gesicht zurück. Ganz wiedersehen mußte er sie.

»Ob du durftest? -- ~Heimkommen~, -- ja! Bei Tag und bei Nacht; heimlich und offen. Es war Zeit. Zwei Wochen später wäre ich gekommen -- zu dir. Vergiß den Brief, -- alle Briefe, -- das Fremde, den Zweifel, -- vergiß alles -- alles. Sei nur bei mir.«

Ja, da war es: das Gefühl der Geborgenheit, süß, zwingend, Heimatsgefühl, -- nein, mehr als nur das, noch etwas andres, -- dieses Unbedingte und Ausschließliche, das keine Macht im Himmel und auf Erden ihr gab: nur er ganz allein.

»Was hast du an der Hand? verletzt? laß es mich sehen,« bemerkte er und wollte das Taschentuch lösen. Sie zuckte zurück. »Thut es so weh?«

»Nein. Nichts. Bitte nicht,« sagte sie hastig, und ein Schatten glitt über ihr Glück.

Erik stand auf.

»Komm hinein. Komm, Liebling. ~Zu Hause~ bist du erst in meinem Zimmer, -- im alten Ledersessel, -- nicht wahr? Und hier ist es noch zu kalt für dich, zu windig.«

Während sie dem Hause zugingen, sagte Ruth: »Unterwegs erfuhr ich durch einen Zufall von der beschleunigten Badereise. Ist es nicht schlimm, daß sie noch in die Schulzeit fiel? nicht in die Ferien? Mir thut es so leid, daß ich nicht mehr rechtzeitig -- --«

»Laß das,« unterbrach er sie halblaut, »-- ich werde dir später alles erzählen, -- später.«

Ruth wandte aufhorchend den Kopf nach ihm. Etwas, das sie fremd berührte, klang aus seinem Ton. Es war nur ein einzelner durchklingender Ton, aber er gehörte nicht zu Erik. Er selbst kam ihr in diesem Augenblick fremd vor. Er sah unverändert aus, -- wie vorhin, -- bis auf den Blick. Der Blick war verändert, unsicher.

Erik ließ sie unbemerkt einen Schritt vorausgehen.

Als sie die Stufen zur Terrasse hinaufstieg, folgten seine Augen aufmerksam jeder Bewegung ihrer Gestalt. Sie war ziemlich stark gewachsen, gleichzeitig hatte sich aber ihr Körper kräftiger, weiblicher entwickelt. Die dunkle Tuchkleidung zeichnete die feinen, weichen Formen ab.

Daß Ruth ihr Haar aufgenommen trug, störte ihn.

»Der Knoten nimmt dich mir fort, -- den duld' ich nicht,« sagte er beim Eintreten in den Flur, und ehe sie es gewahr wurde, hatte er mit geschicktem Griff die breite Schildpattnadel aus ihrem Haar gezogen. In dichten lockigen Wellen fiel es nieder bis zum Gürtel, wie einst.

»Ach nein, -- nicht, -- wo haben Sie die Nadel?« fragte sie verdutzt und griff nach dem Rücken.

»In meiner Joppentasche. -- Aber wiederhole das noch einmal. Nun? ›Sie?‹ oder ›Du?‹. Im Brief stand einmal ›Du‹. Nur einmal? Oder eigentlich -- immer?« fragte er leise.

Sie errötete verwirrt.

»Sie -- -- du -- -- ich --«

Die Hand noch in ihrem Haar, bog er sanft, unwiderstehlich ihren Kopf nach vorwärts, so daß sie das ganze in Glut getauchte Gesicht zu ihm aufheben mußte. Sie schloß unwillkürlich, erschauernd, die Augen und gab seiner Hand nach.

Leidenschaftlich, tiefernst forschten seine Blicke in ihren Zügen.

»Mein. Mein Fürstenkind, meine Königin,« flüsterte er.

Und er beugte sich, und seine Lippen küßten den leise bebenden Mund.

Ruth zuckte unmerklich. Er gab sie sofort frei, und öffnete die Thür zu seinem Arbeitszimmer.

»Hier wartet dein alter Platz auf dich,« sagte er und ging dem Fenster zu. Aber sie war nicht gefolgt. Dem Fenster gegenüber, am Ofen, blieb sie stehn, den Kopf mit dem aufgelösten Haar gegen die weißen Kacheln gelehnt, die Hände auf dem Rücken verschränkt. Ganz versonnen sah sie hinauf zur Zimmerdecke mit fragenden Augen und träumerischem Gesicht.

»Was ist dir?« fragte er unruhig, »-- Ruth! -- was ist dir?«

Es drängte ihn, sie in die Arme zu schließen, -- sie wachzuküssen: »Du liebst mich, -- du liebst mich ja, du weißt es noch nicht, aber ich weiß es für dich! Weiß es gewiß, -- fühle es, sehe es, daß sie da ist, -- daß deine Liebe, die Liebe des Weibes, da ist!«

Aber er schwieg.

Ja, sie war da, -- und doch konnte er so nicht handeln, so nicht sprechen, ohne sie zu verscheuchen. Sie war da, -- wie das Rotkehlchen auf dem schaukelnden Zweig, das aufflog bei seinem Nahen. Sie war da, -- aber greifen konnte er sie nicht.

Erik blickte einen Augenblick schweigend in den Garten hinaus, dann setzte er sich in den alten Ledersessel am Fenster.

»Du bist also doch nicht heimgekommen, Ruth,« sagte er, »nicht ganz zurückgekommen zu mir. Irgend etwas in dir verschließt sich vor mir, -- will mich nicht einlassen. Nicht bis in den geheimsten Winkel deiner Seele. Nicht in alles. Ich bin dir fremd geworden.«

Da löste sie sich vom Ofen, sie flog zu ihm, sie glitt nieder zu seinen Knieen, -- ganz blaß.

»Ja!« sagte sie außer sich, »-- fremd, -- etwas Fremdes, -- ich kann es nicht verstehn und quäle mich.«

»Was ist es? Sage es mir.«

»Ich kann nicht,« murmelte sie.

»Doch, doch! Du kannst. Mußt es wieder lernen, -- zu sprechen, oder auch nur zu stammeln, aus dem Innersten heraus, -- noch aus dem Unklarsten, Unverstandensten --. Es ist nur Scheu. Ueberwinde sie.«

»Es ist, -- im Kuß war es,« sagte sie leise.

»Hat es dich verletzt, -- daß ich dich geküßt habe?«

»Mich?! verletzt? mich?! nein! -- was liegt an mir?«

»-- Für mich -- alles, Ruth. -- Aber warum quält es dich dann?«

Sie verbarg ihr Gesicht in ihren Händen.

»-- Weil, -- es ist dasselbe, was im Brief war, nur in diesem einen, -- als ob er gar nicht von Ihnen kam, -- und dann: wie ich von Ihrer Frau sprach, im Garten, -- und dann: im Kuß, -- da fühlte ich es ganz deutlich, das Fremde darin, und daß es -- --«

»Daß es --?«

»Daß es nicht sein soll,« flüsterte Ruth, »weil es ist, als ob ~Sie~ es nicht sind. Ein Fremder. Ein Schlechterer.«

Er antwortete nicht.

Wie sie aufblickte, schüchtern, fragend, da hatte er die Augen geschlossen.

Nach einer Pause sagte er mit gedämpfter Stimme: »Du täuschest dich. Es ist nichts Fremdes, -- nichts Schlechtes. Ich bin es selbst, -- und in dir selbst ist es, du erkennst es nur nicht, -- mit deinen Kinderaugen.«

Er strich ihr über das Haar hin, und sah hinweg über sie, die, den Kopf unter seiner Hand gebeugt, erwartungsvoll lauschte.

»Weißt du noch, -- als du das erste Mal hier warst, -- was wir da an dieser Stelle miteinander sprachen, und was ich dir versprach? Ich wollte dich aus der Welt der Phantasie, in der du träumtest, in die Welt des wirklichen Lebens führen. Das ist damals geschehen, Ruth, und du bist nicht das Kind mehr, das träumt, sondern ein voll erwachender Mensch, der lebt, -- lebt mit allen seinen jungen Kräften. Aber weißt du, wodurch das gelang? wodurch ich dich so in deinem ganzen Wesen habe bestimmen und entwickeln können? Nur weil es einen einzigen Punkt gab, wohin sich alle vertriebenen Traumgeister, alle verstummten Märchen, alle Mächte der zaubernden und dichtenden Phantasie flüchteten. Dieser Punkt war dein Verhältnis zu mir. Da ging dein Blick noch nicht auf die Wirklichkeit, sondern, über jede Wirklichkeit weit hinaus, auf alles, was einem Kinderherzen anbetungswürdig ist. Da lebtest und gehorchtest du nicht einem Menschen, sondern einem über alle Menschen emporgehobenen Bilde, -- in deinem Innern. Aber diese ganze Traumschönheit, Ruth, in der dein Verhältnis zu mir noch steht, -- sie ist dennoch nur eine glänzende, strahlende Form, eine kindliche Umhüllung, -- nicht das Wesentliche daran. In ihr schläft, wie in einem Märchen, die dir unbekannte Wirklichkeit und Menschlichkeit und wartet darauf, daß sie erwachen darf. Erwachen aus dem Traum zum Leben, wie dein ganzes übriges Wesen.«

Er brach ab.

Sie sah aufmerksam und ernsthaft auf, bemüht, seinen Worten genau zu folgen.

»Deine schönen Märchengeschichten,« fuhr er nach einer kurzen Pause fort, »habe ich dir zerschlagen müssen, weil sie dein volles Leben aufhielten. Das schmerzte nicht sehr, denn die saßen ja nur in deinem Kopf. Wenn ich nun die Phantasiewelt

zerstören muß, die mit deinem ganzen Herzen verwachsen ist, -- und dir Schmerz damit zufüge, -- wirst du dein Vertrauen behalten, Ruth, deine Liebe -- zu mir?«

Sie versuchte aufzustehn, ein Gefühl der Angst überkam sie plötzlich. Er hielt sie zurück.

»Höre mich, Ruth. Wenn ich dir nun sagen würde: der Brief, daß der dir fremd klang, war, weil ich selbst in Zweifel und Zwiespalt und Angst war; -- daß ich dich küßte, war, weil ich nach Glück durstig war und mein Glück langer nicht entbehren kann; -- daß ich es nicht ertrug, dich von meiner Frau sprechen zu hören, war, weil -- ich keine Frau mehr habe, -- weil sie sich von mir trennen wird.«

»Nein!« sagte Ruth atemlos, »das würd' ich nicht glauben. Nicht glauben, auch wenn Sie es mir -- -- Nie und nimmer kann das sein. Kann nicht. Denn sie -- sie war ja so glücklich -- bei Ihnen.«

»Sie?« antwortete er schwer, »-- ja, Ruth, -- sie war es wohl, -- früher. Nicht ihretwegen muß es sein. Meinetwegen. Deinetwegen.«

Ruth hatte sich langsam erhoben. Auf ihrem Gesicht prägte sich ein grenzenloses Befremden aus, -- Zweifel, Unglaube, ja, Entsetzen prägte sich darauf aus. Ihr war, als müsse sie nach einem Entfernten, -- nach Erik rufen, -- ihn zu ihrer Hilfe rufen, vor einem Unverstandenen, Unbekannten. Aber er -- er war es ja gerade, der da vor ihr stand --.

Erik sah den Wechsel in ihren Zügen, die Selbstbeherrschung verließ ihn. Er fühlte nur noch Angst, -- die Angst, sie zu verlieren.

»Ruth!« rief er, »verzeih, daß du vor mir gekniet hast. Ich will es thun, vor dir. Nur sei mein! Nicht nur mein Kind mehr, -- du bist kein Kind mehr, -- ein Weib, -- mein Weib!«

In diesem Augenblick wurde die Thür vom Flur aus aufgerissen. Jonas erschien auf der Schwelle. Er trat nicht ein. Er warf die Thür wieder ins Schloß. Man hörte ihn sich entfernen.

»Jonas!« murmelte Ruth, halb bewußtlos, »-- wir müssen, -- er hat gehört, -- wir müssen nach Jonas sehen.«

Während sie es sagte, ertönte ein dumpfer Fall. Erik sprang auf. Ruth war schon bei der Thür. Sie öffnete sie.

Im Flur lag Jonas am Boden, -- lang hingestreckt. Mit dem Kopf war er im Fallen gegen den Mantelständer geschlagen. Ueber seine linke Schläfe träufelte Blut.

Ruth stieß die Mittelthür auf. Sie half Erik, ihn hineinzubringen in das anstoßende Zimmer, auf sein Bett. In den nächsten Minuten sprachen sie kein Wort. Sie waren stumm um ihn beschäftigt.

»Die Wunde ist gering,« sagte Erik nach einer kurzen Weile halblaut, -- und dann, über ihn gebeugt: »Er kommt zu sich.«

Ruth fuhr zusammen. Sie trat vom Bett zurück; ihre Augen richteten sich auf Jonas mit einem Ausdruck des Grauens, daß er sie erkennen, -- daß er sie sehen würde.

Sie machte Erik ein stummes Zeichen, und ging leise in sein Arbeitszimmer zurück.

Dort blieb sie verwirrt stehen.

Hier? Hier konnte sie noch weniger bleiben. Wo denn? Nirgends konnte sie bleiben, -- nirgends. Im ganzen Hause nicht. Sie mußte also fort. Fort, ehe Erik kam. Fort, ehe Jonas kam.

Und unwillkürlich wandte sie sich wieder der Thür zu, durch die sie soeben aus dem Schlafzimmer eingetreten war.

Nein, -- wohin? Dorthin durfte sie nicht! Abschiednehmen? von wem? Ohne Abschied mußte sie fort. Heimlich. Unbemerkt. -- Für immer?

Sie trat in den Flur hinaus, -- wie hinausgetrieben von ihren eigenen verwirrten Gedanken. Dort blieb sie von neuem zaudernd stehn.

Auf dem Boden, wo Jonas mit dem Kopf hingeschlagen war, sah man ein paar kleine hellrote Flecke. Darüber, am Ständer, hing Eriks Mantel.

Der weite, dunkle Reisemantel, den er damals trug, -- als sie fort sollte, -- und er heimkehrte, -- und als sie ihm an die Brust fiel. -- --

Ruth stand und starrte den Mantel an. Mit klopfendem Herzen und verhaltenem Atem.

Und plötzlich, da wachte es auf in ihr und riß alle ihre Gedanken mit sich fort, -- wild, glühend, unerträglich, -- das Trennungsweh.

Mit den Händen faßte sie den Mantel, sie vergrub ihr Gesicht in seine losen, weichen Falten, mit geschlossenen Augen atmete sie den schwachen Duft in sich ein, der sie an Erik erinnerte, mit bebenden Lippen küßte sie den Saum.

Damals, -- wenn er ihr befohlen hätte, ihm zu folgen, wohin es sei, wozu es sei, -- bis in den Tod, bis in das Verbrechen hinein, -- hätte sie es nicht blind gethan?

Sie drückte die Zähne zusammen; sie stöhnte, und ihr war, als müßte sie gleich laut schreien.

O Gott, auch jetzt, -- wenn er ihr befohlen hätte, ihm zu folgen, wohin es sei, wozu es sei, -- sie hätte es blind gethan! Blind gehorchend, -- gegen allen Augenschein, gegen alles eigene Wissen und Verstehen! Mit ihr durfte er thun, was er wollte. Was ihr auch durch ihn geschehen mochte, -- was lag an ihr? Er aber mußte für sie da oben bleiben, wo sie ihn gesehen, -- sein Leben und sein Haus mußten bleiben, was sie gewesen, -- an ihm lag Alles!

War er sonst noch ~Erik~?

Sie sah ihn vor sich, wie in weiter Ferne, wie er im vergangenen Mai im Mittagssonnenschein dastand, lichtüberstrahlt, die kranke Frau in seinen starken Armen. So hatte Ruth ihn zuerst mit ihr gesehen, -- so ihn geliebt und angebetet, daß selbst das Mitleid darüber verflog. »Du allzuleichte Last!« scherzte er, und Klare-Bel lachte dazu und schlang vertrauend die Hände um seinen Nacken.

Aber nun -- nun riß er ihr die Hände vom Nacken, und das glücklich vertrauende Lachen verstummte, -- und sie, die sich an ihm festgehalten, ließ er fallen, -- er öffnete die Arme und ließ sie, die Hilflose, zu Boden fallen, -- denn eine Last war sie, eine allzuschwere Last für seine Kraft. Frei haben mußte er die Arme, die sich ausbreiteten nach Ruth.

* * * * *

Ruth richtete sich auf; sie strich das Haar aus ihrem Gesicht und schlich langsam zurück in Eriks Arbeitsstube. Auf dem Schreibtisch lag ein Haufen weißer unbeschriebener Blätter. Sie beugte sich darüber und fing an zu schreiben. »Ich muß fortgehen!« schrie es in ihr. Aber Eriks Bleistift formte die Buchstaben ganz anders. So kam heraus: »Ich gehe nicht fort. Ich gehe und bleibe Ihr Kind.«

Sie blickte auf die zitternden Bleistiftstriche nieder wie auf eine fremde Schrift. Das wollte sie also thun? Ja, das wollte sie. Er hatte ja heute gesagt, das alles sei nur in ihrer Phantasie gewesen, in ihrer Einbildung, daß sie sich als sein Kind gefühlt habe, -- so ganz als sein Kind. Aber es konnte doch noch eine Wirklichkeit werden. Wenn sie es selbst verwirklichte. Es in ihrem ganzen künftigen Leben verwirklichte. Wenn sie ganz das wurde, was er sie gelehrt, was er mit ihr gewollt, als er sie zu sich nahm. Ein Stück von ihm, ein Werk von ihm. Sie hatte ja alles von ihm, -- nur von ihm allein. Sie kannte alle seine Gedanken, alle seine besten. Die sollten lebendig werden, nicht nur geträumt: gelebt. Von ihr für ihn.

Ruth nahm das Papier vom Schreibtisch und legte es auf den Lehnstuhl.

Aber trotz dieser kühnen Vorsätze war ihr gar nicht kühn zu Mut, sondern elend und hilflos. Sie hatte ein einziges namenloses Verlangen: sich auf den Boden zu werfen und zu weinen. Erik herbeizuweinen.

Aber da vernahm sie in ihrem Herzen seine Stimme, -- seinen eindringlichen, kurz überredenden Ton: »Den eigenen Willen festhalten! Haltung! Sich selbst gehorchen, -- hörst du?«

Das war doch sonderbar. Klarer, sicherer, wesenhafter denn je stand er ihr bei: Erik gegen Erik.

Leise schlich sie sich aus dem Hause.

Unten erst, an der Gartenpforte, blieb sie stehn und blickte zurück.

Nein, dafür konnte er nichts, -- Erik konnte nichts dafür, daß er anders war, und daß das Leben anders war, als sie es sich ausgedacht hatte. Im wirklichen Leben gab es nun einmal ihre Phantasiegeschichten gar nicht. Die mußte man erst hinzuthun.

Und hatte sie alles das nicht nur geträumt, -- das ganze verflossene Jahr? Wie sie so dastand im Sonnenschein und Vogelsang, da mochte es ihr wohl scheinen, als sei sie zurückgekehrt zum vergangenen Mai, wo sie bange und allein, arm und einsam, hier an der Pforte lehnte und in den Garten sah. Damals meinte sie: von hier ginge der Frühling aus, der ganze wunderschöne, der draußen blühte. Und da träumte sie sich ein Märchen, das »allerschönste von allen«.

Ja, das allerschönste von allen.

So schön, daß sie es nie wieder vergessen konnte. Nein, niemals.

So schön, daß sie es nie hergeben konnte für etwas andres, was ihr das Leben bot. Niemals.

So schön, daß es nichts mehr geben konnte, -- im ganzen Leben nichts, -- was sie nicht immer daran messen, immer damit vergleichen, -- und zu gering befinden würde.

* * * * *

Ruth öffnete die knarrende Pforte und trat auf die Straße hinaus. Ohne es selbst zu wissen, hob sie ihre Hand und strich leise, liebkosend über die kahlen harten Fliederzweige hin, die den Zaun in dichtem Buschwerk umwuchsen.

Dann ging sie, ohne sich noch umzuwenden, mit gesenktem Kopf den Landweg zwischen den Birken zurück zur Station, und ihr langes loses Kinderhaar flatterte im Frühlingswinde. --

* * * * *

Erik stand noch bei Jonas am Bett. Jonas hatte die Augen aufgeschlagen, den Vater neben sich erblickt, war zusammengezuckt und hatte von neuem die Augen geschlossen. Kein Wort fiel zwischen ihnen.

Erik begriff nun den ganzen Zusammenhang, begriff vieles, wofür ihm wohl eher das Verständnis hätte aufgehen müssen, wenn er Gedanken dafür übrig behalten hätte. Der atemlose Fleiß von Jonas, seine Begierde nach Selbständigkeit, sei es auch im engsten Leben, -- dieser Anstrich von Philistrosität, diese Abkehr von aller fröhlichen Unbesonnenheit und Thorheit wurden Erik jetzt verständlich. Nicht Mangel an Temperament, an Jugendfeuer war das gewesen, -- sondern eiserne Ausdauer, Selbstbeherrschung.

Kinderei oder nicht, -- es lag Kraft darin. Er achtete seinen Jungen.

Aber der -- -- achtete ihn nicht.

Jetzt, in dieser Stunde nicht. Ein ganz neues Verhältnis zu seinem Sohn, ein ganz neuer Kampf erwartete Erik jetzt, und er mußte nun seine volle Kraft zusammennehmen, um darin zu siegen.

Ein leises Knaben der Gartenpforte weckte ihn aus diesen Gedanken. Bei dem kaum hörbaren Geräusch durchblitzte ihn ein plötzlicher Schreck.

Er öffnete die Thür zu seinem Arbeitszimmer. Ruth war nicht darin. Er ging über den Flur in das Wohnzimmer. Ruth war nicht da.

Erik stieg in den Garten hinunter. Eine furchtbare Beklemmung drückte ihm die Brust zusammen.

»Ruth!« rief er laut, und erkannte seine eigene Stimme nicht.

Alles blieb still. Es blieb still, wie weit er auch hineinging, bis an die Bank vor dem Gehölz.

Nur ein Rotkehlchen saß auf dem Birkenzweig über der Bank und sang.

Es ließ sich nicht einmal durch die Menschenschritte schrecken; ganz regungslos saß es da, mit erhobenem Köpfchen, ganz selbstvergessen, -- und sang und sang in den grauen Frühling hinein --.

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Spectacle secrets

George Cox

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SPECTACLE

SECRETS.

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BASINGSTOKE:—PRINTED BY ROBERT COTTLE.

[Illustration: No. 1.]

[Illustration: No. 2.]

[Illustration: No. 3.

Anti Pressure

Solid

Blue Steel.]

[Illustration: No. 4.]

[Illustration: No. 5.]

[Illustration: No. 6.]

[Illustration: No. 7.]

[Illustration: No. 8.]

PREFACE.

Every effort of human ingenuity professing to remove or lessen pain and inconvenience, is, naturally enough, hailed with approbation, and the public require not so much to be aroused to estimate fully the advantages proposed, as to be guarded against implicit belief and heedless confidence in the value and importance of the remedy. It is, however, of the utmost importance to be accurately informed what kind of benefit we may fairly expect from the use of the given means, and to what extent this benefit may be obtained; and yet the man who steps forward to state this plainly and fairly, too often fails of the success which his undertaking deserves. Experience proves that such endeavours have been contemned by some, looked upon with cold indifference by others, and viewed with suspicion by nearly all. We are too apt to suspect interested motives, to doubt the sincerity, and undervalue the abilities of men, who have devoted their lives, and the force of their talents, to a particular pursuit; and then, as though this cunning incredulity was closely allied to implicit credence in the wildest chimeras, we become ready listeners, and passive victims, to pompous and plausible charlatans, who make the largest promises, alike indifferent to the practicability or usefulness of their specifics. “It is a great mistake,” said an able English statesman of the last century, “to suppose men harmless because they are blockheads; the dunce thinks neither of country nor of consequences in the pursuit of his petty interests and passions, which may, and often do, lead him to work the greatest public calamities.”

I have refrained from advancing any crude theoretical opinions, which might fairly be questioned. The information conveyed in these pages is of a practical character; has stood the purifying test of time; and, being based upon the immutable principles of optical science, courts every enquiry and challenges all investigation.

My object has been to provide the public with a compendium of sound and standard information on this most interesting and essential subject, in order that, possessing themselves of the truth, and becoming conversant with the real merits of the question, they may no longer be the victims of ignorant, designing, and knavish speculators, who so mercilessly practise on their credulity. I have freely availed myself of facts and observations with which I have become familiar in the course of my own experience and connexion with an establishment of more than one hundred years' standing, and, at the same time, have endeavoured to condense in one publication the essence of many voluminous treatises.

"It is only by condensing, simplifying, and arranging in the most lucid manner possible, the acquired knowledge of past generations, that those to come can be enabled to avail themselves to the full of the advanced point from which they will start."

I have only to add, that though I would not desire to offend the critical acumen of any of my readers, yet, having but little leisure, and those moments of rest being snatched from the busy whirl of commercial pursuits, I have been much more anxious to give solid information in language universally understood, and divested of technicalities, than to employ nice set terms, chosen to please the critic's curious ear.

GEORGE COX.

The first edition of this work having found a ready sale, spite of all the opposition and abuse lavished against it by the itinerant _opticians_, I have reprinted it with such improvements as the kindness of friends and my own experience have suggested.

128, HOLBORN HILL, LONDON, _January, 1844_.

Reviewers' Opinions of this Work.

"The information which this little book contains is really very good and very applicable to the instruction both of the short-sighted, who never reflect before they buy, and of the very long-sighted, who, from excess of cunning in the search of great bargains, are, like our friend Moses in the Vicar of Wakefield, open to very _gross_ impositions in the matter of spectacles and their very _chagrin_ cases. Those who are not opticians or oculists will do well to read the book before they commit themselves in the purchase of glasses either from itinerant or stationary quacks. But this is not all: though a simple monograph of the frauds of one trade, the book may be generalized into "a manual of the whole art of puffing," and an exposure of the silly credulity of the public in all its branches. Mr. Cox also discloses some of the machinery of newspaper puffing in a way which almost tempts us to claim it as "our thunder," it is so much in unison with our published opinions on the subject."

Athenæum.

"In this well-written work Mr. Cox has given a popular description of the eye, and the adaptation of spectacles to correct constitutional defects or organic disease: by attention to a few simple rules which he lays down, any one may effectually fortify himself against the artful representations of dishonest dealers in spectacles "made to sell." The public is indebted to Mr. Cox for having exposed the tricks of the insidious marauders in several towns in which they were practising their impositions, and his tract contains some correspondence between him and several eminent surgeons, from which it appears that they had been represented as vouching for pretended improvements in spectacles, of which they either knew nothing at all, or with regard to which they themselves had been deceived by the fraudulent pretenders."

Christian Advocate.

"This is a useful little work, treating on a subject of universal importance—namely, defining the laws by which deficiency of sight can be assisted, founded on scientific principles, and aided by extensive observation in a long practice; we would recommend a perusal of the pamphlet to such as are about to seek the aid of the maker of spectacles."

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"This little _brochure_ is correct, ingenious, and useful: moreover, it is valuable as exposing the gross ignorance, impostures, and frauds of Jews, pedlars, and other locomotive quacks. The humbug of _amber_ spectacles, _coloured_ pebbles, clarified crystals,

&c., is here thoroughly exploded. Altogether the information in this pamphlet is well deserving of attention."

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"An amusing exposure of the puffing and swindling systems pursued by some self-styled opticians, from which besides may be gathered a good deal of sound, practical information."

Era.

"If every body's sight were impaired, we should strongly hope that this little treatise would become universally known; but as we have reason to believe there are some people in the world who can see a little, we shall only address ourselves to the former, to whom we can confidently recommend the perusal of this talented work. Besides a great deal of necessary and sound information on the use and nature of spectacles, we find a number of _exposés_ of the tricks pursued by many unprincipled persons styling themselves opticians, which is put forth by the author in a very distinct manner."

Blackwood's Lady's Magazine.

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SPECTACLE SECRETS.

CHAPTER I.

“Science should be stripped of every thing that tends to clothe it in a strange and repulsive garb, and especially every thing that, to keep up an appearance of superiority in its professors over the rest of mankind, assumes an unnecessary guise of profundity and obscurity, should be sacrificed without mercy.”—SIR I. F. W. HERSCHEL.

Spectacles and side-saddles, we are quaintly informed, became common in England in the reign of Richard the Second. The ancients, however, knew the power of burning-glasses, and one cunning rogue, we are told, discovered a new way to pay old debts, by means of a round stone or glass used in lighting of fires, with which he melted the bond, written, as usual in those days, on wax. Their burning glasses were spheres, either solid or full of water, their foci were consequently very short and confused. A long interval occurred before spectacles were constructed, and three hundred years elapsed between the invention of spectacles and telescopes.

Our eyes should have our nicest and most tender care, since it is by them we are familiarized with objects of the most exquisite interest and beauty, abounding on the earth we inhabit, and in the starry firmament above us:—

“My soul, while Nature’s beauties feast mine eyes, To Nature’s God contemplative shall rise.”—DODSLEY.

The faculty of sight should be estimated and regarded by us with more than ordinary care, when we reflect that it is the medium through which the most exalted and gratifying impressions are received; and our watchful regard to its healthful preservation and agreeable exercise is the more required from the consideration, that while to its admirable organization and delicate sense of perception we stand so much indebted, those very qualities render it extremely sensitive to injudicious treatment.

It would be a wholesome, fair, and proper regulation, to restrain all from practising as opticians but those practically conversant with the production and application of lenses for the purpose of aiding the exercise of sight. It is considered indispensable for the surgeon and medical practitioner to prepare for his profession by a course of study, reading, and practical operations, and to be subjected to an ordeal where his capabilities are examined and tested. Such an arrangement, though it _may_ sometimes be abused, guarantees to us practitioners who understand their duties; and thus are the many “ills which human flesh is heir to” alleviated and subdued, while those unfortunates who are practised upon by the empiric and miracle-monger, have their calamities aggravated, and their sufferings increased.

It is a question often mooted, how far it is the duty of a just and equal government to interfere in such cases for the protection of its subjects: this, however, is evident, that whatever restrictive laws are framed, if they are attempted to be enforced while a want of information prevails upon the subject, the very people for whose benefit and protection they are introduced, will, likely enough, view them with distrust and suspicion, and, until the imposition has been unmasked, will look upon those who have assumed characters not their own, as persecuted individuals, entitled to their sympathy rather than their detestation. It is by diffusing information, and clearing away obscurity, that we shall erect the best safeguard against delusion. Those who are ignorant are consequently credulous, superstitious, and undefended against the tricks and subtleties of the artful and designing.

If a book is published, our opinion is almost insensibly influenced by what the reviewers say of it. If a new association, a company, or enterprise of any kind is projected, we look to the list of directors, committee, and patrons. Our education and universal custom induces us to pay deference to those whom we suppose to be possessed of superior information, to be men of character and reputation, and entitled, from their position in society, to be regarded with respect.

These legitimate feelings have been so poisoned and tampered with by those who have designedly entered into a conspiracy to hoodwink the people, and share the plunder; and again by the hardly less criminal apathy of others, who, without dividing the spoil, have suffered the trickery to pass unexposed; that professional and literary men cannot but perceive distrust and want of confidence in their decisions, now becoming general among the reflecting and intelligent classes of society, who see that they have been trifled with, and treated as credulous dupes, and that they really have no guarantee for the merits of a production, the purity of a proposal, or the honesty or propriety of any measure to which distinguished names and lofty patronage are appended. The exposé of the practices of the railway, mining, and other bubble schemes illustrates this truth; and the secrets elicited during the discussion on Mr. Serjeant Talfourd’s Copyright Bill, clearly demonstrate how infamously the confidence of “a generous public” has been abused.[1]

The great and benevolent men who existed before us, and devoted their time and contemplations to the interesting science of optics, have fully and clearly demonstrated the laws which regulate the action of light, the cause and effect of luminous phenomena, and the principles upon which vision depends. We have the conclusive and unvarying results of their numberless experiments, performed under every modification of circumstances, to guide us in establishing principles and rules of action, which the studious and practical opticians of our own times have tested, and, ascertaining them to be free from error, now adopt and act upon them.

The captious and consequential may complain of this admission, as tending to detract from the importance with which they might otherwise be regarded; but the optician, who deserves that name, is not anxious to array himself in borrowed plumage, nor to appropriate as his own that which rightfully belongs to others. Granted that we act upon settled and incontrovertible philosophical principles, is it not infinitely more gratifying to have the assurance of a correct result, than to be for ever experimentalizing without arriving at a satisfactory conclusion? The skilful surgeon and the talented engineer are guided in their operations by certain fixed and universal laws, yet no one will dispute that to perform the duties of either of those professions requires much application, skill, and expertness. Precisely so with the optician of the present day. He has fixed, universal, and certain data for his operations; and it is upon his intimate knowledge of these, and the careful and judicious application of them, that his success depends.

When the healthy powers of vision begin to fail, we feel a tender and anxious concern to perpetuate the enjoyment we find to be so intimately dependent upon the uninterrupted exercise of sight, and are instinctively led to seek for a remedy. Much mischief will be avoided, and misapprehension removed, if we consider that in applying artificial aid to the eye, we have to do with one of our most sensitive and easily deranged organs. The human eye is composed of a series of humours and membranes: the outer coating, called the _sclerotica_ (_a_), see _Plate, Fig. 1_, is exceedingly strong, and the muscles which move the eye are attached to it; the white of the eye is a portion of this coating. The _cornea_ (_b_) arches out or projects from the eye-ball; it is transparent, and of a circular form. The next coating to the sclerotica is called the _choroides_ (_c_); it has no muscular motion except at its extremities, near the front of the eye. The _iris_ (_d_) is next apparent; it attaches itself to the sclerotica by a cellular substance called the _ciliary circle_ (_e_). According to the colour of the iris the eye is termed black, blue, hazel, &c. It is composed of two sets of muscular fibres, the one tending, like radii, towards a centre, the other forming a number of circles concentric with the same centre. The aperture in the iris is called the _pupil_ (_f_); it is always round, but varies in diameter as the radial or the circular fibres of the iris are contracted or expanded, according to the quantity and quality of light it is required to admit, acting like a watchful centinel to regulate the amount of rays requisite to transmit a perfect and well-defined image of objects onwards to the brain, which, without its agency, would appear one undistinguishable mass of confusion. The chamber of the eye is darkened by the posterior surface of the choroid membrane having a lining of dark-coloured mucus, called the _pigmentum nigrum_. The last coating of the eye is the _retina_ (_g_), a delicate and most important membrane in the construction of this noble instrument; it is an expansion of the _optic nerve_ (_h_), directly emanating from the brain; and is spread like a net of exquisite delicacy all over the surface of the choroides, terminating at the ciliary ligament. It receives the images of objects by means of the rays of light that enter at the pupil; it is transparent, but appears black on account of the dark pigmentum behind it. The optic nerve passes through a small aperture in the “_architectural dome_” containing the eye, and it conveys the impressions made on the retina into the depository of the brain, where the “very form and spirit of the scene is now conceived.” It is situated a little on one side of the centre of the eye, inclining towards the nose.

To describe more minutely the various fibres, humours, and ciliary processes of the eye, or to enter more fully into its anatomical arrangement, would be incompatible with the design of this publication, which is intended for the “general reader,” and therefore so simplified as that it is hoped he cannot fail to understand. The three transparent humours enclosed by the coats of the eye, viz., the _aqueous_ (_i_), the _chrystalline_ (_k_), and the _vitreous_ (_l_), are, however, too important to be passed over without some notice. The aqueous (_i_) humour it is which gives a protuberant figure to the cornea (_b_); it has a refractive power, similar to that of water, which it also resembles in appearance. The chrystalline (_k_) humour is more transparent than the purest chrystal; its form is that of a double convex lens, which it also resembles in its use, as it converges the rays which pass through it, from every visible object to its focus on the retina. It is suspended in a fine transparent sheathing. The shape or convexity of this natural lens alters occasionally, and shifts a little backwards or forwards in the eye, so as to adapt its focal distance from the retina to the different distances of objects. The vitreous humour is situated at the back of the chrystalline, filling nearly three-fourths of the globe of the eye; it is surrounded by a thin capsule, which sends off a number of membranous processes into the vitreous substance, where they form cells, which, communicating with each other, give a high degree of firmness and tenacity to the whole.

Fig. 2. represents the eye at the time when spectacles are required, the cornea, or the chrystalline, or both, having lost a part of their natural convexity, consequent upon age or constitutional weakness. An object placed at the same distance from the eye as in the perfect eye, (_Fig. 1_), has the focus carried beyond the retina. A convex lens applied to the eye compensates for this loss of capacity, and, converging the rays, corrects the focal distance, and the image is now imprinted naturally on the retina. The reverse of this takes place in the case of the short-sighted; the humours being _more_ convex than in the perfect eye, the rays converge in a focus _before_ they reach the retina. A concave lens carries the focus further on, and, by its aid, an object will be depicted perfectly on the retina.

No. 4 represents a plano convex lens—5, a double convex—6, a plano concave—7, a double concave—8, a periscopic or meniscus lens.

What grandeur and sublimity of contrivance is here blended with simplicity of action and power of expression! How indispensable to a full appreciation of the bounties of nature and the beauties of art by which we are surrounded! To be deficient of this heavenly gift is truly to have “wisdom at one entrance quite shut out.”

Surely every consideration should influence us to treat this invaluable faculty with judicious care, instead of allowing it to be tortured and trifled with by the ignorant and unprincipled.

Having surveyed the general construction, and glanced at the inimitable mechanism of those windows of the soul, we shall be better prepared to understand the reasoning, and to comprehend the principles upon which the science of optics is based. Those of my readers who have leisure to pursue this subject, will find new light, and more convincing illustrations attend their enquiry at every step. It is a subject abounding in beauty and interest, introducing us to new regions of sublimity and grandeur, where the contemplative mind will assuredly find “ample scope and verge enough” to gratify its most exalted anticipations. We have seen the admirable, yet at the same time delicate contrivances by which the functions of the eyes are performed. It cannot fail to have occurred to us, that a machine so beautiful and complete is liable to derangement and improper treatment by the wayward and the ignorant. If it is desirable that a person possessed of a well-constructed watch should understand its general action, and know what treatment it should have to keep it in sound and underanged order, still more essential is it that every individual should possess a clear and familiar knowledge of the nature of vision, and understand the requirements of the eyes. I cannot forbear indulging a sanguine hope that the circulation of this little manual will open the eyes of its readers to the simple facts of the case, and animate them to think and judge for themselves, instead of giving a ready ear to the marvellous and ridiculous tales, which, though, like the sailor’s tough yarn, so often told that the cheat believes them himself, are nevertheless utterly devoid of truth.

FOOTNOTES:

[1] In the month of August, 1838, the solicitor to the Duke of Wellington waited upon Sir Frederick Roe, at Bow-street, in reference to the use which had been made of his grace’s name by “The London Equitable Loan Company.” A gentleman, who was desirous of purchasing shares in the company, seeing the Duke of Wellington mentioned as patron, and that the account of the company was kept with the Bank of England, wrote to the Duke to ascertain if it were true that he was connected with the concern? The duke never had consented to become a patron, but, on the contrary, when asked to do so, answered that he was so situated that he could not comply with their request. On receiving the communication the duke wrote to Sir F. Roe, to see what could be done to guard the public against any transaction which might be entered into in consequence of the use made of his name; and in answer to a letter written by him to the Bank of England, he was informed “that no such company was known there, nor had they any account of the London Equitable Loan Company.” The publicity given to this manœuvre has no doubt saved many a family from enthralment and destitution.

CHAPTER II.

“The subject is of universal importance, since every man, woman, and child in the empire will probably require optical assistance.”—ABBOTT.

The eyes, when in a sound and healthy state, instinctively adjust themselves at a distance of twelve inches from a book or paper, when they are observing the same. This distance is found to be most natural and agreeable; for when we extend it to sixteen, twenty, or thirty inches, the chrystalline lens is stimulated to keep a distinct and clear perception, until, as the distance increases, the object becomes less and less perceptible. When we are compelled to extend this natural distance, experience difficulty in reading small characters, or find it necessary to get more light on what we are observing, we may safely conclude that artificial assistance is needed, and that, judiciously applied, the tendency to decay will be mildly arrested.

The design of spectacles is to supply the loss of power which is experienced by the eyes at different periods of life, and arising from various causes. These productions of art are constructed with a close observance to, and act upon, the same principles as those by which the process of vision is regulated.

Spectacles ought not to do more than maintain or preserve to us the capability of seeing at the natural distance. This is, in fact, all they are intended to effect. When the chrystalline lens of the eye, losing its convexity, fails to converge the rays of light, and bring them to their natural focus on the retina, an artificial lens, of suitable convexity, supplies to it this capability, and compensates for its gradual diminution of capacity. Thus lenses for assisting the sight are fashioned upon the optical principles so apparent in the mechanism of the eye itself, which, it will be observed, is neither round nor flat, but of that nicely moulded convexity which is indispensable for the performance of its functions. If lenses were either spheres or planes they likewise would be ineffective for the purpose proposed.

There is not any material in existence beside pebble and glass, which is calculated for spectacle purposes. The pretended “improvements,” “pellucid lenses,” “refractive transparencies,” “patent amber,” “chrystal preservers,” &c., are new-fangled terms, coined to entrap the uninitiated.[2]

Convex lenses are produced by a series of operations through which a glass or pebble passes, as shaping out from the rough piece, affixing them to the block or frame on which they are worked, grinding their surfaces to the form and focus required, in brass or iron tools of the curvature or radius corresponding. Thus to produce a glass or pebble of any given focal length, we use a tool which is a portion of a sphere or globe of four, five, ten, or any other given radius, or half its diameter. For spectacles usually required, the focus of the pebble or glass, thus fashioned, varies from sixty inches down to five inches. The focus of a convex or magnifying glass is ascertained very readily, thus: hold the lens near to a white surface, as a sheet of writing paper, pinned to the side of the apartment opposite to the window; shift the lens gently backwards and forwards, until the objects before it, as the window frames, flower pots, or the Venetian blinds, are seen inverted upon the paper, clearly and distinctly measure the distance from the paper to the lens, and this distance is the focus: or, by placing a candle at the distance of twelve feet from the paper, and measuring, as before, when the reflected image of the flame is shown most accurately on the paper, we again have the focus denoted. The one method is as much practised as the other; though, in ordering a lens of a given focus, I would recommend a person always to state the method by which he has determined the focus; whether by the sun, or candlelight, which will prevent any mistake arising from the disparity between the two plans pursued.

Concave lenses are made upon the same principle, and pass through similar processes. They are designated by numbers, thus: a concave lens, worked in a tool of four-inch radius, is termed No. 12; five-inch, No. 10; ten-inch, No. 6. &c.

To determine the radius or focus of a concave lens, apply to its surface a convex lens of the same focus, and holding the two together as one glass, between the thumb and finger, at some distance before the eye, give the hand a gentle motion to and fro, and if the objects looked at through the lenses now in contact appear fixed, equal, and of their natural size, then is the focus of the one correspondent to that of the other; but if the convex lens is not of the same focal length as the concave to which it is thus applied, then all objects looked upon will appear to shake and have a tremulous motion.

Another method of ascertaining whether one concave lens is of the same number, and worked in tools of the same radius as another, is to hold one in each hand, placing their edges against each other, with their centres in a parallel line; now withdraw ten or twelve feet from the window, and observe the top and bottom bars of a square of glass: if they appear equal and uniform in all their parts, parallel to each other, and agreeing with the other squares in the window, then are they of the same radius; but if they do not match, the bars will appear disjointed, and higher or lower in one square than in the other. The trial box of sights will be found very useful in making these experiments.

Brazil pebbles, or crystallized quartz, are imported to this country in rough blocks; these are cut or slit, by the aid of pulverized diamond, into slabs or pieces, of the diameter required. Those pieces in which bubbles, waves, or blemishes appear, are thrown aside by the optician who is tenacious of his fair fame, as their imperfections become more apparent in every after-stage of their progress; and when polished, centred, and shaped for the spectacle-frame, they are really improper to be used at all; nevertheless, the needy, or dishonest, rather than lose a fraction of their gains, often persist in working up such imperfect material, and harping upon their being pebble—real pebble—palm them off upon the uninitiated as genuine articles. Pebbles have the following important advantages: they are of equal density, and exceedingly hard, firm, and clear; their surfaces are not liable to become misty or scratched (which circumstance alone often compels a change of glasses): they are of a pure, cool nature, and shew this contrast to glass (which is, on the contrary, produced by the action of artificial heat) in the touch of the finger or tongue to their surfaces.[3] They are, in consequence of these properties, calculated to suit the sight for a longer period than glass; but they need not be thrown aside, when, from the indications already referred to, we find an increase of magnifying power is required, as they can be re-worked readily enough to meet the requirement of the eyes, and at an expense scarcely more than a new pair of glasses, or about one-third of their original cost. The directions for ascertaining the focus of concave or convex pebbles, are the same as described for concave or convex glasses.

This consideration should weigh with those who are apt to be misled by the pretensions of the unprincipled; for pebbles have, in common with many other crystals, a double refracting property, which, if the pebble is cut carelessly, exhibits itself by painfully affecting the vision; two objects, instead of one, are seen, causing a confused and agitating sense of indistinctness, which, in proportion to the exertion of the eye to overcome it, is the more tiresome and distressing. Such faulty and blemished articles, technically called _wasters_, are refused by the optician of any real respectability and character, but are eagerly bought up by those venders, whose object is to purchase what costs them the least money, alike ignorant of, and indifferent to, any other consideration.

Pebbles, therefore, like all the precious stones, which, in fact, are crystals, cannot be properly cut or sliced except in a parallel direction to their natural faces.

Periscopic or meniscus lenses were introduced in the year 1770, and revived at a later period by Dr. Wollaston. Their properties were investigated by many scientific persons, and again candidly examined by Mr. W. Jones; yet, notwithstanding the oblivion to which they were consigned by the universal consent of practical opticians, they are still foisted on the public, under various disguises, and embellished with sundry new appellations. They are concave on one side, and convex on the other, the inner and outer curve differing, in order to produce a focus. When placed in the spectacle-frame, their convex surface is always from the eye; this necessarily exposes their centres to be rubbed and scratched. The halo, or aberration of light, is greater in lenses of this form than in any other. This can be easily proved by placing a double convex, and a periscopic lens, each of the same diameter and focus, say one-and-a-half inch diameter, and three or four inch focus, edgeways together. Let the image of a lighted candle be thrown against a white wall or paper, in a dark situation, through the two lenses, and it will be conspicuously seen that the periscopic lens exhibits this dazzling indistinctness, while in the double convex lens it is scarcely perceptible.

Parallel or flat surface lenses are produced from tools perfectly level, and without any curvature. For spectacle purposes their only use is as shades or shields for the eye, to protect it from the effects of bright and dazzling objects, dust, and wind. They are, however, indispensable in the construction of sextants, artificial horizons, and other mathematical instruments.

Spectacles for travelling by rail-road, on the old beaten path, or by vessels, are usually fitted with parallel glasses, unless the wearer requires focal power as well as a screen, in which case they are of the concave or convex figure, before explained. Almost every combination of light and shade has been used for this class of spectacles; violet, grey, blue, green, crape, wove wire, &c.; but some sensitive and tender eyes failed to receive the relief expected from any of these, and opticians have been repeatedly baffled in their attempts to produce a shade of glass congenial to the requirements of the eye under such circumstances. I have made extensive use of the new neutral tint, or twilight tinge glass, and find it most agreeable to the eye while employing it, and when removed, it leaves the vision undisturbed by the flickering and confused halo so much complained of after wearing other coloured glasses. The cause of this superiority is clearly seen when we remember that, after taking off a pair of green glass spectacles, every object appears of a red colour, while, upon the removal of blue colours, an orange or yellow mantle seems to rest on all which meets the view.

It is of consequence that all such glasses should be really parallel, otherwise a broken and disjointed appearance will be given to objects, the rays of light being abruptly dispersed instead of being transmitted through the transparent medium to the eye, in their natural direction. I have always discountenanced the use of wire, gauze, crape, and muslin substitutes for glass, because, in my opinion, it is a fallacy to assert that they are cooler and more agreeable to the eye. There is abundant space for the circulation of air in the region of the eye if the spectacle-frame adapts itself pleasantly to the wearer’s face; while the eye and common sense may answer together, that to look on things around us, a transparent medium is preferable to a hazy and indistinct one. We do not choose bars and gratings, or coarse curtains, in preference to glass, for the windows of apartments; but if the light is sometimes too intense, we place a shade to soften its dazzling effects. Such precisely is the reason why tinted glass spectacles, for defending the eyes from rain, dust, and wind, are recommended.

Lenses worked by machinery are produced in greater quantities, within a given time, than those worked by hand. They are passed through the different stages of grinding and polishing without having the keen eye of the workman carefully watching their progress, and adjusting the inequalities in their surfaces or edges, which will always appear more or less in the course of working.

The price at which competition demands those lenses shall be rendered, operates against the wearer of spectacles; for the producer cannot afford to throw aside such as are faulty, and the wholesale agent and retail dispenser cannot expect to have, at the low price charged, lenses which will bear a critical examination; and thus all which can possibly be used are thrust into frames of one kind or other, from the common iron or horn sold by the poor hawkers at sixpence, eightpence, and one shilling per pair, to the more expensive frames; while many faulty glasses, after being dubbed with some ear-tickling appellation, and imbibing extraordinary “light-modifying and refractive virtues,” by passing into the hands of the hawker of a higher class, are palmed upon the unfortunate spectacle-purchasers who are simple enough to give credence to the wondrous tale.

Women and children are chiefly employed to cut and edge those cheap glasses to the spectacle-frames; and who can expect they should do them better for the price? And if one glass should be unequally thick, like a wedge, while its companion in the same spectacles is miserably thin; or if the centres, instead of being equidistant from all parts of the rim are nipped into a corner; how

can you feel surprised when you consider that for them to earn a living, it is necessary they should finish several dozen pairs per day, and therefore, expedition, rather than excellence, is the point at which they aim? In many departments, where machinery has supplanted manual labour, the work produced is of a superior character, and will bear more critical examination; but the contrary is the fact in the case of machine-worked optical glasses, and is more especially apparent in such as are intended for microscopic and achromatic purposes. It cannot be denied that, for all such uses, lenses worked by hand, with the ordinary care of a skilful workman, as much excel those produced by machinery, as the accurate and scientific touch of the artist eclipses the random splash of the plasterer.

The trial box, or frame of sights, ranging from the slightest focal power down to the deepest, is a very useful apparatus, both for the optician and his patient. It consists of eight or nine spectacle-fronts, clamped together at one end by a rivet, on which they are yet free to move. The focus of each pair is stamped on the front. They are enclosed by a pair of lids, which forms a handle, to be held by the hand, while one front after another is placed before the eyes, to determine what focus yields the desired assistance. This being ascertained, and having noted down the power we find to suit most naturally, as explained when treating of convex lenses, page 12, we have only to determine what style of mounting we prefer, and whether we will have glasses or pebbles, for the optician to suit us at once with lenses adapted to the sight, and mountings fitting pleasantly to the head. If an interview with the optician is impracticable, it will be ensuring greater accuracy, to mention the exact distance, measured as a straight line from the centre of the pupil of one eye to that of the other; and if the nose, on the bridge between the eyes, is flat or prominent, broad or narrow, since spectacles, suiting the sight most accurately, are frequently an annoyance, rather than an assistance, to the wearer, from these particulars being unheeded.

Two trial boxes comprise the range of convex sight, one for young persons, and those who require spectacles for the first, second, or third time; the other for those eyes which have been long accustomed to spectacles, or from some constitutional or sudden cause, need those of strong magnifying power. The third box contains concave lenses, ranging from No. 1 to 12, which are the sights chiefly wanted, although, in extraordinary cases, No. 13, 14, and even 20, have been required.

Although, throughout this treatise, I have endeavoured to convince my readers that they may and ought mainly to determine for themselves, yet I would recommend a visit to the optician, where it is practicable, in preference to a description of the case; for the same reason that the best written statement of a patient's malady, sent to a physician, does not afford him that familiar acquaintance with the case which an interview of a few minutes would supply.

FOOTNOTES:

[2] The manufacture of glass was known very early, but glass perfectly transparent and colourless was reckoned so valuable, that Nero is said to have given a sum equal to £25 for two moderate sized colourless drinking glasses.—_Starke's Oriental Letters._

Glass for optical uses is heavy, homogeneous, free from streaks and veins. More expensive chemical substances are employed in its manufacture than are used in making common glass.

[3] Pebbles, again, are proved by grinding the edges briskly on a moderately smooth file, or porous stone; they will resist the action of these, and emit sparkles of light as the velocity of the friction is increased, while glasses, on the contrary, yield, and are ground without difficulty.

CHAPTER III.

"Every day's observation shews how far some men may be carried from the most evident and obvious truths, to support a new hypothesis, which has no foundation either in nature or reason; but truth will ever control and prevail over error, though supported with all the powers of rhetoric and novelty."—B. MARTIN.

Where distance, or any other cause, prevents our having access to persons who are competent to suit us properly with spectacles, great care should be exercised to choose those which cause the print of a newspaper, or the ordinary types of a book, to appear of their natural and proper size, while they are viewed at the distance most agreeable for reading, viz., twelve inches from the eye. It is evidently better to "try spectacles" on such ordinary printing as they will be generally exercised upon, than to test them by the very small print with which persons frequently provide themselves. To decipher this, a greater power is demanded than is requisite for usual reading, writing, and needlework, which are the purposes for which we require them, and not for microscopic observation, nor for distant views.

The eyes in which no malformation or disease exists, but which simply partake of constitutional decay, or, from too continued application to sedentary and studious pursuits, are beginning to feel a want of assistance, should have spectacles of sixty-inch focus, which is an exceedingly slight magnifying power; and if these are found to be insufficient to afford an agreeable and natural perception (not an enlarged or magnified image of the letters of a book, &c., held in the hand at the distance of twelve or fourteen inches from the eye), then apply those of the next power, viz., forty-eight inches' focus. If these again are unequal to supply the loss of power or incapacity of the eye to converge the light to a point at the instant it reaches the retina, then lenses of thirty-six inches focus are to be had recourse to; and when these fail to afford agreeable vision, thirty, twenty-eight, twenty-four, twenty, must be progressively adopted, thus gradually descending the scale until the eyes receive such compensation for their progressive decay and loss of power, as spectacles carefully suited to the sight are capable so effectually to supply.

The period at which the sight begins to fail does not at all depend on age, but varies in different persons according to the formation of the eyes, the treatment they have received, and the constitutional capability; therefore, the age of the person requiring spectacles gives but a vague general idea to the optician as to what is required, unless other particulars are stated; such as whether glasses have been used before; the distance at which writing and printing is seen pleasantly without assistance, the focus of those last used, or sending even but a broken piece of the same.

"The proper selection of spectacles for imperfect vision is a point of much deeper importance than is generally believed. An _oculist_ who is only acquainted with the diseases of the human eye, without possessing any knowledge of it as an optical instrument, is often led professionally to recommend glasses when they ought not to be used, or to fix on focal lengths entirely unfit for the purpose to which they are applied, and the _mere vender_ of spectacles and lenses is still more frequently in the habit of proffering such counsel."—BREWSTER.

The near-sighted, or those who require concave spectacles should use those of the slightest power; No. 0, or No. 1, will generally be sufficient at first, but this, by the aid of the trial box, can readily be determined by the wearer himself. There is such an immense benefit experienced by the short-sighted from spectacles which suit their sight, that to argue for their adoption of them would be quite superfluous. Without spectacles they are excluded from observing beautiful landscapes, recognizing individuals, or viewing to advantage any of the crowd of interesting objects around them; but by adopting them they are placed on a par with the long-sighted in such circumstances, while the sharp and microscopic character of their sight _without_ spectacles, gives them many advantages over those possessing ordinary vision.

The short, or near-sighted eyes, have the cornea, and often the crystalline lens, more convex or arched out than in long-sighted eyes. This formation causes the rays to converge to a focus before they reach the retina, but by the application of a concave lens the difficulty is corrected, and the rays are carried on to their proper point for giving a perfect representation on the retina.

This character of sight is very frequent, and is more particularly remarkable among those whose mode of life restricts them to crowded cities, sedentary employments, and confined situations. Those whose infantine and youthful years have been passed in the country, or where the eyes have had a free range of view, not circumscribed by the walls of the nursery, or limited to the observation of objects near at hand, rarely require concave spectacles.[4]

The spectacle-frames next demand our attention, as our utmost care in judiciously selecting lenses of the proper focus for our sight will be neutralized if the frame or mounting in which they are placed does not apply comfortably to the head, leaving the lenses they carry fair and parallel before the eyes. If the front of a pair of spectacles is too short for the wearer's face, he will look upon the edge of the lens, and a portion of the exterior rim of the frame; if they are too long his eye will meet the opposite edge and inner curve of the rim.

Spectacle-frames are fashioned to suit the variety of formation in different individuals, and therefore such should be applied as adapt themselves pleasantly to the temples, across the forehead and before the eyes. The pupil of the eye should, when looking at an object directly before it, see through the centre of the spectacle-eye, so that if the whole of the glass, except the small centre, were painted black, the rays of light would pass through it without distortion of the pupil. The bridge or nose-part of the spectacle-frame should be arched out, made like the crank of a lathe, or perfectly parallel with the knuckles of the sides, according to the formation of the wearer's nose, otherwise the spectacles sit awkwardly on the face too far from or too near to the eye-lashes, with their centres too high or too low for the natural exercise of sight. Trifling as these particulars may seem, they cannot be neglected with impunity. Where these defects are unattended to, the eye is tortured by straining to overcome the difficulty, and striving to accommodate itself to them, instead of their being shaped to meet its requirements. Some old-fashioned spectacles have

short side-pieces, which press most unpleasantly on one point of the temples, and when closed scratch and rub the lenses. Others have very cumbrous and heavy sides, with double lift or common hinge-joints. These also scratch the lenses when folded up, and can only be worn with any degree of comfort when the head is uncovered. Decidedly the best constructed spectacle-frames are those which, without being clumsy, have enough strength to admit of the sides being extended the full width of the face without bending the front, with single sides rather longer than their front for ladies' use, and with turnpin sides (an extending joint, turning on a pivot,) for gentlemen.

The material of which they are composed should be either gold, silver, or enamelled blue steel. Tortoiseshell, also, when well made, is very light and pleasant to wear, particularly for ladies. There is no advantage in large size, or round-eye spectacles, to compensate for their clumsy appearance and great weight; we get a sufficient expanse of observation with the oval-shape glasses without harassing the eye with an excess of light, which the large glasses admit.

Solid blue steel mountings are a decided improvement, and are invaluable for persons who constantly require spectacles. They are wrought from a plate of steel, and shaped as light and uniform as any other town-made elastic blue-steel spectacles, with the advantage of being more durable, and eventually less expensive; for as they have no soldering in their composition, it is scarcely possible to break them, and therefore they rarely want repairing. Blue steel spectacles, in consequence of their being so much in request, are coarsely imitated, and vast numbers are sold by the pretended cheap shops, at apparently low prices which the wearer will find to be immensely beyond their real value. There are thirteen different qualities of the spectacles termed blue steel. The chief part are country made, and roughly put together, some being all iron, others having iron fronts and steel sides; others again bear a tolerably close resemblance to the best town-made articles, and unless the two are compared together, are likely to deceive a casual observer.[5]

The fine elastic blue steel, of the best quality, are exceedingly light, highly polished, and beautifully enamelled. They will retain their appearance for two or three years, when carefully used; and they can be restored to their original appearance at any time for a few shillings' expense.

The anti-pressure spectacles are made of gold, silver, or the elastic steel. They are not adapted for ladies' use, but for gentlemen have been much in demand, as they obviate the necessity of opening and closing a second joint or lengthening piece, and do not press or annoy the nose or temples, but by an equal tenacity preserve their proper position before the eyes.

Single eye-glasses, though very convenient for occasional use, are not to be compared with spectacles for the agreeable and natural assistance they give to vision. The eye should not be dependent on them for continuous assistance. Those who persist in using them should do so as little as possible; but the wiser course is to discard them entirely, and adopt the double eye-glasses where it would be tedious to apply spectacles of the usual kind.

That the vision is more natural and perfect when both eyes are employed than when one glass only is used, must be self-evident, as the axis of each glass, placed as they should be in the spectacles, coincides with the axis of each eye, and the rays of light are thus equally refracted to the eye. Again, the eyes have a most acute and sensitive sympathy with each other, and when a single eye-glass is constantly used they are unnaturally exercised, and prevented from acting in concert. One eye (generally the right eye) has the glass perpetually applied to it; and very frequently, in consequence of this pernicious practice, becomes of a different focus to the other. Mr. George Adams informs us that he did not recollect an instance of a short-sighted person who had occasion to increase the focus of his concaves if he began by wearing spectacles, but that the cases were frequent, where a single eye-glass had been used, in which the persons had frequently required a change of glasses.

The prices of spectacles are diversified and fluctuating, like all other manufactures, so that to publish a list of prices would only tend to mislead and deceive my readers. For instance, the price of a pair of pebbles, used formerly to be one guinea extra to the charge for glasses; they are now reduced to half that sum. A pair of pebbles, of the concave or of the periscopic figure, were at the same time charged twenty-five shillings. These have been reduced in the same proportion. And it cannot be too universally known, that a person can have a pair of good convex glasses fitted into his spectacles, and correctly suited to his sight, at from one shilling and sixpence to two shillings per pair, by any respectable optician. The poorest person may be defended against the tender mercies of the spectacle speculators; for he really can obtain a better article for his money, both in quality and suitableness to his sight, of the respectable optician, and, upon an average, at _a less cost_ than the cheat contrives, by dint of manœuvring, to extract from him. Good lenses, in plain frames, or, in other words, a good pair of spectacles, may be had, correctly suited to the sight, for two shillings and sixpence. Who then, knowing this, would suffer his sight to be tampered with? Truly, those who would stickle for a

shilling in the price of such valuable and essential instruments

“Deserve not the comfort they shed o’er the soul.”

Yet, at the same time, there is no reason why those exorbitant charges should be submitted to, which are often paid without hesitation by the delighted purchaser, when a pair of spectacles appears to suit his sight.

The love of the marvellous, and the insane thirst for novelties, are strikingly displayed in many inquirers for spectacles. The honest, straight-forward, and disinterested counsel of the established tradesman, is looked upon with scowling suspicion; but the preposterous and shallow pretensions of the empiric, decked with all the paraphernalia of fudge and falsehood, are listened to with eager curiosity. If the writer looked to self-interest as his guiding star, his course would be to preserve silence on these subjects; since it needs not to be demonstrated, that the practice and the profit of the regular practitioner are increased by the patched-up and mangled cases, which are, as it were, provided for him, over and above the number who _legitimately require_ the exercise of his skill. But he despises such mercenary calculations, and contends that “The happiness of mankind at large is a principle that ought to be followed out by all individuals at every personal cost, and against every kind of opposition.”—_Medical Examiner._

FOOTNOTES:

[4] In Russia the person having short sight is seated in a chair for several hours daily, with the head placed in a natural position for reading, but prevented from pressing forward. The page is at first placed at the short distance at which the eyes have been accustomed to observe; but this distance is gradually extended, until the humours of the eyes, constantly exercised in endeavouring to accommodate their powers to the gently increased demand upon them, at length acquire the capability of observing at the usual distance.

It is undoubtedly the fact that this character of sight may be acquired; many instances could be adduced of watchmakers and others, whose employments are of a sedentary or studious character, becoming short-sighted.

[5] It will be perceived that it is the workmanship and nice finish of the best town-made spectacle-frames which necessarily increases the price. Thus, a single pound of pig iron, which costs one penny, can be manufactured into watch-springs of the value of £240.

CHAPTER IV.

“Allured by hope of plunder, and intent By force to rob, by fraud to circumvent,”—ÆNEIS.

I shall give a few instances of the manner in which advertising adventurers rack their ingenuity to dress up their announcements in the most catching and attractive style; and, failing to find language sufficiently striking and pointed to arrest attention, scruple not to manufacture terms and apply similies, which, however preposterous and absurd they are seen to be when examined, yet answer their purpose of mystifying the public, and inducing a purchase of the vaunted articles.

We have only to glance at the columns of our newspapers, and the covers of periodical publications, for illustrations of the extent to which the system of scheming, falsehood, and trickery, termed puffing, is carried. In one specious and lofty-toned announcement we are told that the most splendid discovery of the present age is now admitted, by the most unquestionable (?) testimonials, to be “Grindstone Snuff,” which is warranted to cure gutta serena, cataract, and all other diseases of the eyes, while a single pinch scares away headache and nervousness! Another startles the weatherwise by his impudent pretension to be the _only_ maker of barometers and thermometers in London; whereas, if the real truth were disclosed, it would be found that his connexion with the trade consisted in some such occupation as engraving the index plates of the instrument for his employers, who surely have the greater right to be considered real makers. Balsams, cough drops, rheumatism and gout dispersers, pills, cerates, syrups, shaving soaps, cornplasters, and heal-alls—all boast of the wondrous cures effected, and testimonials received. The long list of essences and decoctions, from vinegar to honey, also have the names of distinguished gentlemen of the faculty, the royal family, nobility, clergy, and gentry, appended as bearing testimony to their surprising virtues. “Highgate’s universal irresistible Ointment” we are informed, is an invaluable specific for all disorders.

“But who shall decide when doctors disagree?”

A counter address denounces the same individual as an _uncertificated impostor_, who has no testimonials of his own, but has filched extracts from the only real original certificates and testimonials of “Monsieur Holabolo’s genuine Panacea,” which alone is a radical cure for all internal and external complaints. Another ointment puffer, whose nostrum is warranted to cure the plague and cholera, among other evils, occupies two columns of a newspaper with cures said to be effected by it; and these are flanked with no less than seventy-six names of surgeons and oculists, who, among others, testify to its monstrous virtues!![6]

Now in all these quack advertisements, we find the names, titles, and residences of the professional gentlemen correctly given, which, possibly may be of some consideration. Indeed, I know it is to some few an advantage not to be overlooked, as their names are thus kept before the public eye free of expense to them, and they are, although indirectly, as effectually puffed into notice as the quack himself. Without charging the respectable and high-minded members of the profession with entering into a compact, and designedly lending the sanction of their name and office to these abominable schemes of imposition, and granting full force to the apologies they offer as to its “being customary;” “that the profession generally do it;” “that to interfere would be expensive and troublesome;” and that “it is the fault of the public, who suffer themselves to be deluded by such shallow artifices,” I conceive it to be the bounden duty of every man of honour, when those tricksters employ his name without his sanction or authority, to adopt measures to disabuse that very large section of society, who attach full credit to statements appearing under such auspices.

But it is with spectacle advertisers that we are more immediately concerned, and it is therefore essential to convince every individual of ordinary capacity, that he can, by the exercise of common sense, and the moderate use of his reasoning faculties, safely and judiciously determine for himself, when spectacles are required, and what powers and qualities they should possess; either when the eyes first require restorative aid, or at any subsequent period of life.

Amber spectacles have been bepraised and forced into notice as much as any of these quack specifics. I consider that the apathy and indifference manifested by those who know the statements put forth to be a tissue of falsehoods, are extremely reprehensible. No wonder that thousands have been tricked and trifled with when such novel and plausible pretensions have remained unchallenged, and those who know them to be hollow and deceitful artifices have suffered them to remain unexposed. Amber is so soft that a proper degree of polish cannot be given to it to make it suitable for spectacles. The streaks, specks, veins, and irregularities in it may be detected by the most casual observer. Glass and pebbles assimilate closely to the composition of the eye itself, but amber only imitates its diseased and decayed appearance. When the powers of the eye begin to decline, the crystalline humour becomes somewhat yellow, and as the decay proceeds this tinge increases.[7] Amber is strongly charged with electricity; it has an affinity for oil, grease, and human perspiration; “and it was from amber that the electrical fluid was first obtained.”[8]

Since writing the above, I have received, by the medium of the twopenny post, a printed circular, headed, “_Amber Spectacles._—M——having experienced from the use of amber spectacles that which is expressed by the following eminent gentlemen, considers it to be his duty to caution the public against the use of them:— “Amber is a soft substance, and it is impossible to form it into a perfect lens, and a lens improperly constructed would prove most injurious to vision. Amber, in a moderate heat, becomes sticky; and by cleaning it in a short time, the polish wears off. It is also easily scratched, and soon loses the little transparency it possesses. Glue, as to substance and colour, is quite equal to it; and although purchasers pay an enormous price for amber spectacles, yet they incur a great risk of materially injuring their vision.”[9]

If there even were any merit or superiority in amber spectacles, be it observed, that the persons who prate about _their_ discovery, are not the parties who originated or introduced the article. I have in my possession several which were first brought to this country, and sold by a Prussian mechanic, long before he came in contact with individuals, who took a shameful advantage of his forlorn situation, and, after deluding him with specious promises, reduced him to their own terms. The poor man found remonstrances to be unavailing; and as he knew that redress was both uncertain and expensive, he refrained from farther interference, sighing as he said,—

“My poverty and not my will consents.”

Cautions respecting amber spectacles have frequently appeared in the daily newspapers. On the 17th of APRIL, 1838, the “_Sun_” contained a long advertisement, lauding their extraordinary virtues. In the same page, followed an exposé of the puff; and in another part of the paper was the following paragraph, made to appear as the editor’s remarks:—

“An advertisement appeared in our paper of the 9th instant, calling into question the merits of patent amber spectacles, which have been so highly recommended for the preservative and assisting qualities for defective vision, by men of high character and professional reputation. The names of Messrs. Dollond and Curtis being used, it is right that the public should be apprised of the

ascertained fact, that it owes its insertion, not to the knowledge of those gentlemen, but to the personal pique of interested individuals."

Persons who are somewhat acquainted with the manner in which such paragraphs are got up, well know what importance is to be attached to them; the uninitiated, however, are led to suppose that Messrs. Dollond and Curtis were not of the opinions expressed, but that some of the trade, jealous of the advertisers' "high character," had maliciously questioned the "superior refractive property," "light modifying," "cool," and "soothing" attributes of the admirable amber. But what ought we to think of the professional and literary characters who countenance the system of fraud and delusion practised by puffing advertisers. We might in charity suppose that the signatures of those eminent persons were surreptitiously obtained; and in that case, the straight-forward course they ought to adopt, should be publicly to disavow all connection with the cheats. But if they really hold the opinions attributed to them, we are bound to declare that, opposed as such idle notions are to truth and common sense, their presumption is ridiculous in publishing opinions on a subject of which they are grossly ignorant—ay, grossly ignorant! however capable and popular they may be in their own professions. Indeed many names of able and skilful surgeons are enumerated in the list of patrons and testimonial writers, who would smile at the effrontery of self-dubbed opticians, and the credulity of the public, conscious that they had no pretensions to any superior acquaintance with the subject. The ingenious and talented Dr. Neill Arnott remarks, in his "Elements of Physics,"—"Will it be believed that _there are medical men_ who neither understand mechanics nor hydraulics, nor pneumatics, nor optics, nor acoustics, beyond the merest routine; and that systems of medical education are put forth at this day, which do not even mention the department of physics or natural philosophy;"

But a general diffusion of knowledge is changing the condition of society, and elevating the human character. At first we almost tremble at our own boldness, in demanding proofs of the capability of our teachers; but the mind, gathering power, and unfolding its strength, with every opportunity for its manifestation, insists on having positive proofs, rather than vague pretensions, and demands solid information, instead of empty nothingness, however gorgeously arrayed, or pompously introduced.

FOOTNOTES:

[6] As for operators on the teeth, they have multiplied exceedingly in the land. Their successful career is a _biting_ satire on the credulity of their supporters.

American Quackery.—The cost for advertising quack medicines in the United States, annually, is estimated at 200,000 dollars. A peck of pills per day is considered necessary for Boston, and half a bushel for New York. On an average, only one in twenty-five who take them is actually sick; and the proportion of those dispensing with some necessary of life to purchase nostrums, which do them a positive injury, is in the ratio of eighty-seven to every one hundred throughout the country.

[7] Dr. Petit found the crystalline in the eye of a man eighty years of age so yellow as to resemble amber.

"When exposed to heat it becomes soft, swells, bubbles up, is apt to take fire, and burns with a yellowish flame."—_Heron's Chemistry._

"It gives out electricity by friction. It is an indurated vegetable juice, and not produced by the laws of crystallization, but by the same causes which influence the mechanical condition of gum arabic, and other resinous substances. Insects are often found embedded in it."—_Parkes's Chemistry._

It is a fact, that to silence such objections, a great improvement in amber, very pure and costly, was announced; this was nothing more nor less than yellow plate-glass, the same as is used in stained-glass windows. I have several specimens of these "superlative patent amber" in my possession.

[8] Dr. Neill Arnott.

[9] Dollond—Curtis.

CHAPTER V.

"Nothing extenuate or set down aught in malice."—SHAKSPEARE.

Some instances which have come under my own cognizance will illustrate the way in which gross imposition is practised, and the public morals materially injured, by weakening confidence in those who are, from their education and rank, looked to as guides and

preceptors, and causing the mind to turn with indignation from the needy, but debased and grovelling creatures, who resort to any means, however infamous, to effect their selfish purposes.

A military gentleman, of Stonehouse, was waited upon by a renowned optical quack, who, the moment he entered the parlour, exclaimed, “Goot Got, Sar! vy, you are a’goin plind; the sight is leaving your left eye! If you don’t immejartly take to my improved classes I vill not answer for the konserkences; kataract will grow on it in a month!” The gentleman, taken by surprise, tried on some of the _preservers_, and finally purchased two pairs of hand-folding spectacles, for which he paid four pounds. Some time after, they were more particularly inspected, and proved to be common glass, instead of pebbles, as was represented, and of much stronger focus than the eyes required. The full London retail charge for _such_ articles is 10_s._ per pair.

In the same town the same _distinguished_ individual forced his way into the study of a reverend gentleman, and alarmed him by a similar prognostication. A pair of the “clarified crystals, ground by a peculiar process,” were purchased, price fifteen shillings. Afterwards, upon finding that one eye was irritated, and derived no assistance from the spectacles, the gentleman called upon the optician who had always previously supplied him, and was convinced of the trick which had been put upon him. They were common machine-worked glasses, each of a different focus, and neither of them suitable to his sight. Their proper price, sold in their proper place (viz., by hawkers, in the streets,) is one shilling per pair!

A gentleman of Norwich, struck with the advantages promised by some extraordinary spectacles, paid two guineas for a pair of blue steel, with blue glasses, which were warranted pebbles,[10] and had the additional vexation to be severely censured by several friends, who complained that the fellow had fixed them with similar trash by representing that he (the gentleman) had said, “After you leave mine, do you go down past the Norfolk Hotel, and say I bid you to call on Mr. and Mrs. ——, to sell them spectacles such as I have bought.” This, of course, was a manœuvre of the cheat himself.

A gentleman, of Tavistock, purchased a pair of silver spectacles, declared to be very fine pebbles, price thirty-five shillings; they were merely glass; and as he required a glass in an old pair of spectacles, the pompous hawker offered to _oblige_ him by putting one of his “clarified lenses” to match the focus: for this he charged five shillings and sixpence. It was two inches different in focal length to the original glass! which would have been properly matched, by any resident optician, for one shilling!

One of the hawking tribe called at the residence of Major C——, near Hereford, and represented that M——, Esq., had ordered, on the previous day, two pairs of spectacles, and desired him to call upon his friend, the major, to suit him also. In this case the attack was parried; and, spite of the hawker’s vehement declaration, that the eyes were in a terrible state, he was dismissed, “to call again to-morrow.” Thus the major preserved his eyes, and saved his money. In the evening he saw his friend, and inquired if he had sent a fellow to his house with spectacles? “No,” was the reply, “but you sent him to _me_; for he came this afternoon, saying you had bought two pairs, and wished me to have some of the same kind; therefore, I bought two pairs, and paid him the price he said _you_ gave, viz., three pounds, ten shillings, though at first he wanted four guineas!”

A naval captain, residing at Monmouth, showed me a pair of silver spectacles with six-inch focus glasses, very jagged and splintered at the edges, worth at most twelve shillings, for which he had given one of the tribe of impostors two guineas, and a pair of tortoiseshell (which _did_ suit his sight) into the bargain.[11]

A lady at Belfast was attracted by the showy advertisement of an itinerant optician, and called upon him, “between the hours of ten and six,” for the purpose of purchasing a pair of spectacles. The first thing he did, after staring at her, and impudently declaring that her eyes were being ruined, was to snatch her spectacles from her face, and put a pair of his own in their place. “There, Matam! they are the spattacles for your eyes, those you have peen vearing vill pring on kataract.” “I see pretty well in these,” said the lady, “but my own suit about as well, I think.” “Oh dear no, it’s quite a mistake, your own are retched; put them on—isn’t there a differench now, Matam?” “Yes, there is,” said the lady, (who had too much penetration for the pedlar) “they require cleaning after having been held in your hot hand all this time;” and taking up a washleather she wiped the glasses, and, replacing them, bade adieu to the _testimonialed_ optician.

A lady, who was visiting for a few weeks at Margate, was startled one morning, by a big, blustering, shewily-dressed man, who, after knocking at the street door, pushed past the servant, and rapping loudly at the parlour door opened it without waiting for any reply. “Goot morning, Matam, I am the optician to the royal family; your friend, Lady W——, terives so much goot from my pellucit lenses, she peggd me to call and suit you.” Before all this had been uttered he had taken a package from a confederate, dressed as a livery servant, who accompanied him, and covered the table with his stock. “Your eyes are in a most alarming state Matam, this pair of cold spattacles will suit you.” “Really,” said the lady; “how came Lady W—— to suppose I wanted spectacles? I have never

worn any at any time in my life." "No, that's the vary reason your sight is leaving you; your eyes are vary pad." "What is the price of this pair?" inquired the lady. "Three guineas" was the answer. The price was paid; and after punishing her eyes for a few days, the lady met with a scientific friend who convinced her that they were totally unfit and improper for her, her eyes being in excellent order, and not requiring spectacles at all!

A gentleman, visiting at Canterbury, in 1834, was induced through the representations of the same notorious cheat to purchase a pair of spectacles, which were warranted to dissipate the cataract forming in his eye; the price paid was five pounds. As he was lamenting the terrible state in which he was informed his eyes certainly were (although, strange to say, he was quite unconscious of it) another pair was placed upon his nose, which, he was told he ought to wear as a change, in case the eyes were pained by the efforts of the first pair to dissipate the cataract. Another five pound note was handed over to the hawker, who began to grow quite pathetic; and artfully alluding to the services of the gentleman during the war, and expatiating upon a few circumstances with which he had made himself acquainted in a chat with one of the gossips at the public house where he lodged, he pretended to lament the necessity for the gentleman staying within doors. "What, may I not take a walk or ride as usual? I can't endure being cooped up within doors." "There's danger in your going out," said the pedlar, "except your eyes are guarded with green Refractive Preservers." "Oh, bless me," said the gentleman, "that's very serious; then you really think I ought to have another pair for walking and riding, eh?" "Oh certainly, by all means; nothing else can save your eyes, unless you confine yourself within doors." "What's the price of such a pair of preservers?" "Six guineas, Sir; but as you have bought the others you shall have them for five pounds." "Why, dear me, I shall be ruined in buying spectacles, and yet I never felt that I wanted them before." "That's just the vay, ven the eyes are a'going blind it comes on all at once, my tear Sir."

By this transaction the pedlar actually pocketed three five pound notes. In less than a week afterwards the first two pair were sent to me to have the yellow coloured glasses exchanged for white lenses of four degrees less magnifying power; the price at which the whole three pairs could have been purchased elsewhere would be forty-five shillings.

It will scarcely be credited that the individuals who thus practise on the public are grossly ignorant; and were it not that the anxiety of the purchasers to possess something extraordinary renders them liable to imposition and allays suspicion, such shallow pretensions never would pass undetected.

One of the tribe, who, until lately, practised the art and mystery of his forefathers as a dealer in old clothes, suddenly changed his _profession_, and, calculating the chances to be two to one in his favour, ventured, neck or nothing, to blazon himself forth as an experienced, scientific, and practical optician. A book, bearing his name as its author, and sundry special appointments, obtained by dint of the most brazen assurance and persevering importunity, were ostentatiously paraded before the wondering eyes of her majesty's liege subjects. The public are stultified, and the eminent individual himself, is almost astonished that the scheme should take, and like the "Fly preserved in amber, wonders how the d—— he came there."

There are artists in his locality who can give many _graphic_ illustrations of the disregard to truth, violation of friendship, and cunning perversion of facts, of which this individual has been guilty, and yet no one has a greater array of eminent names and testimonials to show—many signatures of really clever men having been obtained by some means or other. Surely there is much piquancy and truth in the Spanish proverb: "those who know most are oftenest cheated."

FOOTNOTES:

[10] Pebbles, it is scarcely necessary to say, are colourless.

[11] This gentleman stormed most lustily when made aware of the trick which had been practised upon him, and threatened legal exposure to the "professional optician." But this course is seldom resorted to, the dupes recollecting that, while they publish the swindler's villainy, they give us but an indifferent idea of their own discernment, beside the uncertainty and incongruity ever attendant upon Law, thus quaintly sketched by Bentham;—"If a man give you a black eye, you make him pay for it, but if he put your eye out, you get nothing; and whatever is taken from him goes nominally to the queen—really to John Stokes or Jack Nokes who have no concern at all in the matter. If a man kill your pig, you get the value of it, but if he kill your wife or your child, you get nothing—if any thing is got out of him it goes to a stranger, as before. A man sets your house on fire, if by misfortune, you receive amends, if through malice, you receive nothing."

CHAPTER VI.

“See, arm’d with great authority, they come, And with great names and numbers strike us dumb; Reason and common sense to names must fall, And strength of argument’s no strength at all.”—DODSLEY.

I will now produce a few specimens of Puffing Advertisements, which will show how sounding words are senselessly strung together to give an air of importance to their originators, and leave my readers to judge for themselves how far the public ought to be influenced by them. The orthography (?) of these puffs is, in every way worthy of the authors of them. They are given _pure_.

PUFF, No. 1.

Improved Eye Preservers, patronized by the Faculty of the Eye Infirmaries for Cataract, and other improved glasses.

Mr. —— optician to the Queen,[12] Her Royal Highness the Duchess of Kent, &c. sole Inventor of Optical Glasses, ground and shaded on the Exact[13] Principle. Mr. —— has been for twenty-five years a manufacturer, who has devoted his study with time to bring this branch to perfection. Mr. —— has been earnestly solicited to pay a short visit for a limited period. He has the honour to announce his arrival from the London, Bristol, and Edinburgh Optical Establishments.

Spectacles for far and near distances, for those who have a full eye, ground in a peculiar manner.

Sight is often abused by inexperienced persons taking upon themselves the impracticable task of assisting it.

The Improved Spectacles, and other glasses, made by Mr. —— on the authority of professional gentlemen, are the very best ever invented; they have gone through a different process, which clarifies and makes them the greatest improvement ever heard of by candle light or dull day.

Mr. —— can tell by the physiology and figure of the eye when to give the greatest assistance. His glasses are of a refractive quality; so constructed as to effect the greatest relief; manufactured by machinery of a new construction, and by a peculiar way. Turbid glasses destroy the cornea and iris of the eye, and harbingers all ocular diseases.

*** A book will be given for the use of the Improved Spectacles and advice for all diseases.

Sight is injured by buying Spectacles of Shops, or other _chance_ places of sale, totally unacquainted with vision.

Ladies and Gentlemen whose eyes are weak will, by using these extraordinary Spectacles for two or three hours a week, find their matchless qualities, as they are ground in a peculiar way.

Mr. —— will call with a large Assortment.

LICENSED HAWKER, NO. ——

*** This Circular will be called for.

PUFF, No. 2.

The sight of the aged assisted by the Improved Spectacles, upon unerring principles.

Persons have been going round copying Mr. ——’s Bill, who is the only real original manufacturer of them?[14] it has been the cause of many persons nearly losing their sight, Mr. —— has had fifteen years practice on the eye: there is such a monstrous difference in these improved glasses, that one pair will serve a person his whole life. The sight of the aged assisted, the weak strengthened, and the perfect improved, by Mr. ——’s improved spectacles.

Spectacles for those who have a full eye; the glasses are ground in a peculiar manner. Blindness has took place from the ignorance of persons wearing the glasses in common use, owing to the glasses _drawing_ the eyes. These glasses are highly recommended by professional gentlemen, who view them to be the greatest improvement ever known; they have gone through a different process, which clarifies them, and makes them the greatest improvement by candle light or dull day, qualifying you to see the greatest length of time at one sitting; those persons whose eyes are weak, by using a pair of those extraordinary preservers for two or three hours will find they are ground in a peculiar manner.

A treatise will be given for the use of the Improved glasses, with advice gratis for all diseases of the eye. Mr. —— flatters himself he can perform the most difficult cures in the sight with the greatest ease; there is no complaint of the eye but he is acquainted with.

Mr. —— cautions the public against a person who is selling Spectacles which pretend to be his.

Mr. —— will call with a large Assortment of Improved glasses, which will give satisfaction.

LICENSED HAWKER.

PUFF, No. 3.

Caution against a person taking the name of Messrs. ——, the professional opticians: and imposing upon ladies and gentlemen in selling shameful spectacles, as Messrs. —— improved, and charging forty shillings, while Messrs. —— only charges for the same twenty shillings, or, with pebbles, only fifteen shillings.

PERMANENT RELIEF

for all disorders effecting the eyes, and cases of dimness. Were it necessary,

A HOST OF CASES

might be named by which persons, distinguished, have, by their improved scientific and successful using of their

IMPROVED GLASSES

been much benefitted. The honourable patronage noticed at the head of this article, and their hourly increasing patronage, are proofs of their great skill and talent for

ALL DISORDERS OF THE SIGHT.

They have the honour to be professionally consulted by the chief families in the empire. Imperfect sight can only be handled properly by those who by deep study have a talent for

THE ORGANS OF SIGHT.

Many people injure their sight by buying improper spectacles, whereas it is

THE ESPECIAL OBJECT

of Messrs. —— to rest the claim of patronage on those numerous persons of the first quality.

THE NOBILITY AND GENTRY

May be suited with Spherical Pellucid Glasses, of every class, according to their exalted rank.

THE MERCANTILE AND LABOURING CLASSES

may have their daily toil sweetened by these improved glasses; administered, in cases of distress, on terms accommodating to their situations in society.

LICENSED HAWKER, No. ——, A.

PUFF, No. 4.

For a short time only.

Mr. ——, Optician to their Royal Highnesses the Prince and Princess of ——, King and Queen of ——, has the honour to inform the nobility and visitors of ——, he has arrived from the London Royal Eye Infirmary, for a short time only. A reference to the distinguished patronage he boasts, will convince the public he possesses great skill in the Optic Line, and is without a parallel when such organs as the eyes is liable to evils from common glass and pebbles, one being no better than the other! It is his imperative wish to guard the public against them; therefore, he announces his stay will be for a short period.

LICENSED HAWKER, No. ——, B.

PUFF, No. 5.

MAY BE CONSULTED,

Mynheer ——, Practical and Professional Optician, Surgeon-Oculist and Surgeon-Dentist, announces his arrival. In all recent or chronic weakness, a perfect cure is his far-famed Keysell Spectacles, which have the density and translucency of a diamond, and refractive preserving powers, being composed from rare crystals, produced from the Carpathian Rocks, so highly recommended by the faculty. Mynheer M —— being based upon the greatest perfection which the dento-chirurgical art can be carried, can renovate all decay by his succedaneum, which all the faculty of the continental cities recommend. In two seconds it removes pain, and lasts many years.

But it is to the Keysell Spectacles and Terrence Teeth that he would _draw the eyes_ of his friends to: they are fixed in the mouth so that it is impossible to remove them without wires. They increase the beauty by their elegant matchlessness.

LICENSED HAWKER, No. ——

PUFF, No. 6.

POSITIVELY FOR THIS WEEK ONLY.

Messrs. —— have succeeded, after fifteen years' professional practice, and devoting their whole lives to the optic line, in bringing out a wonderful translucency for the organs of sight, coupled with a conductor for deafness. This wonderful discovery brings faulty hearing to perfection. They are so arranged and combined with scientific principles, with the long practice of the inventors, that they will allow such an extent of relief that will quite astonish every beholder.

They are anxious not to be confounded. There are other people who pretend to the skill of Messrs. ——, therefore the public are liable to be imposed upon. Inferior spectacles can be had of persons calling themselves opticians, but Messrs. —— think it is scarcely necessary to state, that their improved Translucency for Spectacles, and Conductors for Deafness, are manufactured under their own eyes, upon spherical principles.

LICENSED HAWKERS, No. ——

One of the Firm may be professionally consulted from 10 to 6.

PUFF, No. 7.

IMPORTANT DISCOVERY.

Mr. ——, Professional Optician, patronized by the faculty of London, Brighton, Bath, Edinburgh, Glasgow, and Paris.

Spectacles ground and shaded on the exact principle of truth, by Mr. ——, the celebrated Optician from the London Optical Establishment, established for a number of years.

Mr. ——, in consequence of the flattering encouragement he received from the first families, he has established himself here for a short time. He has made the study of vision his own, and can remedy any organic defect, neglect, disease, or imperfection. Many individuals of rank and royalty acknowledge the immense improvement. Mr. —— will send a treatise, explaining every thing in the line, to every house, and will attend himself with a splendid quantity of improved glasses.

As several persons travel through the country in his name, he begs the public to look at his patronage at the top of his circular. He is the sole Inventor of the Improved glasses. They have gone through an elaborate process, they are therefore clarified and pellucid. They throw a clearer light, and more brilliant than any others.

*** At home from 2 till 6.

LICENSED HAWKER, No. ——

Please to observe the brass plate in the window.

How often, too, accompanying such advertisements as the preceding, do we find paragraphs, in the laudatory style, to some such effect as the following (see also page 44). It requires but little penetration to arrive at a conclusion as to who are the authors of them.

PUFF PARAGRAPH, No. 1.—We again call the attention of our readers to Mr. —— and his valuable assortment of Spectacles. They are manufactured with extraordinary care, and constructed upon the strictest scientific principles. M. —— has for a long period past devoted his attention exclusively to that important branch of optics—the human eye;—and the proficiency he has attained of the complicated structure of that noble organ has enabled him to adapt glasses to every degree of defective vision. But the highest panegyric which can be pronounced upon the skill of this artist, is the unprecedented number of applications which have been made to him.

Our readers will observe, that his stay is restricted to a few days.

* * * * *

PUFF PARAGRAPH, No. 2.—We have more than once had occasion to allude to the surreptitious conduct of individuals, who are eager to profit by the established reputation of our resident opticians, Messrs. ——, who are about making arrangements for visiting all the neighbouring towns, making this place their permanent residence.[15]

The “Messrs. ——,” the “resident,” the “distinguished,” decamped at the expiration of three weeks.

FOOTNOTES:

[12] The royal arms appear at the head of this elegant announcement. (Query) Ought not the proper authorities to prohibit such vile use being made of the name of royalty.

[13] Query—_Exaction_ principle.

[14] Were those individuals really _manufacturers_, they would not require a Licence to vend their articles. See Act of Parliament, 50 Geo. III. cap. 41, sec. 23. enacts: “Provided always, and it is hereby enacted, that nothing in this Act shall extend to prohibit any person or persons from selling any printed papers, licensed by authority, or any fish, fruit, or victuals; nor to hinder the _real worker or workers, or maker or makers_ of any goods, wares, or manufactures of Great Britain, or his, her, or their children, apprentices, or known agents or servants usually residing with such real workers or makers only, from carrying abroad or exposing to sale, and selling by retail or otherwise, any of the said goods, wares, or manufactures of his, her, or their own making in any mart, market, or fair, and in every city, borough, town corporate, and market town. Nor any tinkers, coopers, glaziers, plumbers, harness makers, or other persons usually trading in mending kettles, tubs, household goods, or harness whatsoever, from going about and carrying with him, or them, proper materials for mending the same.”

[15] It is gratifying, however, to find that many editors of newspapers repudiate the iniquitous system, perceiving that their readers might justly look upon them as participators in the fraud.

One of the puffing, _professional_ licensed hawkers entered the office of the Reading newspaper, and with the authoritative air of an Alexander, desired that his announcement should appear in the front column, and the _usual_ laudatory paragraph in another part of the paper. He was informed that his advertisement could be inserted, but that the proprietors had determined never to admit such insidious clap-trap notices, which, while they injured the resident tradesman, and were looked upon as the _bona fide_ opinions of the editor, generally referred to matters of which he could not honestly express a favourable opinion. The pedlar stood aghast! “What,” said he, “not put in a paragraph? Why, I’d sooner pay for a good paragraph than care about the advertisement at all.”

His _professional_ visit was of unusually short duration, finding it impossible to bribe the press to trumpet forth his praise.

CHAPTER VII.

“It is a strange thing to behold what gross errors and extreme absurdities men do commit for want of a friend to tell them of the same! The help of good counsel is that which setteth business straight.”—BACON.

I have, for many years, visited nearly every town in the kingdom, on commercial pursuits, at intervals of six months; and wherever I have met with the brazen advertisers alluded to, I have issued public notices, and inserted counter-advertisements, to put my friends and the public on their guard against such egregious imposition. Such a step, spiritedly carried out, has uniformly proved successful, and the notable pretenders have decamped from Bath to Norwich, from Brighton to Carlisle, sometimes assuming other names, or changing the initial letters; as S. and E., who had been vapouring away at Norwich, suddenly flitted to Margate, and

there announced themselves as C. and B., the celebrated opticians from the Royal Eye Infirmaries, &c. &c. For low cunning and unprincipled trickery, such adventurers as I have described, stand unrivalled. Upon several occasions they have echoed my cautions, and copied, word for word, remarks levelled at themselves; hoping thus to shield themselves from detection, and confuse the public in identifying them; as the pick-pocket, when the hue and cry is raised of stop-thief, joins in the shout, in order to allay suspicion.

It is in the provincial towns that such persons are most successful; the game is seldom played in the metropolis with so much effect; and although some of the tribe have been lately launching forth dashing advertisements in the London papers, it is understood to be with the design of attracting country customers, and overwhelming their dupes with an idea of their _professional_ importance, rather than with the expectation of effecting sales in London.

When they sally forth to “fleece the natives,” who would think of questioning the abilities of such renowned opticians, armed with testimonials, credentials, and certificates! _so_ recommended by the newspapers, and patronized by such eminent practitioners?!!

The fair trader would defend himself at the same time that he unmasked imposture, and protected his customers, if, when his neighbourhood is infested by such mountebanks, he advertised the simple truth. He would assuredly find

“That those base slaves, ’ere yet the fight be done, pack up.”

A few extracts from the advertisements I have inserted in the London and provincial journals may be useful as specimens.

“Spectacle swindlers are now practising deceptions upon the public to an unparalleled extent! They are principally wandering tribes of licensed hawkers, who change their names, or shift their residences, as occasion requires; copy the language of honest men, and puff off, as their own inventions, the very articles, which, without a shade of difference, have been regularly made and sold for above two hundred years. To accomplish their designs of fleecing the public, they resort to the most pompous and extravagant eulogiums on the peculiar virtues of their ‘Saxon Crystals!’ ‘Patent Preservers!’ ‘Tinted Amber!’ and ‘Light Refractors!’ ridiculous terms, which _they have_ invented, and which, embellished with a long list of distinguished names, are calculated to entrap, and impose upon the uninitiated.

“Spectacle wearers, beware! those tricksters, with all their lofty pretensions, are ignorant quacks. Their charges for the trash they foist upon you, are beyond all precedent, enormous!

“The flagrant impositions daily practised on Spectacle wearers, by hawkers and ignorant pretenders, imperatively demand exposure. The boasting charlatans are certainly indebted to the silence of practical opticians for their successful career, since persons requiring optical aid eagerly listen to whoever promises most. To those who have been victimized not another word is necessary to direct their choice, but experience calls on all who need optical remedies to profit by advice, and procure such important scientific instruments only of the known working optician or his resident agent, and thereby insure every advantage—better quality, lower charges, a liberal trial, and an exchange if not approved of.”

* * * * *

“The patronage such individuals quote has never been bestowed, or has been surreptitiously obtained. Mr. C. has documents from celebrated oculists stating this fact most unequivocally, and authorizing him to give publicity thereto. He has the gratification of knowing that his efforts to expose such fraudulent delusions, to defend the fair trader, and to protect the public, have been properly appreciated by the reflecting and intelligent, who perceive the impropriety of countenancing persons who resort to falsehood, misrepresentation, and dishonest artifices; and allow the superior claim of the respectable resident shopkeeper, whose charges are fair, whose desire and interest it obviously must be to supply the article which will suit and to make any exchange or alteration if required.

“Beware of the tricksters who blazon forth their pretended discoveries, in terms which, however absurd and ridiculous, nevertheless catch the attention; and combined with an array of great names, unbounded assurance, and various manœuvring devices, enable them to foist their worthless wares upon purchasers at the most exorbitant prices.

“Such charlatans are the pests of science, and speculators on the credulity of society.

“Mr. C. feels assured that his friends, and the public generally, will remark the necessity there is for some one, practically acquainted with the science of optics, to come forward and state the real facts of the case, at a time when bombast and chicanery,

supported by the most shameless falsehoods, are put forth by itinerant hawkers and pedlars—the pretended discoverers of a superior method of constructing glasses for spectacles. He is anxious to expose such deceptions, and to protect the Spectacle wearer from the gross frauds and impositions continually practised in the sale of Spectacles at enormous prices, although made of the cheapest material, and in the most inferior manner.

“Such Spectacles are productive of endless annoyance to the wearer; and, instead of rendering any assistance are instruments of torture, producing the most serious consequences to the sight, owing to their imperfect construction and the misapplication of their powers to the purposes required.

“Persons requiring Spectacles are earnestly recommended to seek advice and assistance from opticians or their agents, of known respectability and experience, who are capable of judging what kind of lenses are necessary in each particular case: and to avoid those charlatans whose ignorance of optics is only equalled by their impudence, in obtruding themselves into houses, and alarming the occupiers by declaring that they perceive serious defects in their eyes, the formation of cataract, incipient blindness, &c., in order to give an exalted idea of the value of the remedies they offer.”

* * * * *

“T. H., Watch and Clock maker, agent to Cox, optician of London, begs to caution his friends against the impositions of itinerant hawkers, who boast of exalted patronage, wonderful discoveries, and superior skill in optics, professing to suit the sight by merely examining ‘the figure of the eye.’ Such individuals frequently enter into respectable houses, and terrify ladies and gentlemen by declaring that they perceive serious defects in their eyes, and, of course, that nothing can avert the evil but their wonderful Spectacles; sometimes pretending that their only motive in calling is from their wish to relieve mankind from the chances of losing their sight, and to enable them to see as well at fourscore years of age as at twenty, while their main object is to fill their pockets at the expense of those who have fallen into their snare.

“The fallacy of their statements may always be ascertained by the parties taking medical opinion of known value, and consulting a respectable optician.

“It cannot be too generally known that the best glass lenses, constructed on the most accurate principles, suited to the purposes of vision, and worked by hand, can be had of all respectable opticians, at from one shilling and sixpence to three shillings per pair, shewing that there can be no occasion for persons, who require a change of glasses in their spectacles, to pay a guinea or thirty shillings, and give up their old pebbles or glasses into the bargain.

“A trick was practised at Brighton, during the season of 1834, which shews that those certificated gentry do not hesitate at trifles.

“Two Jews, licensed hawkers, inserted glowing advertisements in the Brighton newspapers, couched in their usual bombastic style, but naming _one gentleman_ only as having taken up his residence at Brighton, and stating that he would wait upon the nobility and gentry with a splendid stock of his _wonderful_ and _improved_ Spectacles.

“A man called at the houses of the gentry, made many sales at the usual swindling prices, and disarmed all suspicions by inviting the purchasers to call at his residence, and make any exchange they pleased. In some cases, where the price was objected to, or the parties were taken by surprise, not having suspected that they wanted Spectacles until this _experienced professional optician_ told them they did, they were, notwithstanding imposed upon, ‘for,’ said he, ‘to prove that I am anxious to preserve your sight, which is rapidly leaving you, and cataract is growing in your eyes, these Spectacles, which are five pounds per pair, I will leave you at half-price, and you may pay me the balance at any time.’ This offer appeared so very liberal that it succeeded in several instances, and, it is scarcely necessary to say, left to the hawker forty shillings profit, five pounds being only mentioned to get more easily the smaller sum.

“But the most profitable part of the scheme is yet to be told. Those who purchased soon found that something was wrong—the patent preservers gave great uneasiness to the eyes, which, suffused with tears, seemed to grieve at the simplicity and credulity of their owners. The residence of Mr. —— was besieged with complaining purchasers, who, when their turn arrived, were ushered into the presence of the other of the partners, and as the person who had sold them the Spectacles promised to make any exchange they required, they asked for a pair which would suit their sight, or a return of the money paid. The man they now saw looked at them, and asked, ‘Am I the person who sold you the spectacles?’ ‘Why, no,’ was the reply, ‘I cannot say you were the gentleman, but he was uncommonly like you, and he told me he would exchange the Spectacles if they did not suit.’

“‘Then you had better find him and compel him to do so, for the trash he has sold you will destroy your eyes and ruin your sight. He is an impostor; I know nothing of him.’ ‘Bless me,’ said the disappointed purchaser, ‘what a scandalous shame! what would you advise me to do now, Sir?’

“‘Why, _my_ Spectacles are produced after twenty years of deep study and research, and manufactured, under my own eyes, upon improved principles, yet I only ask fifty shillings per pair; but I am sorry for you and though those you have bought are vile rubbish, I will take them in exchange, and thirty-five shillings for my Patent Tinted Crystals, which are the only Spectacles proper for the eyes.’ Thus the reader will perceive a double imposition was effected. A., after performing his part in the scheme of deception, kept out of the way until B. had completed the fleecing of the nobility, gentry, and public, and in a few weeks the _resident_ opticians were on their way to other places, chuckling at their success, and inventing fresh plans of operation.”

* * * * *

Page after page has been pirated from the works of eminent authors, and palmed upon the public as their own composition; consequently, though the advice may be excellent, the parties from whom it appears to emanate are vile plagiarists, whose _practice_ is quite uninfluenced thereby. When imposture disguises itself in such a plausible form the difficulty of detection is increased, therefore our best security against deception is to transact business with men of known reputation. The resident tradesman has a character for fair and honourable dealing to maintain. He can be appealed to if any exchange or alteration is requisite, and the spirit of fair competition, now abroad, is the best security against overcharge from him; while the itinerant vender and pompous advertiser has to repay himself for such forced and expensive means of getting custom by exacting great prices, pushing off coarse and inferior goods, and practising any dishonest trick rather than not effect a sale of his wares. It may be said, with great truth, “his articles are not cried up because they are things that ought to be desired, but they are desired because they are generally cried up.”

The Liverpool Mercury of Friday, Sep. 15th, 1834, has some remarks on this subject, which, as they are important and appropriate to our purpose, I transcribe:—

“We beg to caution our readers against the arts of all those who profess to supply the public with superior Spectacles; we have been for many years connected with the business, and we can assure the public that the Spectacle glasses sold by the advertising eye quacks are precisely the same as those provided by any respectable optician, the only difference being in the price. The charlatan varies his charge according to the gullibility of his dupes; sometimes he puts up with double the proper and regular price, but more frequently he exacts three or four times more than a regular and honest optician charges. We recollect a once famous optical quack, in London, who made a large fortune by cheating the public. He advertised _his_ superior glasses, which he assured the public were all ground to the true parabolic curve by his own hand, and for each of these glasses he charged four shillings, whilst the working optician who lived a few doors from him, and who furnished him with all his glasses, could only get nine pence for the very article for which the puffing eye doctor charged four shillings. As we knew both the parties we pledge ourselves to the fact, and, in conclusion, we advise the public to have nothing to do with quacks, whether they be scientific quacks, who are plentiful enough, or other quacks, who swindle people out of their health and cash at the same time.”

CHAPTER VIII.

“Who will, for him, may boast of sense, His better guard is impudence.”

In the early part of the present year I addressed letters to several gentlemen who figure in the list of patrons to the advertising Spectacle quacks, and enclosed a copy of the advertisements in which their names had appeared as giving unqualified approval to the trickster’s _invention_.

From the specimens I have given of such advertisements it is unnecessary to give a verbatim copy again here; and as the truths which this correspondence elicits apply to one and all of the puffing tribe, I have omitted the names of the individuals particularly alluded to, my object being to expose a _system_ of villainy, and not to denounce _one_ or _two_ rapacious creatures, while the rest of the clique escape detection.

Therefore, although many of the remarks in these pages may seem to have only a local or particular reference, they are applicable to the whole tribe of _locusts_, and describe the species too definitely to admit of mistake. The characters sketched are not caricatures, but, unfortunately for the eyes of her majesty’s lieges, really exist _in propriâ personâ_.

Feeling assured that the Duke of Wellington would rejoice to see an exposure of such tricksters, I forwarded to him a copy of Spectacle Secrets, and the following acknowledgment was promptly returned:—

Walmer Castle, _Nov. 11, 1838_.

The Duke of Wellington presents his compliments to Mr. Cox, and has received his letter and the work referred to: he is much obliged to Mr. Cox for the communication.

* * * * *

Copy of a Letter to FREDERICK TYRELL, Esq.

SIR,—The advertisement enclosed frequently appears in the daily and weekly newspapers, to which, as your name is attached, I beg to direct your attention, and solicit an answer to the following questions at your earliest convenience.

1st.—Have you proved the superior efficacy of the Spectacles, (as stated in the advertisement), and consider they merit your unqualified approbation?

2nd.—Will you oblige me by stating what peculiar advantages you consider them to possess over the usual Spectacles, manufactured by the London opticians?

3rd.—Does your approval extend to all the Spectacles sold by the advertiser, or to those which he designates Amber Spectacles only?

I remain, Sir, yours obediently, GEORGE COX.

To Frederick Tyrell, Esq.

* * * * *

Mr. TYRELL'S Reply.

17, New Bridge Street, Blackfriars. _January 29th, 1838._

SIR,—In reply to your letter respecting Mr. —— I have to state, First, That I am not acquainted with any institution which is designated "The Royal Eye Infirmary," to which he states that he is optician. The Royal Ophthalmic Hospital, in Moorfields, is sometimes so called, but Mr. —— is not optician to that institution.

Secondly, That Mr. —— has not any permission from me to make use of my name in advertisements, as approving of any glass, spectacles, or other articles he may either manufacture or sell. And thirdly, That I do _not_ consider his glasses to be in any respect superior to those manufactured by other persons in the trade.

You are at liberty to make use of this communication in any way you deem proper to counteract Mr. ——'s advertisements.

I remain yours respectfully, FREDERICK TYRELL.

To Mr. George Cox.

* * * * *

J. Hodson, Esq., consulting Oculist to the Eye Infirmary, Birmingham, resolved upon coming to London to give me his disclaimer, rather than incur any chance of misrepresentation from an unjustifiable use being made of his signature, he being an entire stranger to me before I addressed him upon this subject.

He authorizes me to state that Mr. —— has no authority or right whatever to make use of his name. About four years since a man came to his surgery, and introducing himself as the inventor of roseate tint preservers and amber spectacles, showed him a pair in silver frames, and, expatiating upon their wonderful properties, mentioned the names of several leading surgeons and oculists who had inserted their signatures in a book which he handed to Mr. Hodson, who, without suspecting the design of the knave, added his to the list, for the same reason, he said, that folks do so at a watering place, a library, or as having visited or seen some particular exhibition—in fact, because it was customary to do so. Four or five days afterwards the same individual called again, apparently in great haste, and requested Mr. H. to lend him two sovereigns, as he had immediate occasion for that sum. He produced a pair of

amber spectacles, and said, “I will leave these as security until I return the money.” Mr. H. began now to suspect the fellow, and guessed it to be very unlikely that he would trouble himself to redeem the Spectacles (worth about twelve shillings) if he succeeded in raising two pounds upon them; he therefore referred him to a pawnbroker in the neighbourhood, whose business it was to enter into such arrangements, which were, clearly quite foreign to his, Mr. H.’s practice.

Mr. Hodson has ever since regretted having (though inadvertently) given his signature, which, as the reader will perceive, is solicited as a mere matter of form, and is then made the most unwarrantable use of, involving the parties in many dilemmas, and exposing them to the ridicule and reprehension of every intelligent observer.

The fact is, if one signature of an eminent person can be procured by dint of false representation or plausible pretence, the rest follow as a matter of course; thus Mr. Hodson signed his name, seeing that some of the “heads of colleges” were there inscribed. Mr. Soden, of Bath, gave his signature because Mr. Ledsam had given his; and Mr. Ledsam signed because Mr. Hodson had done so.

Mr. Alexander, Oculist to the Royal Family, was waited upon by one of the crafty crew, whose object was to get his signature at all hazards. The fellow fawned and entreated, but was sternly resisted by Mr. A. who showed him the door, and declared, if he presumed to make use of his name, in his quack advertisements, he would set a solicitor to work immediately.

Copy of a Letter from ROBERT KEATE, Esq., Surgeon in Ordinary to Her Majesty.

Albemarle Street, _July 17, 1838_.

SIR,—Although I do not consider myself bound to reply to the questions put to me by you, being in utter ignorance of the use which you propose to make of my answer; yet I can have no hesitation in saying that I think Mr. —— has been guilty of an unpardonable liberty in publishing my name, without my sanction, and more especially in appending it to the document (a copy of which you sent to me), and to which I have never affixed my signature. I was requested to look at M ——’s amber spectacles, and I saw no others; and looking through them on a day when the sun shone brightly, they appeared to me to soften the light more than crystal or pebbles; and seeing the names of many eminent surgeons and oculists attached to various certificates, I wrote and signed what I have stated above, and I believe no more; namely, that the amber spectacles seemed to _soften the light_ more than the pebbles.[16] I am not aware of having seen any other sort; and certainly I have not ventured to sign my _approval_ of these, or of any others.

I am, Sir, your obedient servant, ROBERT KEATE.

To Mr. George Cox.

I could give the disclaimers of other gentlemen who have been trepanned into giving their signatures, which are afterwards so pompously paraded by the testimonialed and certificated adventurers; but these will suffice to illustrate the working of the system.

“A wise physician, skill’d our wounds to heal, Is more than armies to the public weal.”—POPE.

I cannot but feel gratified, that this correspondence, while it has substantiated my arguments, affords an opportunity for those gentlemen to explain the real truth of the matter, and to exonerate themselves from the contaminating connexion, which appeared to place their reputation for that “quality called honesty” in jeopardy.

I have received several impromptu effusions from humorous correspondents in different parts of the kingdom, where I have been and unmasked the impositions of spectacle cheats. One says—

“They _make_ not spectacles, you say; With that I can’t agree, Both wife and I have worn their trash, Now spectacles are we.”—QUIZ.

Another—

“A celebrated chemist has ascertained, by very accurate analysis, that there is enough brass in the countenances of the spectacle men of Duke’s Place and Petticoat Lane to make spectacle-frames for all the spinsters in the neighbourhood.”—SATIRIST.

I have, of course, laid myself open to the furious and vindictive hostility of those quacks, whose nefarious practices are exposed, and whose career will be checked in proportion as this treatise is circulated and dispassionately perused. But, secure of the approbation of all my readers who will avail themselves of the information contained in these pages, I may conclude with

satisfaction, since

Friends I have made whom envy must commend, And not one foe whom I would wish a friend.

THE END.

R. COTTLE, PRINTER, BASINGSTOKE.

FOOTNOTES:

[16] When the eyes are distressed and overwhelmed with light, _any_ shade or screen is viewed with satisfaction. Coloured glasses “soften the light” more naturally, and present to the eye equal and parallel surfaces: parasols, veils, and even opaque substances, may thus be said to shield the eye, and “modify bright and strong light,” but it would be as ridiculous to consider these as fit mediums for the ordinary purposes of vision, as it is to select amber for the purpose.

Transcriber’s Notes

pg 43 Changed: and the eminent individval himself to: and the eminent individual himself

pg 45 Changed: ground in a pecular manner to: ground in a peculiar manner

pg 45 Changed: the only real original manufacter of them to: the only real original manufacturer of them

pg 49 Changed: received from the first familes to: received from the first families

pg 60 Changed: charge according to the gullibilty of his dupes to: charge according to the gullibility of his dupes

pg 61 Changed: being to expose a system of villany to: being to expose a system of villainy

pg 62 Changed: The Royal Opthalmic Hospital, in Moorfields to: The Royal Ophthalmic Hospital, in Moorfields

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Shell shock and its lessons

Grafton Elliot Smith

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SHELL SHOCK AND ITS LESSONS

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To MAJOR R. G. ROWS, M.D., R.A.M.C.

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Preface.

Our reasons for writing this book will be explained by the book itself. We desire here gratefully to acknowledge the help of several friends who have considerably facilitated our task. Our thanks are due to Major R. G. ROWS, M.D., R.A.M.C., for his unfailing interest, encouragement and help; to Captains W. H. R. RIVERS, M.D., F.R.C.P., F.R.S., and J. W. ASTLEY COOPER of the R.A.M.C., and Mr. E. GLEAVES, M.Sc., for their valuable suggestions and assistance in the preparation of the manuscript; to Captain W. E. SAWERS SCOTT, M.D., R.A.M.C., Dr. ALBERT HOPKINSON and Mr. W. PERCY STOCKS, F.R.C.S., of Manchester, for help in other ways; and to our colleague, Professor H. BOMPAS SMITH, for reading the proofs and helping us to eliminate some of the more glaring literary defects. To the Editor of the _Lancet_ we are indebted for permission to use part of an article written by one of us. The stream of requests for fuller information and explanation that poured in upon the author of that article made the writing of this book an unavoidable duty.

G. E. S. T. H. P.

THE MEDICAL SCHOOL, THE UNIVERSITY, MANCHESTER.

20th April, 1917.

Introduction.

Some account of the reasons for the appearance of this book is due to the reader. During the last year we have been asked repeatedly, both by members of the medical profession and the lay public, to write a simple non-technical exposition of the ascertained facts of that malady, or complex of maladies, for which we have adopted the official designation “shell-shock.” Until recently such an attempt would have been premature and largely speculative. But it is now possible to collate the medical reports, not only from our own army, but also from those of France and Russia. Valuable and suggestive data have, furthermore, been obtained from such of the German medical journals as have reached us. The facts described in the various accounts which we have seen are in close agreement. The conclusions in this book, therefore, are not based upon our experience alone.

Our object in thus publishing a brief and simple description of these facts is twofold: first, to make them available to those who have neither the time nor the special knowledge necessary for consultation of the medical journals; secondly, to call attention to the obvious significance of these truths for the future welfare and happiness of the nation.

It might seem that to publish a book on this subject at such a time is merely to irritate existing wounds. The topic is painful; perhaps one of the saddest of the many grievous aspects of the war. But a condition exists at present which is immeasurably more painful—the exaggerated and often unnecessary distress of mind in many of the sufferers and their friends, which arises from the manner in which we, as a nation, have been accustomed to regard even the mildest forms of mental abnormality. Of all varieties of fear, the fear of the unknown is one of the greatest. Not the least of the successful work performed in the special hospitals during the war has been the dispelling of this fear by helping the sufferer to understand his strange symptoms (many of which are merely unusual for the patient himself) and, in the light of this new self-knowledge, to win his own way back to health.

It is because we believe that a similar probing of the _public_ wound—the British attitude towards the treatment of mental disorder—though painful, is justifiable and necessary, that we have written the concluding chapters of this book. For it cannot be too strongly urged that the shifting and unstable blend of apathy, superstition, helpless ignorance and fear with which our own country has too long regarded these problems is rapidly becoming our exclusive distinction. It must be realised that America, France, Germany, and Switzerland have long ago faced the problem in the only practical way—the scientific one. And to the long list of sciences which we all agree must be cultivated more assiduously after the war should be added—but not at, or even near, the end—psychiatry, the science of the treatment of mental disorders.

Not patriotic motives alone urge this reform, but common sense and common morality. For shell-shock has brought us no new symptoms. Its sole ground of difference from other disordered states of mind lies in its unusually intense and wide-spreading causes. The problems of shell-shock are the every-day problems of “nervous breakdown.” They existed before the war, and they will not disappear miraculously with the coming of peace. The war has forced upon this country a rational and humane method of caring for and treating mental disorder among its soldiers. Are these signs of progress merely temporary? Are such successful measures to be limited to the duration of the war, and to be restricted to the army? Germany has applied them for years to the alleviation of suffering among her civilian population, with a success which has made her famous—outside England. Can we be content to treat our sufferers with less sympathy, insight and common-sense than Germany?

It is at this time, while our country is anxiously considering how best to learn the lessons of the war, that we wish to call attention to one of these lessons which is in danger of being overlooked.

CHAPTER I.

The Nature of Shell-Shock.

A French doctor has said, “Il n’y a pas de maladies; il n’y a que des malades.”[1] Whatever may be the general validity of this statement, it is undoubtedly true of the nerve-stricken soldier. Every case is a case by itself, and as such it must be considered by anyone, be he layman or doctor, who is interested in its nature and treatment. For the troubles displayed in the many disorders classed under the official title shell-shock are extraordinarily numerous and different, and their removal necessitates a similarly varied repertoire of “opening moves” on the part of the physician.

Although the term shell-shock has been applied to a group of affections, many of which cannot strictly be designated as “shock,” and into the causation of which the effect of the explosion of shells is merely one of many exciting factors, this term has now come to possess a more or less definite significance in official documents and in current conversation. It is for this reason that we have chosen to use it rather than the more satisfactory, but less widely employed term, “War-Strain.” The reader will, therefore, understand that whenever the term shell-shock appears in these pages, it is to be understood as a popular but inadequate title for all those mental effects of war experience which are sufficient to incapacitate a man from the performance of his military duties. The term is vague; perhaps its use implies too much; but this is not altogether a disadvantage, for never in the history of mankind have the stresses and strains laid upon body and mind been so great or so numerous as in the present war. We may therefore expect to find many cases which present not a single disease, not even a mixture, but a chemical compound of diseases, so to speak. In civil life, we often meet with cases of nervous breakdown uncomplicated by any gross physical injury. We are scarcely likely, for example, to meet it complicated by gas poisoning and a bullet wound. Yet such combinations as these—or worse—are to be met with in the hospitals every day.

This is perhaps an opportune place to point out a significant popular misunderstanding concerning the nature of such maladies as we shall discuss in this chapter. A common way of describing the condition of a man sent back with “shock” is to say that he has “lost his reason” or “lost his senses.” As a rule, this is a singularly inapt description of such a condition. Whatever may be the state of mind of the patient immediately after the mine explosion, the burial in the dug-out, the sight and sound of his lacerated comrades, or other appalling experiences which finally incapacitate him for service in the firing line, it is true to say that by the time of his arrival in a hospital in England his reason and his senses are usually not lost but functioning with painful efficiency.

His reason tells him quite correctly, and far too often for his personal comfort, that had he not given, or failed to carry out, a particular order, certain disastrous and memory-haunting results might not have happened. It tells him, quite convincingly, that in his present state he is not as other men are. Again, the patient reasons, quite logically, but often from false premises, that since he is showing certain symptoms which he has always been taught to associate with “madmen,” he is mad too, or on the way to insanity. If nobody is available to receive this man’s confidence, to knock away the false foundations of his belief, to bring the whole structure of his nightmare clattering about his ears, and finally, to help him to rebuild for himself (not merely to re-construct for him) a new and enlightened outlook on his future—in short, if he is left alone, told to “cheer up” or unwisely isolated, it may be his reason, rather than the lack of it, which will prove to be his enemy. And nobody who has observed the hyperæsthesia to noises and light in the nerve-hospital, nobody who has seen the effects upon the patients of a coal dropping unexpectedly out of the fire, will have much respect for the phrase, “lost his senses.” There exist, of course, cases of functional blindness, deafness, cutaneous anæsthesia and the rest, but the majority of the nerve patients show none of these disorders and recovery from them is often rapid.

In a word, it is not in the intellectual but in the _emotional_ sphere that we must look for terms to describe these conditions. These disturbances are characterised by instability and exaggeration of emotion rather than by ineffective or impaired reason.[2] And as we shall see later, in the re-education of the patient, the physician is compelled continually to take this fact into account.

As we have pointed out, every nerve-stricken soldier presents a case by itself. Slavish adherence by the physician to one of the classical names or labels used in diagnosis usually spells failure. The patient must be approached _without prejudice_, and the doctor who wishes to be of real help to him must make up his mind to examine and ponder over the sufferer's mental wounds with as much, nay, even more—care and expenditure of time than would be given to physical injuries. A mere cursory inspection in the course of the formal ward visit is a solemn farce, if it pretends to be a serious attempt to cure the mentally afflicted.

A man standing at "attention" by the side of his bed, surrounded by his comrades and faced by the medical officer, the military sister, and perhaps even by other members of the staff may volunteer the information that he is sleeping badly. But this imposing procession and cloud of witnesses is scarcely conducive to the production of any further evidence as to the cause of his insomnia. For of those causes even pre-war experience makes it possible to assert that their name is legion, and their character often of an exceedingly intimate and private nature.

The formal visiting of patients in the wards, while adequate for the care of physical injuries (which can be subsequently attended to by trained nurses and sisters) and necessary for administrative and disciplinary purposes, is insufficient for "mental cases." It is with this fact in mind that the military authorities have instituted special hospitals in which more detailed attention may be given to the latter class of patients. In these institutions the soldier may have private interviews with his medical officer, and the history of the trouble can be unravelled in conversation. _It is only in this way that any scientific insight into a case of mental disorder can be obtained._

A short time spent in such interviews, or even the perusal, by the uninitiated, of the papers already published in the _Lancet_, _British Medical Journal_, and elsewhere[3], will convince one of the immense complexity of these unusual mental conditions, and moreover, of the absolute necessity of obtaining and understanding the patient's past history, before and during the war. A dozen cases sent back from the front as shell-shock may prove to possess not a single feature in common—except the fact of the shell explosion. And this, as has been pointed out, may be but the "last straw."[4] The patient often discloses in the first interview the fact that he was displaying all his present symptoms _before_ the arrival of the particular shell which laid him out.

It is now possible to attempt a brief sketch of the typical conditions which give rise to some of the chief varieties of shell-shock. Let us take a common case; that of the patient who is returned to this country, figuring in the casualty lists under the terse and businesslike military formula, "shock, shell."

For various reasons, which the reader will easily supply, we choose to present a composite picture of the history of such a soldier. Not all the conditions described here need necessarily have operated in any one case taken at random, but we shall err, if at all, on the side of understatement. The correctness of the description may be checked by a reference to the papers already mentioned.[5]

We must first try to conceive the experiences of the soldier before the occurrence of the knock-out blow, so far as they bear on his present condition. Let us suppose that his period of training has made him physically and mentally fitter than he had ever been before, that no military causes of anxiety or fear, such as the experience or the anticipation of being torpedoed on the outward voyage, have operated to any noteworthy extent in his case. He enters the trenches in first-class condition. The duration of his stay there, provided he is not wounded, or attacked by any bodily illness, will depend from that time forward upon the nature, duration, intensity and frequency of the emotion-exciting causes, and upon himself. By that all-inclusive word "himself" we mean to signify chiefly his temperament, disposition and character.[6]

It must be remembered that one of the greatest sources of breakdown under such circumstances is intense and frequently repeated emotion.[7] By this is meant not only experiences of fear or of sympathy with suffering comrades, in short, those conditions the manifestations of which might cause the man in the trenches to be spoken of as "emotional," but also other mental states associated with general excitement, anxiety, remorse for major or minor errors, anger, elation, depression and that complex but very real state, the fear of being afraid. (The more definite terms of technical psychology are not used here, as it is considered wiser to employ popular language.)

The soldier may be subjected to intense emotional stimuli of this kind for days or weeks without relief. And whereas to the mental sufferer in civil life sleep often is vouchsafed, "setting him on his feet" to continue, more or less effectively, the struggle next day, to

the soldier sleep may be impossible, not necessarily because of his excited mental state, but simply from the lack of opportunity or the disturbances going on about him. In course of time this loss of sleep from external causes may easily set up bodily and mental excitability, which in its turn acts as a further cause of insomnia. The usual mental conditions associated with loss of sleep then rapidly supervene: pains and unpleasant organic sensations, hyperæsthesia, irritability, emotional instability, inability to fix the attention successfully upon important matters for any length of time, loss of the power of inhibition and self-control.[8]

These symptoms, troublesome enough in civil life, become positively dangerous to the man in the trenches, especially if he is in a position of responsibility. In that case his standing as officer or N.C.O. merely adds to his mental distress. Bodily hardship, such as exposure to cold and wet, hunger, and the irritation from vermin, obviously aggravates the disorders we have described.

We must not suppose, however, that the man who is experiencing some or all of these mental and bodily conditions is at this period necessarily displaying any obvious _outward_ signs of his trouble. There may be no tremor, no twitchings, no loss of control of the facial or vocal muscles which would indicate his state even to his neighbours. He may, for a long time, “consume his own smoke.” And during this process he may even appear to his comrades to be steadier and more contemptuous of danger than before. Dr. Forsyth[9] has cited some dramatic incidents, in which officers who imagined that their instinctive fear was becoming apparent to the men under their command took unnecessary risks in order to impress these men with the idea that they were not afraid.

It must be understood that this suppression of the external manifestations of an emotion such as fear is but a partial dominance of the bodily concomitants of that emotion. The only changes which can usually be controlled by the will are those of the voluntary or skeletal muscular system, not those of the involuntary or visceral mechanism. While no signs of fear can yet be detected in the face, the body, limbs or voice, these disturbances of the respiratory, circulatory, digestive and excretory systems may be present in a very unpleasant degree, probably even intensified because the nervous energy is denied other channels of outlet.[10]

The suppression of fear and other strong emotions is not demanded only of men in the trenches. It is constantly expected in ordinary society. But the experience of the war has brought two facts prominently before us. First, before this epoch of trench warfare very few people have been called upon to suppress fear continually for a very long period of time. Secondly, men feel fear in different ways and in very various degrees.

The first fact accounts for the collapse, under the long continued strain of trench warfare, of men who have shown themselves repeatedly to be brave and trustworthy. They may have felt intense emotions, obviously not of fear alone, for a long time without displaying any signs of them. But suppression of emotion is a very exhausting process. As Bacon says, “We know diseases of stoppings and suffocations are the most dangerous in the body; and it is not much otherwise in the mind.”

The second fact mentioned above is of great importance in the consideration of our problem. There are undoubtedly men who seem to be immune to fear of the dangers of warfare. But to them we can scarcely apply the adjective “brave.” The brave man is one, who, feeling fear, either overcomes it or refuses to allow its effects to prevent the execution of his duty.

Other emotional states however, besides fear, arise and require suppression. The tendency to feel sympathetic pain or distress at harrowing sights and sounds, disgust or nausea at the happenings in the trenches, the “jumpy” tension in face of unknown dangers such as mines—all these, like fear, are or have been biologically useful under natural conditions and, like it, are deeply and innately rooted in man. But the unnatural conditions of modern warfare make it necessary that they shall be held in check for extraordinarily long periods of time.

The impossibility of regarding modern methods of warfare in the same light as natural and primitive means of fighting appears very clearly when we consider the instinctive and emotional factors involved in the two sets of circumstances. In natural fighting, face to face with his antagonist, and armed only with his hands or with some primitive weapon for close fighting, the uppermost instinct in a healthy man would naturally be that of pugnacity, with its accompanying emotion of anger. The effect of every blow would be visible, and the intense excitement aroused in the relatively short contest would tend to obliterate the action of other instincts such as that of flight, with its emotion of fear. But in trench warfare the conditions are different. A man has seldom a personal enemy whom he can see and upon whom he can observe the effects of his attacks. His anger cannot be directed intensely night and day against a trench full of unseen men in the same way in which it can be provoked by an attack upon him by an individual. And frequently the assaults made upon him nowadays are impersonal, undiscriminating and unpredictable, as in the case of heavy shelling. One natural way is forbidden him in which he might give vent to his pent-up emotion, by rushing out and charging the enemy. He is thus attacked from within and without. The noise of the bursting shells, the premonitory sounds of approaching missiles during exciting periods of waiting, and the sight of those injured in his vicinity whom he cannot help, all assail him, while at

the same time he may be fighting desperately with himself. Finally, he may collapse when a shell bursts near him, though he need not necessarily have been injured by actual contact with particles of the bursting missile, earth thrown up by its impact, or gases emanating from its explosion. He may or may not be rendered unconscious at the time.[11] He is removed from the trenches with loss of consciousness or in a dazed or delirious condition with twitchings, tremblings or absence of muscular power.

Upon recovery of consciousness, which may take place after periods varying between a few minutes and a few weeks, the immediate disorders of sensation, emotion, intellect, and movement, are often very severe. It may be presumed that at the beginning of the war they must have appeared far more serious to most of the doctors who saw them in their early stages than they would now. This speculation is suggested by the evidence of the case-sheets sent with the men from France in the early period of the campaign. Such diagnoses as “delusional insanity,” and other similar terms taken from the current classifications of advanced conditions of insanity, appear very frequently as descriptions of cases which on arrival in England had almost entirely lost every sign of mental unusualness. In fact, one of the most cheering aspects of work amongst this type of case has been the rapidity with which men who have presented quite alarming symptoms have subsequently recovered.

It may seem almost unnecessary to enumerate the bizarre phenomena which constitute the immediate results of shell-shock, for our newspapers have naturally seized upon such unusual details and have made the most of their opportunities in this direction. But the reader will obtain a clearer idea of the facts if they are catalogued once more.

The most obvious phenomena are undoubtedly the disturbances of sensation and movement. A soldier may be struck blind, deaf or dumb by a bursting shell: in rare cases he may exhibit all three disorders simultaneously or even successively. It should be added that these troubles often vanish after a short space of time, as suddenly and dramatically as they appeared. Thus one of the blinded soldier survivors of the _Hesperian_ recovered his sight on being thrown into the water. Other blind patients have had their sight restored under the action of hypnosis. Mutism is often conquered by the shock of a violent emotion, produced accidentally or purposely. Examples of such “shocking” events taken at random from our experience were the sight of another patient slipping from the arms of an orderly, the “going under” chloroform, the application of a faradic current to the neck, the announcement at a “picture house” of Rumania’s entry into the war (this cured two cases simultaneously), and the sight of the antics of our most popular film comedian. The latter agency cured a case of functional deaf-mutism, the patient’s first auditory sensations being the sound of his own laugh.

The muscular system may be affected in an equally striking manner. Contractures often occur in which a man’s fist may be immovably clenched for months; or his back may be bent almost at right angles to his lower limbs, there being in neither case any bodily change discoverable by the neurologist which can account for such a condition. These contractures, though curable, often prove very obstinate, and at present their nature remains somewhat of a mystery. Other distressing and long continued disturbances take the form of muscular twitchings and tremors or loss of power in the limbs.

Not every nerve-case, however, presents such striking and objective signs as those which we have just been describing. The _subjective_ disturbances, which are apt to go undiscovered in a cursory examination of the patient, are frequently more serious than the objective,[12] and are experienced by thousands of patients who to the mere casual observer may present no more signs of abnormality than a slight tremor, a stammer, or a depressed or excited expression. These afflictions: loss of memory, insomnia, terrifying dreams, pains, emotional instability, diminution of self-confidence and self-control, attacks of unconsciousness or of changed consciousness sometimes accompanied by convulsive movements resembling those characteristic of epileptic fits, incapacity to understand any but the simplest matters, obsessive thoughts, usually of the gloomiest and most painful kind, even in some cases hallucinations and incipient delusions—make life for some of their victims a veritable hell. Such patients may have recovered from sensory or motor disturbances and yet may suffer from any or all of these afflictions as a residuum from the original “shock-complex;” they may suffer from them as a complication of the discomfort attending upon a wound or an illness, or, on the other hand, they may have no overt bodily disorder: their malady then being usually given the simple but all-inclusive (and blessed) description “neurasthenia.”

Now the happiness and welfare of such men obviously is bound up to no small extent with the character of the hospital or hospitals (for the plural number is commonly to be used in writing the history of these patients) to which they are sent. In the general military hospitals the medical officers have neither the time nor, in many cases, the special knowledge, necessary to deal with cases of this kind. Such patients may recover of themselves without any treatment, but a large number of them tend to get worse, and if they are left without attention their symptoms are apt to become stereotyped into definite delusions and hallucinations. Moreover, in a general ward such men may become a constant source of disturbance and annoyance to other patients and to the nurses. One of

the symptoms of their illness is a morbid irritability; they tend to become upset and to take offence at the merest trifles[13]—and this leads to trouble with patients, nurses, and the medical officers responsible for discipline. But if special consideration is shown them by the nurses the other patients are apt to misunderstand it and even to complain of favouritism. In other words, when mixed with wound-cases in a general hospital, these nervous patients are apt to be regarded as a nuisance—which is bad for them and for the proper working of the hospital. Another consideration, too, is that the subjection of such men to irksome regulations of military discipline, and the usual penalties for infringing them, is often so potent a factor in producing disturbances as to be quite fatal to any hope of amelioration.

These considerations have led the military authorities to establish special hospitals for nerve-cases.[14] In such institutions the patients can be nursed and attended to by a staff which, being used to the idiosyncrasies of such illnesses can make conditions more suitable to them.

A man's particular nervous malady is likely to be of common occurrence in the nerve-hospital; it does not render him conspicuous, and therefore an object of fussy solicitude, galling pity, or suspicious contempt, as is too often the case in other institutions. If unwounded, he need not suffer the taunt of "having nothing to show" as his reason for staying in hospital. Further, while in the special hospital, more importance is attached to some of the patient's symptoms, less disturbance is produced by others. The occurrence of a "fit" is viewed by the rest of the men in this class of hospital in a truer perspective, and the patient does not find himself a nine-days' wonder, as he so easily may do in a small auxiliary hospital full of straightforward wound cases.

Up to this point we have discussed the various troubles subsumed under the term shell-shock in what may be termed its initial and middle stages. In the middle stage, the patient having recovered from the severe and acute symptoms constituting the former phase, is left with a motley residuum of troubles, the chief of which we have enumerated on pages 12, 13. In distinguishing between this middle stage and that which follows it, we may perhaps ask the reader to assist us by recalling the difference between a mechanical mixture and a chemical compound. In the former the ingredients of the mixture remain unaltered and unaffected by the proximity of other substances, as for example when sugar is mixed with sand. In the compound, on the other hand, chemical action and reaction occur between the components so that not one of the substances is immediately recognisable in the complex, as for example when carbon, hydrogen and oxygen combine to form alcohol, which resembles none of them.

Now it would be distorting the facts of mind to suggest that while the third stage of shell-shock is a compound (as it undoubtedly is) the middle stage is a mixture. For the very essence of mind is its compound nature. But what we wish to point out is that in this middle stage the abnormalities have had very little time to react upon each other, with the result that there is some resemblance to a state of mixture, the phenomena existing temporarily side by side, so to speak. In this stage a patient may be troubled simultaneously by several unusual mental occurrences, such as terrifying dreams during very light sleep, loss of memory for certain periods of his past, and inability to understand or to carry out complex orders. For a short time in his "bowled-over" state he may be worried by the separate attacks, of these various troubles at different periods of the day and he may be too overwhelmed to try to understand or to attempt to see relations between them. This state of mind, in which the patient is still his "old self," though a somewhat overturned self, resembles the mechanical mixture in our illustration. The reader may obtain some idea of this condition if he recalls any one day in his own experience when "everything seemed to go wrong"; when at one moment he was turning to face this difficulty, at another, that, but still retained to a great extent his usual attitude towards the world.

As has been pointed out, however, the state of "mechanical mixture" is utterly alien to the normal mind, which tends rapidly to interpret, in the light of its own experience, and to integrate as far as possible, its events, however incongruous they may be. The mind cannot, for any length of time, allow a new experience to remain strange or undigested. It must gather in and assimilate that event to the systematised complex which we call its own past experience. It follows that the ultimate result upon any particular mind of a new experience, if it be of a personally significant nature, will depend almost entirely upon the past history of that mind.

Thus for example the question whether the patient can or cannot satisfactorily stand up to his new troubles will be determined not only by his disposition, temperament and character, but also by his previous personal experience.

It is thus obvious to anyone who gives the matter any serious consideration, that the manifestation of a severe psychical shock must necessarily be determined in a large measure by the nature of the mind upon which the injury falls. It would be idle to pretend therefore, that, in diagnosis, the story of the patient's past experience can be left out of account, for the manifestation of the injury will obviously depend largely upon the individual patient's "mental make-up."

Faced by the existence of a number of unusual mental phenomena the patient will inevitably succeed in time in inventing for himself, explanations of their co-existence. This “rationalisation,”[15] as it is called, is a perfectly normal process which is constantly going on in every individual, yet it plays a great part in complicating the mental disorders of the middle stage, and thereby intensifying the patient’s ultimate distress. For instance, he may not be more than temporarily disturbed by the unusual experiences we have mentioned[16] if they assail him separately. But, given time, he will soon begin to connect their appearances, and will argue to himself that these phenomena can have only one meaning: that he is mad or rapidly becoming so. And in this completely erroneous procedure he will be aided and abetted, not only by his own ignorance of the relation of mental normality to abnormality, but also by the general tendency of the uneducated to class everything unusual in the mental sphere as “mad.” Once he is convinced that he is in this state he may easily lose all hope of getting better, thereby increasing enormously the gravity of his case. Completely illogical, but to him entirely satisfactory explanations of his condition will then multiply.

As we have mentioned, this rationalisation is no unusual phenomenon in ordinary life. It will be clear to anyone who gives the question a moment’s thought that few of the non-scientific[17] beliefs held by even a highly educated person have ever been logically reasoned out from fundamental principles. In fact such principles frequently cannot be reached, for the very good reason that they have never been consciously conceived by the individual. One’s views on religion, politics, or the relations and rights of the sexes may exhibit in their outer casings a semblance of rational structure: their core, however, is not reason but emotion. As James expresses it:—

“In its inner nature, belief or the sense of reality is a sort of feeling more allied to the emotions than to anything else ... reality means simply relation to our emotional and active life. This is the only sense which the word ever has in the mouths of practical men.... Whenever an object so appeals to us that we turn to it, accept it, fill our mind with it, or practically take account of it, so far it is real for us and we believe it. Whenever, on the contrary, we ignore it, fail to consider it or act upon it, despise it, reject it, forget it, so far it is unreal for us and is disbelieved.... Whatever things have intimate and continuous connection with my life are things whose reality I cannot doubt.”[18]

Few people, however, realise this truth so clearly, or express it so lucidly, as Professor James. Often we believe that we are logically convinced when in reality we have been convinced first, and have invented reasons for our conviction afterwards. But many of our beliefs and attitudes have been implanted in us in childhood or early youth by processes which could not by the wildest stretch of imagination be called logical. And not the least important of those beliefs are those held by the average Briton with regard to insanity.[19]

For the patient, then, his mental troubles, having intimate and continuous connection with his life, become very real indeed. But the longer he is left alone to “cheer up,” the longer he broods over his troubles in isolation, the longer he is allowed to build theories upon his inadequate and inaccurate data, the more intimately and continuously connected with his life will the abnormalities become. They may come to be so integrated with each other that his very personality becomes tinged. Then he is no longer a normal person battling with his separate enemies, but one who has made terms, and those often disastrous ones, with his closely allied foes. An attempt to cure him at this stage will then necessitate the analysis of a highly complex compound, while in the early and middle stages merely the attack upon separated elements is necessary.

We are concerned at present with the facts of shell-shock, but this is perhaps a suitable place in which to deal with an opinion about this set of phenomena, which is not uncommon, especially perhaps in people above military age. That judgment, expressed sometimes bluntly, but oftener in a more subtle fashion, is that shock or neurasthenia are polite names for nothing else but “funk.” It is not easy to take a dispassionate view of this question, but to persons holding this opinion the following points are worthy of consideration.

First, the most severe and distressing symptoms occur to a surprising extent in the case of those patients whose past history shows that, far from possessing even the normal quota of timidity, they had been noted for their “dare-devilry” and had been specially chosen as despatch-riders, snipers and stretcher-bearers in the firing line. Secondly, it is not uncommon for patients to ask to be sent back to duty because they feel that they have been too long with nothing to do, while it is quite obvious to the doctor that they are as yet unfit to bear any great strain. Thirdly, the seasoned regular, officer or N.C.O.,[20] as well as the young soldier of only a few months’ service may display precisely the same symptoms as those we have described. Such men have frequently been in the army for many years, and have fought on previous occasions with great success. Their strength of mind and body has been demonstrated over and over again, yet at last they have broken down. And they manifest the greatest concern at their unusual symptoms.

It will be readily granted, of course, that there exist among the nerve patients returned from the front cases in which there is genuine fear of the war, arising from memories of the experiences which they have undergone. Even this state of mind, however, is usually expressed by the patient in some such phrase as “I don’t want to go back, but I’ll go quite willingly if I’m ordered to.” It should not be forgotten, moreover, that not a small number of instances are known in which these men prove to have made repeated attempts at enlistment after having been rejected several times, or even discharged from the army, changing their medical examiner until they have succeeded. One case, presenting a great number of the symptoms of shell-shock in a very intense form, including, beside the ordinary neurasthenic troubles, blindness, deafness, and mutism at successive times, was that of a man who had been discharged from the army as medically unfit and had re-enlisted.

Two cases may be quoted here in illustration of some of these assertions:

The first is that of a non-commissioned officer who went through the initial eleven months of the war in France and Flanders, was subjected to every kind of strain, physical, mental and moral, which that stricken field provided; and in addition was wounded twice, gassed twice, and buried under a house, on all five occasions being treated in the field ambulance and then returning to the trenches. After all this experience he had not qualified for sick leave, but was granted five days ordinary leave to return home, apparently in a good state of health. After reaching England and while waiting for a train in the railway station, he suddenly collapsed, became unconscious, and for months afterwards was the subject of severe neurasthenia. Apparently at the front the excitement, the sense of responsibility and especially the example that he felt he should set his men, seem to have kept him right. These stimuli removed, he broke down. The whole of his trouble seemed to be due to the dread lest on his return to the front, the added responsibilities which would fall upon his shoulders (because most of his own officers had been killed and there would be new men to replace them) might be too much for him. His intelligence seemed (to himself) to have become numbed by his experiences, and he became conscious of the unreliability of his memory and of his inability to understand not only complex orders, but, as he put it, “even the newspapers.” It was this that excited in him the dread lest he should be incompetent to discharge adequately the duties which would fall upon him. There was nothing of malingering or shirking in his case. There was no fear of physical injuries or of returning to the front; on the contrary, he was anxious to go back. His fear lest the possibility of his failure would be bad for his platoon was wholly due to that admirable sentiment of regimental loyalty, which comes out so strikingly in the nervous troubles of the non-commissioned officer.

This class of case demands a great deal of patient and sympathetic attention before the real cause of the trouble is elicited, and then months of re-education may be required to build up anew the man’s confidence in himself.

The second case is that of a soldier who had suffered from severe shock symptoms and had recovered. In conversation with the medical officer the soldier expressed his willingness, and even his desire, to return to the front, in full knowledge of the fact that the officer’s report in that sense would lead to his being sent back to fight. That night the patient was awakened by a terrifying dream, the true significance of which was certainly not adequately appreciated by him. Although he dreamt that he was afraid to go back to the front, apparently he did not realise that he was actually afraid—_i.e._, that the dream had any meaning. On examination it proved to be a detailed forecast of the imaginary incidents of his return to his regiment, and of his attempt to commit suicide when ordered to go to France. Here was a man who of his own initiative had asked his doctor to certify him as ready to go back, yet in his sleep the train of thought, started by the discussion of the possibility of his return, working subconsciously, had stirred up images of what this implied, and reinstated emotions of so terrifying a nature that in his dream he preferred suicide to facing the ordeal again.

It may perhaps be allowable to quote in this connection the view of a German neurologist, Prof. Gaupp, on the “shock-cases” which have been sent back from the German front.[21] At the same time it is important to remind our readers that Gaupp is writing of a conscript army, the authorities in which are certainly not notorious for lenity to the individual; further, that up to the time of writing the present chapter, all the “shock” patients in Great Britain have been men who voluntarily elected to serve their country, the majority of them having enlisted in the earliest stages of the war.

In discussing cases where nervous trouble, uncontrollable in nature and intensity, had led to the patients being kept in German hospitals for months, it was sometimes found that the mental foundation which was a causal factor of these troubles was a more or less conscious anxiety concerning the possibility of a return to the front.

“There is no justification,” says Gaupp, “for calling every instance of this a case of malingering or simulation. There are quite capable men of irreproachable character whose nervous system is positively unfitted for the hardships and horrors of war. They have enthusiasm and the best of intentions but these cease to inspire them when the horrors and terrors come. Their inner strength

rapidly decreases, and it only requires an acute storm to break upon the nervous system (such as the explosion of a shell or the death of comrades) for their self-control to vanish completely. Then automatically their condition changes into what is popularly called ‘hysteria.’ The exhausted mind then feels that it is no longer master of the situation, and therefore ‘takes refuge in disease.’ At first, as a rule, obvious signs of terror and anxiety (trembling, twitching, etc.) manifest themselves; if these are cured there still remain chronic symptoms of hypochondria and despondency. Time, however, has its effect in many of these cases.”[22]

If a patient comes into the hands of a physician before the processes of rationalisation and systematisation have become established, the medical officer should be able to meet his difficulties, and help him correctly to interpret his unusual experiences by explaining to him their origin and nature.

“The application of discreet sympathy and tact by a physician who endeavours to discover something of the man’s past mental history may be able to reassure a patient upon his particular trouble with the happiest of results. To a man quite unacquainted with text-books or speculation on psychology there can be no darker mystery than the working of other people’s minds. To such a man the natural conclusion is that his own mental processes are universal and normal. But if, as a result of some nerve-shattering experience of warfare his mind suddenly develops a trick which was quite unknown to him before, though this development may be far from abnormal, to the troubled patient it may seem to be an unquestionable symptom of madness.”[23]

Many of the cases in which a patient has merely needed reassuring have been of this type. A short and very simple explanation of some elementary facts of psychology is often sufficient to bring about an immense change in the man’s condition, which has led to his curing himself. And this is the ideal method of cure.

It may seem that an inordinate amount of space has been devoted to the demonstration of a simple truth, that mental, like bodily disorder, should be treated early, or complications may ensue. But there are reasons for giving so much prominence to this aspect of the subject. The chief is that in our own country, mental disorder is seldom treated in its early stages. Nearly all our elaborate public machinery for dealing with this distressing form of illness is devised, and in practice is available, only for the advanced cases. This war has shown clearly a truth which, of course, was already known before to many doctors, but never adequately appreciated by the general public, that a case of advanced mental disorder may pass not only through various milder stages on its way, but that if intercepted at these earlier stages, it may frequently be cured with ease.

Another point which should be emphasised is this: shell-shock involves no _new_ symptoms or disorders. Every one was known beforehand in civil life. If by any stretch of the imagination we could speak of a specific variety of disease called shell-shock, it would be new only in its unusually great number of ingredients. And the most gratifying truth of all is that even this hydra-headed monster, if caught young, can be destroyed.

From the fact that shell-shock includes no new disorders the important inference may be drawn that the medical lessons taught by the war must not be forgotten when peace comes. The civilian should be offered the facilities for cure which have proved such a blessing to the war-stricken soldier.

FOOTNOTES:

[1] There are no sicknesses, there are only sick people.

[2] This subject has been lucidly discussed by C. Burt, “Psychology and the Emotions,” _School Hygiene_, May, 1916.

[3] Such as for instance, D. Forsyth, _Lancet_, Dec. 25th, 1915, p. 1399; C. S. Myers, _Lancet_, Mar. 18th, p. 608; R. G. Rows, _Brit. Med. Jour._, Mar. 25th, 1916, p. 441; G. Elliot Smith, _Lancet_, April 15th and 22nd, 1916; H. Wiltshire, _Lancet_, June 17th, 1916.

[4] Wiltshire, _op. cit._, p. 1210.

[5] On pp. 4, 5.

[6] The reader who is interested in these important distinctions should consult McDougall, _Social Psychology_, London, 1915, p. 116.

[7] _Cf._ the statements of two experienced neurologists:—Déjerine and Gauckler (written before the war), “Overwork and fatigue are no more a cause of neurasthenia than they are of tuberculosis. Without emotion there are no psychoneuroses.”

(_The Psychoneuroses and their Treatment by Psychotherapy_, Jelliffe's translation, 1913, p. 232.)

[8] An experimental investigation of the mental effects of loss of sleep has been carried out by Miss May Smith of the Oxford Psychological Laboratory. A short account of these experiments and their results is given in "Some Experimental Investigations of Fatigue," by T. H. Pear, _Proceedings of London County Council Conference of Teachers_, 1914.

[9] _Op. cit._, p. 1402.

[10] In his book, "Bodily Changes produced by Fear, Pain, Hunger and Rage," Professor Cannon has given a striking demonstration of the importance of emotion in producing such bodily disturbances.

[11] Capt. Wiltshire, as a result of recent experience near the firing line in France thinks that the men's accounts of the duration of unconsciousness are often exaggerated, owing to their faulty memory of the time at which it occurred. He also says that in his opinion the actual individual shell-shock which prostrates the man is but the final precipitating cause. (_Op. cit._, p. 1207.)

[12] This fact is in danger of being overlooked by members of the public whose knowledge of "shock" is obtained from the newspaper reports.

[13] R. G. Rows, _op. cit._, p. 441.

[14] For particulars of these hospitals, see W. Aldren Turner's Report, _Lancet_, May 27th, 1916, p. 1073. The reports published in the special war numbers of the _Revue Neurologique_ (and especially Nos. 23, 24, November and December, 1915) bear ample testimony to the magnificent work being done by the French in this direction. Not only has special provision been made in each military district for dealing with neurological and mental cases, but also admirable accounts of the work are being published, and those responsible for the care of such patients have been afforded many opportunities for discussing their difficulties and learning from each other.

[15] Or "seeking conscious and rational grounds for actions" (and beliefs) "whose motives are largely unconscious and perhaps irrational." (A description borrowed from Burt's article, _q. v._)

[16] On pp. 12, 13.

[17] (and, obviously, the same may be said of not a few 'scientific' beliefs.)

[18] _Principles of Psychology_, II., 283-324.

[19] The opinions of Dr. Bedford Pierce upon this matter are highly important. _British Medical Journal_, January 8th, 1916, p. 4.

[20] Our personal experience has been of privates and non-commissioned officers only, but there is no _a priori_ reason for supposing that these remarks do not apply to the commissioned ranks. It has been found that in the French Army the cases of neurasthenia amongst officers have been very numerous.

[21] "Hysterie und Kriegsdienst" (Hysteria and War Service), _Münchener Medizinische Wochenschrift_, March 16th, 1915.

[22] The translation is very free, but it fairly represents the sense of the German original.

[23] From a leading article on "War-Shock and its Treatment," in the _Manchester Guardian_.

CHAPTER II.

Treatment.

In discussing the question of treatment we do not propose to deal with general therapeutic measures which every physician in charge of nervous or mental patients is hardly likely to neglect.[24] The importance of a generous and easily digested dietary is generally recognised: as also is the need for quiet and congenial surroundings, and for shielding patients from disturbances, such as noises and the sight of wounded, which are likely to evoke painful emotions and vivid memories of their experiences at the front. It is also obviously important that the physician should deal promptly and discreetly with any bodily ailments from which the patient is suffering, being careful neither to minimise their gravity and so give him any reason for the grievance that he is not receiving proper attention, nor by exaggerating them to add this anxiety to his other troubles.[25] These are questions which may confidently

be left to the discretion of the physician in charge.

Firmness and Sympathy.

But there are certain other therapeutic measures commonly recommended in text-books for application in the cases of patients suffering from neurasthenic and hysterical troubles, which cannot be thus summarily dismissed. As many of these patients are irritable and childishly peevish, it is necessary that they should be treated with sympathetic firmness, tact and insight. But, unfortunately, the words “firmness” and “sympathy” are interpreted in a great variety of ways. While it is important, for purely therapeutic reasons, that discipline should be maintained, and that when the physician has decided what he considers the proper treatment for the patient this should be rigorously carried out, it is manifestly disturbing and injurious in many cases for the officer to insist upon all the exacting details of military rules and regulations. For the mentally healthy soldier, obedience to stern and even harshly rigid regulations is often vitally important; but an attempt by a medical officer to treat a ward of neurasthenic patients in this way usually has disastrous results.

Quite apart, however, from the military aspects of the case, the physician, without really investigating the history of a patient, may label his trouble “hysteria” and forthwith adopt a course of “firmness.” He may assume the attitude of doubting the genuineness of symptoms which are very real to the sufferer. Under the plea of helping to cure the patient the officer may assure him that there is nothing much the matter with him and that if he tries he will soon be all right. Such advice may be justifiable if based on a real insight into the state of the individual sufferer, but this knowledge can be gained only by a patient investigation of the cause of his trouble. If the advice is given without this insight, it is a mere shot in the dark. The fact that the device succeeds in a certain number of cases is no excuse for its general adoption. And when it “misfires” no one realises the fact more quickly than the patient himself. He realises that the officer does not appreciate his condition and his confidence is thereby destroyed.

It is useful, too, to consider for a moment the nature of treatment by “sympathy.” When we used the phrase “sympathetic firmness” we intended to indicate the insistence upon a strict observance of such methods of treatment as a real insight into the patient’s condition may suggest. The word “sympathy” was used in its literal sense of “feeling with” the sufferer. But there is no class of patients upon whom sympathy of the injudicious kind is more prone to work serious harm than the psychoneurotic. The knowledge of this fact is often the excuse for the adoption of the opposite attitude and the prescription of “firmness” which, as we have seen, may be equally unintelligent and injudicious.

But sympathy of the injudicious kind is not _real_ sympathy. For unless the sympathiser has a true appreciation of the patient’s condition, and can look at things from his point of view, he cannot really feel _with_ the sufferer. The latter may arouse in the would-be sympathiser tender emotions and sympathetic “pain,” but unless the sympathiser have insight, the pain, to put it crudely, is not likely to be “in the same place” as that of the patient. Such misplaced emotion and false sympathy, whether on the part of the doctor, the nurse, or the patient’s relations, may do much harm.

In mild cases of mental trouble, however, where the patient still retains a goodly portion of self-confidence and self-respect, this “petting” variety of sympathy may sometimes be effective. Such a patient may be cheered up by the presence of people sufficiently interested in him to be sorry for his condition; and it may help him to look on the brighter side of things and to forget his worries and anxieties. But often it is apt, by suggestion, to aggravate his troubles or even to discourage him from trying to recover.[26] Perhaps it would be more accurate to say that such treatment gives him no inducement to get better.

There are still not a few physicians who regard the group of functional troubles commonly labelled “hysteria” as something closely akin to malingering. If it would not be considered invidious we could quote the opinions of well-known physicians published within the last five years, suggesting that there is no real line of demarcation. (It is not uncommon to meet the expression “_detecting_,” instead of _diagnosing_ hysteria.)

But even among those who regard these serious affections as something more than mere simulation there is a tendency to look upon any form of sympathy as a dangerous pandering to the patient’s lack of will power.[27]

This attitude often finds expression in leaving the patient alone to get better by his own efforts, or in suggesting to him that he is not so ill as he thinks he is, and that all he needs is some work to occupy his attention.

The attempt is often made to justify such methods by the plea that it is “bad for the patient to talk to him of his worries.” But how a physician is to rid a patient of the very root of all his trouble without first discovering and then discussing it with him is not apparent. Nor, again, is it any more rational merely to tell a man who is weighed down with some very real anxiety to “cheer up,” or to “work in

the garden," or "take a walking tour."

We are not maintaining that such methods do not often meet with success in the case of many patients who are only mildly affected and earnestly want to get better. But experience shows that such advice is often fraught with danger, and, in severe cases of mental affection is worse than useless. The experience of those physicians who have been treating such patients with sympathetic insight during the last two years affords a striking condemnation of the theory that it is generally "bad to talk to them of their worries." It has repeatedly happened that as soon as the patient was asked about his troubles he made a full statement of all that was troubling him and was obviously relieved to confess his worries to someone who took an intelligent interest in his welfare.

In many cases the mere unburdening of this weight of anxiety and the removal by the physician of quite trivial misunderstandings which were the original causes of it, were sufficient to cheer up the patient and to start him on the way to complete recovery. Yet many of these men had been inmates of a series of hospitals in which no attempt had been made to discover what was the real source of all the trouble. Thus to their other worries and anxieties was added the real additional grievance that they were being neglected and were of no account. In many cases this constituted a serious aggravation of the patient's mental disturbance and encouraged him to believe that his state was already beyond help.

Those physicians who look upon such milder psychoses as varieties of simulation should be reminded that the methods we have just mentioned are not often likely to be effective in cases of real malingering.

In discussing the therapeutic use of "firmness" we have not thought it necessary to mention those applications of this method which at times are practised by combatant officers at the front. The use of military authority to suppress the minor manifestations of nervousness, or the resort to such expedients as unexpectedly firing off a gun alongside a man afflicted with functional deafness, are merely examples of the application of "suggestion." They are akin to the use of "firmness" by the physician who has not investigated the cause of the patient's trouble. The results of such expedients are as erratic in the one case as in the other. But there is no need for us to discuss this practice further, except to add that the knowledge that such "treatment by military authority" has been tried before, still further diminishes the justification for resorting to such measures when the patient reaches the home hospital.

Isolation. Many physicians regard isolation as an appropriate method of treatment for soldiers suffering from shock, and they urge in justification of such a procedure the success which often attends its use in civil cases. We do not deny the utility of isolation for suitable cases, and success has attended its use when the patient's condition obviously required it. But the circumstances which were responsible for causing the mental disturbance in the soldier may be of a totally different nature from those which have upset the civilian; and therapeutic measures which may be appropriate in eliminating the civilian's sources of irritation might be wholly unsuitable, if not positively harmful, in the case of soldiers.

It cannot be too strongly emphasised in connection with this subject that most of the theory and practice of treating hysteria by isolation has been developed in civil life, and in very many cases with reference to well-to-do women living in the lap of luxury. When such persons develop hysterical symptoms, some sources of irritation in the home or the social environment are often responsible. By isolation the patient is removed from the noxious influence of both domestic worries and mistaken sympathy; his or her whims and fancies are compulsorily subordinated by self-discipline and consideration for others. At home it is impossible satisfactorily to enforce such measures and the attempt to do so will almost inevitably fail, because sympathy, curiosity and anxiety on the part of various relatives hinder the attainment of these objects. By isolation the patient is removed from these unfavourable psychical influences. Through the freedom from such disturbing stimuli, the abnormally intense reaction of the mind is reduced. And in many patients of this class the desire to be cured or to be active, which is produced by the boredom of isolation, works favourably.[28]

But in most soldiers the circumstances are altogether different. In the first place, the patient secures the change of surroundings by his removal from the trenches to the hospital. Isolation, therefore, can hardly be justified on that score. At the same time, the removal to a military hospital at any rate should obviate all danger of his being pestered by foolish relatives and friends with their mistaken sympathy or excessive attention. And as regards the importance of discipline and routine, the soldier is in a position very different from that of the wealthy society lady, for he has already been subjected to such training.

In some instances, however, just as in the civil cases, the boredom of isolation may produce the good effects noted above. But there is the corresponding disadvantage that if you isolate a man and put a special nurse to look after him it is impossible to convince him that his case is not serious. It may, indeed, help him to persuade himself that he is really going insane. As a matter of

experience, it is found that very many men cannot stand isolation for long; they feel that they must break out, even if they realise that punishment is certain for doing so. The conversation of patients who are undergoing treatment by isolation is often perfectly frank about it. They tell the medical officer they will break out at the first opportunity; that the few hours of freedom would more than compensate for the punishment which would come afterwards. Again, it must be apparent that, when the trouble is due in any considerable measure to the re-awakening of emotions linked up with some painful earlier experience, isolation is not likely to be effective in many cases, and may be definitely harmful. Neither should it be forgotten that such measures fail to isolate the patient from his worst enemy, himself.

Even in those cases in which it is useful, isolation, if unduly prolonged, may spoil its own good effects. It may so accustom the patient to a solitary mode of existence that the presence of other persons may make him irritable when at the end of his time of seclusion he is compelled to associate with his fellows.

There is another fact which has to be taken into consideration—and this applies especially in civil practice, where the patient or his family have to pay for the treatment. We refer to the expensiveness of treatment by isolation. Unless it can be shown that it is the best or the only hopeful method to adopt, the physician must feel some hesitancy in the majority of cases, in prescribing such costly measures.[29]

Déjerine and Gauckler[30] have given an admirable account of the use of isolation in the treatment of neurasthenia and hysteria. They are careful to point out, however, that even in the case of civilian patients, with whom of course their treatise is concerned, “isolation, even accompanied by rest and overfeeding, is never enough.” It is merely an adjunct, though, under certain circumstances, a necessary one, of the treatment by persuasion. But “it would be irrational to look upon the isolation of neuropaths as a therapeutic necessity from which one might never depart. It only applies to particular cases.” In proceeding to define the class of civilian patients for whom such methods are appropriate they emphasise the value of isolation for those whose troubles are due to, or aggravated by, “a bad family environment.” In most cases the circumstances of the war-stricken soldier do not come within the categories which they suggest as justifying isolation. Moreover, most of the benefits which they attribute to this therapeutic measure, _i.e._, removal from home surroundings and from the particular worries and anxieties which have caused the mischief, are attained (as we have already pointed out) when the soldier is an inmate of a special—or, in fact, of any—hospital.

When Déjerine and Gauckler proceed to define the different degrees in which the method of isolation may be practised; _viz._: (1) strict isolation; (2) absolute isolation from one’s family circle and environment, and (3) isolation from one’s family circle alone, or from one’s usual environment alone—it becomes clear that the treatment of every soldier who enters any hospital inevitably comes within the scope of categories 2 and 3.

Even when writing of hysterical women these French physicians tell us that—

“to show how slightly (their) experience has inclined (them) towards any systematic treatment of the psychoneuroses by isolation,” isolation has not seemed (to the doctors) to be necessary for “at least a third of the neuropathic women who have been cared for at the Salpêtrière. Again, it must be added that, of the patients admitted, a certain number have been received at the hospital and naturally submitted to the discipline which belongs to an isolation ward much more for humanitarian and social reasons than because absolute isolation seemed to be formally indicated.”[31]

From the completely different nature of the circumstances of the nerve-stricken soldier and civilian respectively it is clear that such total isolation can be considered necessary for soldiers only in very few cases, even though the modified forms of isolation, to which reference has been made, may be useful for most of such patients. The important point that emerges from this discussion is the necessity which is laid upon the physician of determining, in the case of each individual patient, whether isolation of any kind is desirable, what form it should take, and especially when it should be used, modified or discontinued.

Suggestion and Hypnosis. We have already touched briefly on the need for sympathetic firmness and for inspiring the patient with confidence that he will recover. But such firmness can be useful only when it is supported by respect for and confidence in the physician. In most cases such respect can be gained only by acquiring a real insight into the patient’s condition and by treating him tactfully and reasonably. It is too often forgotten that the neurasthenic patient’s continual and intense criticism of himself makes him especially quick at intuitively becoming conscious of the physician’s failings. Under such circumstances, if the doctor does not secure the patient’s respect and convince him that he really understands his condition, the former’s firmness and confident assurances will avail him nothing: he has shown his hand; his failure will excite contempt; and the patient’s intractable, _enlightened_ stubbornness will be fatal to any further hope of influence on the part of that particular physician.

Ever since mankind first sought help from his fellows for his afflictions of body or mind, confidence in the efficiency of the adviser's ability has been an essential factor in leech-craft. To be able to convince a patient that he is going to recover and that medical advice will help towards that end is certainly not the least of the physician's qualifications. But unless the assurances given him are based upon real insight and understanding, the process of securing the patient's confidence is not very different from the charlatan's blatant boasting. In other words, it is analogous to the confidence trick.

The confidence which is inspired in the patient by his conviction of the physician's real understanding of his condition is an altogether different matter. Such "suggestion" necessarily enters into all successful treatment and this applies in a very special manner to the cure of mental ailments.

But the question arises, is it useful or desirable to supplement these measures of suggestion which are incidental to all human intercourse, by more positive measures of induced "suggestion" or hypnotism? There are wide discrepancies of opinion with regard to this matter. And, in endeavouring to come to a conclusion concerning it, it is important to eliminate as far as possible the emotional tone which the warm discussion of this question has aroused in the past.

The positive usefulness of hypnosis in relieving many of the acute symptoms in recent cases of shell-shock has been fully demonstrated by the important series of articles by C. S. Myers, in the _Lancet_.[32] When it is possible by such means to restore to the patient his lost memory or speech or banish his despondency it often proves that the only hindrance to the complete restoration of his normal personality has been removed.

"It may be argued," to quote Myers's own account, "that mutism, rhythmical spasms, anæsthesia, and similar purely functional disturbances disappear after a time without specific treatment. But no one who has witnessed the unfeigned delight with which these patients, on waking from hypnosis, hail their recovery from such disorders can have any hesitation as to the impetus thus given towards a final cure. More especially is this the case in regard to the restoration of lost memories. Enough has already been said here about the striking changes in temperament, thought, and behaviour which follow on recovery from the amnesia... The restoration to the normal self of the memories of scenes at one time dominant, now inhibited, and later tending to find occasional relief in abnormal states of consciousness or in disguised modes of expression—such restoration of past emotional scenes constitutes a first step towards obtaining that volitional control over them which the individual must finally acquire if he is to be healed.

Thus the minimal value that can be claimed for hypnosis in the treatment of shock cases consists in the preparation and facilitation of the path towards a complete recovery."[33]

Even if we admit that other measures, such as the administration of chloroform for the cure of hysterical mutism, may in some cases effect similar improvements, this should not blind us to the incontrovertible fact that hypnotism has been proved to be a valuable therapeutic agent in the early stages of shell-shock.

As a cure for certain patients who have passed the acute stages of shell-shock or other forms of war-strain, its use requires great discrimination in the selection of suitable cases and extreme care in its practice. It is very probable, too, that hypnotic suggestion by itself should never be regarded as sufficient treatment for these cases, though undoubtedly it may be of great use as a part of such treatment.

A view endorsed by some well-known physicians is that all psychotherapy should be addressed to the functions of consciousness, and that hypnosis, which is addressed to the functions of automatism, is therefore undesirable. As a general statement this is undoubtedly true of a great number of cases, but there occur instances in which it seems that this sensible rule may be wisely and judiciously broken. In some cases hypnosis helps in more quickly breaking down resistances, which occur in patients too beset by their own auto-suggestion and false beliefs to be able easily to grasp the arguments and persuasions which the physician may have spent days and weeks in vainly endeavouring to get accepted. Thus assistance may be sought without in any way interfering with subsequent treatment of the patient by psychological analysis and re-education.

The following instance illustrates the use of hypnotic suggestion in the manner described above.

The case was one of violent spasmodic tremor in the right arm of a soldier. When in a state of convalescence from a wound and shell-shock he suddenly encountered his company officer, to whom he was greatly attached. This officer had lost his right arm since he was last seen in France by the patient. The shock of suddenly meeting the officer in this condition set up the man's tremor. The case came under psychotherapeutic treatment some weeks later, when the patient, who was an extremely emotional

individual, had lost all hope of recovery. Any attempt at purposive movements of the right hand and arm threw all the muscles of the right side of the body into a violent state of jerky tremor.

Long continued treatment by persuasion failed to effect any improvement whatsoever. The medical officer in charge of the case therefore decided to try hypnotic suggestion. This was easily carried out; the hypnotic state being moderately deep, though the patient was still in touch with his environment. Hope, courage and assurance of recovery _following his own effort_, together with determination to make every endeavour, were suggested to him. The patient was assured at each sitting that his nerves and muscles would every day respond more and more to his efforts at self-control. After a very few short sittings the man's hopeless attitude became changed to one of hope, effort and attention in the waking stage, and there was a slight but decided improvement in his voluntary power. Hypnotic suggestion was then given up, and the treatment was continued by means of encouragement, exercises and explanation of his trouble, with the result that two months later he was fit for discharge from the hospital.

It may reasonably be doubted whether methods of persuasion alone would have cured this man. In any case, it is clear that it would have taken a very long time. It is also probable that hypnotic suggestion alone, if continued, would very quickly have removed the symptoms. It may be doubted, however, whether it would have effected a permanent cure in a person so open to auto-suggestion. It seems, therefore, that a judicious combination of methods was advisable.

We are of the opinion that hypnotic treatment, when used with skill, discretion, and discrimination, has its place in the treatment of shell-shock and similar conditions, both in the acute and chronic stages.

In the majority of cases of some considerable duration, however, and in practically all those in which the trouble is due to some ante-war worry or emotion, it may be regarded as provable that hypnosis _alone_ will be of relatively slight use and in many cases may be positively harmful, for under such circumstances, even with the most favourable conditions, it would result merely in the removal of symptoms; and the removal of one may be followed by the appearance of another, which may even be induced by the process of hypnosis. Moreover, in cases where there is a tendency to the development of a double personality hypnosis may have the effect of increasing the risk. Further, if the patient has sufficient of his own will-power to enable the process of re-education to be carried out, it is clearly undesirable, both on psychological and ethical grounds, for the doctor to impress his influence from without.

In considering the possibility of the usefulness of hypnotic suggestion it is important to bear in mind that various factors may come into play in impressing an event upon the patient's memory, or in determining the effect of the shock from which he is suffering when he arrives in hospital. In the first place there is the vividness or intensity of the stimulus; in the second, the degree of recency; in the third, the frequency of the stimulus; and in the fourth its relevancy. By the latter is meant the extent to which a given event appeals to the individual's past experience, and becomes integrated into his personality.

A patient who has recently received a severe shock, the effects of which alone represent the real trouble, without the disturbance of any antecedent experience, might quite well be relieved by hypnotic suggestion from sleeplessness, pain, or amnesia; and in some cases this removal of the acute symptoms which determine the persistence of the shock effects may lead to complete recovery. A single and sudden wholly irrelevant experience, such as the bursting of a shell, which has no relationship whatever to the patient's past experience, and produces effects by its vividness and its recency, might quite well be neutralised by another kind of wholly irrelevant intrusion, such as hypnotic suggestion. This argument may perhaps be made more intelligible by a homely analogy. A temperate man walking along the street might be thrown temporarily into a condition of faintness or collapse by seeing some ghastly accident, but by taking a "brandy and soda," which to such a man would be a wholly irrelevant experience, the physiological expressions of his emotions might be controlled and he might be able to proceed on his way, and to overcome completely the effects of the transitory occurrence. But in the case of a man who, for example, had been greatly worried by monetary troubles for a number of years, the "brandy and soda" would not produce anything more than a temporary alleviation of his troubles. The latter illustration represents the chronic psychosis which, as Déjerine has so admirably explained, is quite unsuitable for hypnotic treatment. But the distinguished French neurologist's statements do not seem to apply to the former type of case, due to a vivid recent shock, in the symptomatology of which troubles before the shock play no part. In such cases the results of hypnotic suggestion are often brilliant, if erratic, as is the "brandy and soda cure" for the man who is overcome by a sudden terrible experience in the street.

There are, however, patients who have not sufficient will-power or intelligence to be properly re-educated, to whom a certain amount of suggestion may be of some use.

Those who have used hypnosis in civil practice are aware that in certain individual cases of long-standing trouble, such, for example, as chronic alcoholism, hypnotic treatment is of unquestionable value. Among soldiers suffering from the long-standing effects of shell-shock, hypnosis may be able in some cases to help in the restoration of health with an effectiveness that no other method can rival.

Both the danger and the possible usefulness of hypnotism may be illustrated by an actual case. It is that of a man all of whose companions were destroyed by the bursting of a shell, and who suffered for months afterwards from complete loss of memory. A medical man hypnotised him, and perhaps with undue tactlessness, brought back the memory of the critical incident at the front, stripped of all the episodes which led up to or followed it. This excited in him the most violent emotions, and he became sick with terror; for the revived incident seemed perfectly real to him, or, as he described it afterwards, “it jumped up against him,” and for weeks he was so utterly terrified that he would not go near the doctor. Even though he could not retain the memory of any other recent events the horror of that experience seemed to have made him remember his dread of a particular medical man. But by making use of the information gained during that revival under hypnosis of an incident unknown to anyone but the patient, which his amnesia up till then had kept sealed up, it became possible for another medical officer to bridge the gap between his memory of previous events and the experiences which the patient was known to have had in the military hospitals.

In speaking of the results of hypnotic treatment as being brilliant but erratic, it is important to remember that the same observations apply to suggestion without hypnosis. For instance, the application of electricity to the vocal cords in cases of hysterical aphonia affords an admirable illustration of the treatment by suggestion, even if the method savours of charlatanism. An excellent demonstration of the part which psychical factors play in such cases is afforded by the story of a sailor on the German battle-cruiser _Derfflinger_, recorded by Blässig.[34]

“A seaman from the _Derfflinger_ was brought into a naval hospital with loss of voice on Dec. 22nd, 1914, and could speak only in a whisper. He said that he had always had good health, with the exception that as a child he had diphtheria, but recovered without tracheotomy or any complication. His voice had always been clear and well under control. At the beginning of December he had a slight cold, which he attributed to sentry duty on deck in very stormy and wet weather. While in the ammunition chamber of the big guns he was greatly upset during the firing and suddenly lost his voice. After fourteen days he recovered his speech. On Feb. 12th, 1915, he returned to hospital with complete loss of voice, immediately after the naval engagement in the North Sea. On Feb. 15th he was treated with electricity, directly applied to the vocal cords, and on March 20th he was discharged with complete recovery of his speech. But on returning to duty, as soon as he went on board his ship his voice was suddenly lost for the third time, and he remained aphonic.”

This is clear evidence of the fact that his trauma was psychical. His previous history perhaps contains the clue explaining why, in his case, it was his voice which was affected. The application of the faradic current was suggestion pure and simple.

In emphasising the limited usefulness and possible danger of suggestive therapeutics in many cases that are not quite recent, we have not been referring to that method of suggestion which is involved to a greater or less degree in all successful treatment of disease—the process of gaining the patient’s confidence and impressing him with the idea that he is going to recover.

“The conversational attitude, the familiar manner of talking things over, the heart-to-heart discussion, where the physician must exert his good sense and feeling, and the patient be willing to be confidential” is the method which Déjerine calls ‘psychotherapy by _persuasion_.’ “It consists in explaining to the patient the true reasons for his condition, and [for] the different functional manifestations which he presents, and above all, in establishing the patient’s confidence in himself and awakening the different elements of his personality, so as to make them capable of becoming the starting-point of the effort which will enable him to regain his self-control. The exact comprehension of the phenomena which he presents must be gained by the patient by means of his own reasoning.... The part that the physician plays is simply to recall, awaken, and direct....”[35]

No one who has not had the experience of guiding mental patients in the way so lucidly expounded by the French physicians can form any adequate conception of the remarkable efficacy of these common-sense methods in restoring to those who are afflicted a normal attitude of mind. It is certainly saving considerable numbers of soldiers from the fate of insanity. These methods are not novel, even if the fuller comprehension of their mode of operation is only dawning upon us now. This point has been admirably expounded by Déjerine and Gauckler, from whose book we must quote once more:—

“May we be permitted to quote a few lines in which Bernardin de St. Pierre has defined, more exactly and better perhaps than we could do, and with a sort of prescience of what is needed, the very rôle that we would like to [see our physicians adopt towards their

patients].

I wish that there might be formed in large cities an establishment, somewhat resembling those which charitable physicians and wise jurists have formed in Paris, to remedy the evils both of the body and of one's fortunes; I mean councils for consolation, where an unfortunate, sure of his secret being kept and even of his incognito, might bring up the subject of his troubles. We have, it is true, confessors and preachers to whom the sublime function of offering consolation to the unfortunate seems to be reserved. But the confessors are not always at the disposition of their penitents. As for the preachers, their sermons serve more as nourishment for souls than as a remedy, for they do not preach against boredom, or unhappiness, or scruples, or melancholy, or vexation, or ever so many other evils which affect the soul. It is not easy to find in a timid and depressed personality the exact point about which he is grieving, and to pour balm into his wounds with the hand of the Samaritan. It is an art known only to sensitive and sympathetic souls.

Oh! if only men who knew the science of grief could give unfortunate people the benefit of their experience and sympathy, many miserable souls would come to seek from them the consolation which they cannot get from preachers or all the books of philosophy in the world. Often, to comfort the troubles of men, all that is necessary is to find out from what they are suffering (_Etude de la Nature_, 1784)."

Déjerine and Gauckler add:—

"One could not express any better, or any more directly, what we never cease to maintain, however lacking in science it may seem at the first—namely, the real therapeutic action of kindness.

Liberated morally, and having regained consciousness of self, and freed in addition from his functional manifestations by the appropriate processes ... the patient is cured. He is cured from his actual attack. But his mental foundation, his psychological constitution, still remains in the same condition which permitted him under emotional influences to become a neurasthenic. The rôle of the physician is, therefore, not ended. He must still build up his patient's life, still practise prophylaxis, and get the patient into a condition where his character will be established."[36]

Rational Treatment. So far in this chapter we have been discussing what may be described as general methods of treatment, which do not _necessarily_ involve any attempt to probe into distinctive individual symptoms and to discover the real fundamental cause or causes of the trouble. The measures so far considered are empirical rather than rational. But they are the only methods of treatment discussed in most of the text-books.

It is an axiom in medicine that correct diagnosis is the indispensable preliminary to the rational and intelligent treatment of disease. This fundamental principle is universally recognised in dealing with bodily affections; but it is the primary object of this book to insist that _it is equally necessary to observe the same principle in the case of mental illness_.

It may seem ironical to stress this elementary consideration, but it is notorious that accurate diagnosis is too often ignored in cases of incipient mental disturbance. It is idle to pretend that such a procedure is unnecessary, or to urge in extenuation of the failure to search for causes that many patients recover under the influence of nothing more than rest, quiet, and ample diet.

Many mild cases of illness, whether bodily or mental, may and do recover even if undiagnosed or untreated. But on the other hand many mild cases get worse; and it is the primary duty of the physician correctly to diagnose the nature of the trouble and to give a prognosis—to decide whether the illness is mild or severe. Some of the most serious cases of incipient mental trouble are those of patients who do not seem to be really ill, and are easily overlooked by a visiting physician. They are quiet and inoffensive and display no obvious signs of the insidious processes that are at work in them. But all the time they may be, and often are, brooding over some grievance or moral conflict, worrying about their feelings, misinterpreting them and gradually systematising these misunderstandings until they become set as definite delusions or hallucinations. If, acting on the belief that it is bad to talk about a patient's worries, the physician leaves such a man alone, he is clearly neglecting his obvious duty. For the whole trouble may be due to some trivial misunderstanding which he could easily correct.

In the severer forms of mental disease, precise diagnosis is even more intimately related to treatment than in the case of bodily illness. For when a patient's illness is recognised as some bodily affliction, such as pneumonia or appendicitis, certain general lines of treatment are laid down as soon as the appropriate label has been found for the complaint, though, in the case of the latter illness, there is added the further problem of whether or not surgical interference is indicated.

In cases of mental disturbance, however, the general lines of treatment cannot thus arbitrarily be determined merely by finding an appropriate label. It is true that as in the treatment of bodily disease, certain general principles must be observed, such as the provision of abundant and suitable food, and the protection of the patient from all disturbing influences. But the essence of the mentally afflicted patient's trouble is some particular form of anxiety or worry which is _individual and personal_. The aim of the diagnosis, therefore, should be not merely to determine the appropriate generic label for the affliction, but rather to discover the particular circumstances which have given rise to the present state. The special object of the physician should be to remove or nullify the exciting cause of the disturbance; and in order to do this it is essential that he should discover the precise nature of the trouble. The diagnosis, therefore, must be of a different nature from that demanded in case of physical illness, where the condition may be adequately defined by some such generic term as "lobar pneumonia" or "acute appendicitis," and its gravity estimated by the general condition and physique of the patient. In the case of mental trouble, the physician has to make an individual diagnosis, based not only upon an insight into the personality but also into the particular anxieties of each patient.

But even when it is recognised that exact diagnosis of the particular circumstances of each individual patient is essential, if the trouble is to be treated rationally and with insight, there still remain many difficult problems as to procedure.

Amongst those whom experience has convinced of the efficacy of psychological treatment for this class of case, there are indications of a divergence of opinion in the matter of procedure. Some believe that it is sufficient if the medical man has discovered the real cause of the trouble and explained it to the patient. Other workers look upon a preliminary psychical examination merely as a means of diagnosis, the unveiling of the hidden cause of the trouble; and consider that the treatment should be the laborious and often lengthy process of re-educating the patient, and so restoring to him the proper control of himself. It is of the utmost importance to emphasise the undoubted fact that those who maintain either of these views to the exclusion of the other are committing a grievous and dangerous error, for there is no sharp line of demarcation between the two procedures.

A sensible and intelligent man, once the cause of his trouble has been made clear to him, may be competent to continue to cure himself, or, in other words, to re-educate himself, and completely to conquer the cause of his undoing. But the duller and stupider man may need a daily demonstration and renewal of confidence before he begins to make any progress. It is precisely analogous to the experience of every teacher of a class of students; the brilliant man will seize hold of a principle at once and learn to apply it without further help, whereas the dull man needs repeated and concrete demonstrations before it sinks into his understanding.

In dealing with soldiers, and this applies with especial force to the regular army, the conditions in many of the cases differ considerably from those of the civilians. Trifling forgetfulness in the civilian would perhaps not be a serious cause of worry, but in the soldier, inured by years of training to strict discipline, forgetfulness of even trivial instructions, or any difficulty in understanding complex orders, is likely to bring down upon his head condign punishment. Such lapses are regarded by the soldier as extremely serious offences, because years of training and discipline have inculcated this idea. When as the result of shock such soldiers are afflicted by even slight forgetfulness, they become worried by it much more than would the civilian and exaggerate its importance until it becomes a real terror to them. As the result of their training they may regard such phenomena as altogether abnormal; and by a process of rationalising what to them is a novel experience, they are apt to imagine that they are going mad. Such patients often dream about incidents in their army life when they had been forgetful and got into trouble; they become obsessed with the haunting fear that they are likely to get into perpetual difficulties, are worried by the thought that they are incompetent for the duties to which they have been accustomed, and may imagine themselves debarred from all useful work. However, they are easily reassured when the medical attendant explains to them that in ordinary life civilians are frequently subject to such experiences, and that it is only the special circumstances of army life which make such trivial lapses seem serious to them. Not only is the soldier much more scared by such things than the civilian, but it is also a very remarkable phenomenon, and certainly one which came as a surprise, that the neurasthenia of a soldier is apt to be very much more serious than that of the civilian. For when a really brave man is stricken by fear he is more seriously affected by the terror of an experience which to him not only has a larger element of novelty than in the case of the civilian, but also wounds him more deeply by convincing him that he is lacking in that very quality which is most essential for his professional work.

The Therapeutic Value of Work.

It should be unnecessary to emphasise the desirability of preventing the neurasthenic from dwelling upon his subjective troubles by occupying his mind with other things. This end may often be achieved by the provision of suitable occupation, and where possible, for many obvious reasons, this occupation should take the form of useful work. The worker then feels that he is not a mere burden upon the hospital which is treating him: the institution in its turn benefits materially. But it is necessary to sound a note of warning

against the indiscriminate prescription of work as a panacea. First of all it should be certain that the work is of such a kind as really to interest the patient and to occupy his mind. There are many varieties of work, especially of manual labour, which can be performed mechanically, and do not succeed in distracting the attention from worries and anxieties. But more important even than this is the consideration that there are some mental troubles from which no form of work will distract the patient. Especially is this the case in many of the psychoneuroses caused by the war. The sufferer is often haunted day and night by memories which torture him not merely by their horror but also by another aspect which is even worse: the ever-increasing moral remorse which they induce. A patient may be troubled not only by the terrible nature of the memory but by the recurring thought, “If I had not done” this or that, “it might never have happened.” The reader will easily see how such a thought may arise in the mind, especially of a nerve-stricken officer or “N.C.O.” after weeks of brooding in private upon the memory of a disaster. Now, such self-reproaches are frequently based upon entirely insufficient evidence, and if the medical officer is given the opportunity of calmly discussing their foundations with the patient, the result is often to reassure him and to enable him to view his past in an entirely new light. It is then, and not before then, that he will be able cheerfully to enter upon useful occupation and to benefit by it. To suppose that the mere physical fatigue induced by a day’s hard work will banish all forms of insomnia betrays an ignorance of one of the most important causes of this malady; _viz._, mental conflict. It is well known that bodily fatigue in the case of a mentally excited patient may merely increase his unrest at night. Again, anyone who has had a few months’ experience of receiving the confidence of these nerve-stricken soldiers will know that some of their troubles are so poignant that the attractions of the (apparently) most interesting kinds of occupation leave them cold.

To sum up, the physician may confidently prescribe work when, by investigating the history of any particular case, he has satisfied himself that such occupation will be likely successfully and profitably to distract the patient’s mind from his worries. But the prescription of work for the patient must be regarded as a sequel to, not as a substitute for, the performance of work by the doctor.

FOOTNOTES:

[24] Such, for example, as those set forth in the series of articles in Vol. VIII, of Sir Clifford Allbutt’s _System of Medicine_, 1899, pp. 88-233.

[25] The part played by bodily disease in the causation of mental disturbance has been concisely summarised by Sir G. H. Savage in the introductory chapter on Mental Disease in Vol. VIII, of Allbutt’s _System of Medicine_, pp. 191-195.

[26] Or in some mild cases, to encourage him to wish to remain an invalid under such pleasant conditions.

[27] In his careful studies of these conditions, C. S. Myers has called attention to the mistaken notion of regarding these troubles as “fundamentally due to disordered volition,” _Lancet_, Sept. 9th, 1916, p. 467.

[28] This explanation of the reasons for the use of isolation is taken from Mohr’s article in Lewandowsky’s _Handbuch der Neurologie_.

[29] As Sir Clifford Allbutt has pointed out (_op. cit._, p. 158).

[30] _The Psychoneuroses and their Treatment by Psychotherapy_, translated from the French by Jelliffe, 2nd Edition, 1913, p. 311.

[31] _Op. cit._, p. 315.

[32] Feb. 13th, 1915 (p. 316); Jan. 8th, 1916 (p. 65); Mar. 18th, 1916 (p. 608); and Sept. 9th, 1916 (p. 461).

[33] _Op. cit._, p. 69.

[34] _Münchener Medizinische Wochenschrift_, June 15th, 1915, p. 335.

[35] Déjerine and Gauckler, _op. cit._, p. 283.

[36] _Op. cit._, pp. 302-3.

CHAPTER III.

Psychological Analysis and Re-education.

The methods of treatment which have been described in the foregoing pages: sympathy, firmness, isolation, suggestion in its various forms, and hypnosis; while all useful in their proper place, often prove to be of no avail in cases of psychoneurosis. Where the distressing symptoms lie on the surface so that both they and their causes are easily discoverable by the physician—if, indeed, they have not been known from the beginning, to the patient himself—it is sometimes possible to bring about a complete cure without any very penetrating analysis by the doctor of the mental antecedents of the patient's present condition. Thus, for example, a courageous and keen soldier who, suffering from loss of sleep and from the harassing experiences of the battlefield, eventually breaks down, the precipitating cause perhaps being shell-shock, may need little more to set him on his legs than the comfort, assiduous attention, and pleasant distractions of a Red Cross hospital. For the civilian whose chief trouble is the irritability caused by a multiplicity of minor business worries, or family jars, a few days of isolation, giving perhaps, among the other benefits which we have mentioned, the opportunity to think things out, may have excellent results. The beneficent action of hypnosis in removing the acute disturbances caused by shell-shock has already been illustrated. But a large number of cases fall into none of these categories. Sympathy merely annoys them, isolation tortures them, for besides letting them think—usually in a very unwise way—it helps to confirm their impression that they are seriously ill, just because it involves the treatment of them as special cases. Suggestive measures may be to them like water on a duck's back, and hypnosis may prove of no avail. Firmness may have merely the effect of proving to the doctor that there exist patients firmer than himself. But, fortunately, psychical methods are not exhausted. There still remains at least one—that of psychological analysis and re-education.

The employment of psychological analysis in medicine means the resolution of the patient's mental condition into its essential elements, just as by chemical analysis it is possible to determine that water, for example, is composed of certain definite proportions of oxygen and hydrogen combined in a particular way. Re-education is the helping of the patient, by means of the new knowledge gained by analysis, to face life's difficulties anew.

It is sometimes urged that if this be all that is meant by psychological analysis, alienists have been doing this ever since insanity was first treated, nay, further, doctors have been practising it since the time of Hippocrates. It is pointed out that when a patient is first interviewed by the physician, an inquiry is always made into his mental state and behaviour, and into the presence of delusions and hallucinations or other unusual mental phenomena. His relatives are questioned concerning the relation of his recent behaviour to that at the time when he was considered normal. Now the answer to this assertion is that such an investigation is useful, indispensable in fact, but it cannot be called psychological analysis.

The point may become clearer to the untechnical reader if he will imagine for a moment that a carver, skilled in separating the legs and wings from the body of a bird, should claim to be practising anatomy. The anatomist would at once object that while such separation of limbs from trunk is a small detail which sometimes forms part of the anatomist's task, it can scarcely be called more than a preliminary to his study. For first of all, while to a carver a leg is an ultimate unit, to the anatomist it is, for the naked eye, a collection of bones, muscles, tendons, skin, nerves, veins, arteries, nails and the rest, and, seen through the microscope, a tremendous organisation of infinitely more complex structures. Furthermore, it might be pointed out that merely to separate these more minute structures into their constituent parts and to name them, by no means constitutes the whole of the work of the intelligent anatomist. He wishes to study the inter-relations of these parts, the way in which they work together for the common good of the leg. And lastly, the leg must not be studied only in separation from the trunk, for its functions are subordinate to the requirements of the body as a whole.

So, in the same way, to record that a man is suffering from a delusion of persecution or an unreasonable fear of open spaces is merely to "carve up" the condition of his mind. First of all it must be ascertained how far that delusion has interpenetrated with the rest of his mental life; whether, for example, his false belief is restricted to a specific kind of persecution from a particular person, or is a general delusion that everybody and everything in the world is against him. And again, if the delusion is strictly specific, it is important to know whether it has been the cause of secondary false beliefs, produced by rationalisation, to buttress the primary delusion against the inevitable contradiction from facts which it would otherwise suffer.

Further, the nature of the delusion must be analysed. Why is it of this and not of that persecution? Why is this particular person feared or hated? Is it a constant factor in the patient's existence, or does it break out at certain times? If so, the patient's life at these critical periods must be carefully examined. The doctor must discover where the patient was at the time, what he was doing and thinking, who were his companions, and so on.

Next comes the important inquiry into the history of the delusion. And here, just as the anatomist is able nowadays to mobilise for service all his knowledge of comparative anatomy and evolution, so if the physician has really scientific knowledge, not only of the

delusions in other patients, but also of the development of ordinary beliefs in sane people,[37] he will be immensely helped in his search, and may be enabled thereby to make many short cuts to the essential facts. He will endeavour to date the important stages of development of the delusion; to find a time when, so far as the patient knows, his mind was free from it.

Thus we may say that a psychological investigation of a case of mental disorder dissects its normal as well as its abnormal phenomena into their functional elements. Compared with the procedure which merely records such gross units as delusions or hallucinations, it is as anatomy to mere carving, however skilful the latter may be.

But the psychological investigation is not merely comparable to anatomical dissection. We have also compared the mind to a chemical compound, rather than a mechanical mixture. Especially is this true not only of the normal but also of the abnormal mind, when the latter has had time to settle down into its new position of relative equilibrium and integration; when, for example, a delusion has become so fixed that the patient's life is entirely ordered in obedience to it, and he has ceased to have any doubts as to its reality or to struggle against its domination.[38] It is only when the warring elements in the mind are relatively independent, and before they have succeeded in "making terms" with each other, that the mind even remotely resembles a mechanical mixture. It follows, therefore, that psychological analysis of a case of mental disorder is usually comparable to _chemical analysis_ as well as to anatomical dissection.

Now the most striking result of chemical analysis is to show that the appearance and general properties of the elements composing a compound are different from the appearance and properties of the compound itself. This is exactly the case, too, with mental analysis. A mere dissection of an abnormal condition is sometimes sufficient in the milder cases to serve as the basis for curative measures,[39] but in more advanced cases, or those of longer standing, real analysis is necessary in order to get at the unknown factors.

It is just at this point that a number of investigators of mental disorder decline to go any farther on the path of research. Up to this stage, they say, one is relying upon ascertained facts, for one has the warrant of the patient's own memory for the data obtained. Further analysis of a mental phenomenon must inevitably involve appeal to unconscious factors. And, once one has called in the unconscious as a means of explanation, psychology becomes a mere "tumbling ground for whimsies."

Probably there are few people to whom this statement does not appear to express the universal verdict of common sense. That is precisely what it does. But it should be unnecessary to point out that common sense alone is not always the most reliable guide to the discovery of fact. Unaided common sense not only informed men for centuries that the sun moved round the earth, but told them so with such finality and conviction that extraordinarily unpleasant consequences ensued for those who did not believe in such an obvious fact. And the old belief, wholly false as it is, has still to be unlearnt by every child.

In the same way, the 'common sense' point of view which we have described is not flawless. It assumes that a patient is able not only to surmount the great difficulties of translating his experiences and beliefs precisely into words—a difficult task even for the well-educated person—but also to account for and explain them truthfully.

It may, however, be pointed out that, though this last-mentioned misleading assumption is widespread, it is by no means so universal or so tenacious in man as the "belief of his own senses" that the sun goes round the earth. In fact, quite apart from the teachings of modern psychology, we frequently find well-founded suspicions in the lay mind that a man is not always competent to give the basis of and reasons for his mental condition. This view is summed up in the famous advice to the future judge, "Give your decision, it will probably be right. But do not give your reasons, they will almost certainly be wrong."[40]

What ordinary man, unversed in the subtleties of theology or comparative religion, could give to an agnostic a satisfactory account of the reason why—being let us say, a Christian, and a Protestant Christian—he is a Primitive Methodist or an English Presbyterian? Let us complicate the matter further by supposing that this sect to which he now belongs is not that in which he was brought up by his family! Many of the factors which have contributed to his present religious beliefs may have been entirely forgotten now, recallable only with the greatest difficulty[41] and with the help of a second person skilful in such investigation.

We may take as a good example of the historical complexity of significant attitudes and actions in life, the process of falling in love—especially if it is not, or at least seems not to be, love at first sight. It is generally admitted that, in the development of this psychological phenomenon, onlookers see most of the game. In other words, the actions of the two persons who are gradually becoming more and more attracted to each other are partly determined by motives, which, unknown to them, are patent to their observant relations and friends.

Further examples may be given to illustrate this important and oft-disputed point. Let us suppose that a musical critic, after hearing a new symphony by an unconventional composer, immediately writes a lengthy appreciation of the performance. It is clear that nobody would expect him to be able to give, off-hand, an account of his reasons for every sentence of the criticism. But it is obvious that a single phrase in this account may be but the apex of a whole pyramid of memories emanating from the critic's technical training, his attitude towards the new departure, experiences highly coloured with emotion which a few notes of the music may have evoked, and his mental condition at the time he heard the performance. Nobody denies that these may have shaped or even determined his criticism. But who believes either that they were all conscious at the time of writing the article, or that he could resuscitate them without much time and trouble and perhaps the help of a cross-examiner?

Again, there are occasions when society expects that a man shall be unconscious of the reasons for some of his actions. He is expected, for example, to behave politely, attentively and chivalrously to ladies, not because at the moment of taking the outside of the pavement he remembers why he does so, but simply because he has been brought up in this way. And conversely, too conscious politeness in a man arouses in others—and often rightly—the suspicion that it is a recent acquisition.

We see then that it is rare for a man to be able to give a true account, even to himself, of the reasons underlying his important acts and beliefs, when his mental condition is relatively calm and his social relationships are normal. But when a case of mental disorder is in question it becomes quite obvious that the patient is frequently not in a position to give, either to himself or to another, anything like a complete or true enumeration and description of the antecedent experiences which have brought about his present condition.

It therefore becomes necessary to admit that unconscious factors of great importance may play an influential part in the production of mental disorder and that, therefore, some way must be found of tapping these submerged streams.

The most direct way into the complexities of the unconscious mental processes of a person is afforded by a study of his more "unusual" actions and thoughts. For few persons are so completely adapted to their environment or so perfectly balanced that moments never arise in which their mental behaviour is not surprising, either to themselves or to others. And even the Admirable Crichtons of our acquaintance are not entirely immune from errant moments—at least in their sleep. The dream, then, is the chief gate by which we can enter into the knowledge of the unconscious. For in sleep, the relatively considerable control which most of us in waking life possess over the coming and going of mental events is almost if not entirely abrogated. Thoughts and desires, which, if they attempted to dominate consciousness in waking life, would be promptly suppressed, arise, develop and expand to an astounding extent in the dream.

This statement, of course, is entirely independent of the implications of any one "theory of dreams." Its truth is evident to anyone who has honestly recorded or considered his own dreams for even a short period.

Other unusual mental processes are manifested in such events as "slips of the tongue," "slips of the pen," the mislaying of important objects, the forgetting of significant facts, or conversely the inability to get an apparently unimportant memory out of one's mind. All these phenomena, common enough in the normal individual, are usually more frequent in the abnormal mind. Besides the patient's voluntary account of, and comments upon, these events,[42] other methods of obtaining data are possible to the physician. He will note the matters about which in conversation the patient is apt to become silent, embarrassed or inexplicably irritated, to hesitate, to say he has forgotten, or even to lie. All these sidelights upon the mental make-up are carefully noted by the physician and the deductions from them compared, not only with the patient's accounts of himself on different days—narratives which when put together may show important discrepancies and thin places—but also with the information obtainable from his family. These devices serve to bring to light in an extraordinary manner a whole number of memories, many of them of immense significance for the comprehension of the patient's present mental state, which it would be utterly impossible to discover in mere conversation or even by cross-questioning.

It is sometimes felt that these methods which savour strongly of catching the patient tripping, while they may unearth some interesting details of his past life, do no more than exhibit under a strong magnifying glass a few minute excrescences upon his otherwise fair mental countenance. But it should be pointed out that nobody who has ever honestly collected together and compared the memories which have coalesced to compose a dozen of his dreams—especially if he has done so with the help and under the cross-examination of a candid friend who knows him well—will maintain that the material thus found is unimportant. As Professor Freud says, "The dream never occupies itself with trifles." It is probably just because the thoughts and desires underlying the dreams have been refused their normal outlet, that they express themselves in such bizarre forms.

Moreover, the fact should not be overlooked that in other sciences—including the most exact, the physical sciences—the most profoundly important general conclusions are often arrived at by the examination of unusual phenomena, of nature "caught tripping." The study of the thunderstorm was the foundation of our present knowledge of that great force which is active not only in thunderstorms but throughout all matter. Observation of the sporadic and relatively unusual volcanic eruptions of the mind may prove to be an important foundation of our future knowledge of general psychology. As in the inorganic, so in the organic world, there is no sharp line dividing normal from abnormal, and the unusual phenomenon is sometimes simpler and more easily studied than the usual, as "Sherlock Holmes" was so fond of demonstrating.[43] From a scientific standpoint, then, we have every justification for pressing to the utmost our study of the unusual mental phenomena exhibited by the patient, and for our belief that their nature is not unimportant, but highly significant for therapeutical purposes.

Another objection, however, is frequently levelled against such a procedure, from quite a different direction, or rather from a number of directions. This objection can be expressed simply in words, such as "One ought not to probe so deeply into a patient's innermost mental life," and is not to be met by a single argument. The reason is that it is polyhedral in form, and that each of its faces or aspects must be considered separately. For it should be obvious to everyone that such an objection cannot be flippantly waved away.

The aspects of this question which seem to have more particularly appealed to the critics of the method which we are describing, are at least four in number, which we may describe as the æsthetic, social, medical and moral.

The origin of the first, the æsthetic aspect, is easily seen. It is quite clear that in the investigation of the inmost secrets of a person's life (and particularly of a life which has become so entangled and complicated that the help of another is sought for its restoration to 'mental tidiness') there must emerge frequently much that the patient finds unpleasant to relate. When we remember that a neurosis often (perhaps always) occurs as a result of the patient's inability to adjust his instinctive demands to the opportunities of his environment, it becomes clear that in the investigation of his history discussion is inevitable of mental events in which the fundamental instincts have played a great part. Now, of those important instinctive impulses, it is obvious that in a civilised community few are so often thwarted, deliberately repressed, or otherwise obstructed as the powerful one of sex. It therefore follows that in a large number of cases the discussion of sexual matters becomes unavoidable. Some critics have seized on this point as the weak spot against which to launch their attacks, descanting upon the unpleasantness, even the nauseousness, of such discussion. Not all of them, however, make it clear whether in their opinion it is the patient or the doctor who should be shielded from such unpleasant experiences. If the latter, the verdict of society would probably be that the sooner a man requiring such protection was excused not only from these uncongenial duties, but from all medical obligations whatever, the better for the community. If the former, it may be pointed out that every reasonable person will agree that the man who does not tell the whole truth to his doctor or his lawyer is a fool. Furthermore, even under present conditions, if it be considered advisable in the interests of the patient's bodily health, the doctor does not hesitate to ask, and the patient to answer, questions about the most intimate matters, some of them literally and not merely metaphorically nauseous.

We may therefore dismiss the æsthetic objection as unworthy of the consideration either of a conscientious doctor, or of a reasonable patient.

We may turn now to what we have designated the social aspect of the objection. It should need little explanation. There has arisen a convention, subscribed to consciously or unconsciously by many, that the doctor shall ask and the patient answer quite freely questions relating to the patient's bodily well-being, but that any unusual mental occurrences must be considered the patient's private affair into which it is not the business of the doctor to pry.

It would be rash to deny that up to a certain point this convention is susceptible of defence. But, carried too far, it is productive of disastrous results. Moreover, it is impossible for a doctor to treat many varieties even of physical disease without becoming to a great extent the confidant not only of the patient but often of his family. And there is no doubt that the present unwritten law that the doctor should confine himself to the patient's physical ills is often judiciously disobeyed by very many successful practitioners. Yet it must be recognised that the convention exists, and like all social usages is extremely tenacious.

The chief medical objection, which we shall now consider, is usually expressed in some such form as the assertion that "it makes the patient worse to talk about his worries" and that one should rather "try to make him forget them." Let us examine these statements, both of which contain a certain amount of truth, but if applied without qualification to serious cases of incipient mental disorder can by their respective negative and positive tendencies do an incalculable amount of harm. They are often the result of

applying experience acquired by the successful reassuring of a certain type of “malade imaginaire,” to the consideration of far more complicated cases in which such easy and straightforward treatment is impossible. A man, let us say, visits a doctor and confesses to him his fear that he is suffering from some organic disease. The physician after a careful examination proves to the patient by objective means that there is nothing the matter with him; the sufferer is reassured and returns to his daily business and in due course forgets about this worry or ceases to be troubled by the memory of it. Here the diagnosis, treatment, and cure may be uncomplicated and “on the surface.” But even here it should be emphasised that in one sense, far from “making the patient worse” to talk about his trouble, the talking about it was the _sine quâ non_ of cure; otherwise the doctor would never have known of the fear. In another sense, however, talking about the trouble did make the sufferer worse—but for a short time only, during a confession of his apprehensions, or perhaps even for a few days, if more than one visit to the consulting room were necessary before the doctor’s verdict could be obtained.

But not all visits to the doctor end so briefly or so easily as this. The patient’s trouble, on examination, may prove to be organic and of long standing. Does the doctor consider then that it is his duty to emulate the Christian Scientist or to “make the patient forget it?” On the contrary, he does not flinch from the employment of the most searching methods of investigation, lengthy and often painful treatment, and, if it seems necessary in the patient’s interest, he will carry out or arrange for operative interference which may be difficult, expensive, by no means free from danger, and is quite likely to “make the patient worse,” perhaps for a considerable time, before its beneficial results appear.

It is therefore idle to argue that on the one hand psychological methods of treating mental disorder are unnecessary because some patients get better without their application; while, on the other, they are dangerous because they may make a patient worse. The same remarks could be applied to most of the successful operative methods of present-day medicine. All of them are fraught with grave potentiality for harm if applied by unskilled persons.

The degree to which the doctor is medically justified in probing the patient’s intimacies is obviously dependent upon the individual case. Not all patients require such drastic incisions; a fact which has been clearly shown in the special military hospitals. An intelligent man of strong will, whose social relations have hitherto been normal and happy, might be temporarily “bowled over” by the emotional stress of the campaign, but after a few inquiries into the causes of his mental anguish and a few explanations, he is often set on his feet again.

We must not forget, however, the other side of the picture. There are many patients, who, far from being made worse by the confidential recital and discussion of their mental troubles to a suitable person, experience great relief as a result of this unburdening. Men in the military hospitals have expressed this over and over again, in such phrases as, “I have been bursting to tell this to someone who would understand,” or, “I have seen many doctors since I left the front, but you are the first who has asked me anything about my mind.” Frequently the troubles prove to be caused by their ignorance of the great individual differences in minds, so that the appearance in them of a new but by no means pathological mental phenomenon frightens them unduly. We have already referred to cases of this kind in Chapter I.[44] Another frequent cause of the most intense and continuous mental anguish is the exaggerated self-reproach which the patients attach to some real, but in the judgment of others, comparatively trivial defect or delinquency in themselves. To borrow an expressive phrase, the neurasthenic has “lost his table of values.” It is in such cases that a talk with a tactful, sympathetic, broad-minded physician may produce the happiest results.

To assume that one can make the patient forget such worries as these without first discovering what they are, is obviously fatuity at its grossest. Moreover, as we have seen, it is quite insufficient merely to discover that the patient is “suffering from hallucinations” or delusions and then to tell him to dismiss them from his mind. To suppose that, without understanding the nature of and the specific reasons for the development of a particular hallucination, one can “make the patient forget” his interpretation of a real experience which has appealed to him night and day for weeks, or banish a delusion which is gradually becoming systematised and rationalised—_i.e._, intimately interwoven into the tissues of the whole of his experience—is an assumption which has no foundation in fact.

The point cannot be too much emphasised that many of these patients are quite sane, if conduct be regarded as the criterion of sanity; but they are growing afraid of the appearance of these abnormal phenomena, and take them for signs of incipient—or, more usually perhaps, of established—insanity. Hence follows the important corollary that while treatment by isolation has obvious advantages in certain cases, in the particular group of patients which we are now discussing it is often dangerous, for the reasons already emphasised in the last chapter. The presence of such mental phenomena is usually confided to the physician only after great hesitation, and such worrying experiences are common in cases of insomnia and other disorders, which, though troublesome,

do not appear to be grave. It is therefore possible that isolation may have serious effects in many cases in which its net result seems merely to be that the patient is no better.

It is granted then that in some instances (by no means all), the patient may be temporarily pained by the dragging into daylight of the causes of his worry, but it is usually a case of _reculer pour mieux sauter_. This procedure is often inevitable in the medical treatment of many disorders which have become complicated to any considerable extent.

We pass now to a difficult task; the consideration of the moral objections to the procedure of psychological analysis. The difficulty obviously lies in the circumstance that, while in the discussion of the other objections one could continually point to facts upon which at least, the great majority of civilised people are in cordial agreement, such unanimity is not so complete upon moral questions. Some of the varieties of the moral objection, however, are not based on such disputable grounds. For example, there is the argument that it is bad for the patient that he should have his inmost mental life dissected and analysed in the thoroughgoing way which we have described, since it is important for the preservation of his self-regard that, as far as possible, he should consider himself “master of his soul.” With the latter sentiment no reasonable person would quarrel. And where it is possible (as it often is) for a slight mental tangle to be straightened out without an extensive and lengthy inquisition, we hold that it is urgent in the patient’s interest that his privacy shall be respected. It should be pointed out, however, that since this procedure is equally in the interests of the honest physician—for it will save him time and trouble—it is likely to be adopted wherever possible. In the special military hospitals, for instance, it was often found unnecessary, in mild cases, to press the inquiry very far; the patient “learning his lesson” successfully at an early stage of the proceedings.

But it obviously does not follow that the fact of a man having for very sufficient reasons, admitted the physician into his confidence, must necessarily bring as a consequence a diminution in his self-respect. On the contrary, he often emerges from such an examination with increased confidence and a better opinion of himself, especially if, as so often happens, his self-reproaches have been unfounded. The civilised world contains a relatively large proportion of people who habitually confess their shortcomings to priests. One may recognise that the confessional has its defects, but the assumption that to have recourse to it inevitably promotes mental flabbiness is obviously unfounded. The business man who, when faced with the necessity of successfully meeting an entirely new situation, consults his legal adviser, is not usually blamed for his lack of self-reliance. Conducting one’s own legal transactions, like doctoring oneself, may appear (to the vulgar) to show independence, but its results are not always happy.

It is therefore perfectly fair to claim that none of the arguments against the use of psychological analysis have any very great significance. In some cases, however, they express valuable reminders that this delicate and powerful instrument, like all others with these attributes, must be used with care and discretion.

We may now proceed to take stock of our present position and briefly to summarise the contents of the foregoing remarks. Many cases of “functional nervous disorder” or “neurosis” exhibit as their most important characteristics symptoms, the underlying factors of which are demonstrably _mental_. A neurosis may be regarded as the failure of an act of adaptation.[45] The resultant mental disturbances do not seriously affect the “reason” or the “intellect” as was formerly supposed, but are in character predominantly instinctive and emotional. The neurotic’s behaviour in the face of an insurmountable difficulty presents a considerable resemblance to that of a child. The reasons why this analogy is not always obvious (though often it is quite plain) is that while in the child one can usually appreciate the cause of the emotional disturbance and watch its progress, these possibilities are often excluded in the case of the civilised neurotic adult. Both his insurmountable difficulty and the historical circumstances which have made it unconquerable may (they do not always) lie within his inmost mental life. Further, the child’s difficulty usually is caused simply by his inability to adjust himself to his environment; or perhaps more often to adjust his environment to himself. The adult neurotic, on the other hand, adds to these difficulties the further significant one of a lack of inner harmony. There are warring elements inside as well as outside him: he is trying to fight the enemy with an army which has mutinied.

It follows then that any attempt to restore equilibrium between himself and his social environment must be accompanied by a similar endeavour to bring about his inner harmony. Therefore, in such cases, a certain amount of psychological analysis is indispensable. Without such investigation the application of physical or psychical methods of treatment must inevitably be a shot in the dark.

The task of psychological analysis is rendered difficult by the fact that not all the motives of the patient’s present beliefs, attitudes and actions are conscious; the entry into consciousness of some of the unacceptable motives and memories is obstructed by various mental processes. When the action of these shielding mechanisms has been subverted by various means the real

significance and history of the patient's present mental condition becomes clear to him. In the light of this new self-knowledge he begins to cure himself. In a few cases he may require little or no subsequent assistance, but usually a process of re-education[46] is necessary. He may still require to be helped over some of the obstacles which he meets, and he may need more or less frequent encouragement and advice to an extent determined by his disposition, temperament, and character. By these means he is "freed from himself," liberated from the exaggerated emotional tone which has become attached to so many of his memories, and so enabled to face life anew with a harmonious and integrated mind.

The procedure which we have discussed is precisely that which the sensible mother adopts towards a child who exhibits sudden and unreasonable fear, anger, or any socially undesirable emotion. The same method is adopted towards the man who, having muddled his financial affairs, appeals for advice to an experienced and judicious business friend. "Firmness"—of the unsympathetic and unintelligent order—may occasionally produce good results in both these instances, but usually it only makes matters worse. Paying for the commercial muddler a few of his chief debts may remove his embarrassment for the time, but if unaccompanied by an attempt to reform his business methods, the result will usually be merely that such a treatment will enable him to incur fresh liabilities. So it is when a symptom or set of symptoms in a neurosis is unintelligently removed: new troubles frequently break out in fresh places.

We believe that there exist and can exist no serious arguments against the procedure of psychological analysis and re-education which we have just described. But now we come to speak of a procedure introduced during the last few years which has certainly not escaped criticism both of the most flattering and the most hostile kind. This is the method of "psychoanalysis" which we owe to Professor Sigmund Freud, of Vienna, who developed it as an extension and elaboration of the pioneer work of his former master, Professor Pierre Janet[47], of Paris.

Perhaps few terms in medicine have aroused so much misunderstanding, so much criticism, well-informed and ill-informed—and so much enmity as this word "psychoanalysis." This latter fact alone, however, should not prejudice the reader for or against it. He will probably remember that it is the exception, rather than the rule, for an innovation to be received without hostility, not only from the general public, but also from experts who work in provinces bordering upon the field in which the new method is introduced.

It should be pointed out that much of the heated discussion which has raged around this word psychoanalysis is due to the fact that the term has different meanings, as used, not only by its enemies, but by its friends. Psychoanalysis, according to Dr. Jung, is a _method_; "a method which makes possible the analytic reduction of the psychic content to its simplest expression, and the discovery of the line of least resistance in the development of a harmonious personality."[48]

Psychoanalysis is therefore a method of psychological analysis. Why, then, have we not used the term psychoanalysis in the earlier part of the book? It was purely to avoid unnecessary and acrimonious discussion on any particular doctrinal aspect of the question which this term may be taken to imply.

It is clear to every thinking person that, in analysing a mental state the physician should use every legitimate means at his disposal. If these means include, as they do, the valuable assistance derived from the study of the patient's dreams, his "associations" whether free or constrained,[49] and other mental phenomena, the doctor may use them freely without thereby subscribing to any one "doctrine of psychoanalysis."

The term psychoanalysis has been widely applied, not only to the diagnostic method, but also to the theories which underlie and determine the subsequent process of re-education. This seems to be a misuse of the useful word "analysis." It may be objected that in all scientific analysis there is some directive hypothesis to be confirmed or disproved, and that in this sense all analysis is based on theory. This is true, but it seems inadvisable to confuse the analytic process with the theory which directs one form of it.

When we come to consider the theoretical presuppositions which underlie the different methods of re-education adopted by various physicians, it is not surprising, at this early stage of our knowledge, to discover differences of opinion. The physician will find at every step that in "tidying up" the disentangled functions of the patient's mentality he will need not one theory but many, for his problem is life itself.

All his own human sympathy, with its indispensable basis, a knowledge of his own strength and weaknesses, all his learning in physical science and psychology, all his knowledge of morality and religion must be available for immediate and efficient use. In one interview he may have to lay down the law for the benefit of some ignorant and distressed patient who is desperately anxious to follow his advice unquestioningly; in the next he may be at close grips with a mind more flexible and independent than his own,

knowing well that his every little victory must be consolidated, and that every position won may be subsequently counter-attacked by his patient. He must be ready to suggest, discuss, persuade as the time and the conditions indicate.

While, therefore, the ultimate lines on which an ideal diagnostic analysis and curative re-education will be possible are as yet undefined, it would serve no good purpose in a book of this length to raise discussion on the question of psychoanalysis. Its future will be settled, not in the heated atmosphere of the debate, not in the acrid polemics of the correspondence columns, but in the calm, careful examination by the individual worker of his own actual findings and the honest comparison of them with those of others.

FOOTNOTES:

[37] Such development involves a complicated set of processes the nature of which is by no means obvious to unaided common sense.

[38] "... for example, a patient may maintain that he is the king, but that an organised conspiracy exists to deprive him of his birthright. In this way delusions are sometimes elaborated into an extraordinarily complicated system and every fact of the patient's experience is distorted until it is capable of taking its place in the delusional scheme." Bernard Hart, _The Psychology of Insanity_, Cambridge, 1914, p. 32.

[39] _Cf._ p. 15_f._

[40] _Cf._ Hart, _op. cit._, p. 66_f._

[41] The reader may pass an interesting time in trying to give himself or others an historical account of the events in his life which caused him to choose his present profession. He will probably find that memories emerge of incidents and conversations which have been forgotten for years. Yet he may find that they have influenced his present life and his action at any moment of the present, to a very great extent. Their present action clearly has been unconscious.

[42] It should not be forgotten that when a patient in an early stage of mental disorder voluntarily seeks the doctor, his _active co-operation_ in the task of tracing the causal factors of his trouble is of the greatest value. This assistance cannot be relied upon after the patient has been certified as insane and removed to an asylum, or even after he has been taken to the doctor at the instance of others. For obvious reasons he is then more likely to hide than to reveal his eccentricities. The simulation of insanity is comparatively rare: it is difficult and usually easily detected. It is dissimulation—the concealment of symptoms of disease—which is the doctor's greatest enemy. The deluded man may hide his delusions because "everyone knows that these beliefs are mad:" the melancholic may pretend for the time to be cheerful in order that his liberty may not be interfered with. (_Cf._ K. Jasper's _Allgemeine Psychopathologie_, Berlin, 1913, p. 317.) Such attitudes of the patient are obviously strengthened by our present custom of delaying the treatment of mental disorder.

[43] In his account of the wonderful exploits of "Sherlock Holmes," Sir Arthur Conan Doyle was merely applying, with inimitable skill and literary resourcefulness, the methods of clinical diagnosis in medicine to the detection of imaginary crimes. The unusual phenomenon in medicine or in crime often affords the most obvious clue to the expert who can appreciate its significance, whereas a simple dyspepsia or a commonplace murder may present insoluble problems, because they reveal no distinctive signs to guide the investigator.

[44] p. 17_f._

[45] Dr. C. G. Jung's view, _Analytic Psychology_, p. 234.

[46] It is of importance to remember that successful re-education utilises the emotional factors in the patient's mental make-up, by helping him to realise the value of the things which will make life once more attractive and worth living. In this process the more the physician knows of the patient's social, moral or religious relations, the earlier and more satisfactory will be his success.

[47] CORRECTION.

An unfortunate error in the second paragraph on page 73 escaped our notice during the correction of proofs. Professor Pierre Janet was not formerly the teacher of Professor Freud, but his fellow pupil when they were studying under Charcot in Paris.

[48] _Op. cit._, p. 256_f._

[49] _Cf._ Hart, _op. cit._, p. 69_f._, Jung, _op. cit._

CHAPTER IV.

Some General Considerations.

It is instructive to compare the public attitude towards insanity with that adopted in the case of another serious disease, tuberculosis.

There is nowadays a general conviction, not only amongst the medical profession but also amongst a large proportion of the educated public, that tuberculosis is a curable disease. It may exist in a mild and incipient form in many persons regarded as healthy, and, if properly treated in its early stages, with due regard not only to the actual disease in the bodily organism, but also to the healthy environment of the individual, it is almost certainly conquerable. Not many years ago, however, this happy belief did not obtain. A person “in consumption,” especially if “consumption was in the family,” was regarded as being in a very serious and almost hopeless condition. The patient, shielded from fresh air, inappropriately and insufficiently fed, often succumbed, supplying one more example to support the unscientific conception then prevalent of the inheritance of the disease. But such conditions are passing away. In our medical schools and hospitals special attention is paid to the diagnosis and treatment of early forms of tuberculosis; the importance of preventive measures is emphasised; the influence of the patient’s environment in favouring or combating the disease is explained; and the future medical practitioner is afforded frequent opportunities for personal investigation of tubercular patients. The old ideas about the “inheritance of consumption” are greatly modified. No longer is a patient’s disease explained as “in the family” and left at that. Preventive measures, early treatment, an attempt justly to appreciate the relative influence of heredity and environment are the watchwords of the modern medical attack upon tuberculosis.

If, however, we consider the attitude of the general public in this country towards the malady of insanity we find a mixture of ignorant superstition and exaggerated fear. From these there springs a tendency to ignore the painful subject until a case occurring too near home makes this ostrich-like policy untenable. The sufferer is removed to a “lunatic” asylum, neither himself nor his relatives being spared the gratuitous extra wrench to their feelings aroused by this name, which has long struck terror into the uneducated mind. He is taken away by the relieving officer of the district, often under the pretence of being given “a few weeks in a convalescent home at the sea-side,” and eventually finds himself under lock and key. Here, as is well known, he is treated with great kindness. Neither public money nor the exertions of the staff are stinted in the effort to render his lot as pleasant as possible—“the asylum to-day has become a model of comfort and orderliness.”[50] But the proportion of doctors to patients is on the average, one to 400, and it is exceedingly difficult to ensure that all patients, once inside the “lunatic” asylums, shall be regularly visited by friends from the outside world.[51] The attitude of the general public is not deliberately cruel, but it appears to be far more benevolent than it really is. The community treats the sufferer well, when, _but not before_, he has become a “lunatic.” It allows his delusions to become fixed, his eccentricities and undesirable acts to harden into habits, his moods of depression to permeate and cement together the whole of his life—and then interns him and treats him kindly for the rest of his life, but does not give him facilities for gratuitous treatment while he is still sane. _That is the British procedure to-day._

Lest we should be accused of exaggeration, or worse, we will quote here from published articles and reports.

Dr. Bedford Pierce says:—

“Let me state in a few words the defects of our present system. At present, broadly speaking, no person unable to pay its cost can receive adequate treatment until he is certified as of unsound mind. This practically means that no special treatment is possible until he has utterly broken down, and is so seriously affected as to convince a magistrate that he is decidedly insane. No general hospital will receive such a patient; the public asylums are all closed to any one who begs for protection or treatment, for county asylums cannot receive voluntary boarders even when the cost of their maintenance is forthcoming.

Consequently there is no alternative but to apply to the Poor Law authorities, who, under certain circumstances, provide treatment for a period of two weeks in the workhouse infirmary. The whole system is radically wrong. When the wife of an artisan becomes depressed after confinement, surely it is cruel in the extreme to make her a pauper and send her to the workhouse infirmary, pending a decision as to whether she is insane or no. It is obvious in such a case that this course will not be adopted until the last possible moment, and consequently much valuable time is lost.

Every practitioner will be able to call to mind patients travelling steadily towards insanity in unfavourable surroundings. This question is brought even more prominently before consulting physicians, especially those interested in nervous and mental diseases." (_Op. cit._, p. 42.)

In the words of the report of the Medico-Psychological Association:—

"The present system, which compels all persons, except those able to pay adequately for their maintenance, to apply to the Poor Law authorities in order to secure treatment, is unsatisfactory and unjust. In doubtful and undeveloped cases temporary care can be given only in workhouses or Poor Law infirmaries, which, with very few exceptions, lack proper facilities for treatment.

A system which artificially creates paupers in order to obtain medical treatment necessarily acts as a deterrent, so that too frequently there is serious and even disastrous delay."[52]

This is not exactly locking the stable door after the horse has gone; it is double-locking him thoroughly, expensively and often unnecessarily, in someone else's stable.

Let us, for a moment, compare this state of affairs with that existing in the case of tuberculosis. Nobody now believes that the scientific way of treating this disease consists in waiting until the patient has become a positive danger to others, and then locking him up. This point needs no elaboration. But another fact in this connection should not be forgotten. The tubercular patient usually seeks the doctor _of his own free will_, often obtaining treatment in a relatively early stage of the disease.

There are, however, many reasons that deter the mental sufferer from seeking medical help. One of the strongest of these is the wish to cure himself by his own unaided efforts. This is a laudable desire and one which is extremely helpful and important in mild and uncomplicated cases of relatively recent occurrence, but of which, as we have seen,[53] the gratification is not always possible. Another factor is the natural disposition which the patient shares with the rest of conventional humanity, to conceal his worries, not only from his friends, but perhaps above all from those of his own household. This tendency to concealment, however, often only aggravates his mental distress. Particularly is this the case in adolescents. As is well known, a talk with a kindly, sympathetic and wise person, or even a confession to such an adviser, frequently means the end of many painful mental conflicts.

But in addition to these very natural reasons for deferring recourse to medical help, there are in our own country special causes for delay. These are due to the prospects imagined by the sufferer to be awaiting him if he discloses his trouble.[54] The treatment of incipient mental disorder is often a long and complicated process for which the average general practitioner has seldom either the time or the special training. In very few hospitals in this country is out-patient attendance for such maladies practicable. For the mental sufferer whose means are not considerable, there exists nothing if the efforts of the general practitioners fail, but trying to cure himself, or, if he becomes worse, admission to an asylum. Unfortunately, however, the average asylum, with its one doctor to 400 patients, does not and can not meet his needs. The successful treatment of mental disease usually requires individual care, often lasting over long periods. When it is remembered that the asylums contain a considerable percentage of patients whose bodily diseases, apart from their mental troubles, require the doctor's attention, and further, that by the time the patient reaches the asylum, his disorder has usually passed through its initial stages, it is easily seen that our asylum system in its present state—to put it mildly—is far from conducive to recovery from mental disease. Considering that, in spite of these drawbacks, 33 per cent. of the patients are discharged,[55] we can only gladly recognise the efforts made by the asylums; we are, however, bound to ask: _What percentage of the inmates need ever have entered the asylum?_ It may be objected that it is easy, but unfair, to ask such a question seeing that no satisfactory answer can be given. To this objection there are two replies: first that, judging from the present state of affairs, this question cannot be publicly asked too often; secondly, that materials for an answer are already forthcoming. It is conclusively proved by the experience of other countries that a large proportion of the patients might have been cured without being sent into an asylum. Thus, for example, in Germany, in the province of Hesse, by reason of suitable treatment during the early stages of mental illness the authorities were able to postpone for ten years the erection of a new asylum.

"The Psychopathic Hospital at Boston, Massachusetts, ... was built by the State expressly to deal with recent acute cases. No fewer than 1,523 patients were received in its first year, and of these 590 were received under a temporary care law, which provides for a week's detention only; large numbers were also received on a voluntary basis, so that during the year _48 per cent. of all patients escaped the usual lunacy procedure_.

On reading the reports of work done, one is struck with the enthusiasm of the medical staff and the vast field of research undertaken. During the two years eighteen medical men describe their work covering almost every department of psychiatry:

juvenile crime, tests for feeble-mindedness, incidence of syphilis, alcoholism, hydropathy in its influence on red blood cells, treatment of delirium, prophylaxis, analysis of genetic factors, salvarsan treatment, tests of cerebro-spinal fluid, and last, but not least, the value of out-patients' departments and after-care. There is a special social service department for the purpose of following up cases in their homes, and it was found that of every 100 admissions 20 needed supervision on discharge, 24 needed advice, 3 required assistance in arranging their discharge, and 10 showed a need for prophylactic work in their families.

This bald statement of the activities of the Boston State Hospital shows plainly what an important service it renders in providing treatment apart from ordinary asylum associations. It shows how it is possible at such a hospital to organise a medical service which covers all departments of psychiatry; and further, that when the mental symptoms clear up, a patient need not be thrown back into old associations without help or supervision.

This hospital at Boston is but one of many that have been established in the United States in recent years. Some of the others are due to private munificence; in particular, reference may be made to the Henry Phipps Psychiatric Clinic at Baltimore, the medical staff of which consists of a director, assistant director, a resident physician, two assistants, and five [resident medical officers]. In addition to these are the heads of three research laboratories dealing (1) with clinical pathology and bio-chemical investigation, (2) with neurological research, and (3) with psychopathology." (Bedford Pierce, _op. cit._, p. 42.)

In advocating the establishment of separate pavilions for nervous and mental disease in direct association with the general hospitals, Dr. Bedford Pierce says:—

"At La Charité Hospital in Berlin, the visitor enters a small park, and Dr. Ziehen's clinic is but one of many detached buildings devoted to special diseases. It is as easy and simple for the patient suffering in mind to get advice there as for another with eye and lung trouble."

Let it be noted that none of these German patients, on returning to their relatives and friends, suffer from the stigma of having been to an asylum. In our country some of those same friends during the patient's absence would often have been engaged in "sympathetically" spreading the news of the sufferer's absence and his whereabouts to everybody in the district. To a certain type of mind there is a ghoulish fascination in gloating over the illnesses and afflictions of neighbours. Even though people addicted to such habits may salve their own consciences by exclaiming "poor fellow" at the end of their narrative, the effect of their conduct is none the less brutal and offensive. This is not the place for the discussion of so remarkable and important a phenomenon of social psychology. Nevertheless it plays a great part in the causation of the prevalent dread of treatment for mental disorder.

For many reasons the psychiatric clinic is not regarded by the public as a "lunatic" asylum. In the Giessen clinic in Germany, for instance, both nervous and mental diseases are treated. The patient afflicted with tremor or a paralysed finger visits this institution as well as the sufferer whose troubles if neglected might develop into mental disease. Difficult medico-legal cases resulting from such incidents as those arising from the claims by workmen and others for compensation after accident are sent to this clinic for observation and opinion. "Rest-Cures" and similar treatment are also carried out there. The official title of the institution, displayed at the entrance, is "Clinic for Mental and Nervous Diseases." The institution is therefore regarded by most people in quite a different light from the asylum, and it is not spoken of by the general public with bated breath. One of us, while working in the laboratory of a German psychiatric clinic, was introduced to a visitor who made some remark about "when I was here." To the question, "Were you on the staff, then?" the visitor answered quite naturally, "Oh no, I was here as a patient."

With this experience may be contrasted another incident, this time from our own country. Delegates from a certain Board of Guardians paid a visit to the county asylum to inspect the arrangements made for the comfort of the inmates from their own district. In the next week's local newspaper a report of the visit appeared in the form of the chief delegate's speech at the subsequent board meeting. This report consisted of "funny" stories of the eccentricities of the patients the visitors had seen, and of the delusions from which some of the victims were suffering, with sufficient detail to enable many of the relatives, and possibly some of the friends, of these "lunatics" to identify the afflicted ones. The newspaper account of this humorous effort was punctuated at suitable intervals with "laughter."

It is obviously not claimed that these two accounts are typical either of Germany or of England. But what is claimed is that of these two public attitudes the clinic system promotes the one, the "lunatic" asylum the other.

Before leaving the comparison of insanity with tuberculosis we must remind the reader of some other facts that are important in this connection. We have seen[56] that the scientific study of tuberculosis has materially modified the earlier views concerning its

hereditary transmission. It is now held that tuberculosis is not inherited as such; but that a child of tuberculous parentage may begin life with a subnormal power of resistance to the disease and perhaps greater risk of exposure to infection. If later he develops the disease, it is traceable directly to his environment. The corollary is that if his environment be improved, and his body's power of resistance increased meanwhile by all the means in our power, he has a considerable chance of living a life free from the disease. Thus the old pessimistic view is replaced by a distinctly optimistic one.

In the mental disorders that are indubitably traceable to organic disease of the central nervous system, heredity doubtless plays a great role. But two points should be remembered in this connection. First, among asylum patients the number of mental disorders which cannot, _post-mortem_, be traced to organic causes is very great as compared with those that can be so related. For example, of 1,325 patients received at the Burgholzi Central Asylum and University Psychiatric Clinic, Zürich, Dr. C. G. Jung states:—

"... in round figures a quarter of our insane patients show more or less clearly extensive changes and destruction of the brain, while three-fourths have a brain which seems to be generally unimpaired or at most exhibits such changes as give no explanation of the psychological disturbance.... We must take into account the fact that those mental diseases which show the most marked disturbances of the brain end in death; for this reason the chronic inmates of the asylum form its real population, and among them are some 70 to 80 per cent. of cases of dementia præcox, that is of patients in whom anatomical changes are practically non-existent."[57]

In a great number of mental disorders our present knowledge of anatomy, physiology and pathology is of little help as a means of throwing any light upon the patient's condition. While in no way attempting to belittle the magnificent work in these subjects during the past century, it should be pointed out that its very success has brought about, especially in this country, an unfortunate tendency to regard these methods as the only ones suitable for attacking the problems of insanity. But nothing is more certain than that in the psychoneuroses: hysteria, neurasthenia, psychasthenia and the rest, anatomical and physiological knowledge has not yet passed beyond the theoretical stage[58]. But it is equally indisputable—and the statistics of shell-shock cases have strengthened the evidence for this assertion—that the psychological mode of attack, the treatment of mental disorder by mental means, is now firmly established as a practical method.

It appears, therefore, that precisely in those cases of psychoneurosis which yield to psychical treatment, there is no anatomical, pathological or chemical evidence of inheritance.

But while the contributions of anatomy, physiology and pathology to the treatment of psychoneuroses have not yet gone beyond theoretical and mutually conflicting suggestions, the psychological method of investigation and treatment on the other hand has proved itself of practical use in restoring patients to a normal state of mental health. What scientific justification therefore have we, when considering the action of heredity, for lumping together the organic and the functional mental disorders? The psychoneurosis is often simply a progressive state of mal-adaptation to environment; a mental twist which can be corrected if treated suitably at a sufficiently early stage. Its specific nature is frequently explicable almost entirely in terms of the peculiar educational, family or social relations of the patient's environment. The war has shown us one indisputable fact, that a psychoneurosis may be produced in almost anyone if only his environment be made "difficult" enough for him.[59] It has warned us that the pessimistic, helpless appeal to heredity, so common in the case of insanity, must go the same way as its lugubrious homologue which formerly did duty in the case of tuberculosis. In the causation of the psychoneuroses, heredity undoubtedly counts, but social and material environment count infinitely more.

To some readers the above argument may seem so obvious as to be superfluous. To ascribe a patient's entangled state of mind to heredity without attempting to discover how far his own personal experiences have tended to bring about that mental condition, would seem as fatuous as attributing to heredity the financial muddles of a son who has inherited from his unbusinesslike father a badly managed estate. The trade-adviser called in to help might for a moment consider the possibility that the son may have inherited his father's unpractical character, but surely his first serious efforts would be to discover where the business methods were wrong or antiquated and to improve on them. So it is with the mental patient; his own history is the important desideratum. That of his parents may cast valuable light upon his trouble, but even then it is often just because their own difficulties have contributed to the making of his environment.

One of the most dangerous and misleading terms in our language is the word "neuropathic;" for it is made to signify so many things that it ends by meaning nothing. Etymologically, it should mean "afflicted with disease of the nerves," a conception the precision of

which we shall discuss below. Yet on the return from the front of patients afflicted with “shock” one heard the opinion at first that the cases were those of “neuropathic” men: that the soldiers who became affected by shock were weaklings or were descended from mentally afflicted or nervous parents. It is, of course, unquestionable that in a large army there must be many soldiers with tainted family histories; and it is probably equally certain that such factors play some part in determining the greater susceptibility of certain men to shock. But it would be a gross misrepresentation of the facts to label all the soldiers who suffer from mental troubles as weaklings. The strongest man when exposed to sufficiently intense and frequent stimuli may become subject to mental derangement. It is quite common to find among the patients suffering from shock senior non-commissioned officers who have been in the army fifteen or twenty years (much of which time has been spent in foreign service under trying circumstances, such, for example, as the South African War), and have stood this severe strain. Such men can hardly be called weaklings or “neuropathic.”

Even in those cases where there is a definite history of a neurotic parent, it would be a mistake hastily to conclude that when the son of such a man or woman becomes a victim of shell-shock it is due to heredity. For when the detailed history of such patients is obtained the fact comes out quite clearly that the social disturbances in the household of such a nervous person may be amply sufficient to inflict severe psychical injuries upon young children.

Further, in many cases the histories themselves clearly and definitely reveal the real etiology of the mental condition, and point to emotional disturbances in children, due to the cruelty of drunken parents, a rankling sense of injustice, a terrifying experience, which may have been an accident or deliberate maltreatment by some human being, or again, to the appalling conditions created in some of these homes by nervous and irritable parents, as the real trauma which the “shock” has served to re-awaken.

But when we come to ask _what_ disease of the nerves, or, more strictly, of the nervous system, is implied in speaking of the “neuropathic” we find no satisfactory answer. Certainly no one disease is regarded as being the causal factor. And the list of theories is overwhelming. Disturbances of the genital, vaso-motor, or digestive systems, demineralisation, chemical disturbances of nutrition of hepatic or cholæmic origin, visceral ptosis, cerebellar disturbance, thyroid disorder, complex disturbances in functioning of the blood vessels, intoxication, exhaustion[60]: these are some of the numerous theoretical suggestions proposed to account for neurasthenia only. Whether the unfortunate neuropath is supposed to be afflicted by one or all of these is a matter which we certainly cannot decide; for the theories proceed from many different sources.

But we must not lose sight of another important fact in this connection. The neuropathic person’s mental troubles, or those at least for which he seeks relief from the physician are by no means in the clouds of theory. They are real enough, and as a rule not to the patient only, but also to his relatives and friends, with whom he finds it difficult to live amicably. Those troubles are based upon fear, anxiety, anger, and excessive curiosity concerning matters about which the normal person would not bother his head. They find expression in outbursts of pugnacity or of unusual self-assertion with its emotion of elation, often followed by self-abasement and subjection, inordinate desires either to be alone or never to be alone, floods of tender emotion, possibly following close on the heels of a mood of blatant self-assertion with no regard for the feelings of others. These relatively simple processes of mind, occurring sometimes in comparative isolation, sometimes inextricably blended or kaleidoscopically transient, are the real marks of the so-called neuropath or neurotic. Bodily troubles may, and often are, added to these. But as every physician knows to his cost (and sometimes to the patient’s), and as faith-healers know to their advantage, these bodily diseases are usually exaggerated by the neurotic sufferer, and frequently prove to have but a slight material basis. In other words, the real marks of the “neurotic” are mental.[61] And one need not be a technical psychologist to see that the above list is nothing but an enumeration of the instincts and emotions possessed in common by all men.[62]

If then, the neuropath is merely displaying instincts which are common to all mankind, what is the difference between him and the normal human being? The difference is psychologically slight, sociologically immense. While his normal brother reacts instinctively and emotionally to his physical and social environment in such a way and to such a degree as to promote his own welfare and that of others, the neuropath does not. Nobody calls the townsman a neuropath who before crossing the street waits on the pavement until the stream of traffic has thinned. If he did not wait we should rather call him a fool. But the instinct of fear is largely at the bottom of his so-called intelligent caution—especially if he has ever witnessed a distressing street accident. But what do we say of the man who waits and waits until finally he is too afraid to advance, eventually stealing down to another place so that he may cross in safety? He is very likely to be called a neuropath. Or what shall we say of the unfortunate man whose caution has gone so far that he cannot cross _any_ open space whatever, and is said to be suffering from agoraphobia?

Or again, take the case of a man whose personality, family or country, is grossly and publicly insulted. If he strikes at the aggressor, do we call him neuropathic? But we seldom hesitate to apply this term to the man who is inordinately touchy, ever on the watch for

the least suspicion of insult towards himself or anything even remotely connected with him. The emotion of fear underlies both the attitude of caution and of “funk,” that of anger, the righteous indignation of the stalwart and the querulous, peevish irritability of the neurasthenic. The difference between the behaviour of the normal man and the neuropath lies primarily in the circumstances that provoke emotion in them, and secondly in the violence and duration of the emotion itself.

We should remember also that many varieties of animals display the kind of behaviour we have described, and regard as so unusual, if not utterly eccentric, in our friends. Professor William James reminds us of the chronic agoraphobia of our domestic cats; and the tamer of wild animals has good reasons to respect the incessant touchiness of some species of the genus _Felis_. Do we invoke theories of visceral ptosis, intoxication and the rest to explain the behaviour of the average cat or mule? Scarcely. We say that these animals are actuated by instinct. Our arrogance makes it difficult for us to suppose that our suffering human brothers are also acting instinctively. Yet this is undoubtedly the case.

It has been said of the neurasthenic with aptness and truth that he behaves like a child. But if a child, normal in its behaviour up to a certain day, suddenly manifests fear of being left alone for a moment in a room with closed doors, or in a street, do we rush for our “Liddell and Scott” and forthwith proceed to babble of claustrophobia or agoraphobia?[63] Do we follow this up by solemnly invoking complicated physico-chemical theories concerning the state of his blood or other bodily fluids? Finally, do we brand him as “insane” or at least “neuropathic?” What we do in this case, if we have any sense, is carefully to investigate the causes of the emotional outbreak. We try sympathetically to understand and re-educate the child to meet such situations without fear. In other words, we use a method precisely similar to that which proves to be of such great use in treating the psychoneuroses.

The analogy—if it be an analogy and not perhaps an identity—between the two cases goes still farther. The child who manifests extreme fear at “inadequate” causes, such as we have described, not infrequently agonises his mother—perhaps soon after his outburst of fright—by an exhibition of foolhardiness which, if we did not know of the previous sign of weakness, would cause one to look upon him as fearless. In short, the child’s fear is restricted to one or two special situations. So it is with many neurasthenics. Some, for example, may be driven through traffic in a fast motor car without experiencing the slightest fear, though they cannot bring themselves to enter an ordinary slow suburban train; others may surprise us not only by their exhibition of anger at what we should consider an absurdly slight provocation, but by their tolerance and self-control in other (to us) much more annoying situations. Their exaggerated emotional reactions are excited not by general but by specific stimuli; and a little tact, insight and patience on the part of the physician often reveals in their past experience, psychological factors which explain the tremendous personal importance and overweighting of these stimuli. If for neuropathic we write: “unduly hampered by instinct and emotion”—and this is all we have the right to do[64]—we represent the matter more truthfully.

Among the laity, before the war, the justification of an attitude of inertia towards the treatment of mental disorder (more particularly of the psychoneuroses) was often based upon two statements. The first was that many of the phenomena reported were not real, but were the imaginings of hysterical women. If to this it was objected that men were not immune to hysteria[65] one was met by the retort: “But they are ‘neuropaths.’” This war has, however, removed from honest people’s minds the possibility of regarding these phenomena in such a shamelessly unscientific light. In the military hospitals there have been hundreds of patients suffering from psychoneuroses, who are demonstrably neither women nor neuropaths, in any of the legitimate senses of these terms. And many of these men have suffered intensely. Their fears and other emotional troubles are such as they usually conceal as long as possible, until further endurance is intolerable. Their troubles are real enough to them. “But they are unreasonable,” the healthy philistine may object. Some (by no means all) of the fears _are_ unreasonable, if by that is meant that the actual danger (as the healthy man estimates it) and the emotion which it evokes in the patient are entirely disproportionate. But who among us has “sized up” life’s dangers so accurately that he can say he knows the precise degree of fear which each one _ought_ to evoke?

In some country places the inhabitants to-day are more afraid of the presence in their houses of peacock’s feathers or of hawthorn blossom than of scarlet fever. Their fears are unreasonable. But we do not call these people neurasthenics. As a matter of fact, neurasthenia is one of the last diseases likely to attack these rustics. If they vouchsafe any reason for their fear, it is safe to assert that it will be a rationalisation, for its real sources are hidden from them. And if we really wish to discover the cause of their fear we turn for help to the records of folk-lore and ethnology. In other words, we investigate the history of the fear. This history may go back many centuries and the process of recovering it from a series of clues will prove a task of infinite fascination. Now the history of the neurasthenic’s fear is likewise obtainable and much more easily, for it is of much more recent date. Its discovery often means the freeing of a mind from torment, the restoration of a useful member to society, and the enrichment of the science whereby other similar liberations may become possible. But how few investigators, as yet, have been attracted by this tremendous unfilled field of knowledge!

However, our philistine, while agreeing to this, may, and often does, change his ground. He may add: “When I said that the phenomena were not real I had in mind rather the pains and the paralyses from which the hysteric and neurasthenic suffer—or say they suffer.” To this we may answer in the words of Dr. Purves Stewart:—

“... we must recognise that the neuroses are real diseases, as real as small-pox or cancer. A sharp distinction must be drawn between a hysterical or neurasthenic patient and a person who is deliberately shamming or malingering.... The hysterical or neurasthenic patient usually has no knowledge of the disease which he or she may unconsciously simulate. The various paralyses and pains from which hysterics and neurasthenics suffer are as real to the patient as if they were due to gross organic disease.”[66]

There is a view which, while eminently useful and sensible in so far as it concerns neurology alone, is apt, by virtue of these good qualities, to retard the progress of psychical treatment of the neuroses. For it tends to focus the attention of the medical world on their physical basis alone. Such a view is expressed by Dr. Purves Stewart in the manual from which we have just quoted. In his chapter on the neuroses he says:—

“The old definition of a neurosis as a nervous disease devoid of anatomical changes is inadequate. _Disease is inconceivable without some underlying physical basis._[67] The lesion need not be visible microscopically: it may be molecular or bio-chemical.”[68]

Now from the purely material standpoint such a statement is above reproach. But some important reflections occur as one thinks over the paragraph, and especially the statement: “Disease is inconceivable without some underlying physical basis”—as applied for example, to neurasthenia. What are the important signs of disease in the neurasthenic, or what unusual phenomena are there which cause him to seek the doctor? Chiefly, as we have seen on p. 91, the undue dominance in his mental happenings of instinct and emotion. But we cannot say that this by itself is a sign of disease. Otherwise we shall arrive at the paradoxical conclusion that wild animals, savages and children form the diseased class _par excellence_.

The behaviour of the neurasthenic differs from that of the normal person only in degree, and some sane men might be unhesitatingly regarded as neurasthenic by one class of society, normal by another.[69]

Moreover, it is perfectly clear that if we adopt any of the usual views as to the relation between body and mind, not only disease, but health too is “inconceivable without some underlying physical basis.” Yet of the molecular or bio-chemical aspects of that basis we know practically nothing which would help us to understand even ordinary mental occurrences. So when a normal, physically healthy mother bursts into tears of joy on her son’s return from the front, is sleepless when she knows he is in the trenches, forgets some of her daily duties in perpetually thinking of him, is “on edge” and irritable when she has had no letter from France—though we may be perfectly justified in believing that there are molecular or bio-chemical nervous changes underlying her behaviour, we do not dream of invoking these as explanations of her condition, for of them we know little. Neither do we call her neurasthenic. We understand her condition in that we correctly refer it to the action of instinct and emotion. Its cause is clear to us, and if we attempted to treat it we should know beforehand that the best cure would be the restoration of her loved one, the next best, sympathetic help in facing her worries, the removal of unfounded fears and the production of a serener outlook on the future. In other words, the diagnosis, the tracing of causes, and the treatment would be entirely mental, with no reference whatever to the physical basis, the existence of which we obviously should not deny. Similarly, if a man is troubled by a great moral conflict which produces in him sleeplessness, irritability, abstraction and the rest, the physical basis of his emotional condition may be “materially” treated. His sleeplessness may be reduced by bromides, his irritability and depression by alcohol; but who, if he knew of the great mental conflict, would dare merely to prescribe these?

And this, in the case of many of the psychoneuroses is the crux of the whole matter. The root of the trouble is mental conflict, the complete details of which can seldom be found on the surface of the complex of symptoms. To palliate them one by one is often to provoke new ones. The conflict is sometimes clearly apprehended by the patient, but even then is often jealously guarded from everyone else. Sometimes, however, it is not clearly conscious in all its details, even to him. This is especially the case, if as so often happens, he habitually shuns the thought of it. Faced with an inability to adapt himself to his circumstances, he instinctively relapses into a more childish way of meeting the situation—hence the tears, the irritability, the mental distraction and the rest. This phenomenon, we repeat, is not new. We all acknowledge its existence when we say that the “nervy patient behaves childishly,” though perhaps we do not realise what a true conception of the matter we are expressing.

To sum up, while it is indisputable that the psychoneuroses, like all mental phenomena, have a material basis, we should clearly distinguish between fact and theory in our existing knowledge. Every doctor will naturally seek to make the fullest use of his

learning in building up the bodily health of the neurasthenic. But to sit with folded hands and wait for the advancement of our knowledge of microscopic anatomy, physiology or bio-chemistry would be fatuous when there are other and more direct means of treating the numerous and often pathetic cases, which urgently call for cure. The view that “disease, like health, is inconceivable without some underlying physical basis” is sound and useful, but must not be allowed to blind us to the vital significance of the mental factor and its corresponding importance in the diagnosis and treatment of “functional” disease.

It is an indisputable fact that many modern physicians are apt to concentrate their attention almost exclusively upon the bodily ills of their patients. Yet the majority of doctors, especially those who in general practice get to know their patients intimately, admit readily, even eagerly, that not a small number of the maladies which come under their notice are seriously complicated, if not dominated, by mental factors. To take a simple and obvious example, insomnia may be caused by distressing mental conflicts quite as often as by physical disease. The doctor, however, even if he suspects this fact, often hesitates to proceed further in the light of such knowledge.

For this there are several reasons. In the first place, his arduous, lengthy and expensive medical course has usually never vouchsafed him five minutes’ specific training concerning the manifold ways in which human nature may succeed or fail in adapting itself to the complex environment which we call civilisation. Any wisdom of this kind that he has picked up is due to his own interest and insight in social matters. The university’s contribution to his psychological knowledge usually consists in showing him a handful of comparatively hopeless caricatures of mentality in his short series of visits to the asylum.[70] It is as if one tried to teach electrical engineering by a few exhibitions of broken-down dynamos, navigation by half-a-dozen cursory inspections of wrecks, finance by a short series of visits to the bankruptcy courts.

The result of this strange conception of medical education is different according to the mental make-up of the particular physician. There are many whose insight and sympathy enable them to penetrate successfully for some distance into the Cimmerian darkness of the patient’s mental troubles. But do we believe that insight and sympathy alone are sufficient for the successful diagnosis of disorder or disease of the heart or lungs? Mental disorder is subtler, more varied than these, but like them it proceeds along definite lines in definite situations, and it is capable of description even as they are. It is therefore insufficient even for the talented doctor to rely entirely upon his natural gifts. But in what other branch of science would it enter his head to do so?

But not all doctors happen to be of the type we have described. There exist many excellent practitioners who are temperamentally so constituted that to them these unaided excursions into the investigation of mental trouble would never suggest themselves. Predominantly objectively-minded,[71] “without a nerve in their bodies,” calm and confident, practical and quick to apply their knowledge in the physical sphere, they have no natural inclination towards the study of such disorders as we have mentioned; and their teachers have too seldom done anything to supplement the exclusively materialistic studies[72] of their medical course. When, as not seldom happens, he is faced by a case of hysteria or neurasthenia, such a practitioner is inclined to regard the malady, if it does not prove tractable by rest, change, drugs and diet, massage, electricity, etc., either as “fanciful” and requiring firmness unveiled or veiled,[73] or as the beginning of a lamentable and grave attack of mental disorder. Unfortunately the number of cases yielding to firmness is not gratifyingly large. The hysterical patient, too, has a will of his own, and frequently proves this fact in a disconcerting manner. The neurasthenic, knowing long before the doctor tells him, that he ought not to worry, that he ought to “buck up,” frequently becomes acutely critical of his physician, and his powers of judgment are all the keener for their frequent whetting upon his own deficiencies. Not that he should not worry, but _why and how_ he should not worry is what he wants to know.

This criticism of the brusque, cheery way in which such a physician may treat mental troubles is not meant to be one-sided or unfair. For some patients, the “firmness” treatment is the right one; others may be so impressed by the doctor’s cheery personality that they recover. But it is safe to say that these are seldom serious cases. The intelligent, highly moral, over-worked business man must not be given the same treatment as the society lady suffering from lack of honest labour—and nobody knows this better than the patient.

This objective way of regarding cases of neurasthenia readily tends on the one hand to make the physician underrate their importance (as when he expects to cure them with “firmness”) and on the other, when they prove impregnable to such attacks, to cause him to exaggerate their seriousness. For, he may argue to himself, if they are beyond cure in this way, what is to be the future of the patients except permanent eccentricity or even insanity? Only a deeper knowledge of the subject can save him from this top-heavy oscillation from unfounded optimism to equally baseless pessimism.

We have noted two of the common obstacles which obstruct the path of the physician anxious to treat mental disorder: his own lack of training and, in not a few cases, his temperamental inclination to look exclusively for visible and tangible material evidence of disease. There is, moreover, at present another serious obstacle consisting in a widespread social convention. This is the unwritten law which commands a person to hide any troubles of a mental nature not only from his friends, but even from his doctor, though he may speak of his physical disabilities to everybody with unblushing frankness. Much could be written on this subject, but the inconsistency of the current attitude has been satirised with inimitable wit and humour by Samuel Butler.

His whimsical fancy has created a civilised country in which this convention does not exist; in which, in fact, the opposite belief obtains. In that land, while a man's bodily ills are counted a disgrace, and not to be mentioned, his mental troubles are regarded as physical illness is with us. The name of that country is _Erewhon_. In _Erewhon_, we are told, physical illness is not only considered shameful but is punishable by imprisonment. Mental trouble, on the other hand, even irritability or bad temper, is regarded as illness requiring the attention of physicians, known as "straighteners." And the consequences of this are that a man will dissimulate the existence of indigestion, giving out that he is being treated for dipsomania, while in answer to questions about his general condition another will quite freely and truthfully say that he is suffering from snappishness. We in England, says the explorer,

"never shrink from telling a doctor what is the matter with us merely through the fear that he will hurt us. We let him do his worst upon us and stand it without a murmur, because we are not scouted for being ill, and because we know that the doctor is doing his best to cure us and that he can judge our case better than we can; but we should conceal all illness if we were treated as the Erewhonians are when they have anything the matter with them; we should do the same as with moral and intellectual diseases—we should feign health with the most consummate art till we were found out...."

This convention inevitably influences the "straightener's" attitude towards his patients, as we are told by the traveller in a description of an interview between his host and an Erewhonian doctor:—

"I was struck with the delicacy with which he avoided even the remotest semblance of inquiry after the physical well-being of his patient, though there was a certain yellowness about my host's eyes which argued a bilious habit of body. To have taken notice of this would have been a gross breach of professional etiquette. I was told, however, that a straightener sometimes thinks it right to glance at the possibility of some slight physical disorder if he finds it important in order to assist him in his diagnosis; but the answers which he gets are generally untrue or evasive, and he forms his own conclusions upon the matter as well as he can. Sensible men have been known to say that the straightener should in strict confidence be told of every physical ailment that is likely to bear upon the case, but people are naturally shy of doing this, for they do not like lowering themselves in the opinion of the straightener, and his ignorance of medical science is supreme. I heard of one lady, indeed, who had the hardihood to confess that a furious outbreak of ill-humour and extravagant fancies for which she was seeking advice was possibly the result of indisposition. 'You should resist that,' said the straightener, in a kind, yet grave voice, 'we can do nothing for the bodies of our patients; such matters are beyond our province, and I desire that I may hear no further particulars.' The lady burst into tears and promised faithfully that she would never be unwell again."

FOOTNOTES:

[50] Hart, _op. cit._, p. 7.

[51] _Cf._ Dr. Bedford Pierce's statement, (_op. cit._, p. 43), "I have met persons otherwise level-headed who cannot be persuaded to enter the grounds of an asylum. Not infrequently all sorts of excuses are made to escape the duty of visiting a relative who is under care, and so real is the danger of neglect that the State has decreed that no order for reception shall be granted without an undertaking that the patient shall be visited at least every six months."

[52] p. 5. The italics are ours.

[53] pp. 77 and 78.

[54] We have in mind throughout the discussion, not the richer members of the community, for whom a relatively expensive holiday or period spent in the nursing home is easily possible, but the great majority of the public, to whom even the ordinary doctor's bill may be a source of financial embarrassment for months or years.

[55] R. G. Rows, _Journal of Mental Science_, January, 1912.

[56] pp. 77 and 78.

[57] _Analytic Psychology_, London, 1916, p. 318.

[58] “Everybody agrees,” say Déjerine and Gauckler (_op. cit._, p. 214_f_), “that neurasthenia is a neurosis, _i.e._, a nervous disease without any known lesions.... Neurasthenia is due wholly to psychological factors which are essentially, if not exclusively determined by emotion.” They then proceed to compare the “materialistic” theories of neurasthenia, showing that they are all still merely speculative.

[59] _Cf._ pp. 19 _et seq._

[60] _Cf._ Déjerine and Gauckler, _op. cit._, p. 214_f._

[61] As Professor Kraepelin says, “Nervenkranker sind Geisteskranker” (“Those ‘suffering from nerves’ are _sick in spirit_.”).

[62] The reader should consult Mr. W. McDougall’s excellent treatment of this subject in his _Introduction to Social Psychology_—especially pp. 45-89.

[63] The remarks of Mr. George Bernard Shaw on Max Nordau’s “Degeneration” (_The Sanity of Art_, especially p. 88) might be consulted in this connection.

[64] _Cf._ E. Régis, “Les Troubles Psychiques et Neuro-Psychiques de la Guerre,” _Presse Médicale_, 23, p. 177, May 27th, 1915.

[65] This term is derived from the Greek word for the womb. Hysteria was once thought to be due to the wanderings of the uterus about the body. The term well deserves its place beside that other ornament of psychological medicine—the word “lunacy.”

[66] _The Diagnosis of Nervous Diseases_, 3rd Edition, London, 1911, p. 355.

[67] Italics ours.

[68] p. 355.

[69] This was seen repeatedly in the treatment of the relatively uneducated soldiers who had become slightly neurasthenic as a result of the war, especially of those whose life had been spent in open-air manual work, or in the strict and healthy routine of the regular army. They complained of emotional irritability, minor lapses of memory such as the forgetting of relatively unimportant names or of errands, disturbed sleep, soon “getting fed up” with their amusements (_e.g._, “jig-saws,” or billiards for hours every day, month after month in a converted schoolroom or outhouse!). Not only did these phenomena disturb them, but in a great many cases they seemed to prove to these unfortunate men that they were insane, or rapidly becoming so. They would anxiously ask such questions as, “What is it that makes me so irritable at a slight noise, or at being brushed against by another patient? I used not to be like that.” Their conduct was also regarded as unusual by their companions. Now would not the head of a business firm, an over-worked medical man, a university professor or an army officer in a position of responsibility, confidently expect to be allowed _ex-officio_ a certain number of these eccentricities without being called “diseased?” But let him drop the privileges and shelter of his rank, live for a few weeks as a private in a barracks with a number of high-spirited and thoroughly healthy soldiers and his behaviour might certainly be considered by them to be queer, if nothing worse.

[70] Reform of this state of affairs is urgently needed. The matter is of such fundamental and far-reaching importance that we have devoted part of the next chapter to the further consideration of its bearings.

[71] “Tough-minded,” “matter-mongers,” modern writers have called this type, contrasting it with that of the “tender-minded,” “reason-mongers.”

[72] Of a brilliant teacher of physiology, one who was himself intensely interested in the sciences bordering on his own subject, it was related that when, in lecturing upon the functions of the nervous system in man, he approached difficult problems, he used to say, “But that is a matter for the psychologist.” Whereupon the class heaved a sigh of relief and prepared to take notes upon the next subject.

[73] “... strong electric shocks, cold douches, and other decorous substitutes for a sound birching.” W. McDougall, _Psychology_, London, 1912.

CHAPTER V.

Some Lessons of the War.

Are we, as a nation, doing all that we should for the mentally afflicted? This is the question—no less urgent and important now than it was a century ago—to which we call the serious attention of the reader.

It is no new discovery to recognise the immediate importance of its proper consideration, of the honest facing of the present conditions, and of the urgency for such reform as shall lead to an affirmative answer to our question. Already it has been the subject of considerable discussion in recent medical literature, and in the medical press numerous efforts have been made to bring it to the attention of the general public. In July, 1914, the Medico-Psychological Association of Great Britain and Ireland, a body composed chiefly of the medical officers of our asylums, issued the report of a special committee which had been appointed, in November, 1911, to consider the "status of Psychiatry as a profession in Great Britain and Ireland, and the reforms necessary in the education and conditions of service of assistant medical officers." Unfortunately, within a few weeks of its publication, the outbreak of war prevented that discussion of the question which would otherwise assuredly have followed the publication of so momentous a statement. For in the report stress was laid on the "absence of proper provision for the early treatment of incipient and undeveloped cases of mental disorder," on the lack of adequate "facilities for the study of psychiatry and for research" and upon "the unsatisfactory position of assistant medical officers" in the asylum service. Clearly the stressing of such points by a committee, thoroughly competent to form a judgment in such matters, compels a negative answer to our leading question. The report makes it perfectly clear that this country has grievously lagged behind most of the civilised nations in the treatment of mental disease.

Yet all attempts in the way of important and far-reaching reform have been frustrated, at least during times of peace, by a strange state of indifference and inertia and by lack of knowledge. Thus, even so recently as January 15th, 1916, the _British Medical Journal_ was responsible for the statement "The only hope that our present knowledge of insanity permits us to entertain of appreciably diminishing the number of 'first attacks' lies in diminishing habitual and long enduring drunkenness and in diminishing the incidence of syphilis."[74] This statement would have been sufficiently amazing if it had been made three years ago; but when the hospitals of Europe contain thousands of "first attacks" of insanity, which are definitely _not_ due either to alcohol or syphilis, the only conclusion to be drawn is that its author must have been asleep since July, 1914, or have become so obsessed by a fixed idea as to be unable to see the plain lessons of the war. Syphilis, no doubt, is responsible for a considerable number of cases of insanity, and drink perhaps for some more[75]; but the incipient forms of mental disturbance which the anxieties and worries of warfare are causing ought to impress even the least thoughtful members of the community with the fact that similar causes are operative in peace as well as in war, and are responsible for a very large proportion of the cases of insanity. But—and this is still more important—it is precisely these cases which can be cured if diagnosed in their early stages, and treated properly. The chief hope of reducing the number of patients in the asylums for the insane lies in the recognition of this fact, and in acting on it by providing institutions where such incipient cases of mental disturbance can be treated rationally, and so saved from the fate of being sent into an asylum. We may refer the reader to p. 82 _et seq._, on which was given a short account of the success of these reforms. We reiterate some of the advantages of the clinic system—treatment of the patient without the necessity of the ordinary asylum associations and the consequent social stigma; and the considerable reduction in the number of patients requiring internment in asylums which has followed upon the establishment of the psychiatric clinic.

In this country insuperable obstacles in the way of this urgent reform have been raised by our distinctive national obstinacy, and our blind devotion to such catch-phrases as "the liberty of the subject,"—even when this involves the eventual incarceration of the patient whose liberty to escape treatment and to become insane, is the issue jealously defended. Now, however, the stress of war has compelled us to see matters in another light. The present war, which has been responsible for destroying so many illusions, has worked many wonders in the domain of medicine.

The rational and humane treatment of early cases of mental disturbance has now been inaugurated on precisely those lines which have been so long urged, with such little success, by the more far-seeing members of the medical profession.[76]

A good example of this reform is the splendid work now being carried out, at the Maghull Military Hospitals, near Liverpool, for officers and men, organised and superintended by Major R. G. Rows. The institutions are specially devoted to the treatment of soldiers suffering from "shock" and other psychoses. The success already achieved there is sufficient evidence of the great value of these special hospitals for the treatment of nervous and mental disorders in their early stages.

But if the lessons of the war are to be truly beneficial, much more extensive application must be made of these methods, _not only for our soldiers now, but also for our civilian population for all time_. We have before us the practical experience of those countries which have undertaken this great experiment in preventive medicine, yet apart from the encouraging results of its treatment practised in our special military hospitals, its present position in this country is only too accurately described in the report to which we have referred. With few exceptions[77] “the subject (of mental disease) is left severely alone.”[78] Our arm-chair writers direct their attention to safer subjects, such as eugenics, for example, and here they can be happy in feeling they are on secure ground, because they are aware that their neighbour knows little more about it than they do. Or they inspire reports, and I quote a sentence from a recent report as a contrast to the encouraging sound of the word ‘recovering.’[79]

In the _Standard_ newspaper a few days ago, (_i.e._, in 1914) there was a reference to a report issued by the London County Council in which one paragraph began with the statement, ‘Once a lunatic, always a lunatic.’ This is the message sent in this country to our sufferers, a message as brutal as it is unjustifiable. Again, in the _Standard_ of February 11th in the year of grace 1913, there appeared the statement that ‘the Camberwell Guardians have issued instructions that the use of “anklets” on violent lunatics in their institutions is to be discontinued.’

With reference to the dictum “Once a lunatic always a lunatic” we should like to call attention to another statement in this report. “The fact that, _even under the present conditions of delayed treatment, about 33 per cent. of those admitted to the asylums of England and Wales are discharged recovered_, demonstrates that the feelings of helplessness and hopelessness, with which such illnesses are usually regarded, are by no means justified. The evidence of many authorities who have had practical experience of the value of treatment during the incipient stages of the illness, shows conclusively that the exercise of scientific care during the early phases of mental disorder would save many from such a complete breakdown as would necessitate certification and removal to an asylum. In all other branches of medicine facilities for dealing with disease in its initial stages are recognised as indispensable and therefore the Committee regard it as essential that, in the large centres of population at any rate, means should be provided to obviate the delay that now exists in providing adequate treatment for mental disorders. It is, therefore, recommended that psychiatric clinics should be established.”[80]

Again, at the International Congress of Medicine in London, in August, 1913, an important discussion of these problems was introduced by an account of the Henry Phipps Psychiatric Clinic which has been established in Baltimore for the treatment of mental disorders, and for teaching and research in this subject. In the course of the discussion special emphasis was laid upon “the necessity for _teaching the medical profession and the public_ that many mental disorders are absolutely recoverable, that good hospital and scientific treatment save many, that the mere economy of our monster institutions represents a sham economy paid for by the patients and their families, and that psychiatry must extend beyond the asylums.”[81]

Emphasis was also laid upon the importance of making these hospitals, for the care and cure of those suffering from mental illness, centres for scientific education and research and for the development of prophylactic measures. For, unless medical students are provided with facilities for the study of these early cases the present deplorable condition of affairs will be perpetuated. All honest medical work is essentially research; for every individual patient presents problems which need investigation; and facilities should be provided for making such enquiries under the most favourable conditions. As Dr. Flexner has well said,[82] it is impossible “to develop two types of physician, one to find things out, the other to apply what has been ascertained. For the same kind of intelligence, the same sorts of observation, knowledge and reasoning power are needed for the application as for the discovery of effective therapeutic procedure.”

This last consideration leads us to the examination of another potent factor in the present situation, _viz._:—

The Attitude of the Medical Profession. When it is remembered that mental factors play an important rôle in the causation and continuance not only of obviously mental disorder but also of bodily troubles, and that therefore successful diagnosis and treatment must inevitably take these factors into account, it may seem remarkable that the medical profession as a whole should take so little interest in, and know so little of psychology. Even when the psychological aspect of their problems becomes the outstanding element in diagnosis and treatment, the vast majority of medical practitioners show little or no inclination to satisfy their scientific curiosity and to endeavour to understand the condition of their patients.

But this attitude becomes more comprehensible, and in a certain measure more excusable, when we look into the courses of instruction provided for students in our medical schools. What training in psychiatry—to say nothing of psychology and psychopathology—have they received in the schools? How many hours have been spent in lectures or demonstrations upon

mental diseases? And how has this modicum of time been spent? How many hours are devoted to actual _personal investigation_ of patients suffering from early mental disorder? All the instruction in such matters that our students get at present in most of the medical schools is given in a few hours during one term, when they visit an asylum where demonstrations are given of _advanced_ cases of mental disease: “melancholia,” “mania,” “dementia,” etc.

Lest we may be accused of wild statements, let us quote again from the Medico-Psychological Association’s report. (The italics are ours.):—

“... the attention given to mental diseases before qualification is much less than that given in many other countries. Owing to the absence of clinics, the medical student _has no opportunity of observing borderland or undeveloped cases_.” (p. 6.)

“To this absence of teaching facilities is due the lack of knowledge of the general practitioner, who should be competent to recognise, and possibly to deal with, some of the earliest symptoms; _to this we owe the lack of real equipment in those who enter the lunacy service_.” (p. 21.)

In this connection it is interesting to quote from a comparatively recent report on medical education. Four years ago the Carnegie Foundation for the Advancement of Teaching published a report on “Medical Education in Europe.” This work was remarkable both for its perspicacity and thoroughness and for the frankness and detachment with which its author, Dr. Abraham Flexner, expressed the opinions he had formed after a detailed study of the medical schools of this country and on the Continent. This valuable and important document was barely noticed by the medical press in this country. But this is not the place for a discussion of the psychology of this conspiracy of silence. For it certainly does not imply any reflection upon the impartiality or the thoroughness of Dr. Flexner’s research; on the contrary, it is a silent tribute to the seriousness of the exposure of the weaknesses of our medical schools. But the report is also a most valuable appreciation of the strength of our methods of medical education. It provides a minute analysis and comparison of the methods of teaching clinical medicine in Great Britain and on the Continent. The summary clearly defines the distinctive merits of the British system, and has such an important bearing upon the questions we are considering in this book that we will quote its most essential paragraph.

“The limitations by which medical education in Great Britain is hampered have now been candidly exposed. It is nevertheless true that in respect to the student, nowhere else in the world are conditions so favourable. In our discussion of Germany we pointed out that its clinical instruction was overwhelmingly demonstrative; that the student _saw_ and _heard_ but almost never _did_. Clinical education in England has completely avoided this wasteful error. It is primarily practical. It makes, indeed, the huge mistake of assuming that a more scientific attitude towards the problems of disease is in some occult way hostile to practicality; for it protests against the adoption of modern methods of investigation, as though practical teaching would be in some inexplicable fashion endangered thereby. However, that may be, the English are indubitably correct in holding that sound medical training requires free contact of the student with the actual manifestations of disease. It is the merit of English and, as we shall also perceive, of French medical education that the student learns the principles of medicine concurrently with the upbuilding of a veritable sense-experience in the wards, and that he acquires the art of medicine by increasingly intimate and responsible participation in the ministrations of physician and surgeon. The great contribution of England and France to medical education is their unanswerable demonstration of the entire feasibility of the method of instruction which the end sought itself imposes.”[83]

We have quoted at length this vivid and accurate portrayal of the distinctive feature of British methods of clinical instruction in order to emphasise the fact that in the teaching of psychological medicine the British utterly neglect this excellent method of instruction which Dr. Flexner considered so admirable a feature of our medical schools. The British method of teaching psychological medicine, so far as the subject is taught at all,[84] is that of class-demonstration, but, as we have seen, the avoidance of exclusive reliance upon this method is the feature on which Dr. Flexner congratulates the British schools. On the other hand, while the Germans are criticised for their adherence to the class-demonstration, it should be remembered that, although this source of weakness appears in their undergraduate classes, it is they and not we who provide facilities, in their clinics, to the post-graduate student for free contact with patients in incipient stages of mental illness.

Therefore we have neglected to apply, in the case of mental diseases, the very methods which in all other branches of medicine have been so conspicuously successful as to be selected by an impartial critic as the distinctive merit of British medical training.

We have indicated briefly the type of instruction in psychiatry obtaining in our medical schools at present. Its educational value is certainly very slight; and—what is worse—it serves to give the future doctor a hopeless outlook on insanity. For the instruction of students in the nature and treatment of tuberculosis we do not send them to some sanatorium to gaze upon patients dying from the

disease. They personally examine patients in the early stages and learn to recognise the subtler manifestations of the onset of the tubercular attack, when there is some hope of giving useful advice and saving the sufferer. Why cannot mental disease be dealt with in the same way? Why cannot our students be afforded, in general hospitals, the opportunity of personally examining patients in the incipient stages of mental disturbance? They would then not only acquire a knowledge of the real nature of insanity, but would also learn, in the school of experience, the individual differences which are exhibited in the working of the normal mind, a lesson which would be of the utmost value to them in dealing with _all_ their patients, whether their ailments be bodily or mental. But in addition such a training would impress on them, in a way that nothing else could do, the vitally important fact that mental disease is curable, and is not the hopeless trouble which is likely to be suggested by the spectacle of a few asylum patients in advanced stages of lunacy.

Even, however, if the asylums afforded better facilities for the proper study of mental disease than unfortunately is the case in most institutions in this country, they are usually not sufficiently near the medical schools to permit the student properly to acquire his knowledge, as he does of other diseases, by frequent and regular attendance for a considerable period of time. Nor, as yet, have many of the medical officers in our asylums sufficient up-to-date knowledge of psychiatry to enable them usefully to co-operate with the medical schools and the teaching staffs of the general hospitals in achieving the desired aim. We know that there are some exceptions to this general statement, and fortunately they are becoming more numerous. But viewing the condition of affairs in the country as a whole, in respect of this important matter, one can only accurately describe it as deplorable. These are hard words, and we are well aware that their use may expose us to the charge of superficial, uninformed and even spiteful criticism. Let us, therefore, turn to the gratifyingly frank and honest statements of the asylum workers themselves, embodied in the report from which we have quoted.

“_The tendency of routine to kill enthusiasm and destroy medical interests._

The promotion or advancement of a medical officer depends so little upon his knowledge of psychiatry that he has no inducement for that reason to devote himself to an earnest study of the subject. His work is apt to begin and end with the discharge of essential routine duties to the exclusion of careful clinical and scientific investigation.

The work assigned to junior medical officers is, in the majority of cases, monotonous, uninteresting and without adequate responsibility. For those whose personal enthusiasm keeps alive in them the desire to extend their knowledge, such opportunities as that of study-leave are rarely afforded them. The existing system, therefore, leads to the stunting of ambition and a gradual loss of interest in scientific medicine. It tends, therefore, to produce a deteriorating effect upon those who remain long in the service.”[85] (pp. 8 and 9.)

Methods of Making Appointments.

“Appointments are made by lay committees, which, though they are generally wishful to appoint the best candidate, are in most cases without expert advice, and without adequate knowledge of the factors involved. The results are, therefore, generally haphazard in character, often dependent upon influence or personal consideration, as they frequently bear out little relation to the actual claims and qualifications of the candidate.” (p. 7.)

We submit then, that our expression of opinion is but a paraphrase of the authorised report. The study of this publication as a whole will only deepen this impression in the reader.

In the foregoing paragraphs we have pointed out the vital importance of research in relation to mental disease. All properly conducted clinical work is of the nature of original investigation; and in the examination of patients suffering from mental disturbance this is particularly the case. But a vast amount of research work must be carried out in properly equipped hospitals and laboratories if we are to deal with the problems of lunacy in the same efficient manner as we have learnt to treat tuberculosis. In this connection it is important to emphasise the lack of an adequate knowledge of normal psychology among many of the medical officers and the absence of psycho-pathological research in so many of our asylums.

It must not, however, be inferred that the only reform needed is an increase and improvement of the _mental_ treatment of mental disease. It is not merely the psychological side that is neglected. The most depressing aspect of the present state of affairs _is the comparative absence of all research_. Investigations into the material basis of mental disease, while certainly more numerous than psychological investigations, are at present few in number. Hosts of problems concerned with the nervous system are awaiting investigation, and the admirable results obtained by the small band of energetic workers in our country serve to show how sadly our

nation is neglecting its golden opportunities for accomplishing much more in this respect. Important problems in connection with the normal and morbid anatomy of the nervous system, its pathology and its bio-chemistry, suggest themselves to the worker at every step. The physiological and psychological effects of different diets, of drugs like the hypnotics, _et cetera_, how little we know of them! Are we to rest content in leaving this vast unknown land to be charted by other nations?

Original research is thus urgently needed in all those departments which should be included in asylum work. But it is also necessary for the researches to be co-ordinated. Not a few individual doctors in our asylums, usually members of the junior staffs, are endeavouring to carry on original investigations; but in the majority of cases the absence of any prospect of direct or indirect personal benefit from this work damps their enthusiasm, if it does not make such work wholly impossible. And, of course, without the willing co-operation of the asylum authorities co-ordinated researches cannot be carried out.

We shall again quote from the report of the Medico-Psychological Association in justification of our statement:—

“Research is largely dependent on individual enthusiasm, but can certainly be stimulated and maintained by the co-operation of the senior medical staff. There is reason to fear that such work is undertaken in some quarters without any guidance or encouragement from seniors, and laborious original investigations have received little or no recognition from those in authority.... Although there is no uniformity of practice, report is made that in many asylums junior medical officers are placed in charge of chronic cases only, and have no duties in reference to the treatment of newly-admitted cases. This appears to be most undesirable. Junior medical officers, in addition to their statutory routine duties, should be given the opportunity of co-operation with their senior colleagues in clinical work. Consultation between the various members of the medical staff in doubtful and interesting cases is very desirable....” (p. 30.)

If the reader will pause for a moment, and in imagination put himself in the position of a junior medical officer, “_placed in charge of chronic cases only_,” he will not only come to understand the “stunting of ambition and the gradual loss of interest in scientific medicine” of which he has read, but may admire the self-restraint of a report which can speak in temperate language of such a state of affairs.

Another difficulty that stands in the way of this urgently needed reform in medical education is the inadequacy of the text-books available for the student. In many of these text-books the introductory chapters contain some, often irrelevant,[86] morbid anatomy, and the remainder deals with “psychology.” The latter frequently consists largely of anecdotes, often “funny” and sometimes more appropriate to the “after-dinner” hour than the text-book, and enumerations of the mental _symptoms_ of the cases. In practically every available English text-book the latter are depicted only as they appear after they have become fixed, habitual, hardened and rationalised. Such “units” of terminology as “delusions,” or “delusions of persecution,” “hallucinations,” etc., are freely used. In other departments of clinical medicine the text-book writer does not describe a patient as suffering from a cough, and leave it at that; yet the phrase “suffering from delusions” is the veriest commonplace in the text-books. Yet just as a cough may be due to tuberculosis of the lung, pharyngeal irritation, hysteria, or a variety of utterly different causes, each class of case requiring a different treatment, so the causes of delusions are even more infinitely varied.

But the gravest defects of these text-books is that few of them make any attempt whatever, except in the case of such forms of disease as have an organic cause, to explain the _development_ of the trouble, the precise nature of the primary cause or causes and the way in which the disturbance of the patient’s personality has been gradually effected.

Unfortunately there are serious defects in many of the works upon general psychology which render them almost useless to the student of psychological medicine. This may explain, if it does not excuse, the quaint selection of subjects, often wholly irrelevant or inappropriate, which form the contents of the psychological section of many English books on mental disorders. But this deficiency is not a sufficient excuse for the neglect of the kind of instruction that is of vital importance for the proper understanding of such disorders. When books such as those written by McDougall, Stout, Hart, Shand, and Déjerine and Gauckler, are available, it is possible to use the facts of normal psychology as the natural, rational and necessary means of explaining and interpreting departures from the normal state.

We may summarise here some of the chief defects of our national system of treating mental disorder. First and foremost is the serious waste of time which almost invariably occurs before the mental sufferer comes under medical care. This is due to a variety of causes—all of them preventable. The chief is that, lying in the path of patients who would _voluntarily_ seek help, there is the insurmountable obstacle of the asylum system and its restrictions. The men in the asylum service, who have the opportunity of acquiring an intimate knowledge of mental diseases, are _forbidden_ to carry that knowledge into the outside world for the benefit

of the mental sufferer. If a patient, suffering from a mental disorder in its earliest and easily curable stage, should voluntarily go to an asylum and ask for advice, all that can be done for him is to suggest that he should consult a medical man outside, or to recommend him to call and see the relieving officer. Now, unless the patient has considerable means, it is practically certain that he will be able to consult no medical man who is conversant with—much less expert in—the treatment of early mental disorder. And, though the relieving officer's intentions may be of the best, it is just his 'help' and all that it means, that the unfortunate is so desperately striving to avoid. In short, all that the officials under our present system can say to such a man is, "Go away and get very much worse, and then we shall be allowed to look after you!" Can stupidity go farther than this?

Even, however, if the doctor were allowed to help such a person in the asylum, this would be far from an ideal solution of the difficulty. Entry into such an institution, even if voluntary, would entail the serious social stigma which has been so often mentioned. Furthermore, the asylum, with its associations and implications, particularly the assumption of the irresponsibility of the patients interned in it, would destroy one of the chief therapeutic agents in the treatment of such cases. We mean the conviction of the patient that he is still responsible for his actions, and that he is still able, under direction, to cure himself.

The place to which such a patient should be able to go is obviously one which is exempt from any stigma; one in which of his own free will he may stay for a time under care, or if this be unnecessary, as is very frequently the case, which he may visit at frequent intervals for advice and treatment. It should be staffed by skilled specialists who are familiar with the diagnosis and treatment of _early_ and _incipient_ mental disorder, not only with that of advanced insanity. For years such institutions have existed in other countries and form an important part of their contribution towards the alleviation of human suffering.

The chief functions of such a psychiatric clinic would be:—

(1) Attendance on the mentally sick.

(2) The provision of opportunities for personal intercourse between patients and the psychiatrists in training.

(3) The theoretical and practical instruction of students.

(4) Advising general practitioners and others who are faced with difficult problems arising in their daily work.

(5) To serve as a connecting link between investigation in the large asylums and that in the anatomical, pathological, bacteriological, bio-chemical, psychological and other laboratories of the universities.

(6) The scientific investigation of the mental and bodily factors concerned in mental disease.

(7) The furtherance of international exchange of scientific knowledge concerning mental disorder, by the welcome accorded to visitors from other countries.

(8) The dissemination of medical views on certain important social questions and the correction of existing prejudices concerning insanity.

(9) When necessary, the after-care of the discharged patient.

We have already given some details of the activities of a few of the clinics abroad[87] and have pointed out their valuable function in saving a high percentage of patients from the fate of an asylum, while at the same time relieving the community of the serious expense of keeping these patients for life as pauper lunatics.

We may quote from an article by Dr. R. G. Rows[88] describing the psychiatric clinics at Munich and Giessen:

"They are carried on upon the lines of 'freely come, freely go,' as far as is consistent with the safety of the patient and of the public. In neither of these clinics is any legal document necessary for the admission or discharge of patients. But where the character and severity of the mental disturbance require the longer detention of the patient in the clinic or in an asylum, such detention can be exercised only under a legal procedure which carefully safeguards the rights of the patients.

In this way it is possible to avoid the stigma which is attached to certification and seclusion in an asylum. That this is appreciated by the general public is demonstrated by the number of people who make use of the opportunities offered them. To the clinic at Giessen, with its seventy beds, between three and four hundred patients were admitted in 1907. From the report of the clinic at Munich for the years 1906-7 we learn that there were 1,600 admissions in 1905 (the first complete year after it was opened), 1,832 admissions in 1906, and 1,914 admissions in 1907. At the present time admissions go on at the rate of ten or twelve per day. It

should be mentioned that at Munich the clinic is open night and day for the reception of patients, so that they can be brought under the care of an expert at the earliest possible moment, and the painful impressions produced often by detention and restraint by unskilled persons and unsuitable surroundings are reduced to a minimum. This immediate treatment at the hands of men experienced in insanity is a matter of the greatest importance, from the point of view of a favourable termination of many of these cases.

Let us now consider the actual treatment of those admitted into these institutions. What most strongly impressed us in these clinics was the absence of noise and excitement amongst the patients; it was certainly an ample demonstration of the value of the means of treatment adopted. It is recognised in the first place that patients must not be crowded together: none of the wards contain more than ten beds.... For the patient who is too excited to be kept in bed or who disturbs the others too much, experience has shown that prolonged warm baths provide the best means of quieting him and bringing him into such a condition as will allow of his being kept in the ward. The extent to which the bath treatment is employed may be judged from the fact that besides the baths used for ordinary purposes of cleanliness there are in the clinic at Munich eighteen baths for prolonged treatment, five movable baths, one electric, and one douche bath. The wet pack is occasionally used. The baths are so arranged that the patient can remain in the bath for days or weeks as the case demands, sleep there and take his food there. The result of the treatment is that hypnotic drugs and confinement to a single room have come to be regarded as evils to be used only on rare occasions; in fact, the single rooms are occupied by convalescent and quite quiet patients and not by recent and acute cases.

Treatment on these lines will of course necessitate the employment of a large medical and nursing staff. At Giessen, with 70 beds and between three and four hundred admissions a year, there are five medical officers including the director. At Munich, with one hundred and twenty beds and three or four thousand admissions, there are fifteen medical officers to carry on the work of examination and supervision of the patients. The nursing staff must be provided in the proportion of at least one to five. This is of course a high figure, but there are two conditions to be remembered: first, the very large number of admissions dealt with, and secondly, that these clinics are established not for the housing of the insane, but for the care and cure of those suffering from incipient mental disturbances—a most important distinction, and one not yet fully appreciated in this country.

Besides the patients admitted into the clinics for treatment, a large number obtain advice and help from the out-patients' department."

It should be mentioned that in Germany there is a psychiatric clinic attached to every university.

Among the most important functions of a clinic are instruction and research. Each assistant in the Munich clinic carries on some chosen line of study. In order that he may have better facilities for becoming acquainted with the literature on the subject and finishing his selected work, he is given, besides his annual month's leave, two months of each year for this purpose. Frequent evenings are set apart for discussions of original work carried on in the clinic and elsewhere. Besides this, numerous short courses in special subjects are provided, so that it is possible to enter the clinic for instruction in matters requiring a special knowledge of delicate technique and diagnosis.

Of very special importance in the Munich clinic is the course for qualified medical men. In 1907 this was attended by _sixty men, of whom one third were foreigners_. What can we, in Great Britain, show in comparison with this? Our physical, chemical, physiological, and pathological laboratories attract distinguished foreigners from the universities of other countries, though twenty would be a number on which even our most celebrated laboratories would pride themselves. But how many foreigners come to us to study insanity? Very few indeed, and the reason is not far to seek.

In the Munich clinic, again, we find well equipped rooms for clinical examination, for the deeper investigation of mental life by experimental psychology, for the study of morbid anatomy and pathology and for the finer examination of the blood and other fluids of the body. Furthermore, these laboratories are not only spacious and well-equipped, but are occupied by busy, keen and skilled workers. Testimony to their activity is afforded in abundance by their frequent publications.

We submit, then, that the clinic system is a decided advance in the treatment of mental disorder which other countries have adopted while for years we have stood by with folded hands.[89] From the humanitarian and the scientific point of view there is everything to be said in favour of the clinic. The practical Englishman will, however, ask "What about the financial aspect? Are not these institutions, with their heavy proportion of doctors and nurses to patients, prohibitively expensive?"

The answer to this question is that certainly the clinic is relatively more expensive than the asylum. But since the function of the clinic is to save as many patients as possible from entering the asylum, it is obvious that its expense must be judged from a special standpoint. The maintenance of a repair shop is always comparatively costly, whether the material to be mended be human or not. The cost per day of repairing a motor car is usually distinctly higher than the daily charge for garaging it in its broken-down state. Yet we gladly pay the higher charge for the simple reasons that a motor car in its garage is of no use to us, and that the daily charge for housing the car would amount to a colossal figure if paid for many years. Cannot we apply the same reasoning to the case of the mentally disordered human being? This is to take the very lowest view of the value of the individual to the community. Yet it would seem that the British public, so far, has been impervious even to this financial consideration.

But, it may still be asked, cannot the doctors in the asylums carry out the work suggested? The answer to this is, that apart from the undesirability of allowing a patient suffering from a mild mental disorder to be associated with an institution housing the definitely insane, it is a physical impossibility for the asylum doctors to do this work so long as the present proportion of doctors to patients remains unchanged. How many members of the British public realise the fact that it is quite usual for an asylum doctor to be in charge of at least 400 patients, and that this number sometimes rises to 600? When it is remembered that insane patients are even more prone than the average person to suffer from physical ailments, and that their mental disorders are infinitely complicated by the delay incurred before they come under medical care, it becomes clear that the doctor who would succeed in treating such patients individually would require titanic energy and the addition of at least twenty-four more hours to each of his working days. We cannot therefore compare the staff of a clinic with that of a British asylum, for the staff of the latter is lamentably and obviously too small.

Regarding the financial aspect of the question we may quote again from Dr. Rows' article:—

"... we shall no doubt be met with the objection that the provision of such institutions will involve the expenditure of such an immense sum of money. I believe we spend in Great Britain about £3,000,000 a year on those suffering from various forms of mental affliction. That, certainly, is an immense sum to spend while getting so little in return. A large proportion of this money is spent in housing, feeding, clothing, and taking care of the 97,000 inmates of the county and borough asylums of England and Wales. We learn from the commissioners' report, published in 1910, that 20,000 patients were admitted into these asylums during the previous year, and of these, over 30 per cent. were discharged after a longer or shorter detention. Now it may safely be said that very few of these 20,000 fresh admissions did obtain, or could have obtained, any advice for their mental illness at the hands of anyone who had had experience of mental disorders, before they reached the stage when certification and seclusion in an asylum became necessary. When we visited Giessen we were informed by Professor Sommer that in the province of Hesse, by reason of suitable treatment during the early stages of mental illness they had been enabled to postpone for some years the erection of a new asylum in the province. Is it not therefore fair to assume that, if facilities were provided whereby expert advice and treatment in a well-organised psychiatric clinic could be obtained by those threatened with a mental breakdown, we should save enough of the £3,000,000 to justify the expenditure involved in the establishment of such clinics? Further benefits would be derived from them in that we should be able to avoid the breaking-up of the home, which now, in so many instances, follows the removal of the bread-winner of the family to an asylum and his long detention there."

And

"... it may be suggested that we should attempt to demonstrate the possibility of saving money in order to carry the public with us in the matter. I do not think that is necessary. The value of treatment of the early stages of mental disorder cannot be expressed in pounds, shillings and pence. Moreover, I submit that our duty as medical men is to guarantee the satisfactory treatment of the patient, and we have no right to allow our action to be dominated by monetary considerations. I feel sure that the more this question is placed before the public in an intelligent manner, the more we insist upon the necessity for early treatment and for scientific knowledge as a basis of any treatment, the less will the public grumble about expense. We have ourselves to thank if the public refers so constantly to money matters. Do we ever encourage the public to regard the question from any other point of view? Do we point out that insanity is a product of civilisation? Do we encourage people to regard insanity as an illness for which something can be done and which should be treated with intelligent and humane consideration? Do we not rather say with the public, "Lock him up, put him where he can neither harm himself nor his neighbour?" Do we not talk of sterilising the unfortunate sufferers and preventing marriage and procreation before we have made an honest effort to investigate what insanity really is, what is the mechanism of its production, and how we can teach those so afflicted to help themselves? How then can we expect the public to do anything but grumble at the expense? The public has not objected to spend money in other branches of medicine when the necessity has been demonstrated, and there is no reason, if the members of the lunacy service in this country will develop

confidence in themselves, why they should not be able to instil confidence into those outside the profession."

Suggested Reforms. After the depressing picture of the present state of affairs in this country it will be asked, "What should be done to remedy it?" The answer to this question is clear and definite.

For the relief of the mentally afflicted amongst us, and especially for the prevention of insanity, it is our bounden duty as a nation to take measures such as most civilised countries have adopted some time ago. For this purpose it is necessary that there should be hospitals to which patients in the early stages of mental disturbance can go, without any legal formalities, and receive proper treatment from physicians competent to diagnose their troubles and to give them appropriate advice. It is important that such special hospitals should be attached to general hospitals, so that sensitive patients may not be deterred from resorting to them by the fear of the stigma which in this country, unfortunately, is so inseparably linked with the idea of a "lunatic asylum." It is also important that such institutions should be affiliated to medical schools, not merely to ensure the adequate education of the coming generations of medical practitioners, but also to afford the staffs of such hospitals the proper opportunities for carrying on the work of investigation which is essential for the success of the scheme we have sketched out.

No less important and urgent a reform than the foregoing, however, is another consideration—the _legal_ aspect of the treatment of the mentally deranged.

The glaring defects of the present system have been well and briefly pointed out by Dr. Bedford Pierce in his article from which we have quoted, published in the _British Medical Journal_ of January 8th, 1916.

Again, Sir George Savage, writing in Allbutt's _System of Medicine_ (Vol. VIII, p. 429) states:—

"The lunacy legislation of this country, despite the Acts of 1890 and 1891, remains in an unsettled state; and the care and treatment of the insane are burdened with vexations and unnecessary restrictions. Not only are the steps required for the placing of a person of unsound mind under legal care complicated and clumsy, but they result in many cases in a delay of that early treatment which is so important in cases of mental disease."

Dr. F. W. Mott writes:—

"There is yet one point which it is desirable to mention, as the result of both hospital and asylum experience, and that is the necessity of some earnest attempt being made to establish a means of intercepting, for hospital treatment, such cases of incipient and acute insanity as are not yet certifiable. It is probable that many would not come into the asylums, and a certain number of cases thus come under observation willingly, and in time to retard the progress of the disease. Practitioners could send doubtful cases for observation and treatment to such hospitals, where, moreover, the opportunity would be afforded of improving their own knowledge as to the early signs of insanity."[90]

He urges the desirability of the establishment of special wards in connection with general hospitals, pointing out that a mental case coming from such a ward would not thereby be stigmatised as insane. He quotes from 'an American writer on psychiatry':—"Fortunate would be the community in which there was a fully equipped and well-organised psychiatrical clinic under the control of a university and dedicated to the solution of such problems. The mere existence of such an institution would indicate that people were as much interested in endeavouring to increase the public sanity as they are in the results of exploration in the uttermost parts of the earth, or in the discovery of a new star."[91]

The Medico-Psychological Association's report says:—

"The lunacy law does not permit of the establishment of clinics on the lines which have been recommended, nor does it provide for the admission of uncertified cases to the public asylums. This, for the present at any rate, renders nugatory the suggested schemes for affording treatment for incipient and non-confirmed cases of mental disorder, and with that, to a large extent, fail the opportunities for study on which stress has been laid for adding to the knowledge and increasing the efficiency of asylum medical officers." (p. 10.)

Such weighty opinions as these serve to emphasise a further factor in the urgently needed reform—the necessity for a thorough overhauling of the law of lunacy, so that, while guarding the liberty of the subject, every obstacle should be removed that obstructs patients threatened with the dire calamity of insanity from securing preventive treatment at the earliest possible moment.

In the _Lancet_ of August 5th, 1916, Dr. L. A. Weatherley writes:—

“The great fact that must be continually brought forward in all these discussions is that, according to the reports of the Commissioners in Lunacy, the _recovery-rate of mental diseases is to-day no higher than it was in the ‘seventies’ of last century_. The ever-increasing difficulty in getting mental cases with small means quickly under skilled care must, I feel sure, account to a great extent for this lamentable fact.”

“Marking time” since the seventies of the last century—how does this condition compare with that of most of the other branches of medical science? Heart disease, diphtheria, tuberculosis, tetanus, sepsis of all kinds, all these troubles and many others have shown unmistakable signs of yielding to the incessant and many-sided assaults of medical research. And, of insanity, all we have to report in this country is “little or no progress for fifty years.” Verily we have buried our talent deep in the ground.

Finally, we may quote from an article the opening sentences of which might have been written yesterday, yet it was published in 1849! It was the fourth report of the visiting committee of Hanwell Asylum. The committee say:—

“In the constitution of the Hanwell Asylum we are also struck by the paucity of the medical officers attached to it. There appear in round numbers to be about 500 patients on the male and 500 on the female side, yet there is only one resident medical officer attached to each department, and one visiting physician for the whole establishment. The inefficiency of so small a medical staff is obvious. If we look across the Channel we find in Paris that the Salpêtrière, with its thousand patients, has four times the number of visiting physicians and ten times the number of resident medical officers. The disproportion between the sane and the insane is here so great that it is impossible under such a system to bring any moral influence to bear upon the afflicted multitude.”

“... There ought to be a more numerous medical staff _and a permanent clinic_ attached to such an institution.... The County Asylum of Hanwell, supported largely as it is by county rates and parish assessments, is as much a hospital as St. George’s or St. Bartholomew’s, and ought to have a medical staff as numerous and efficient as those of any other metropolitan hospitals. While charity might thus be administered upon the highest principles of Christian benevolence, something ought to be done to advance our knowledge of science and thereby enable us to relieve the afflictions of suffering humanity.”

The dust lies thick upon this volume, published a short time before the _Crimean_, not the present war. And to-day, like this early Victorian committee, we still ask for clinics, we still ask for scientific work to be carried out by a more numerous and better equipped staff, we still look across the Channel with admiration—in short, approving the better, we follow the worse. We have dawdled away half-a-century and more in comparative idleness. Now the war has taught us our lesson. Are we to forget it again?

Excuses for inertia, brought forward before August, 1914, can be accepted no longer. The thousands of cases of shell-shock which have been seen in our hospitals since that time have proved, beyond any possibility of doubt, that the early treatment of mental disorder is successful from the humanitarian, medical and financial standpoints. It is for us, not for our children, to act in the light of this great lesson.

FOOTNOTES:

[74] p. 105.

[75] It should not be forgotten, however, that resort is often made to alcohol as an easy means of drowning the worry of an incessant mental conflict. In other words, it is clear that in treating alcoholism, as in treating insanity, we are not absolved from the plain duty of seeking its mental cause or causes. “Drink” then, in many cases, appears rather as a secondary complication than as a primary factor.

[76] _Cf._ W. Aldren Turner, _op. cit._

[77] One of the most gratifying of these is the generous gift of a clinic to London by Dr. Henry Maudsley. Up to the present this institution has been rendering valuable service to the country as part of the 4th London General Military Hospital.

[78] _Appendix to Medico-Psychological Association Report_, p. 18.

[79] “One thing which impressed ... [us] ... when going through ... the Giessen clinic with Professor Sommer, was the frequency with which we heard him utter the word ‘recovering’ as we passed the patients.” _Ibid._, p. 17.

[80] _Op. cit._, p. 2.

[81] _Op. cit._, pp. 15-16.

[82] _Vide infra._

[83] p. 202.

[84] “... at present we have few facilities for teaching the subject, and the subject is not taught.” (_Medico-Psychological Association’s Report_, p. 20.)

[85] Concerning this sentence the _British Medical Journal_ wrote, on Nov. 29th, 1914, “A more severe indictment of the existing system than is contained in this report it would be difficult to frame.... We can add nothing to this strongly worded condemnation except an expression of agreement with the opinion that the statement of the facts submitted demands the earnest attention of public authorities and all interested in the welfare of the insane.”

[86] Irrelevant because such books give an account of the morbid anatomy of the nervous system only as it presents itself after disease of very long duration.

[87] pp. 82 _et seq._

[88] “The Development of Psychiatric Science as a Branch of Public Health,” _Journal of Mental Science_, January, 1912.

[89] The gratifying establishment of the Maudsley clinic and the provision of facilities for out-patient treatment at a few hospitals in England and Scotland are signs that matters are at last improving. But we are sure that the physicians in charge of such out-patient departments would be the first to admit their inadequacy and to urge the desirability of the psychiatrical clinic of the kind described in this book.

[90] _Archives of Neurology_, 1903, Vol. II, p. 1.

[91] _Archives of Neurology_, 1907, Vol. III, p. 28.

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Some old masters of Greek architecture

Harry Douglas

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[Illustration: TROPHONIUS SLAYING AGAMEDES AT THE TREASURY OF HYRIEUS.]

SOME OLD MASTERS OF GREEK ARCHITECTURE

By HARRY DOUGLAS

CURATOR OF [Illustration: Decoration] KELLOGG TERRACE

[Illustration: Decoration]

PUBLISHED AT THE QUARTER-OAK GREAT BARRINGTON, MASS., 1899 [Illustration: Decoration]

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[Illustration: Decoration]

TO EDWARD FRANCIS SEARLES

WHOSE APPRECIATION OF THE HARMONIES OF ART, AND WHOSE HIGH IDEALS OF ARCHITECTURE HAVE FOUND EXPRESSION IN MANY ENDURING FORMS, THIS BOOK IS RESPECTFULLY INSCRIBED.

[Illustration: Decoration]

PREFACE

The temptation to wander, with all the recklessness of an amateur, into the traditions of the best architecture, which necessarily could be found only in the history of early Hellenic art, awakened in the author a desire to ascertain who were the individual artists primarily responsible for those architectural standards, which have been accepted without rival since their creation. The search led to some surprise when it was found how little was known or recorded of them, and how great appeared to be the indifference in which they were held by nearly all the writers upon ancient art, as well as by their contemporary historians and biographers. The author therefore has gone into the field of history, tradition and fable, with a basket on his arm, as it were, to cull some of the rare and obscure flowers of this artistic family, dropping into the basket also such facts directly or indirectly associated with the architects of ancient Greece, or their art, as interested him personally. The basket is here set down, containing, if nothing more, at least a brief allusion to no less than eighty-two architects of antiquity. The fact is perfectly appreciated that many fine specimens may have been overlooked; that scant justice has been done those gathered, and that the basket is far too small to contain all that so rich a field could offer.

This book, therefore, aims at nothing more than a superficial glance at the subject, and the author will be content if he has accomplished anything toward bringing those great geniuses of a noble art into a little modern light, who have been left very much to themselves in one of the gloomiest chambers of a deep obscurity.

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CHAPTER I.

THE POPULAR APPRECIATION OF ARCHITECTS.

Of all the fine arts none more completely answers for its _raison d’être_ than architecture. In this art alone do we find the harmonious mingling of æsthetical fancy with utilitarian purpose. It is this feature of usefulness that completes its well-rounded perfection, rather than detracts from it, and dignifies its mission of existence. Architecture, in its capacity to draw to its enrichment the other arts, may be compared to the polished orator, whose purpose is to sway the judgment of his audience by forensic effort, embellishing his language with the flowers of rhetoric, adapting his gestures to graceful emphasis, and controlling his voice to suit the light and shade of his thought. So sculpture has been stimulated by architecture and has contributed to its ornamentation; painting has been invoked to the highest accomplishments, and music has awakened within its walls voice and harmony. “The progress of other arts depends on that of architecture,” Sir William Chambers very truly says. “When building is encouraged, painting, sculpture, gardening and all other decorative arts flourish of course, and these have an influence on manufactures, even to the minutest mechanic productions; for design is of universal advantage, and stamps a value on the most trifling performance.”

It is perhaps not a little odd that despite its pre-eminent importance, and the high rank which it has ever assumed, from that early time when the first rays of dawning civilization began to warm the latent germs of culture and refinement in human nature, to the present day, it is the only art that has not, with very rare and isolated exceptions, stamped renown upon those who have practised it as a profession, and lifted the artist into the lasting remembrance and gratitude of the admirers of his works. How greatly the painter, the sculptor, the musician, are identified with their arts, and the products of their brush, chisel or pen! how great has been their praise, how lasting and unstinted the esteem in which they have been held! but how reserved has been the applause that has encouraged the architect who has given to the world the grand and noble results of his skill and genius, and how soon he himself has been forgotten! It happens only too often that it is the name of the distinguished painter that stamps the value of his canvas rather than the merits of the picture itself. The title of a beautiful piece of sculptured marble is not asked with greater eagerness than that of the artist who created it. Bach and Beethoven and Mozart are played and sung to the popular audiences rather than their fugues, their sonatas and their symphonies.

But what is known of the artists who have reared the greatest monuments of enduring architecture? Their personality, and even their names, appear to have faded from popular recollection. This seems to have been the fact from the earliest days of the art in Greece and Rome to the present time. The exceptions are so rare, throughout all the intervening ages, and the waving prominence of the art, that they might almost be numbered upon the fingers of a single hand.

The reader, if he is not a professional architect, or an amateur who has read deeply in his favorite subject, can arrive at the truth of this seemingly exaggerated statement, if he will lay aside this book for a moment and try to recall the names of the designers of some of the more conspicuous monuments of architecture he has visited at home or abroad.

“I will erect such a building, but I will hang it up in the air,” exclaimed Michael Angelo when he saw the dome of the Pantheon at Rome. The reader may remember this boast of the great Renaissance genius, the fulfilment of it in the colossal dome of St. Peter’s, and be satisfied that his memory has captured one architect of celebrity. If the beautiful Florentine campanile of Giotto looms up in his recollection he will think at once also of that early artist, but perhaps not more so in connection with that ornate tower than in association with the Pre-Raphaelites. Of course, he will not overlook Inigo Jones, whose very name is stamped upon the memory

by reason of its peculiarity, or Sir Christopher Wren, the creator of St. Paul's, and the British idol. If he is an admirer of the picturesque architecture of Venetian churches and palaces, the Italian Palladio may not escape him; and if of French Renaissance, the Louvre façade will possibly suggest Perrault, and the Parisian roofs Mansard. If he is a native of our "Modern Athens," of course, the peril in which the classic front of the State House rested for a time, at the hands of a _fin de siècle_ legislature, will not permit him to forget Bulfinch, and Trinity Church will bring to memory the only Richardson. But aside from a few names such as have been mentioned, with possibly a sprinkling of others fixed in the memory, by incident or association, the average reader, however well acquainted he may be with the numerous luminaries of the other arts, will be unable to say who was responsible for the beauty and nobility of many buildings that have individualized the cities and towns of their location to the art-loving world. Who, for example, can tell of the authors of the cathedrals at Milan and Siena, Cologne and Strassburg, Rheims and Amiens, Wells and Litchfield; the Giralda at Seville; the Church of the Invalides at Paris; the Strozzi Palace at Florence; the Henry VII. chapel at Westminster Abbey; the much and justly admired south façade of the old City Hall in New York; Grace Church in that city; the Capitol building in Washington, or that model of colonial architecture in America, the Executive Mansion?

It is not, however, the purpose to here speculate too extensively upon the apparent lack of justice on the part of the general public which has been done the architects of all climes and times, but to gather together a few facts concerning the Old Masters of early Grecian architecture that are not popularly known, and recall some of the leading lights of that art so inimitably practised by the Hellenic people during their progress from archaic darkness to the zenith of their æsthetic culture.

It is but repeating a well-worn truth to say that the influence of the early Grecian architects upon the followers of their art in all countries of recognized civilized enlightenment, throughout the ages that have succeeded them, has been an almost dominant one. Robert Adam, the architectural authority in the time of George III., says, in the introduction to his work on the ruins of the palace of the Emperor Diocletian: "The buildings of the ancients are in architecture what the works of nature are with respect to the other arts: they serve as models which we should imitate and as standards by which we ought to judge; for this reason they who aim at eminence, either in the knowledge or practice of architecture, find it necessary to view with their own eyes the works of the ancients which remain, that they may catch from them those ideas of grandeur and beauty which nothing, perhaps, but such an observation can suggest."

It is equally true that no country that has experienced an evolution in intelligence and culture, during the twenty-five hundred years that have fled since the time of Pericles, has succeeded in introducing any new school of architecture, that has not been compelled to draw upon ancient Greece for many of the most important and essential features of the art it could only modify, but never wholly re-create.

The Gothic, or pointed-arch style, that sprung into such beautiful being in the thirteenth century, and reigned a queen within the Christian countries of Europe for several centuries thereafter, came more nearly answering for an original scheme of architecture than perhaps any other of equal importance, and yet had it been deprived of the Grecian props that helped to sustain it, it must have fallen to the ground.

In the Gothic the effort was made to incline the inherited principles of architecture more closely toward the spiritual progress of the people, but when at last it had run its course, and was dethroned, owing to a realization of the fact that even a closer allegiance to classic models could be made to answer still better spiritual requirements, how completely did the artistic temperament of the people revert to Greece and Rome, as the light of their returning inspiration and truth appeared with the dawn of the sixteenth century. Renaissance architecture and Renaissance art swept Europe like a wave, and the people turned with reactionary enthusiasm to the ancient standards of art, as they did to the study of classic authors, and to the writing of even Greek and Latin verses.

The debt of gratitude, therefore, which posterity has owed the originators in ancient Greece of the three noble orders of architecture—namely, the Doric, Ionic and Corinthian—can scarcely be overestimated, for it is to those three orders or styles that all subsequent architects have turned for the fundamental truths of their art. They may not have followed each or all with conventional strictness; but they have not succeeded in escaping from borrowing many of the features there everlastingly fixed by the unerring geniuses of classic times.

"Famous Greece! That source of art, and cultivated thought, Which they to Rome, and Romans hither brought."

The uses to which the Greek and Roman architectural forms, principles and ornaments have been put since the birth of the Renaissance have broadened largely, and would seem to preclude any possibility of their ever again falling into even partial

desuetude. It is not only in the more pretentious buildings, monuments and ornamental structures that abound so plentifully in the populous and wealthy cities that classic models and features are so liberally employed, but even the unpretentious and simple rural homes cannot escape their use. What is more common than the Doric mutule or Corinthian modillion, so frequently seen in the cornices of modern houses, or the Ionic dentils that show their teeth below a piazza roof or over the door casing of a colonial dwelling? The various combinations of the fret, the egg and dart, the bead and fillet, the honeysuckle, the acanthus and many other Grecian _motifs_ of ornamentation, are met with constantly, not only in buildings of a public or private nature, but in furniture and fresco, in interior decoration, and in enhancing the attractiveness of almost any article of use or ornament. Even the simple ogee moulding, which is employed, if nowhere else, about the door panels of the humblest abode, is classic in its origin, and had its archetype in the entablatures of those stately and beautiful temples dedicated to the pagan gods of ancient Greece.

It must not be inferred, however, that all the individual features employed in the Greek orders found their birth in the brains of Hellenic architects. Sir Jeremy Bentham says:

“From Egypt arts their progress made to Greece, Wrapt in the fable of the Golden Fleece.”

This statement, however, though poetical, is much too sweeping to be literally correct as to architecture. The Greeks borrowed a little—a very little—not only from the Egyptians, but from the Assyrians, the Chaldeans, the Persians, and other western Asiatic races as well; but so altered what they had borrowed, so refined it and entwined it with original conceptions of their own, that the captive features could have returned again to their native lands without fear of detection. Indeed as to the origin of some of the architectural features which the Greeks are supposed to have taken from the countries of a more unrefined people to the south and east of them, and especially as to the volute, so conspicuous in the Ionic capital, which is supposed to have been a Persian conception, there is much dispute.

Professor T. Roger Smith, of London, very truly observes: “We cannot put a finger upon any feature of Egyptian, Assyrian or Persian architecture the influence of which has survived to the present day, except such as were adopted by the Greeks. On the other hand, there is no feature, no ornament, nor even any principle of design which the Greek architects employed that can be said to have now become obsolete.”

In discussing the three primary orders of which mention has been made, and to which he adds the Tuscan and Composite, both of Italian or Roman origin, and closely dependent upon the original three, Sir William Chambers remarks: “The ingenuity of man has hitherto not been able to produce a sixth order, though large premiums have been offered, and numerous attempts been made by men of first-rate talents, to accomplish it. Such is the fettered human imagination, such the scanty store of its ideas, that Doric, Ionic and Corinthian have ever floated uppermost, and all that has been produced amounts to nothing more than different arrangements and combinations of their parts, with some trifling deviations scarcely deserving notice; the whole tending generally more to diminish than to increase the beauty of the ancient orders.... The suppression of parts of the ancient orders, with a view to produce novelty, has of late years been practised among us with full as little success; and although it is not wished to restrain sallies of imagination, nor to discourage genius from attempting to invent, yet it is apprehended that attempts to alter the primary forms invented by the ancients, and established by the concurring approbation of many ages, must ever be attended with dangerous consequences, must always be difficult, and seldom, if ever, successful.” Thus is seen the marvellous discretion and judgment exercised by the Grecian architects in selecting from contemporary art that alone which was best to perpetuate, and thus is well expressed in the statement of indisputable fact, a tribute to their originality and creative genius.

And who were these Old Masters of classic architecture—older in point of service to their art by thousands of years than Giotto and Raphael and Michael Angelo and Inigo Jones and Sir Christopher Wren, and many others who might be mentioned, and who in campanile and cathedral, in public building and private palace, in monument and mausoleum, have proved themselves justly entitled to the laurels with which they have been crowned, but who nevertheless are but disciples of Hellenic and Roman masters? Where do we find the biographies of the original Old Masters of architecture recorded? Where can we turn to read of their lives, of their deeds and achievements, of their aspirations and ambitions, of their shortcomings and their foibles? Where are written down those anecdotes and incidents of personal interest, so entertaining in association with their works or their art? What, in fact, were their names? There is comparatively little recorded of the lives of the Greek and Roman architects with which to answer these questions; strange as it may appear, even their names are unfamiliar, and in many important instances are forgotten altogether. Among that large galaxy of brilliant men which Greece in her prime produced, who figured prominently in almost every walk of life, who were great in war and in peace, in philosophy and poetry, in satire and history, in oratory and valor, and as great, if not greater than in all, in statuary and sculpture—a galaxy clinging to the memory in all ages of human progress, because never excelled, the

name of a Grecian architect is a strange sound, and does not ring in tune, if it is ever heard at all, with the names enrolled upon the list of Greek immortals.

The sculptors and statuaries of ancient Greece are especially well remembered in the popular mind, and Myron and Phidias and Praxiteles and Polycletus call for no introduction to the ordinarily informed lover of art; not so the designer of the Parthenon or the Temple of Theseus, or the Erechtheum, or the Choragic monument of Lysicrates. It is strange that the artist who modelled or chiselled a bull or a cow or a Faun or a nude Venus, or any pagan god or goddess, however much we may praise the excellence of his skill, should be remembered by posterity, while the artist, his contemporary, who designed the most beautiful and graceful buildings of all time, which in their glory were the pride of their people, and which in their decay and ruin are still the loadstones that attract pilgrims from the most distant lands, is forgotten, and, it would appear, denied almost the humblest mention. Can it not be said of the Grecian architects, as well as the Grecian sculptors, that under the magic of their touch “Stones leap’d to form, and rocks began to live”? Were not the temples they reared in all the pride of surpassing beauty, which tempted the sculptor’s caress on frieze and pediment, and which gave shelter to those works of the statuary’s art which Shakespeare recalls so vividly when he draws the simile:

“They spake not a word. But, like dumb statues, or unbreathing stones, Stared at each other, and look’d deadly pale,”

as much entitled to give immortality to their creators as the works, however competitive, of other branches of art to their authors? And still so incidentally and indifferently have the historians and biographers of their time alluded to the Grecian architects, that little or nothing is to be found to quench that desire to know of them personally, which an interest in their grand achievements may well awaken.

Did we not know it to be otherwise, we might think that they, too, were like the poor architect of whom Goethe speaks: “He is employed in lavishing all the luxury of his fancy upon halls from which he is to be ever excluded, and display his ingenuity in bestowing the utmost convenience upon apartments he must not enjoy.” But it does not appear that any social discrimination was exercised against the Greek architects to cast a shadow upon their present or future fame.

It is popularly believed that the great buildings of the ancient world were very long in the process of construction—that they, in fact, took many decades and sometimes even hundreds of years to complete. If this were true it might in a measure explain the obscurity in which their architects have been left, inasmuch as the original designer of the building might have been forgotten ere the last of his successors had finished the work he had undertaken. But this is not altogether the fact. Even the pyramid of Cheops—that colossal marvel of the creative genius of man—we are informed by some authorities took but thirty years to construct, ten of which were given to the building of a road leading to the site of the pyramid, for the greater facility in handling the huge blocks of stone to be used. Neither were the temples and public edifices of Greece and Rome, as a rule, long in building, being generally undertaken and finished during the influential period of a public man’s career, or the reign of a single emperor. There were, of course, exceptions to this rule, as, for example, the temple of Apollo at Delphi, that erected to Diana at Ephesus, and that dedicated to Jupiter at Athens; but in nearly all such instances it will be found that the temples were destroyed and rebuilt during the long interval which is supposed to have passed from the time when their foundations were first laid, to that which found them again in all respects completed structures; or, if not destroyed and the work undertaken anew, the delay was caused by some political influence which contributed to check the continuous prosecution of the work, implying no procrastination on the part of the original builders. But even in the most of such cases the names of the various architects who were from time to time associated with the work are at least known, if their biographies are not more fully recorded.

It may be stated broadly that both the Greeks and the Romans were rapid builders when the size of their edifices is taken into account. Especially is this true of the time of Pericles, if we are to believe the testimony of Plutarch: “Every architect strived to surpass the magnificence of design with the elegance of execution, yet still the most wonderful circumstance was the expedition with which they [the buildings] were completed. Many edifices, each of which seemed to require the labor of successive ages, were finished during the administration of one prosperous man.” And the great biographer also adds: “... Hence we have the more reason to wonder that the structures raised by Pericles should be built in so short a time, and yet built for ages, for each of them as soon as finished had the venerable air of antiquity; so now they are old they have the freshness of a modern building. A bloom is diffused over them which preserves their aspect untarnished by time, as if they were animated by a spirit of perpetual youth and unfading elegance.”

Another mistaken idea is that the sculptors of ancient times were also architects. Some instances occur where, like the Italian, Michael Angelo, a prominent sculptor of Greece or Rome, made architecture one of his accomplishments, but they were not as numerous as they are supposed to have been, and the rule seems to be the reverse: that the sculptors of antiquity had no technical knowledge of architecture, and that the arts were quite as distinctly practised as professions in early times as they are to-day.

There remains to be presented only one other reason for the indifference shown the early architects by their contemporary writers and public, which is so well expressed by an English historian in his discussion of the Coliseum at Rome, that it may well be quoted as a type of the excuse offered by apologists of the same class: “The name of the architect to whom the great work of the Coliseum was entrusted has not come down to us.[1] The ancients seem themselves to have regarded this name as a matter of little interest; nor in fact do they generally care to specify the authorship of their most illustrious buildings. The reason is obvious. The forms of ancient art in this department were almost wholly conventional, and the limits of design within which they were executed gave little room for the display of original taste and special character.... It is only in periods of eclecticism and Renaissance, when the taste of the architect has wider scope and may lead the eye instead of following it, that interest attaches to his personal merit. Thus it is that the Coliseum, the most conspicuous type of Roman civilization, the monument which divides the admiration of strangers in modern Rome with St. Peter’s itself, is nameless and parentless, while every stage in the construction of the great Christian temple, the creation of a modern revival, is appropriated with jealous care to its special claimants.” In other words, the pupil is a fitter artist to awaken the personal interest of those who admire his works than his master; and the revived imitation of more consequence to the public than the original model. If this were true, why should the Coliseum, “the most conspicuous type of Roman civilization,” upon which the pilgrims of the North, as we are informed by Gibbon, based the longevity of Rome itself, when in their rude enthusiasm they gave expression to the proverb, “As long as the Coliseum stands, Rome shall stand; when the Coliseum falls, Rome will fall; when Rome falls, the world will fall,” _divide_ the admiration of the stranger with St. Peter’s? Should it not, rather, be subordinate to the Christian cathedral of Bramante, Raphael and Michael Angelo? Is there not a touch of the _reductio ad absurdum_ in this argument? Such reasoning does not seem to be quite obvious upon other grounds as well. If it is the fact that the ancients regarded the names of their architects as of little interest, and their buildings as wholly conventional, why does Vitruvius speak of four of the principal temples of Greece as “having raised their architects to the summit of renown”? Why is it that Rhœcus and Theodorus, Ictinus, Mnesicles, Dinocrates, Detrianus, Apollodorus and many other architects—to whom more particular mention will be made later—are remembered in ancient history with more or less circumstantiality, not only in association with their works—all conventional, if we are to accept this writer’s judgment—but also on account of their individual merit, while the architects of the buildings which departed most from that same conventionality, both in plan and detail, as, for example, the Erechtheum, the original Odeon of Pericles and even the Coliseum itself, where:

“Firm Doric pillars formed the solid base, The fair Corinthian crown the higher space, And all below is strength, and all above is grace,”

are lost in the ocean of oblivion?

Do not our modern authors overlook the fact that the architects of their own age share, as a rule, in the same popular indifference, and that the period of revival is no exception to the period of inception; that the one has inherited from the other not only the forms and principles of its art, but the same neglect of its artists?

Whether this is true or not, the fact must remain and be accepted with patience or impatience, as we please, that there is little preserved for us by the ancient writers in respect to their architects. Two rather conspicuous exceptions, however, occur to this general rule in respect to Pausanias, the Lydian, and Vitruvius Pollio, the Roman.

Pausanias lived toward the close of the second century after Christ. He was a great traveller and a close observer, his observations having been confined principally to works of art, such as public buildings, temples and statues, which he mentions in direct and simple language. He visited most of the states of Greece at a time when that country was still rich in her treasures of art, and what he has to say of what he saw there would tend to indicate that while he was by no means a critic or a connoisseur, he was still a faithful and minute recorder of what appealed to his taste or excited his curiosity.

Vitruvius, however, was not only a writer on architecture, but a professional architect as well, who resided in Rome about a century earlier than Pausanias, or in the time of Augustus. He is practically the only writer of his time who has given us technical information concerning the ancient buildings. Vitruvius wrote his treatises upon architecture at a very advanced age, and, it would appear, much in defence of the pure Greek models which were even in that time being corrupted. The frankness with which he hopes for

fame by reason of his book, and exposes his poverty as well as the unprofessional practices of his brother architects, is not the least attractive feature of his discourse: “But I, Cæsar,” he exclaims, “have not sought to amass wealth by the practice of my art, having been contented with a small fortune and reputation, than desirous of abundance accompanied by a want of reputation. It is true I have acquired but little, yet I still hope, by this publication, to become known to posterity. Neither is it wonderful that I am known to but few. Other architects canvass and go about soliciting employment, but my preceptors instilled into me a sense of the propriety of being requested and not of requesting to be entrusted, inasmuch the ingenuous man will blush and feel shame in asking a favour; for the givers of a favour, and not the receivers, are courted. What must he suspect who is solicited by another to be entrusted with the expenditure of his money, but that it is done for the sake of gain and emolument? Hence, the ancients entrusted their works to those architects only who were of good family, and well brought up, thinking it better to trust the modest than the bold and arrogant man. These artists only instructed their own children or relations, having regard to their integrity, so that property might be safely committed to their charge. When, therefore, I see this noble science in the hands of the unlearned and unskilful of men, not only ignorant of architecture, but of everything relative to buildings, I cannot blame proprietors who, relying on their own intelligence, are their own architects; since, if the business is to be conducted by the unskilful, there is at least more satisfaction in laying out money at one’s own pleasure rather than at that of another person.”

Vitruvius also epitomized in his books on architecture much that had been written prior to his time by his professional brethren of Greece and Rome, and so preserved something of what otherwise might have been entirely lost.

Allusion has been made to these two writers with some particularity, for the reason that they will be more quoted than any others in the course of this volume, but it must not be inferred that they are alone responsible for all the knowledge which has come down to us respecting the Greek and Roman architects, little and unsatisfactory as it is.

Although it has been shown that the historians and biographers of ancient Greece made no attempt to treat architects with especial favor, it would not be just, however, to close this chapter without quoting from Homer to prove that lie, at least, could rank them as among those who, by serving the people in the highest sense, were entitled to unusual hospitality:

“... What man goes ever forth To bid a stranger to his house, unless The stranger be of those whose office is To serve the people, be he seer, or leech, Or architect, or poet heaven-inspired, Whose song is gladly heard?...”

FOOTNOTES:

[1] There is an old ecclesiastical tradition, which is much doubted, that the architect of the Coliseum was a Christian by the name of Gaudentius, who suffered martyrdom in its arena, and that the services of thousands of Jews contributed to its erection.

CHAPTER II.

THE MYTHICAL AND ARCHAIC ARCHITECTS AND BUILDERS.

History does not probe so deeply into the earliest annals of the races that inhabited the Peloponnesian peninsula, that it does not show them to have been pre-eminent as builders; nor does it follow the ancient Greek people throughout the long ages that spanned their evolution and decadence, that it does not find them in all the stages through which they passed, leaving at least some of their walls, temples or monuments to resist the ravages of all time, and the decaying influences of the elements. They built, therefore, not only well, but perhaps better than they knew, and have proved that if the creations of their intellects were immortal, as we know, the works of their hands were not altogether perishable.

The Pelasgic tribes, who were the first of which there is any record to have inhabited Greece, were great wall-builders, and past-masters of defensive architecture in those early ages. Although we may not have the names of the individual architects among them, we have their racial works still before us to evidence the fact that whoever the architects were, they knew their business eminently well. The Acropolis at Athens possesses the finest example that remains of Pelasgic mural work, in the fortified retaining wall which surrounds it, and which is sometimes called after the race that built it, the Pelasgicum.

It is claimed also by some authorities that the Pelasgi were the original architects and builders of the “Long Walls” that connected Athens with her seaport gates, and of such parts of the peribolus as were not the authentic work of the builders under Themistocles and Cimon, and subsequent architects to be hereafter mentioned.

The Cyclopes, who belonged to Pelasgic times, were likewise remarkable wall-builders, lending their name to a kind of mural work in a manner original with them, and having the attributes of great solidity and endurance. The ruins of houses and other structures erected by them have been found also at Tiryus and Mycenæ, on the plain of Argos.

Speaking of the circuit wall at Tiryus, Pausanias describes it as being “composed of unwrought stones, each of which is so large that a team of mules cannot even shake the smallest one;” and of Mycenæ, the more important city, a short distance from Tiryus, where the circular treasury of Atreus and other evidences of Cyclopean architecture have been excavated by Dr. Henry Schliemann, Euripides asks the question: “Do you call the city of Perseus the handiwork of the Cyclopes?”

Modern archæologists are inclined to the opinion that the Cyclopean builders were not, as originally supposed, the one-eyed giants whom Ulysses encountered in his voyages, as related in the Homeric legends, but an entirely distinct Thracian tribe, which derived its name from king Cyclops. After being expelled from Thrace, where were their early homes, they migrated to Crete and Lycia; thence following the fortunes of Prœtus, and giving him protection with the gigantic walls which they constructed as against Acrisius, his twin brother, who was very quarrelsome, as twin brothers not often are.

These Cyclopean walls, which are still to be found throughout Greece, as already stated, and also in some parts of Italy, were made of huge, uncut polygonous stones, sometimes twenty or thirty feet wide, piled upon each other without cement, frequently irregularly, with smaller stones filling up the interstices, but occasionally in regular horizontal rows. There were, in fact, not only several kinds of these walls, but several eras in which they were built as well.

It is not, however, the intention here to discuss the nature and extent of the Pelasgic and Cyclopean constructions, it being sufficient to recall the fact that so far as the Pelasgians generally are concerned, they were not only the progenitors of most of the early architectural monuments of eastern Europe, but were skilled in the arts and learned in the fables of the gods as well, bequeathing both religious rites and many arts to their children, the Greeks. It remains only to add, also, that so closely were they identified with the art of building that it is believed their very name is derived from their leading pursuit, for it is thought that the term Pelasgi may be interpreted to mean “stone-builders” or “stone-workers.”

In this allusion to the Pelasgians as builders, it was stated at the outset that the names of the individual architects among them are not known; this was perhaps unfair to Æacus, if he can be ranked as an architect, and who is classed as a Pelasgian, although of divine parentage.

Æacus was a son of Jupiter by Ægina, daughter of the river god, Asopus, and, like the Cyclopeans, he was particularly expert in the matter of walls. He was as well a very just and pious individual or myth, who was frequently called upon to hold the scales of justice, not only as between mortals, but also immortals. He was born on the Island of Ægina, the temporary residence of his mother, after whom it was named. At the time of his birth the island was uninhabited. This very unpleasant condition of isolation for the mother and son was quickly remedied by Jupiter, who changed the ants that abounded there into men, placing Æacus over them as king.

Æacus always kept on the very best of terms with the gods, propitiating them in many ways, and at last becoming a great favorite with them. Indeed, so strong was his influence in celestial circles that at one time when Greece was afflicted with a drought, in consequence of a murder that had been committed, the Delphic oracle declared that the only person who could help the situation at all was Æacus. He was accordingly appealed to and persuaded to petition the gods for relief. The result was that his petition was favorably answered. Æacus thereupon erected a temple to Zeus Panhellenius on Mount Panhellenion to show his gratitude, and possibly to keep himself in that position where he might trespass upon the good-nature of his heavenly friends again at some future time, should there be necessity.

Æacus surrounded his island with high walls to protect his people against pirates. It is probable that these walls attracted the admiration of Apollo and Neptune, and prompted them to retain the professional services of their builder to assist them in erecting the walls of Troy. But here it was that Æacus failed, for as one diamond can only be accurately judged when placed in comparison with another diamond, so Æacus, however successful he may have been as a wall-builder by himself, was outclassed when he came into competition with the occult knowledge of Apollo and Neptune.

The story is that when the Trojan walls were completed, three dragons appeared and rushed upon them to test their strength. The two dragons which attacked those parts of the walls built by the celestial associates of Æacus had their heads broken for their pains, but the one which flew at the mortal’s share of the work made a hole in the wall which let it into the city. Apollo at once

prophesied that Troy would eventually fall through the hands of the Æacids, which prophecy, of course, proved true. Whether this failure had anything to do with the future of Æacus or not, it would be difficult to say, but the fact is that after his death he became one of the three judges in Hades, with special jurisdiction over the Europeans, which necessarily insured his being overworked until the end of time.

With a people possessed of so large and varied an assortment of deities, suited to every possible human need and shade of mortal endeavor, it would be strange indeed if there was not some mythical or legendary character among the Greek gods to preside over architecture, if not as a distinct art, at all events in association with some of its kindred branches. That the Greeks did not ignore such a necessity is found to have been the case, and the great Dædalus rises most admirably to the occasion in personifying the early infancy of architecture as well as sculpture and wood-carving.

Dædalus, like most of his spiritual relations and associates, led a life of much romance and adventure, not unmixed with hardship and trial. He was either a native Athenian or Cretan, a point upon which there is some dispute, as well as upon another involving his parentage. It is perhaps sufficient to know that Dædalus flourished in the age of Minos and Theseus, and was introduced more or less into the legends pertaining to those two early characters.

It is upon Dædalus that responsibility must rest for the first introduction of jealousy into the personality of artists, a vice, by the way, which they have never been quite able to shake off from his time to the present. Dædalus was rather sorely afflicted with this unfortunate trait, and to its early exhibition is due much of his subsequent misfortune. It was in connection with his devotion to sculpture that his jealousy first involved him in trouble. He became very expert as a carver generally, and undertook to instruct his nephew Perdix in the art. In due time and under the careful tutorage of his uncle, Perdix also became proficient, and in a moment of inspiration is said to have invented that very useful tool of the mechanic, the saw. This it was that excited Dædalus, who, in a fit of jealous rage, threw his nephew over the Pelasgic walls of the Acropolis, killing him instantly as he supposed.

Dædalus was, of course, condemned to death for this unseemly and cruel manifestation of envy, but managed to escape and fly to Crete. There his professional reputation had preceded him, and he obtained the friendship of king Minos. In Crete he developed his latent architectural skill, and built a very elaborate and intricate dwelling for the hideous monster Minotaur, since known as the celebrated labyrinth at Cnossus. The story of how Theseus, with the connivance of Ariadne, the charming daughter of Minos, slew this monster, is one of the most thrilling of the mythological legends, and is quite familiar.

Just how Dædalus incurred the displeasure of Minos does not seem to be very clearly stated by the early authorities. It appears that he was in some way entangled with the creation of a wooden cow, also with Pasiphaë, the wife of Minos, and even with the birth of the horrible Minotaur. Possibly it may have been Minos who this time became jealous. However that may be, the friendship which had existed between Dædalus and the king finally became strained, and the former was compelled to fly the country, which he did in a very literal way, as king Minos had seized all the ships on the coast of the island, cutting off, in consequence, the only means of escape. The architect, however, possessed much ingenuity and inventive genius of his own, even to a more marked degree than that manifested by the nephew he had dropped over the Athenian precipice, and with the aid of some feathers, a little wax, and Pasiphaë, who secretly contributed her assistance, he manufactured a pair of wings for himself, and another pair for his son, Icarus, who was with him at the time. Thus it will be seen that the first flying machines were invented by an architect.

[Illustration: THE FLIGHT OF DÆDALUS AND ICARUS.]

When the father and son started for Sicily, over the Ægean sea, like a pair of huge birds, Dædalus flew conservatively and cautiously, being careful not to rise too near the sun, where it was supposed by the ancients to be very hot; but Icarus, with the spirit of youth and the enjoyment of the exhilaration consequent upon the novelty of his method of locomotion, gave a deaf ear to the protests of his father, and, in emulation of Apollo, soared so high that the sun melted the wax in his wings. His feathers flew off, and down he dropped into the waves below. He was drowned, and that part of the Ægean sea into which he fell was afterward called the Icarian sea, in commemoration of this unfortunate accident, which Darwin has so well described in verse:

“... With melting wax and loosened strings, Sunk hapless Icarus on unfaithful wings; Headlong he rushed through the affrighted air, With limbs distorted and dishevelled hair; His scattered plumage danced upon the wave, And sorrowing Nereids decked his watery grave. O’er his pale corse their pearly sea-flowers shed, And strewed with crimson moss his marble bed; Struck in their coral towers the passing bell, And wide in ocean tolled his echoing knell.”

Dædalus, who could not stop to rescue his son, continued steadily on his course, and, attempting no experiments with his frail wings, finally landed safely in Sicily, where he established himself again, professionally, under the royal patronage of Cocalus, king of the Sicani. Here he did most excellent work, until king Minos, his old enemy, found him out, and began to make it unpleasant for him again. Minos, hearing that Dædalus was in Sicily, sailed with a great fleet to that island, but fortunately for the architect, his enemy was murdered as soon as he arrived there by Cocalus or his daughter. In the mean time Dædalus, anticipating the trouble that was in store for him, again made an escape, this time to Sardinia, where he tarried a while, but finally visited other countries, notably Egypt.

These are the substantial facts of Dædalus's career, as contained in the earlier legends, but later Greek writers tell a much more fanciful and improbable story of his life, which there is no urgent necessity to believe, as the one mentioned is quite fanciful enough and probably more authentic. They say, among other things, that Dædalus was an astrologer, and that he taught his son that science, who, soaring above plain truths, lost his wits and was drowned in an abyss of difficulties.

Dædalus may have been an astrologer and may have been other things as well, but that he was an architect cannot be doubted from the fact that so many buildings are ascribed to him. Among his works may be mentioned the Colymbethra, or reservoir in Sicily, from which the river Alabon flowed into the sea; another an impregnable city near Agrigentum, in which was the royal palace of Cocalus; still another a cave in the territory of Selinus, in which the vapor arising from a subterranean fire was received in such a way as to answer for a vapor bath. He enlarged the summit of Mount Eryx for a foundation for the temple of Venus, and he is said to have been the author of the temples of Apollo at Capua and Cumæ, and the temple of Artemis Britomartis in Crete. In Egypt he was the architect of a very beautiful propylæum, or vestibule to the temple of Hephæstus at Memphis, for which he was rewarded by being permitted to erect in it a statue of himself, the work of his own hands.

As a sculptor he also executed many works of art—but the architectural side of his career can only be considered here. It will not be out of place, however, to mention some of the inventions ascribed to him to assist the mechanic. It is claimed for him that he was an expert carpenter, having been taught that trade by Minerva, and that he originated the axe, the plumb-line, the auger and glue.

Dædalus, in fact, seems to have personified the earliest Grecian art, and his name, which, when translated, signifies "ingenious," or "inventive," stands for that period in Greece when form and shape and expression were given inanimate substances by the use of tools and mechanical appliances.

When Dædalus threw his nephew over the high walls of the Acropolis, and naturally thought that he had killed him—an opinion in which it is apparent the people of Athens shared—he was very much mistaken, for Minerva, the patron goddess of the city, realizing what a great mistake it would be to allow so bright and promising a young man to go to an early death, exercised her magic, and saved him by changing the falling artisan into a bird, which was given his name, "Perdix," or, as translated, Partridge.

To Perdix, who was especially skilful as a worker in wood, is attributed, in addition to the invention of the saw, suggested to him by the backbone of a fish or the teeth of a serpent, it would be difficult to say which, the chisel, the compasses and the potter's wheel. Whether he invented any of these things after he became a partridge or not is another mythical uncertainty, but probably not, as his changed condition and feathers would have made it very awkward for him to have done so, although most anything was possible in those days.

Perdix is also called Talos by some writers, and Pausanias mentions him by still another name, Calos, and states that after his death he was buried somewhere on the road leading from the theatre in Athens to the Acropolis.

It might be interesting, but certainly a task beyond the scope of this book, to mention all the mythical personages of the archaic or early period of Grecian art, who were in a way more or less remote, responsible for special features of artistic treatment that graced the buildings of that time, such, for instance, as Dibutades, who was the first to make masks on the edges of gutter tiles. Dibutades was a sculptor, and the idea which he originated is said to have been suggested to him by seeing his daughter trace the lines of her lover's profile around the shadow which it cast upon a wall. He filled in the lines with clay, and, moulding it to the face, gave to the world the art of modelling.

Among the artists belonging to the Dædalien, or legendary period of Greece, who may be classed more distinctively as architects, however, were Polycritus, who had to do with the building of the town of Tanagra by Poemander, and Pteras, who was supposed to have been the architect of the second temple to Apollo at Delphi. The legend is that the first temple was made of branches of the wild laurel from Tempe, and that Pteras constructed the second of wax and bees' wings—rather an unsubstantial building material,

it might be inferred. Eucheir, a painter, and Chersiphron and Smilis, architects and statuaries, are also of this traditional period, and were representative of skill in their arts.

All these names, however, although supposed to have been originally purely mythological, were probably later assumed by or given to mortals who were specially expert in the particular branch of art which the name taken suggested. These individuals, to complicate matters, no doubt, became entangled with the early mythological stories, and finally lost their identity completely, or to such an extent as to make it quite impossible to separate the fact from the fiction in their respective cases.

An illustration of such a confusion is to be found in respect to the architects, Rhœcus and Theodorus, who had to do with the building of the temple of Hera at Samos, for the worship of which goddess Samos was celebrated, and who, in association with Smilis, were the architects of the labyrinth at Lemnos.

The writers who have mentioned these artists are quite numerous, and have so differed in respect to their dates, and confounded the accounts of their careers and achievements, that it is difficult to sift anything like a satisfactory story from the confusion created. The most probable deduction that has been made, however, is that Rhœcus flourished about 640 B.C., and was a son of Phileas of Samos; that Theodorus, the architect, was his son, and that another Theodorus, a statuary, sometimes mistaken for the architect, was a nephew of the architect Theodorus, the son of Telecles, also a gifted sculptor, and a grandson of Rhœcus.

The temple of Hera, alluded to as the work of the father and son, was three hundred and forty-four feet long by one hundred and sixty feet wide, and, according to the “Antiquities of Ionia,” a decastyle, dipteral structure, or possessed of a double row of columns composed of ten columns in each row. Pausanias thinks that the temple was of very great antiquity, a fact apparent to him from the statue of Hera which it contained, which was made by Smilis, of wood, as were the early statues of Greece.

The Lemnian labyrinth, according to Pliny, contained fifty columns and innumerable statues, and had very remarkable massive gates, so delicately poised that a child might open or shut them. Modern travellers have had difficulty in finding any trace of this labyrinth, although there is little doubt that it once existed. It is not to be classed with the more visionary labyrinth in which the Minotaur was caged.

It is claimed for both Rhœcus and Theodorus that they were the first to invent the art of casting statues in bronze or iron, but as this art was known before their time by the Phœnicians, it is likely that they were responsible for nothing more than having introduced it into Greece. This is probably true also of other early mythical characters of Greece, to whom is attributed certain inventions in the arts which have been found since to have existed much earlier than their time in Egypt or elsewhere.

Theodorus is also credited with having been the architect of the old Scias at Sparta, and of having advised the use of charcoal beneath the foundation of the temple dedicated to Artemis, at Ephesus, as a remedy against the dampness of the site. Theodorus was a great admirer of his father and of the temple to Hera, which they built together. He attested his appreciation of the latter by writing a book descriptive of it.

As for Smilis, who belongs to the mythical period, and whose name when translated stands for “a knife for carving wood,” or “a sculptor’s chisel,” he is also accredited with having been the first to devise the art of modelling in clay. He is to be classed more as a sculptor than an architect, but of an inferior standing to Dædalus. In fact, his only connection with architecture, according to Pliny, seems to have been his association with Rhœcus and Theodorus in the building of the labyrinth at Lemnos. It is possible that even here he was employed more in the line of a sculptor than in lending any professional assistance as an architect.

Pausanias mentions a pupil of Theodorus of Samos, who, it would appear, achieved considerable distinction both as an architect and sculptor, but more especially in the latter capacity. His name is given as Gitiadas, and his birthplace as Lacedæmon, where he flourished about 724 B.C., as stated by some authorities, but much later according to others. The architectural work for which he receives credit was the temple of Athena Polionchos at Sparta, which, it is said, was constructed entirely of bronze. It also contained a bronze statue of the goddess of Gitiadas’s own workmanship, and many bas-reliefs representing the labors of Hercules, the exploits of the Tyndarids, Hephæstus releasing his mother from her chains, the Nymphs arming Perseus for the expedition against Medusa, and other mythological subjects, all executed in the same metal. This extensive use of bronze suggested the name “Brazen House,” which was given the temple. It would seem that Gitiadas was possessed of other accomplishments, and served Minerva with equal distinction as a poet, writing his poems all in the Doric dialect.

A still stranger _compôte_ of fact and fable, of hypothesis and conjecture, of celestial and terrestrial biography, is to be found in the accounts of the brothers Agamedes and Trophonius, who were the architects of the great temple of Apollo at Delphi, and of the

treasury of Hyrieus, king of Hyria in Bœotia.

The temple to the beautiful and accomplished son of Jupiter and Latona, the god of music and prophecy, as well as other things of equal or less consequence, was the fourth to be erected upon the same site on Mount Parnassus, in the ancient city of Delphi, known to the older poets as Pytho, a name derived from the serpent Python which Apollo slew. In this temple, which was the first of the four to be built with stone, the others having been constructed out of the branches of the bay tree and other equally perishable materials, dwelt the much respected and frequently consulted Delphic Oracle. The spot in the temple from which the prophetic vapor issued to inspire the priestess with second sight was said to be the central point of the earth, and that where the two eagles despatched by Jupiter to ascertain that point met and fell.

Pythia, the priestess of Apollo, who gave mouth to the oracles, sat on a sacred tripod placed over the opening from which the vapor issued, and gave forth her words of wisdom in prose or poetry as the occasion demanded. If in prose, her prognostications would be immediately verified, and if in verse some time must elapse before they could be fulfilled. Pythia was not always on duty, but could be consulted only on certain days during the month of Busius in the spring.

There is no doubt but that she made some very remarkable prophecies, but, alas! it is also recorded that, like some of the political oracles of these degenerate times, her prophetic vision was not infrequently influenced by “a previous interview.” A notable case of this kind was that in which the Alemæonidæ were entangled; who for political reasons and effect rebuilt the same temple after it was destroyed by fire in the year 548 B.C., as we shall see later.

But we have drifted from the subject. It is claimed by some that Agamedes was the son of Stymphalus, who was murdered and had his body cut up in pieces, and a grandson of the old ancestor of the Arcadian Arcas, who in turn was a son of Zeus. Others say that the father of Agamedes was Apollo, and his mother was Epicaste, and still others are of the opinion that his parents were none other than Zeus himself and Iocaste, another name for Epicaste, and that Trophonius was his son. All this genealogy is, however, disturbed if we accept the more probable one, that he was a son of Erginus, king of Orchomenus, and that he was a brother of Trophonius. By the way, Trophonius is also said to have been a son of Apollo. When these two young men attained to manhood they became very expert in the art of building temples to the gods and palaces for kings. Thus having established enviable reputations in their profession, they were retained to plan and supervise the works mentioned.

It is in respect to these architects that the first authentic account of a misunderstanding as to professional compensation is related. It must not be thought that because some of the early architects were related to the nobility of Mount Olympus, they were any the less mercenary than are architects in our own time, or were any more inclined to work for nothing than are their professional descendants of to-day.

Plutarch tells us that Agamedes and Trophonius, after working hard upon the Delphic temple, and not receiving any pay, began to lose faith in the mortals who were backing the undertaking. As they grew more and more dubious about their compensation, and possibly having notes or bills to meet, they finally decided to appeal directly to Apollo, in whose glorification the shrine had been built.

Apollo, who was consulted through the Delphic Oracle, informed them that he must have time to think the matter over. In other words, he could not be hurried in his decision, but would give them an answer at the end of seven days. It is not unlikely that the Oracle saw an occasion here where it might be a matter of financial prudence to consult with the other side before rendering a decision. However that may be, the two architects were told that Apollo wished that they should spend the intervening time in “festive indulgence.” Thinking from this, quite naturally, that they were in the good graces of the god, and suspecting no ungodly duplicity, Agamedes and Trophonius set about to enjoy themselves according to the most liberal interpretation of their instructions. The result was that at the end of the seventh day they were found dead in their beds, whether from too much festivity on their part or too much duplicity on the part of the Oracle, no one knows, but the inference is conclusive that as they were dead it was not necessary to give them the professional compensation they had been so anxiously demanding.

Cicero tells the story a little differently, and eliminates the question of compensation from it. He says that they consulted Apollo to know what in his opinion was “best for man”? This being a much easier question to handle, Apollo took but three days to answer it, but the consequences of the consultation to poor Agamedes and Trophonius were quite as disastrous. It may be that, taking everything into consideration, it is best for man to be dead, but most architects don’t think so, and had Agamedes and Trophonius anticipated such an answer, it is probable that they would have asked no questions.

Pausanias relates an altogether different legend and connects it with the treasury of Hyrieus, which Agamedes and Trophonius built, instead of with the temple of Apollo. The story by Pausanias would tend to show that these architects were even more mercenary than Plutarch has given us to understand they were.

It seems that in constructing the treasury they contrived to have a stone so placed that it could be taken away from the outside of the building at any time, and thus offer an entrance to the vaults. No one of course had any knowledge of this secret entrance but themselves. In consequence, after the building was finished, and it was used for the purpose for which it was intended, these two covetous brothers carried away from time to time goodly portions of the treasure as it was deposited. The king soon heard that there was a leak in his treasury, and that he was losing money rapidly. He was naturally annoyed and much perplexed when he found that the locks and seals of his treasure house remained intact and uninjured. He thereupon set a trap to catch the thief. Just what kind of a trap it was is not explained, but after some little time Agamedes was caught, and Trophonius, finding his brother ensnared, cut off his head, to save his own, doubtless, and prevent the discovery of his association in the robbery. This very unfraternal act of Trophonius was not allowed to go unpunished, however, and Apollo, or some other god, caused him to be swallowed up in the grove of Lebadea.

Pausanias further states that Erginus, the father of Agamedes, was known as the “Protector of Labor,” that Trophonius was called the “Nourisher,” and that Agamedes had the reputation of being the “Very Prudent One.” There can be no doubt about Agamedes’s prudence, such as it was.

Trophonius, it appears, had a still further career after his death, as an oracle, conducting his business from the spot where he was swallowed up in Lebadea. He was especially prophetic in matters relating to futurity. Those desiring to consult him were conducted to a cavern, and furnished with a ladder, by means of which they could descend into it. They were then given the information for which they were in quest, either by means of their eyes, or their ears, or such of their senses as the occasion seemed best to suggest. Some say that one of these visitors, after having gone into the cave, and being treated in this way by the oracle, returned never to smile again; but Pausanias contradicts the story.

There is another belief in regard to these architects which must be simply alluded to. It is that Agamedes and Trophonius were deities of the Pelasgian times; that Trophonius was a giver of food from the bosom of the earth, and for that reason was worshipped in a cavern, and that Agamedes was not the wretched thief of Pausanias, but, on the contrary, a very generous character, who gave liberally from underground granaries.

A parallel to the story of the robbery of the treasury of Hyrieus by Agamedes and Trophonius is told by Herodotus in respect to the two sons of the builder of the treasury of the Egyptian king Rhampsinitus. These two young men, it seems, were also caught, while pilfering, in a trap, described with great circumstantiality by the “Father of History.”

CHAPTER III.

THE ORIGINATORS OF THE THREE ORDERS.

Who were the originators of the three great and primary orders of Grecian architecture is still a question which the discussion of the legendary and mythical architects, which has been briefly entered into, has not answered. It may be assumed inferentially that as the earliest of the Greek temples which have been referred to as the works of the progeny of the gods were in the Doric style, the pagan deities of Greece may claim some share of credit for having introduced that noble design to the world. The Ionic and Corinthian styles, however, are still to be accounted for, and as there is good ground to assume that they made their advent into architectural art at much later dates no celestial origin can be claimed for them.

Vitruvius, in relating his account of the origin of all three orders, alludes more directly to the birth of the Doric, and tells a story so picturesque and entertaining of the other two that although recognizing how well it may be known to the professional architect, it is difficult to resist the temptation to give it here entire:

“Dorus, the son of Hellen, and the nymph Orseis, reigned over the whole of Achaia and Peloponnesus, and built at Argos, an ancient city, on a spot sacred to Juno, a temple which happened to be of this order. After this many temples similar to it sprung up in the other parts of Achaia, though the proportions which should be preserved in it were not as yet settled.

“But afterward when the Athenians, by the advice of the Delphic Oracle in a general assembly of the different states of Greece, sent over into Asia thirteen colonies at once, and appointed a governor or leader to each, reserving the chief command for Ion, the son

of Xuthus and Creusa, whom the Delphic Apollo had acknowledged as son, that person led them over into Asia, and occupied the borders of Caria, and there built the great cities of Ephesus, Miletus, Myus (which was long since destroyed by inundation, and its sacred rites and suffrages transferred by the Ionians to the inhabitants of Miletus), Priene, Samos, Teos, Colophon, Chios, Erythræ, Phocæa, Clazomenæ, Lebedos and Melite. The last, as a punishment for the arrogance of its citizens, was detached from the other states in a war levied pursuant to the directions of a general council; and in its place, as a mark of favor toward King Attalus and Arsinoë, the city of Smyrna was admitted into the number of Ionian states, which received the appellation of Ionian from their leader Ion, after the Carians and Lelegæ had been driven out.

“In this country, allotting different spots for sacred purposes, they began to erect temples, the first of which was dedicated to Apollo Panionios, and resembled that which they had seen in Achaia, and they gave it the name of Doric, because they had first seen that species in the cities of Doria. As they wished to erect this temple with columns, and had not a knowledge of the proper proportions of them, nor knew the way in which they ought to be constructed, so as at the same time to be both fit to carry the superincumbent weight and to produce a beautiful effect, they measured a man’s foot, and, finding its length the sixth part of his height, they gave the column a similar proportion—that is, they made its height, including the capital, six times the thickness of the shaft, measured at the base. Thus the Doric order obtained its proportion, its strength, and its beauty from the human figure.

“Under similar notions they afterward built the temple of Diana, but in that, seeking a new proportion, they used the female figure as the standard; and for the purpose of producing a more lofty effect they first made it eight times its thickness in height. Under it they placed a base, after the manner of a shoe to the foot; they also added volutes to its capital, like graceful, curling hair, on each side, and the front they ornamented with cymatia and festoons in the place of hair. On the shafts they sunk channels, which bear a resemblance to the folds of a matronal garment. Thus two orders were invented, one of a masculine character, without ornament, the other bearing a character which resembled the delicacy, ornament and proportion of a female.

“The successors of these people, improving in taste, and preferring a more slender proportion, assigned seven diameters to the height of the Doric column and eight and a half to the Ionic. That species, of which the Ionians were the inventors, has received the appellation of Ionic.

[Illustration: THE ORIGIN OF THE CORINTHIAN CAPITAL.]

“The third species, which is called Corinthian, resembles in its character the graceful and elegant appearance of a virgin, in whom, from her tender age, the limbs are of a more delicate form, and whose ornaments should be unobtrusive. The invention of the capital of this order is said to be founded on the following occurrence: A Corinthian virgin, of a marriageable age, fell a victim to a violent disorder. After her interment her nurse, collecting in a basket those articles to which she had shown a partiality when alive, carried them to her tomb, and placed a tile on the basket for the longer preservation of its contents. The basket was accidentally placed on the root of an acanthus plant, which, pressed by the weight, shot forth, toward spring, its stems and large foliage, and in the course of its growth reached the angles of the tile, and thus formed volutes at the extremities. Callimachus, who for his great ingenuity and taste was called by the Athenians Catetechnos, happening at this time to pass by the tomb, observed the basket and the delicacy of the foliage which surrounded it. Pleased with the form and novelty of the combination, he constructed from the hint thus afforded columns of this species in the country about Corinth.”

The comments of Sir Henry Wotton in his “Elements of Architecture,” written in England during the latter part of the sixteenth century, upon this legendary account of the source of the three orders given by Vitruvius, are sufficiently attractive and quaint in language and spelling to warrant their being quoted also:

“The Dorique order is the gravest that hath been received into civil use, preserving in comparison of those that follow a more _masculine aspect_ and little trimmer than the Tuscan that went before, save a sober garnishment now and then of _lions’ heads_ in the _cornice_ and of _triglyph_ and _metopes_ always in the _frize_.... To discern him will be a piece rather of good _heraldry_ than of _architecture_, for he is knowne by his place when he is in company and by the peculiar ornament of his _frize_, before mentioned, when he is alone.... The _Ionique order_ doth represent a kind of feminine slenderness; yet, saith Vitruvius, not like a housewife, but in a decent dressing hath much of the _matrone_.... Best known by his trimmings for the bodie of this _columne_ is perpetually _chaneled_, like a thick-pleighted gowne. The _capitall_, dressed on each side, not much unlike women’s wires, in a spiral wreathing, which they call the _Ionian voluta_.... The _Corinthian_ is a columne lasciviously decked like a courtezan, and therefore in much participating (as all inventions do) of the place where they were first born, Corinth having beene, without controversie, one of the wantonest towns in the world.”

As for the Composite order, which, as has been already stated, is but a mixture of the Ionic and Corinthian, it would seem that Sir Henry has very little patience. He says with a contempt which he makes little effort to conceal: “The last is the _compounded order_, his _name_ being a briefe of his _nature_: for his pillar is nothing in effect but a _medlie_, or an _amasse_ of all the preceding _ornaments_, making a new kinde of stealth, and though the most richly tricked, yet the poorest in this, that he is a borrower of his beautie.”

There are those who in relentless search for truth at the expense of sentiment and poetry would spoil the pretty story which Vitruvius tells of the invention of the Corinthian capital by claiming for Egypt the distinction of being the mother-country of the order, and ascribing to that form of the Egyptian capital that bells out toward the abacus, and which is surrounded by open lotus leaves, as the archetype of the last of the three Grecian orders. There is, however, more probability to the story of Callimachus than there is similarity between the Egyptian and Corinthian capitals, in our opinion.

If we accept Callimachus as the originator of the Corinthian, although there does not appear any name of an architect to receive the individual credit for the invention of the Doric order, we may as well accept the deduction which Vitruvius draws in respect to Hermogenes, an Ionian architect, who is said to have flourished about 600 B.C., and credit him at the same time with being the first to introduce the feminine proportions and attributes into his art, and with having perfected, if he did not originate, the queenly Ionic order.

“When Hermogenes was employed to erect the temple of Bacchus at Teos,” says Vitruvius, “the marble was prepared for one in the Doric style; but the architect changed his mind, from the idea that other proportions, afterward called Ionic, were more suitable for the purpose, almost inducing the inference that Hermogenes was the inventor of those delicate proportions; he appears unquestionably to have displayed great skill and ingenuity in all his designs, and to have entertained the opinion that sacred buildings should not be constructed with Doric proportions, as they obliged the adoption of false and incongruous arrangements.”

Another fact which Vitruvius does not touch upon might tend to point to Hermogenes as the originator of the Ionic order. He was a native of Alabanda in Caria, and if it is true, as some authorities believe, the volute was an ornament in early use in Asia Minor, he was doubtless familiar with it; and, appreciating its graceful possibilities, introduced it into the matronly Ionic.

Hermogenes is conceded to have been one of the most celebrated architects of antiquity. In addition to the temple of Bacchus which he designed for Teos, one of the eastern Ionian cities, and the birthplace of Anacreon, as well as other noted ancient characters, he erected in the city of Magnesia, in Lydia, a temple to Diana in the Doric order. About each of these temples he wrote a book, both of which were still in existence in the time of Augustus. In one he described the temple to Diana as a pseudodipteral, or false dipteral temple, a form which he invented. It is called false or imperfect because of the economy of the inside row of columns on each of the long sides of the cell, the outside row being allowed to remain. The effect from a distance was the same as a double row, while considerable expense was saved. The temple to Bacchus he described as a monopterus, or a round temple, having neither walls nor cell, but merely a roof sustained by columns.

Hermogenes’s great ambition appears to have been a desire to foster and encourage the use of the Ionic order in preference to the Doric for temple construction. In this opinion he was later sustained by Tarchesius, another writer on architecture, who may be dated as sometime later than 470 B.C., and by Pytheus, whom we shall meet again as one of the architects of the tomb of Mausolus.

Although Vitruvius mentions the origin of the Corinthian order in close connection with that of the Doric and Ionic, it must be borne in mind that Callimachus, whom he credits with the Corinthian, was a much later artist than Hermogenes. The use of the Corinthian column by the architect Scopas in the temple of Athene at Tegea in 396 B.C., has led to the inference that Callimachus must have lived prior to that date, and the fact that he gave to that style of architecture the appellation of Corinthian, that he was a native of Corinth. Lübke, in his “Outlines of the History of Art,” however, does not give to Callimachus the full and undisputed credit for originating the Corinthian style, claiming that the order existed before his time, although he does not mention when or where. Lübke would interpret the story of Callimachus and the basket as meaning that it was he who gave to the capital its final perfection. It is somewhat strange also that although Callimachus is conceded to have been the first to develop this order, if he did not absolutely invent it, there is no mention of any building having been designed by him in the Corinthian style.

There seems to be little dispute over the fact that Callimachus was neither as a sculptor nor an architect to be placed in the van of the distinguished artists of early Greece. As a sculptor, in which capacity he is best known by his works, his style was stilted and artificial, rendered so by the artist’s disposition to be finicky and fastidious in his execution. Indeed, he is said to have been

unwearied in polishing and perfecting, and to have sacrificed the grand and sublime in the exercise of too great refinement and purity. Callimachus was never satisfied with himself, and possibly on that account others were not satisfied with him, as a certain degree of self-esteem is necessary to invite public approval. The Greeks gave him a name, based upon his peculiarities, which Pliny has translated as "_Calumniator Sui_." His faculty for invention was evidenced in other respects also, as he is credited with having originated the art of boring marble, and Pausanius describes a golden lamp which he invented, and which he dedicated to Athene, which when filled with oil burned exactly a year without going out.

It may be said broadly of the Grecian people in their employment of the three grand orders of architecture that the first two—namely, the Doric and Ionic—more closely harmonized with the dignity and nobility of their national character. In fact, Greece arrived at the pinnacle of her civilization and brought her philosophy of human existence not only in theory, but in practice, to its highest ideals before the Corinthian order of architecture appeared to claim a share in her artistic reputation. The stately solidity of the Doric and the graceful purity of the Ionic lent the perfection of architectural framework to the mental strength and loftiness of ideal of the Hellenic people. They seemed to accord with the philosophy that was originally preached from under the shadow of their pediments and entablatures. We can almost see the doubting and mystified Theon stepping from the Doric portico where Zeno held forth, to compare that philosopher's stoical dogmas with the doctrines of Prudence preached in the Ionic-encompassed garden of Epicurus, by a philosopher ever destined to be misconstrued and wrongfully interpreted.

"All learning is useful," taught Epicurus; "all the sciences are curious; all the arts are beautiful; but more useful, more curious and more beautiful is the perfect knowledge and perfect government of ourselves. Though a man should read the heavens, unravel their laws and their revolutions; though he should dive into the mysteries of matter, and expound the phenomena of the earth and air; though he should be conversant with all the writings and sayings and actions of the dead; though he should hold the pencil of Parrhasius, the chisel of Polycletus or the lyre of Pindar; though he should be one or all of these things, yet not know the secret springs of his own mind, the foundation of his opinions, the motives of his actions; if he hold not the rein over his passions; if he have not cleared the mist of all prejudice from his understanding; if he have not rubbed off all intolerance from his judgments; if he know not to weigh his own actions and the actions of others in the balance of justice, that man hath not knowledge, nor, though he be a man of science, a man of learning or an artist, he is not a sage. He must sit down patient at the feet of Philosophy. With all his learning he hath yet to learn, and perhaps a harder task, he hath to _un_learn."

The Corinthian order, on the other hand, notwithstanding all its charm, beauty and variety, seemed to lack that steadfastness of character which bound so firmly the other two orders to the hearts of the Grecian people, and was never admitted into their fullest trust and confidence. Indeed, it is generally conceded that the Corinthian model grew in favor as the architectural art of Greece declined; and only when Greece, losing her autonomy, began to lose her ambition and intellectual greatness and independence. It reached its fullest vogue with the later or Greco-Roman architects, who sacrificed much of purity in art for lavish and sightly display. With the Greeks the Corinthian was sparingly employed, and generally called upon for their smaller and less important buildings; on the other hand, with the Romans, enriched by additional features and ornamentation of their own, it became the favorite order, not alone for portico and temple, but for public and private buildings of every nature.

[Illustration: Three columns]

CHAPTER IV.

EARLY GRECIAN ARCHITECTS.

In the year 548 B.C. the great temple to Apollo at Delphi, the work of the legendary architects Agamedes and Trophonius, was destroyed by fire. Of the four temples to the same deity that had been reared upon the same site, this was the first in which marble was employed as a building material. Naturally the question will present itself, how could a temple built of marble be destroyed by fire? The answer is, that while the main walls of the cell and the columns, entablatures, pediments and other exposed parts of the early Greek temples were built of marble, stone or sun-dried bricks, the roofs were generally of wood, and were heavily timbered, sometimes calling for great strength to support marble tiles. Much of the interior building material was also of wood, as well as the statuary with which the earlier temples were lavished and enriched. Thus if fire was started within the building, either by accident or, as not infrequently happened, by the hand of an incendiary, there was sufficient combustible material for it to feed upon and to heat the entire structure, reducing the otherwise enduring marble to crumbling lime.

The temple of Apollo having been thus destroyed, the much revered and highly respected Oracle was left without shelter and a place of business. This state of things of course could not long be allowed to continue, and the Amphictyons, a legislative body, having under its special care the Delphic temple, at once came to the front and ordered a new temple built at a cost of about $300,000. One-fourth of this sum was to be paid by the Delphians and the remaining three-fourths were to be contributed by the other cities of Greece and those nations which were in the habit of consulting the Oracle—a very proper distribution of the expense, considering how extensive and widespread was the renown and appreciation of the priestess. Amasis, King of Egypt, volunteered a thousand talents of alumina, thus showing what his feelings were in the matter, and the Alcmæonidæ, one of the oldest and most aristocratic families of Athens, undertook the contract, it is hinted, mainly for political reasons. This may be true, as they were much involved in local politics, especially with the banishment of Pisistratus, the tyrant, and they may have seen an opportunity in the rebuilding of this temple to make themselves very popular. They certainly went about it in the right way to achieve such a result, and did actually gain much influence by their generosity and the broadminded manner in which they disregarded the strict terms of the contract to do handsomer and better work than it called for. One particular illustration of their liberality has attracted the attention of the historian: it was the building of the temple in Parian marble, instead of Porine stone. While the Alcmæonidæ were prosecuting the work in this generous spirit, they did not neglect their fallen enemies, the Pisistratidæ, and threw out occasional innuendoes to the effect that the Pisistratidæ could tell more about the origin of the fire that destroyed the late temple than they evidently cared to, thereby intimating a crime as against their rivals that it might have been difficult to have proved. They even won the Oracle to their side by similar simple and ingenuous methods, with the result that ever afterward the Oracle did not hesitate to speak a kind word for the Alcmæonidæ and favor their native city, Athens.

The architect of this new temple was Spintharus, a Corinthian. As nothing further seems to be known of him, we have been somewhat particular to mention the importance of this work, to show that Spintharus was an artist who stood very high in his profession at the time. But as the temple was one of the longest in process of construction, taking about seventy-two years to complete, it is not likely that Spintharus lived to enjoy the full fruition of his work.

It may be of interest to add that no structure of its kind throughout all Greece was made the depository of richer or more extensive treasure than this temple to Apollo at Delphi, a fact not to be marvelled at if we do not lose sight of the Oracle. We have already seen how it excited the cupidity of the brothers Agamedes and Trophonius. What they appropriated to themselves from the rich vaults of its predecessor was, however, comparatively insignificant to the wholesale robberies that went on from time to time of the fifth temple designed by Spintharus. Herodotus says that the wealth of Delphi was better known to the Persian Xerxes than were the contents of his own palace, and that after forcing the pass of Thermopylæ he detached a portion of his army to capture Delphi. It failed to do so, only through the interposition of the Oracle or some other deity. Many years afterward the Phocians plundered the temple of what might be represented by $10,600,000 of our money. Still later the Gauls also made a rich haul, which the Romans afterward found in their city of Tolosa unexpended, probably because there was so much of it; and Nero is said to have taken from it five hundred bronze statues at one time.

But these robberies fade into insignificance when the insult heaped upon the Delphians and their Oracle by Constantine the Great is recalled. This Roman vandal not only removed the sacred Tripod and Brazen Column which supported it, but degenerated their use to the adornment of the hippodrome of the new city he built on the Bosphorus. The Brazen Column may still be seen in Constantinople, but the sacred Tripod has disappeared forever. There is a little story connected with a first disappearance of the Tripod that may be worth the telling. It was lost at sea, but afterward recovered by some fishermen. When Pythia was asked to decide to whom it should be given, her answer was that it should be bestowed upon the wisest man in Greece. Accordingly it was sent to Thales of Miletos. He, however, was too modest to retain it, and passed it over to Bias as a wiser man; Bias was also embarrassed by the selection, and presented it to another of the Grecian sages; he to still another, and so on, until it had made the circuit of pretty much every person in Greece with any claim at all to superior wisdom. Finally, however, it came back once more to Thales, who successfully ended its itinerary by dedicating it to the Delphic Apollo.

One of the earliest of the great temples to be erected in the Ionic order was that begun in the Ionian city of Ephesus in Asiatic Greece by Ctesiphon, a Cretan architect born in Cnossus, and his son, Metagenes. This temple was erected to the glory of the many-breasted and mummy-like appearing Artemis, a goddess peculiar to the Ephesians, whom the Greek colonists there doubtless inherited from the Asiatic races that preceded them in their Ionian settlement. There was nothing of the graceful, virgin-like characteristics of Apollo's sister, the Arcadian Artemis, in this Ephesian goddess, but the Ionian Greeks were quite partial to her, attended her with eunuch priests, and built in her honor this temple, so grand and magnificent that it was regarded as one of the seven wonders of the world.

Before alluding to some of the interesting facts that have been preserved concerning the early history of this great temple it may not be out of place to touch upon a custom which prevailed in Ephesus in respect to the employment of architects, which Vitruvius relates. He says: “In the magnificent and spacious Grecian city of Ephesus an ancient law was made by the ancestors of the inhabitants, hard in its nature, but nevertheless equitable. When an architect was entrusted with the execution of a public work, an estimate thereof being lodged in the hands of a magistrate, his property was held as security until the work was finished. If, when finished, the expense did not exceed the estimate, he was complimented with decrees and honors. So when the excess did not amount to more than a fourth part of the original estimate, it was defrayed by the public, and no punishment was inflicted. But when more than one-fourth the estimate was exceeded, he was required to pay the excess out of his own pocket.”

The honest Vitruvius almost sighs as he adds: “Would to God that such a law existed among the Roman people, not only in respect to their public, but also of their private buildings, for then the unskilful could not commit their depredations with impunity, and those who were most skilful in the intricacies of the art would follow the profession! Proprietors would not be led into an extravagant expenditure, so as to cause ruin; architects themselves, from the dread of punishment, would be more careful in their calculations, and the proprietor would complete his building for that sum or a little more, which he could afford to expend. Those who can conveniently expend a given sum on any work with the pleasing expectation of seeing it completed would cheerfully add one-fourth more; but when they find themselves burdened with the addition of half or even more than half of the expense originally contemplated, losing their spirits and sacrificing what has already been laid out, they incline to desist from its completion.”

There are, perhaps, some people even at the present time who can be found to echo these sentiments of Vitruvius, and exclaim: Would to God that such a law existed among the American people, especially in New York and Chicago!

Theodorus of Samos, it will be remembered, laid the foundation of the temple to Artemis of Ephesus in the year 600 B.C. To guard against the destruction of the temple by earthquakes, a marshy site was chosen, and Theodorus insured a firm foundation, by using charcoal, which was rammed down solidly, and then covered with fleeces of wool. Ctesiphon and his son did not, however, begin the superstructure until about forty years later.

The dimensions of the building were very extensive, and although the architecture was full of grandeur, grace and beauty were not sacrificed. The length was four hundred and twenty-five feet; the width two hundred and twenty feet. One hundred and twenty-seven Parian marble columns, each sixty feet in height, surrounded the cell in double rows, sixteen appearing in the front and rear façades, and forty each on the sides. Herodotus states that most of these columns were presented by the rich Crœsus, and some by other kings. The cell, according to some authorities, was devoid of a roof, but Mr. Wood, in his “Discoveries at Ephesus,” indicates otherwise. The whole edifice, both exteriorly and interiorly, presented great richness and elaboration of carving. The shafts of the columns in front of the building were carved in relief, in three broad bands, to nearly half their height, and those in the rear, in one band, to about one-quarter of their height. The frieze and pediments were also worked out by the chisel of the sculptor in designs of great and imposing beauty.

Many of the stones used in the building were very massive. An idea of how huge some of these blocks were may be gathered from the fact that the architrave alone contained pieces of marble thirty feet long, and that Ctesiphon and Metagenes were forced to invent special machinery and contrivances to convey the stones for the columns to the building from the quarry eight miles distant. Vitruvius explains these contrivances as follows: “He [Ctesiphon] made a frame of four pieces of timber, two of which were equal in length to the shafts of the columns, and were held together by the two transverse pieces. In each end of the shaft he inserted iron pivots, whose ends were dovetailed thereinto, and run with lead. The pivots worked in gudgeons fastened to the timber frame, whereto were attached oaken shafts. The pivots having a free revolution in the gudgeons, when the oxen were attached and drew the frame, the shafts rolled round, and might have been conveyed to any distance. The shafts having been thus transported, the entablatures were to be removed, when Metagenes, the son of Ctesiphon, applied the principle upon which the shafts had been conveyed to the removal of those also. He constructed wheels about twelve feet in diameter, and fixed the ends of the blocks of stone whereof the entablature was composed into them; pivots and gudgeons were then prepared to receive them in the manner just described, so that when the oxen drew the machine the pivots, turning in the gudgeons, caused the wheels to revolve, and thus the blocks, being enclosed like axles in the wheels, were brought to the work without delay. An example of this species of machine may be seen in the rolling stone used for smoothing the walks in palæstræ. But the method would not have been practicable for any considerable distance. From the quarries to the temple is a length of not more than eight thousand feet, and the interval is a plain without any declivity. Within our own time, when the base of the colossal statue of Apollo in the temple of that god was decayed through age, to prevent the fall and destruction of it, a contract for a base from the same quarry was made with Pæonius. It was twelve feet long, eight feet wide, and six feet high. Pæonius, driven to an expedient, did not use the same as Metagenes did, but

constructed a machine for the purpose by a different application of the same principle. He made two wheels about fifteen feet in diameter, and fitted the ends of the stone into these wheels. To connect the two wheels he framed into them, round their circumference, small pieces of two inches square, not more than one foot apart, each extending from one wheel to the other, and thus enclosing the stone. Round these bars a rope was coiled, to which the traces of the oxen were made fast, and as it was drawn out the stone rolled by means of the wheels; but the machine, by its constant swerving from a direct, straightforward path, stood in need of constant rectification, so that Pæonius was at last without money for the completion of his contract." The uninitiated who have speculated as to how the ancients succeeded in moving and transporting considerable distances such huge blocks of stone, without the assistance of our modern machinery and contrivances, are given in this quotation from Vitruvius some hint as to the ingenuity and inventive ability of the early architects and builders.

The temple, however, was slow in building, and Ctesiphon and Metagenes, after writing a book on their great architectural work, passed away in due course of time. Their places were filled by other architects, of whom there is no record, but Demetrius, a priest of Diana, together with Daphnis and Peonius, Ephesian architects, finally completed the work some two hundred and twenty years after it was begun by Ctesiphon and his son. In the course of that long interval, Scopas, an architectural sculptor of Paros, of whom there will be more to relate as we go on, contributed one column, which was regarded as so beautiful that it was accepted as a model for those that followed.

Together with its architectural glories, the interior was made a depository for many of the finest works of the great artists of antiquity, and Scopas is said to have introduced Caryatides here. This is doubted, but he certainly furnished a very grand statue of Hecate; and Praxiteles, with his almost equally gifted son, adorned the shrine.

Tradition relates that upon the very night that the great Alexander was born, the Ephesian temple was destroyed by fire, through the rapacious greed for notoriety of one Herostratus. This antique fire-bug, when put to the torture for his crime, confessed that his only object was to gain immortality for his name, an ambition which he succeeded in accomplishing through the stupidity of the states-general of Asiatic Greece. They decreed that the name of Herostratus should never be mentioned, and of course it always was, as all the contemporary historians felt impelled to record the fact that a man by the name of Herostratus was not to be mentioned, and to give the reasons therefor, and much more about Herostratus which, had there been no decree, might have been left unsaid. The result was and has been that a crank of antiquity has lived by name for twenty-five hundred years, and is quite likely to live for as many more.

When Alexander the Great reached maturity, doubtless feeling the depression consequent upon having his advent into the world which he was destined to dominate, associated with the destruction of so magnificent a temple to the Asiatic Diana, offered, it is said, to pay the cost of its restoration, provided—there is frequently a proviso coupled with these liberal offers—provided his name should be inscribed on the new edifice. While the Ephesians were made glad by the offer, they did not readily fall in with the proviso. The cleverness of their diplomatic reply, however, appealed to the susceptible side of Alexander's human nature, and effected a compromise. They told the Macedonian that "it was not right for a god to make offerings to gods."

The architect for the new temple was the great favorite of Alexander and his fellow-countryman, Dinocrates, who it is said rebuilt the edifice on even a more extravagant scale than was the first. Much of the marble and sculpturing of the old temple entered into the new, and the painters, statuaries and sculptors of the time again lavished upon it their best art. The walls were embellished from time to time by Parrhasius and Apelles; and Timarete, the first female artist of note of whom there is any record, contributed a picture of the honored Artemis. It is related that the folding doors or gates of this new temple were made of cypress that had been allowed to season for four generations, and that when the pieces of cypress wood were glued together the glue was allowed to remain for four years to harden. Mutianus, a Roman architect, states that when he found them, which was four hundred years afterward, they were as fresh and beautiful as when new.

Some remains of the splendor of this pagan temple are still doing architectural duty. The great dome of the beautiful Byzantine church of Santa Sophia in Constantinople, now a Turkish mosque, is supported by columns of green jasper, brought from the Ephesian temple by the Roman Emperor Justinian, and two of the pillars in the cathedral at Pisa are also from the same source.

There is some confusion as to the works of art and decorations associated respectively with the two temples just described which it would be vain to attempt to clear up, believing that it matters but little, inasmuch as it is not likely that Herostratus could have destroyed completely the first temple, and that the services of Dinocrates were engaged more in the line of making good the damage done than in erecting an entirely new edifice. The upper colonnades of Corinthian columns, however, which Mr. Wood

shows as appearing in the interior of the temple, are clearly the work of Dinocrates.

Demetrius, the priest of Diana, and his associates, Peonius and Daphnis, the three architects who completed the first Artemesian temple, having flourished over two hundred years after the foundation of that structure was laid, are not, of course, to be classed among the earlier of the Grecian architects, and, properly, should not be treated under this heading; but as they are all grouped together in the erection of another great Asiatic-Greek temple, and are not further met with, it may be just as well to add what there is in respect to them at this time.

The temple referred to was that dedicated to Apollo in the Ionian city of Miletus, not far distant from the scene of the joint labors of these architects at Ephesus. Its order was also Ionic, and although not as large as that to Artemis, it could have been very little, if any, inferior to it in columnar effect and general impressive beauty, if not grandeur. It was three hundred and two feet in length by one hundred and sixty-four feet in width, and, like the temple at Ephesus, was surrounded by double rows of columns, each column, however, being sixty-three feet in height. Indeed, Strabo, the celebrated Roman traveller and geographer, who visited the ruins of the temple during the first century before the Christian era, testifies that “it is the greatest of all temples,” and adds that it remained without a roof “in consequence of its bigness”; but this allusion to its roofless condition is probably due to the fact that the building was never wholly completed. Pausanias also gives it high praise, and speaks of it as one of the wonders of Ionia, and Vitruvius numbers it “as one of the four temples which had raised their architects to the summit of renown”[2]—a renown, it would seem, that has been very much begrudged them, as the literature of their time furnishes practically no data in regard to them personally, and what estimate can be formed of them is wholly based upon the importance of their works.

Peonius, we are told, was an Ephesian, but as to even the nativity of the other two architects we are in the dark, although Daphnis is supposed to have been a Miletian. There is also some little uncertainty as to the exact date when they exercised their profession, but it is probably safe to say that it was sometime within the first half of the fourth century before Christ.

Two columns of the great temple to Apollo have stood proudly against the attacks of time, and although scarred by their long battles, are yet evidencing the glories of a structure of which they were once but an insignificant part.

In the year 555 B.C. there lived four architects, to whose skill was entrusted the building of a temple that should be in all respects worthy to stand for the respect due the dignity, power and extreme longevity of the great Olympian Zeus—the king-god of the Greeks.

The foundation for this shrine was laid in the time of Pisistratus, a tyrant of Athens, who contributed several architectural works to that city, but whose several banishments greatly interrupted their building. This was particularly the case with the great temple to Zeus. However, it was sufficiently advanced for Pisistratus to dedicate it before he fell from power. It has been stated that it was due to the genuine dislike which the Athenians felt for Pisistratus and his sons, who succeeded him, that four hundred years were allowed to flow by before the temple was finished. This is hardly just to a ruler of great loyalty to his native city, and of unquestioned integrity in the discharge of his public duties. It is more probable that the delay was due to the animosity of the rival Athenian family of Alcmæonidæ, who, piqued by jealousy, fanned a flame of opposition to the works of Pisistratus that continued for several centuries.

Antistates, Antimachides, Calleschros and Porinus were the four architects engaged by Pisistratus, who, like their professional brothers employed on the temples of Diana, Apollo and Ceres, were, according to Vitruvius, entitled to immortality for the grandeur of their works, but about whom there is no other information to be given.

This temple to Jupiter was not built upon the Acropolis at Athens, like that to the patron goddess of the city, Minerva, but upon a raised peribolos within the city below, and on the site of an earlier temple to the same god, erected in the time of Deucalion, but which had perished from the ravages of ages.

It was like most of the early Doric temples, of peripteral construction, or surrounded by columns on all four sides. Aristotle, who saw it before it was finished, was so much impressed by its size that he compared it to the Pyramids; and one of his scholars remarked that “though unfinished, it called forth astonishment, and when finished would be unexcelled.”

Perseus, king of Macedonia, and Antiochus Epiphanes of Syria (176-164 B.C.) finally finished the cell and placed the Corinthian columns of the portico, employing for the purpose a Roman architect of great skill by the name of Cossutius. It was then, probably, that Livy made the remark “that among so many temples this is the only one worthy of a god.”

Sylla, however, when he laid siege to Athens, some forty years later, robbed the temple most unmercifully, carrying away with him many of the columns to Rome. But his work of destruction was more than compensated for by his successor, Hadrian, two hundred years still later, under the immediate direction of the celebrated Roman architect, Luigi Cannia. Hadrian, in his love of great architectural effects, was inspired to beautify the peribolos with a peristyle one hundred rods in length, and his architect contributed a new section to the temple itself, and added three grand vestibules.

The sacred enclosure, after Hadrian had finished it, which had a circumference of about twenty-three hundred feet, was ornamented by statues, contributed in great numbers by different cities. The length of the temple at this time, according to Stuart, was, upon the upper step, three hundred and fifty-four feet, and its breadth one hundred and seventy-one feet. The columns, which surrounded the cell, now all Corinthian, numbered one hundred and twenty-four, all of Pentelican marble, of which there are sixteen still standing. In the pronaos, or inner portico, Hadrian caused to be placed four statues of himself, two in Thracian and two in Egyptian marble, which were, perhaps, three more than a moderately modest man might have felt necessary.

Another gorgeous temple to the great Jupiter was begun about five years later than that at Athens by the architect Libon, an Eleian, in Olympia, which Lysias speaks of as “the fairest spot in Greece.” In Olympia the spiritual and physical natures of the Grecian people may be said to have combined in the perfection of development. Here the glories of the body, the capabilities of the finest muscular strength and athletic action, were exhibited in gymnasium and stadion, and here the religious spirit of the people arose to the fullest intensity, and as though doubly inspired by the action and strength of the perfect body, found expression in temple and sanctuary.

So great was the reward, so enthusiastic the reception accorded the champions in the athletic games of Olympia, that they call forth a protest from the sensitive Vitruvius, who seems to feel that the honors conferred upon them should have been reserved for the literary lights of the time. “The ancestors of the Greeks,” he complains, “held the celebrated wrestlers who were victors in the Olympic, Pythian, Isthmian and Nemean games in such esteem that, decorated with the palm and crown, they were not only publicly thanked, but were also, in their triumphant return to their respective homes, borne to their cities and countries in four-horse chariots, and were allowed pensions for life from the public revenue. When I consider these circumstances, I cannot help thinking it strange that similar honors, or even greater, are not decreed to those authors who are of lasting service to mankind. Such certainly ought to be the case; for the wrestler, by training, merely hardens his own body for the conflict; a writer, however, not only cultivates his own mind, but affords every one else the same opportunity, by laying down precepts for acquiring knowledge and exciting the talents of his reader.”

So attractive was this spot on the banks of the Alpheus in Ellis, in natural charm, as well as in the purposes for which it was visited, that it is here, as nowhere else in Greece, with the possible exception of the Acropolis at Athens, the Grecian architects lavished their best skill and best illustrated their appreciation of the fact, that the effect of fine buildings is greatly augmented by grouping them gracefully together in one place, producing, as it were, an architectural picture. “Many objects,” says Pausanias, “may a man see in Greece, and many things may he hear that are worthy of admiration, but above them all the doings at Eleusis and the sights at Olympia have somewhat in them of a soul divine.”

The worship of Zeus was an old worship in Olympia, so that when Libon was entrusted with authority to erect a new temple to that deity, out of the spoils taken in subjugating the Pisans and other neighboring cities which had revolted from the Eleans, he gave free reign to his art, and produced a Doric temple which rivalled that in Athens, though not as large.

Pausanias informs us that the Olympian temple was two hundred and thirty feet long, ninety-five feet wide and sixty-eight feet high; that it was surrounded by marble columns and covered with marble cut in the form of tiles. The front and rear pediments were adorned with sculpture, as well as the metopes of the frieze. The interior was of two orders of columns supporting lofty galleries, through which there was a passage to the throne of Jove “glittering with gold and gems.”

It was this temple of Libon’s that became, soon after its completion, the casket which held the _chef d’œuvre_ of Phidias, the colossal statue of Jupiter carved in ivory and gold, of which Quintilian observes that it added a new religious feeling to Greece. The story is well known how Phidias, being asked by his nephew Panænus, a painter, who assisted him in the decoration of the temple, how he could have conceived that air of divinity which he had expressed in the face of this noble statue, replied that he had copied it from Homer’s description of the god. Jupiter was presented naked to his waist, but draped from his girdle down. The significance of this was that the great Jove, knowing himself to be of heavenly origin, thought it best to conceal himself in part only from man. He was also given a beard for the reason that the Greeks, clinging to the Oriental notion, believed that beards carried with them an air

of majesty; an idea, by the way, which was not shared in by the Romans, who spoke with derision of their bearded forefathers, and permitted the wearing of beards only to those who were in disgrace, and to poor philosophers, who probably, like our poor modern poets, found a visit to the barber's an unnecessary and expensive luxury.

Rome during these early times, and before she had awakened to the cultivation of the arts at home, was prone to borrow from Greece the talent of which she was in need. It was about this time that we find the first record of such a call made by Rome upon her eastern neighbor for architects. The demand was answered by the two architectural sculptors Damophilus and Gorgasus, who were imported by the Dictator Posthumius to erect two temples in Rome, one to Castor and Pollux or, as some authorities assert, to Liber and Libera (Bacchus and Proserpine), which stood near the Forum and Temple of Vesta, and the other to Ceres, on the slope of the Aventine hill, near the Circus. These temples were vowed by Posthumius, in his battle with the Latins, 496 B.C., and were dedicated by Viscellinus some years later.

Before closing this chapter, in which the attempt is made to gather together some of the earlier architects of Greece, it may be as well to include within it a number of such artists who though not rising to the highest fame, or who were not connected with the most elegant buildings of their time, nevertheless had the good fortune to have their names preserved in history.

Pliny tells a rather amusing and interesting account of such an architect by the name of Bupalus, who probably flourished about the year 524 B.C. He is said to have come from a very old family of artists who exercised the art of the statuary from the beginning of the Olympiads; but as Pliny simply speaks of him as an architect and artist, but does not mention any building attributed to his skill, he becomes a subject for notice only in connection with the Iambic poet Hipponax, whom he used his art to torment. Pliny relates that Bupalus and his brother Athenis amused themselves by making caricatures of the satirical poet. Hipponax was undersized, thin and ugly, and probably, like the modern poet Pope, suffered his physical defects to give him a cynical view of life. The caricatures of the playful Bupalus and Athenis naturally affected unpleasantly his _amour propre_, and he employed the weapon at his command, his ironical pen, to strike back at his tormentors, with the result that he gave them a good pen lashing in a satirical poem, in which he also chastised his Ionian brethren for what he considered their effeminate luxury. In the same poem, also, he did not spare his own parents, and it is said that he even had the temerity to ridicule the gods.

There is, of course, always some one to start the story that a woman is at the source of all the infirmities that any particularly conspicuous man suffers from, and there are those who claim that Bupalus did not originate the trouble, but that it started through the fact that the architect had a very beautiful daughter of whom Hipponax was greatly enamored. Like the earlier Iambic poet Archilochus, who got into a similar scrape, the girl's father refused to permit his daughter to marry a poor little withered poet, with the result that the poet's life was ever after embittered. How very bitter Hipponax became, especially against the ladies, is illustrated by a remark which is attributed to him: "There are," he said, "only two happy days in the life of a married man—that in which he receives his wife, and that in which he carries out her corpse."

After his death Leonidas of Tarentum, in an elegant epigram, warned travellers not to pass too near his tomb, lest they rouse the sleeping wasp. The grave of Hipponax, by the way, instead of being covered with ivy and roses, like that of a mild poet, was planted with thorns and thistles.

Pausanias mentions several of these more obscure architects. Agnaptus was one, who built a porch in the Altis, or wall at Olympia, called afterward by the Eleans the "porch of Agnaptus," and Antiphilus, Pothæus and Megacles were three other waifs on our sea of oblivion. They were responsible for the Treasury of the Carthaginians also at Olympia. Pyrrhus, with his two sons, Lacrates and Hermon, built the Olympian Treasury of the Epidamnians. There were ten of these Treasuries, by the way, raised by different states, which were not only architecturally very beautiful, but which contained statues and other offerings of great value.

Strabo mentions an architect and sculptor by the name of Hermocreon, who designed a gigantic and beautiful altar at Parium on the Propontis in Asia Minor; and Eurycles, a Spartan architect, who built the baths at Corinth, and "adorned them with beautiful marbles," must not be overlooked, although he may have been of a much later date.

FOOTNOTES:

[2] The other three temples which Vitruvius praised thus highly were those to Diana at Ephesus, Jupiter Olympus at Athens, and Ceres at Eleusis.

CHAPTER V.

THE ARCHITECTURAL EPOCH OF PERICLES.

The age of Pericles was so distinctively an era in the advancement of the arts, especially architecture, not alone in the city where Athene shed her divine intelligence and tutelary influence with generous favor, but throughout all the Hellenic states, and has left so many models and criterions for the architects of all time to follow, that a few words in reference to Pericles himself and the sculptor Phidias, into whose hands he entrusted the direction of his public buildings and the adornment of Athens, may be admissible, before we consider the architectural geniuses who sprung forward to meet the great requirements of the time.

Pericles was a descendant of that noble and refined, if sometimes unfortunate, house of Alcmæonidæ, which did so much for the Delphic temple of Apollo, and a son of Xanthippus, the victor of Mycale, and Agariste, niece of Cleisthenes, founder of the later Athenian constitution. The date of his birth is not known, but that he early evinced a leaning toward the fine arts and philosophy is recorded. Under Pythocleides he studied music, under Damon political science, under Zeno philosophy; but it remained for the erudite Anaxagoras to give the final burnish to his character and thought. He was therefore, both by birth and disposition, as well as cultivation, possessed of a mind singularly comprehensive in its grasp of the advantages which the arts of peace could contribute to the progress of his people, and naturally turned his attention to their exploitation and development, when he became dominant in the year 444 B.C. His rule of peace lasted but thirteen years, or until the breaking out of the Peloponnesian war, but was crowded with numerous artistic and architectural triumphs.

That he may have gone a step too far in the encouragement of pleasure and the peaceful virtues among a people of warlike antecedents and a future before them of foreordained defence and conquest, if not final defeat, may be a subject for speculation; but that he gave an impetus to literature and art, and by the fervent warmth of his patronage fostered the growth of genius in a way that had not been equalled before his time, and which has never been excelled since, is the principal reason, doubtless, for his immortality.

His head was abnormally long, a defect which the artists of his time invariably corrected with a helmet when painting or sculpturing his portrait, and the contemporaneous comic poets and satirists as continually ridiculed in verse and jest. Speaking of his eloquence and powers of persuasion, Thucydides relates a pleasant story in respect to his dexterity in this regard. When Archidamus, king of the Lacedæmonians, asked Thucydides whether he or Pericles was the better wrestler, he replied: “When I have thrown him and given him a fair fall, he, by persisting that he had no fall, gets the better of me, and makes the bystanders, in spite of their own eyes, believe him.” But in other respects his physique was well proportioned and his bearing noble and commanding. His manner was dignified and reserved, his eloquence strong, fearless and convincing, and his general appearance such as to inspire the people to compliment him with the name “Olympian Zeus,” a character in which his portrait was also painted by his favorite, Phidias.

An English writer well says that the age of Pericles was “the milky way of great men,” for it was certainly clouded to whiteness with intellectual stars. The names associated with this era are not only among the most celebrated in all Grecian history, but among the most renowned that have sprung forward in the history of all the world. Poets, philosophers, dramatists, musicians, sculptors, painters, architects, not only arose in great numbers under his fostering encouragement, but to the highest eminence in their respective avocations. In fact, it seems as though the human plant that had long been growing, strengthening and broadening upon Hellenic soil had suddenly sprung into the fullest flower and enveloped itself in intellectual beauty.

The Athens which we so frequently see pictured in all her restored architectural grace and grandeur, the Athens which from her Acropolis of chiselled white so proudly surveys the Ægean sea and surrounding plains, is the Athens of Pericles, noblest of all cities in the pursuits of virtue, of beauty and contentment, and in the pure realization of that happiness which the practice of the arts alone can afford.

The budding of Athenian architectural magnificence may be said to have begun under Themistocles and Cimon, the immediate predecessors of Pericles, but not to have ripened and flowered in its perfection until his advent into power. Then it was that the task of building a city in every way worthy of the people who had proved their prowess before the Persian hosts in war, and who in peace could delight in the musical poems of Homer, was pushed to a speedy realization with enthusiasm.

Nothing in all the biography of Pericles has contributed so greatly to the perpetuity of his fame as this attention which he gave to the development of the architectural magnificence of Athens. “That which gave most pleasure and ornament to the city of Athens,” says Plutarch, “and the greatest admiration and even astonishment to all strangers, and that which now is Greece’s only evidence that the power she boasts of and her ancient wealth are no romance or idle story, was his construction of the public and sacred

buildings. The materials were stone, brass, ivory, gold, ebony and cypress-wood; the artisans that wrought and fashioned them were smiths and carpenters, moulders, founders and braziers, stone-cutters, dyers, goldsmiths, ivory-workers, painters, embroiderers, turners; those again that conveyed them to the town for use, merchants and mariners and ship-masters by sea; and by land, cartwrights, cattle breeders, wagoners, rope-makers, flax-workers, shoemakers and leather-dressers, road-makers, miners. And every trade in the same nature, as a captain in an army has his particular company of soldiers under him, had its own hired company of journeymen and laborers belonging to it banded together as in array, to be, as it were, the instrument and body for the performance of the service. Thus, to say all in a word, the occasions and services of these public works distributed plenty through every age and condition."

"Architecture," says Robert Adam, "in a particular manner depends upon the patronage of the great, as they alone are able to execute what the architect plans." This being so, the architects of his time had in Pericles a patron in every way worthy their best efforts. Indeed, so ambitious was he to grace the city of his nativity with all the beauties of architecture that his enemies found here a pretext for censure, and complained that he spent too much of the public treasure for such a purpose. He met the criticism, however, with the argument that those who pursued the arts of war should not be the only ones to receive support at the expense of the state, but that those who possessed the skill and industry of true artists and artisans were quite as much entitled to public encouragement and support as the soldier.

This answer for a time appeased the clamor of the opposition, which had been set up against what they would lead the people to believe was extravagance and wastefulness on the part of Pericles. But it soon broke out again. When finally it became no longer bearable, Pericles addressed his accusers and said: "If you think that I have expended too much let the money be charged to my account, not yours, _only let the new edifices be inscribed with my name and not that of the people of Athens_." It is to the credit of the Athenians that their pride was touched by the words of their ruler and their cupidity restrained. They at once replied that Pericles might spend as much of their money as he pleased, and they even went further, and insisted that he should not spare the public treasury in the least. Like all great men, Pericles was assailed in a variety of ways. When his enemies did not accomplish their purpose in bringing him to public disgrace by one method of assault, they tried another. We have seen how they failed in one instance; another was similar in accusing him, in complicity with Phidias, of appropriating to his own use the public treasure, donated to pay for the golden plates on the chryselephantine statues of the latter's creation. But this charge also not proving successful, they attacked his religious character, strange as it may appear, when it is remembered how deeply he was interested in erecting temples of pagan worship. But he survived the slanders of his time and continued his aims and purposes in life, content, doubtless, that posterity should judge him aright, as did the majority of the people of his own time. His last words are perhaps the best epitome of his life's work: "No Athenian ever put on black through me."

Teleclides has put into verse the great surrender which the Athenian people appeared finally to make to Pericles of their rights in peace and war:

"The tribute of the cities, and, with them, the cities too, To do with them as he pleases, and undo; To build up, if he likes, stone walls around a town; And, again, if so he likes, to pull them down; Their treaties and alliances, power, empire, peace and war, Their wealth and their success forevermore."

As already stated, in no branch of the arts did the age of Pericles make a deeper and more lasting impression than in that of architecture. Although the Doric order was employed many hundred years before his time, and the Ionic scarcely less many, yet the finest types of each and the examples of these orders which stand for their most perfect and artistic development are to be found in the Acropolis at Athens in the time of Pericles, the Parthenon serving as the criterion of one and the Erechtheum as the model of the other. That these orders should have been brought to such perfection and endowed with their crowning dignity and grace, must alone prove without further argument, if need be, that the architectural talent and artistic sense of the age was incomparable.

The part which the great sculptor Phidias played in the art drama of his time has been already alluded to, but not sufficiently, perhaps, to exclude a further reference to him.

The comparison has often been made between Phidias and the talented revivalist of the fifteenth century, Michael Angelo, and a casual consideration of the two eminent artists would indicate that it was a proper one. They were both sculptors, both painters, both engravers (Phidias of gems), but they were not both architects, as is erroneously assumed. As to the respective degrees of talent which each manifested toward the branches of art which he professed, they also differed widely. In sculpture the school of Michael Angelo will not outlive that of Phidias, but in painting, especially in its application to mural decoration, the Greek must bow

to the Italian. In architecture also Phidias possessed none of the technical knowledge and skill which in Michael Angelo enabled him to suspend the great dome of St. Peter's "as if in the air," and which was so important a factor in his long artistic career, manifested in other ways as well, and gaining for him perpetual applause. However, the two artists may be well compared, inasmuch that they both created epochs of their own; and both excelled in exhibiting a noble understanding as to the high and exalted possibilities of art that has never been equalled.

Phidias's comprehensive grasp of broad artistic effects had as much to do, probably, with gaining for him the favor of Pericles as his technical skill. Quintilian calls him the "Sculptor of the gods." He realized the greatness of large things and could calculate their power in influencing the imagination and understanding. He was once invited, together with his contemporary artist, Alcamenes, to design a statue of Minerva, destined to be placed upon a high column. When both statues were finished and exhibited, that made by Alcamenes was at once preferred on account of its elegance of finish, while that by Phidias was rejected as being rough and crude. Phidias, however, insisted that each should be shown from the high pinnacle upon which it might ultimately be placed. When this was done all the elegant graces of the statue of Alcamenes were lost to sight, as well also the apparent roughness of that by Phidias, which now took on the perfect proportions he had foreseen. This story will serve to illustrate the breadth of his artistic discernment.

Of all the artists of his time, Phidias was by far the best gifted to have placed in his hands, by Pericles, the supervision of the public buildings of Athens, and to have entrusted to his discretion and judgment the planning, posing and arranging of the grand architectural _mise en scène_, which his patron had determined should be set there. If Phidias did not draw the actual plans of a building or other structure, his judgment could indicate its order, its location and such other characteristics it should possess to harmonize with the features with which it was to be associated. He could group the majestic masonry of his time in grand display, could beautify it with his own chisel, and could form and mould the complete architectural picture. If he was not the architect of the Parthenon, he at least enhanced its effect with the magnificence of his sculpturings and designs in the metopes of the frieze and the tympanums of the pediments, some of which are still to be seen among the "Elgin marbles" in the British Museum, of which Canova remarked they would alone compensate for a visit to England. It is not improbable, also, that he may have suggested the Caryatides of the Erechtheum, and proved to the Egyptians, from whom the architectural idea was borrowed, how far more beautifully and gracefully such figures could be carved in Athens than on the banks of the Nile.

There can be no doubt as to the value of statuary, which was the special province of Phidias, in enhancing the _ensemble_ of Grecian architectural grouping, and particularly valuable was the colossal figure of Minerva Promachus in contributing to the grandiose effect of the Athenian Acropolis. This noble work of Phidias was seventy feet high and made entirely of bronze, said to have been taken from the Medes, who disembarked at Marathon. The colossal goddess stood exposed, and in a position where, in looking far away over the Ægean sea, she might be an inspiration to the returning Athenian mariner, and where, in glancing from her lofty eminence, "she seemed, by her attitude and her accoutrements, to promise protection to the city beneath her, and to bid defiance to her enemies."

Another architectural statue, if it may be called such, was that of the same goddess, in gold and ivory, which dominated the interior of the Parthenon. This work of Phidias, second only in beauty and size to the chryselephantine statue of Jupiter at Olympia, is said to have cost $465,000. The figure of Minerva was forty feet in height, and was presented standing in a tunic which reached to her feet. A casque covered her head, her right hand held a spear, and her left a figure of Victory. The exquisite workmanship of the carving on the buckler resting at the feet of the deity came near involving Pericles and Phidias in another web of trouble, for it was asserted that the sculptor had introduced his own portrait and that of his patron among the combatants of a battle between the Athenians and Amazons, there portrayed. The captious objection was set up that such a liberty was insulting to Athene. Phidias, as related by some writers, was cast into prison for this act of impiety, and died there. Others claim, however, that this was not so, but that Phidias, before sentence could be passed, fled to Elis, where he at once entered upon the work of modelling the great statue of the Olympian Jupiter.

In respect to both statues, he was implicated with Pericles, as accused by his enemies, with pilfering the gold donated for their construction. These various accusations have led to considerable confusion in respect to much of his personal history and final end, and although it was proved by removing the gold plates and weighing them, that he was not guilty of the alleged crime, it is very probable that his death was as much due to disappointed hopes and mortification consequent upon the false charge as it was to any public executioner of the time.

CHAPTER VI.

THE ARCHITECTS OF THE AGE OF PERICLES.

It is not the intention, in recalling some of the more conspicuous architects who flourished in the time of Pericles, to confine them to those only who were directly in his employ, but to group together all who became prominent factors in the architectural development of that age, both for some years before and after Pericles's reign of power.

To have carried forward the many important works which the great leader instituted, and which were advanced with a precision and rapidity remarkable for that or any other time, considering their size and importance, the skill and services of many architects were brought naturally into requisition. As a result we have the record of an unusually large number of such artists, and in respect to a few some little specific data relating to their lives. The architects, however, of many of the most important works are unknown.

If we approach Athens, like the Attic mariner of old, through the Piræus, one of its sea gates, we are attracted at once to the beautiful architectural display which this seaport town, some five or six miles distant from the Grecian metropolis, presents. The entrance to the harbor was ornamented with two lions, and the harbor-basin was fringed with magnificent colonnades and porticos, which disguised the warehouses and bazaars. Within the town were numerous temples, two theatres and other buildings of artistic effect and merit.

The road to Athens lay between massive fortified walls having a width of fifteen feet at the top, and built to a height of sixty feet. They were known as the "Long Walls," and they enclosed a space about the Piræus, said by Thucydides to have been not less than one hundred and twenty-four stadia in circumference, or about fifteen miles.

It is only just to state that the walls which led from Athens to Piræus, as well as those which connected it with the other sea gates of Munychia and Phalerus, were originally planned and partly executed under Themistocles and Cimon. Themistocles intended to construct these walls to a height of one hundred and twenty feet; but Pericles deemed this entirely unnecessary, and cut the height in two, as we have seen. He also added a third wall between that running to the north of the Piræan fortifications and that reaching to the Phalerum. Socrates speaks of having heard Pericles mention this wall to the people.

The architects for much of this massive mural work were Hippodamus and Callicrates, and because Pericles did not hurry them to the same extent that he hurried others engaged in perhaps less important, if more decorative, undertakings, Cratinus, the satirist, ridiculed the slowness of the work, while aiming a sly shaft of irony at Pericles's oratorical gifts:

"Stones upon stones the orator has pil'd With swelling words, but words will build no walls."

Hippodamus was one of the geniuses of his day, and has been called the "Wren of his age." Perhaps it would be more fitting to speak of Sir Christopher Wren as the Hippodamus of _his_ time, inasmuch as the architectural achievements of the Greek were on a much more magnificent scale than those of the Englishman. Among some of the conspicuous works credited to him was the grand Athenian Agora, or Forum, which was made up of a rich assemblage of colonnades, temples, altars and statues, all taking his name as the Hippodamæa. But whether he is to be credited with being more especially a civil engineer than an architect may be inferred from his work at the Piræus and in laying out entire cities.

He was called the "Excentric Architect" doubtless because he mingled with the practice of his profession a desire to be considered as thoroughly versed in all the physical sciences, a personal affectation which caused him to be ranked among the sophists. It is claimed that it was against Hippodamus that Aristophanes aimed much of his wit.

Hippodamus was the son of Euryphon of Miletus, one of the most famous of the Greek physicians and among the first to have knowledge of the difference between the veins and arteries, and the uses of each. As to his early education and advantages we are not informed, he being referred to by early writers only in a professional way.

Besides his employment upon the "Long Walls," the Agora and other edifices, Pericles engaged his talents, as we have intimated, in laying out the port of Piræus, which he did, with broad streets and avenues intersecting each other at right angles across the city. This plan of street construction he also introduced in other cities of Greece and her colonies with which he had to do, especially at Thurü on the site of the ancient Sybaris, which he visited with the Athenian colonists, and later at Rhodes. This last-mentioned city, which in the age of Pericles was one of the most beautiful, regular and prosperous of the times, was almost wholly the work of Hippodamus.

Callicrates, who assisted Hippodamus with the “Long Walls,” was also an associate of Ictinus, perhaps the greatest architect of his time, in the building of the Parthenon on the Athenian Acropolis. The architect Callicrates should not be mistaken for the Lacedæmonian sculptor of the same name who achieved great celebrity for his skill in carving the most minute objects, and of whom it is related that he made ants and other insects in ivory which were so very small that their limbs could not be distinguished by the naked eye. This seems all the more remarkable when it is remembered that the ancients had no magnifying glasses.

A walk of five or six miles under the shadows of the tall walls of Hippodamus and Callicrates to view the greater architectural glories of the city of Athens in the time of Pericles will doubtless repay us. While this queen city of the ancient world is enrobed in many triumphs of the builder’s art, we will probably pass them all by for the time being to examine more carefully the gems that stand forth from the Acropolis, glittering under the blue Grecian sky like white jewels in the proud city’s coronet.

This magnificent citadel, protected by Pelasgian walls and dedicated to the pagan deity Minerva, could be entered but upon one side, the western, where the massive gate or vestibule of the Propylæa occupied the centre. Fragments of this great gate still give evidence to the modern traveller of its former stately splendor.

“Here,” says Bishop Wordsworth, “above all places at Athens, the mind of the traveller enjoys an exquisite pleasure. It seems as if this portal had been spared in order that our imagination might send through it, as through a triumphal arch, all the glories of Athenian antiquity in visible parade. It was this particular point in the localities of Athens which was most admired by the Athenians themselves; nor is this surprising; let us conceive such a restitution of this fabric as its surviving fragments will suggest—let us imagine it restored to its pristine beauty—let it rise once more in the full dignity of its youthful nature—let all its architectural decorations be fresh and perfect—let their mouldings be again brilliant with their glowing tints of red and blue—let the coffers of its soffits be again spangled with stars, and the marble antæ be fringed over as they were once with delicate embroidery of ivy-leaf ... and then let the bronze valves of these five gates of the Propylæa be suddenly flung open and all the splendors of the interior of the Acropolis burst upon the view.”

If this imaginative restoration of the sublimities of the Propylæa is not sufficient to excite some interest in the building and the slave-born architect who was its creator, let the glowing words of Symonds be added, which refer not only to the grand vestibule itself, but to the Panathenaic processions which were wont to pass its gates.

“Musing thus upon the staircase of the Propylæa we may say with truth that all our modern art is but as child’s play to that of the Greeks. Very soul-subduing is the gloom of a cathedral like the Milanese Duomo when the incense rises in blue clouds athwart the bands of sunlight falling from the dome, and the crying of choirs upborne on the wings of organ music fills the whole vast space with a mystery of melody. Yet such ceremonial pomps as this are but as dreams and shapes of visions when compared with the clearly defined splendors of a Greek procession through marble peristyles in open air beneath the sun and sky. That spectacle combined the harmonies of perfect human forms in movement with the divine shapes of statues, the radiance of carefully selected vestments with hues inwrought upon pure marble. The rhythms and melodies of the Doric mood were sympathetic to the proportions of the Doric colonnades. The grove of pillars through which the pageant passed grew from the living rocks into shapes of beauty, fulfilling by the inbreathed spirit of man nature’s blind yearning after absolute completion. The sun itself, not thwarted by artificial gloom or tricked with alien colors of stained glass, was made to minister in all his strength to a pomp the pride of which was a display of form in manifold magnificence. The ritual of the Greeks was the ritual of a race at one with nature, glorying in its affiliation to the mighty mother of all life, and striving to add by human art the coping stone and final touch to her achievement.”

The Propylæa stretched in all about one hundred and seventy feet across the western side of the citadel, and was entirely built of Pentelic marble. In the centre was a portico sixty feet broad of six fluted Doric columns, each column thirty feet in height, and all supporting a noble pediment. From this portico projected on either side a wing, entered through three Ionic columns. Six Ionic columns assisted in supporting the roof of the vestibule. The marble beams of this roof were from seventeen to twenty-two feet in length and correspondingly solid. The ceiling was richly carved and ornamented. Immediately in the rear of the Ionic columns and at the end facing the Acropolis stood the terminal wall, with its five bronze gates, the centre one, which was the largest, being sufficiently broad to allow the passage of a chariot or other such vehicle. Beyond this wall and its gates was the posticum, adding eighteen feet to the depth of forty-three feet which the building otherwise possessed. The temple of the “Wingless Victory,” and the “Painted Chamber,” containing the finest works of the painter Polygnotus, as they have been named, formed the wings, which presented unbroken walls to the front, relieved only by the four Ionic columns that supported the graceful entablature and pediment of the temple of Niké Apteros on the right.

As the building was begun in the year 437 B.C., and was entirely completed within a period of five years, and was one of the most imposing structures of its day, Pausanias is led to reflect that, “in felicity of execution and in boldness and originality of design, it rivalled the Parthenon.” Lübke’s comment on the structure is: “Thus in this building the idea of fortress-like defence, as well as festive welcome, was equally expressed. Especially admirable, however, was the rich ceiling of the great three-naved court, both on account of the bold span of its beams and the magnificent decoration of the spaces between them (the coffers), which were brilliant with gold and colors.[3] The Ionic form of the columns in the interior also corresponded with this festive, cheerful character; while the two rows of columns on the outside, together with the rest of the exterior of the building, exhibited the seriousness and dignity of the Doric style.”

Thus has much been quoted in description and eulogy of this noble piece of architecture; would that as much might be quoted in respect to the talents and career of its gifted designer, but of him there is only the shadow of comment, from which it is possible to weave but the faintest fabric of certainty concerning his life.

His name was Mnesicles, and we are told that he was a slave born in the household of Pericles. That he should have been chosen to create so important an architectural work speaks for the privilege which the humblest born might hope to attain in rising to positions of trust and prominence in the days of that great leader. Mnesicles early manifested an aptitude for architecture, and was permitted by his illustrious patron and owner to exercise his talent in the erection of buildings of inferior consequence before being entrusted with more ambitious works. The Propylæa was not the only work of magnitude upon which he was engaged, nor was it the most beautiful, in the judgment of some critics, although the most important, for he was the architect as well of the graceful Doric temple of Theseus, which has always been regarded as one of the finest architectural conceptions the ancient city of Athens possessed.

[Illustration: THE FALL OF MNESICLES FROM THE PROPYLÆA.]

An incident in his life which awakened the affectionate interest of Pericles and the solicitude of the goddess Athene, whom he was serving so well, is told by Plutarch and other early biographers. It is in effect that while inspecting the almost completed work of the Propylæa he fell from the summit of the pediment and was most severely injured. He was taken at once to the house of Pericles, where he received the personal attention of the great ruler. It was while he lay at death’s door that it is said Minerva appeared to Pericles in a dream, and told him to administer to Mnesicles a medicine distilled from the wall-plant pellitory. This was done, and the life of the architect was spared. The only other fact associated with the life of Mnesicles which has been preserved to us is one mentioned by Pliny to the effect that the sculptor Stipax of Cyprus made a statue of the architect which became very celebrated in its time, and which was called _Splanchnoptes_. It was given this name because it represented a person roasting the entrails of the victim at a sacrifice, at the same time blowing the fire with his breath. There is nothing suggestive of the architect in question or his profession, but it is supposed to have been a statue of Mnesicles, from the fact that Pliny speaks of the subject as having been a slave of Pericles, who was cured of the wounds received in a fall from the Propylæa by an herb which Minerva had suggested should be given as a medicine. It is unfortunate that the statue has not survived to give us some idea of the features of at least one of the great architects of antiquity. Some recent discoveries on the Acropolis have, however, brought forth fragments which are supposed to have been parts of the base.

If there is any one of the Greek architects of the time of Pericles who can be said to have secured for himself a degree of popular notoriety throughout subsequent ages it is the accomplished Ictinus, the chief architect of the Parthenon and the designer of at least two other conspicuously beautiful buildings of which we know—namely, the temple of Apollo Epicurus, near Phigalia in Arcadia, and the temple of Ceres and Proserpine at Eleusis. It is, no doubt, due, however, to his connection with the Parthenon that his fame has so long endured.

As already stated, Callicrates assisted in the building of the Parthenon, and Phidias contributed the designs for the relief carvings in the pediments and metopes, executing much of the work with his own hands. Although Vitruvius says that “both Ictinus and Callicrates exerted all their powers to make this temple worthy of the goddess who presided over the arts,” it is not likely that Callicrates’s share in the work was equal to that of Ictinus, but was confined more to the heavy masonry, and in offering to Ictinus such advice as he might seek in giving to the building the greatest substantiality and permanency.

The Parthenon, which, among the several masterpieces of the Acropolis, must be acknowledged the greatest, stood upon a rocky elevation in the citadel, which so far elevated the structure as to bring the pavement of the peristyle upon a level with the capitals of the columns of the eastern portico of the Propylæa. This was the same site which had been occupied formerly by an earlier temple

to Minerva, known among the Athenians as the Hecatompedon on account of its proportions.

The Parthenon of Ictinus is said to have cost one thousand talents, or what would be equal to about $1,100,000 of our money. It was begun the year 422 B.C., and completed at the expiration of sixteen years. It conformed to the usual shape of the Greek temples, being rectangular and peripteral. The length from east to west was two hundred and twenty-seven feet and seven inches, the width a little over one hundred and one feet. The Doric order was employed for the exterior, the columns which surrounded the cell on all sides being thirty-four feet in height, with a diameter of six feet at the base. There were forty-six of these columns, springing directly from the stylobate or steps, all fluted with twenty channels, and each carrying its share of a very beautiful entablature. The gables or pediments at each end of the temple were of flat pitch. The total height of the building from the steps to the top of the gables was sixty-four feet. White marble from Mount Pentelicum, “wrought,” as Mr. Kinnaird expresses it, “with the exquisite finish of a cameo,” was the material employed for the entire structure, with the exception of the supporting timbers of the roof, which were wood covered with marble tiles.

The interior, to quote Mr. Kinnaird again, “enshrined the chryselephantine colossus with all its gorgeous adjuncts, and comprised sculptural decoration alone for one edifice exceeding in quantity that of all recent national monuments; consisting of a range of eleven hundred feet of sculpture and containing, on calculation, upward of six hundred figures, a portion of which were colossal, enriched by painting and probably golden ornaments. Here has been really verified the prediction of Pericles that, when the edifices of rival states would be mouldering in oblivion, the splendor of his city would be still paramount and triumphant.” In respect to the richness of its interior treasures, very much the same idea is expressed by Bishop Wordsworth, who says, in the course of his description of the building: “It would, therefore, be a very erroneous idea to regard this temple which we are describing merely as the best school of architecture in the world. It was also the noblest school of sculpture and the richest gallery of painting.”

The cleverness of the architects in insuring to the Parthenon, after its completion, the appearance of absolute harmony of proportion in all its outward lines, is one of their best claims to that celebrity which they have justly earned. As it goes so far toward illustrating their great professional skill, the reader may be interested in reading the language used by Professor Roger Smith of London in explaining the measures adopted by Ictinus and possibly Callicrates also, to correct the optical defects which the Parthenon might otherwise have possessed when completed.

“The delicacy and subtlety of these [optical illusions] are extreme, but there can be no manner of doubt that they existed. The best known correction is the diminution in diameter or taper, and the _entasis_ or convex curve of the tapered outline of the shaft of the column. Without the taper, which is perceptible enough in the order of this building, and much more marked in the order of earlier buildings, the columns would look top-heavy; but the _entasis_ is an additional optical correction to prevent their outline from appearing hollowed, which it would have done had there been no curve. The columns of the Parthenon have shafts that are over thirty-four feet high, and diminish from a diameter of 6.15 feet at the bottom to 4.81 feet at the top. The outline between these points is convex, but so slightly so that the curve departs at the point of greatest curvature not more than three-quarters of an inch from the straight line joining the top and bottom. This is, however, just sufficient to correct the tendency to look hollow in the middle.

“A second correction is intended to overcome the apparent tendency of a building to spread outward toward the top. This is met by inclining the columns slightly inward. So slight, however, is the inclination, that were the axes of two columns on opposite sides of the Parthenon continued upward till they met, the meeting point would be 1952 yards, or, in other words, more than one mile from the ground.

“Another optical correction is applied to the horizontal lines. In order to overcome a tendency which exists in all long lines to seem as though they drop in the middle, the lines of the architrave of the top step and of other horizontal features of the building are all slightly curved. The difference between the outline of the top step of the Parthenon and a straight line joining its two ends is at the greatest only just two inches.”

Still another correction which Professor Smith alludes to, in respect to the vertical proportions of the building, he does not discuss more than to say: “The small additions, amounting in the entire length of the order to less than five inches, were made to the heights of the various members of the order, with a view to secure that from one definite point of view the effect of foreshortening should be exactly compensated, and so the building should appear to the spectator to be perfectly proportioned.”

The Parthenon was not, as is popularly supposed, a temple for the worship of Minerva. The sanctuary for that particular purpose was in the Erechtheum, a triple temple, located upon the Acropolis not very far distant from the Parthenon, and having wings dedicated respectively to Minerva Polias, to Erechtheus or Neptune, wherein was a well of salt water, and to the Nymph

Pandrosus, daughter of Cecrops. The Parthenon, however, served as a national treasury and repository for the valuable offerings to the goddess, as well as “a central point for the Panathenaic festival,” where prizes might be distributed to the victorious competitors. Indeed, the decorations of Phidias would tend to corroborate this inference, as the sculptured low relief of the frieze represented the Panathenaic procession. The rich relief carvings in the tympanums of the front and rear pediments of the building, also by Phidias, the designs of which may be found described in almost any work on Grecian art, have been reproduced in some of the vignettes of this book.

In alluding to the Erechtheum, which, like the Parthenon and the Propylæa, still presents shapely and beautiful ruins to grace the Acropolis, attract the tourist and lend to the lover of art the best criterion of the ideal age of Grecian architecture, we must mourn the fact that the architect who designed this magnificent example of the Ionic order is not known, and it is not likely that he ever will be. The building was not finished at the time of the death of Pericles. Because of an inscription found in the Acropolis, and now in the British Museum, containing the particulars of a minute professional survey of the unfinished parts, made by an Athenian architect named Philocles, in the year 336 B.C., this architect has been given by some the credit of having been the author of the entire structure; but that he could not have been is clearly proven by the known fact that much of the temple was constructed, as we have stated, in the time of Pericles, or about one hundred years earlier. Nothing further, by the way, is known of Philocles than is here given.

About two thousand years had passed without that great leveller Time or the corroding influences of the elements marring to any very serious extent the beauty and completeness of the Parthenon, during which period it had suffered two changes most antagonistic to its original purpose, having been transformed at one time into a Christian church and at another into a Turkish mosque. In respect to the first transformation, it is well to note that the significance of its name was not wholly lost in the change. Parthenon means Virgin, and the Christians called the church into which they turned it the Church of the Blessed Virgin. It was seen entire by Spon and Wheeler in 1676. But when the Venetians, in their war with the Turks, eleven years later, besieged the citadel, they threw a bomb upon the roof of the noble structure, which, passing through it, ignited the powder which had been stored in the building by the Turks. The result was an explosion which divided and reduced the temple to its present condition, save for further depredations which seem hardly creditable. The iconoclastic Turks found this pride of Pericles most useful as a quarry upon which to draw for much of the material used in their own buildings, and it is to be regretted also that Lord Elgin should have found it necessary to enrich a distant museum in London with many of its most beautiful carvings, adding further desecration to “what Goth and Turk and Time had spared.” Vitruvius informs us that Ictinus, in collaboration with another architect, not otherwise mentioned, wrote a book upon the Parthenon, his greatest masterpiece.

After searching the world over for her dear, lost daughter, the beautiful Proserpine, who had been spirited away to the realm of Pluto, Ceres finally gave up the quest and mournfully settled down at Eleusis, a city in fertile Bœotia, about fourteen miles from Athens. Here was erected in her honor and in memory of Proserpine an Ionic temple by the people for whom she became sponsor. The Persians, during their invasion of Attica, burned the temple, but Pericles caused it to be rebuilt, and selected Ictinus as the architect. He erected a handsomer structure in the Doric style, which, it is said, was without exposed columns.

Whether Ictinus lived long enough to complete the temple to Ceres and Proserpine or not, or was called away for other purposes, is not known, but it appears that other architects were associated with its design and erection, both before as well as after his connection with it. Corœbus is mentioned also as an architect, in the employ of Pericles, who began the work on the mystic cell, but that his sudden death resulted in the substitution of Ictinus. It is more probable, however, that Ictinus had previously furnished the design of the building and that Corœbus had been merely acting under his supervision. Following Ictinus was another Athenian architect appointed by Pericles, and the designer of the demos of Cholargos. He is said to have built the pediment of the temple with the timpanum open, according to an ancient fashion, in order to light the cell, which, if Strabo is to be believed, was capable of accommodating thirty thousand persons.

In the time of Demetrius Phalereus, the immediate successor of Alexander, Philo, or Philon, as his name is sometimes written, a very eminent architect, also of Athens, was engaged to add a portico of twelve Doric columns to this temple of Ceres. That Metagenes of Xypete, and son of Ctesiphon, who has already been discussed in our allusion to the temple of Diana at Ephesus, should be mentioned as the architect who completed the entablature and an upper row of columns to this Eleusian temple, is probably a mistake. The time of Metagenes was, as we have seen, much earlier (about 560 B.C.), and while he might have been engaged upon the first temple to Ceres at Eleusis, it is quite impossible for him to have been employed by Pericles in the building of that with which Ictinus had to do.

When Alaric, the German, made his angry invasion into Greece in 396 B.C., because refused command of the armies of the Eastern empire, he destroyed very many works of Greek art, and this temple among them was one of the unfortunates that assisted to satiate his wrath.

The third important work with which Ictinus is reported to have been connected was the Doric temple to Apollo in the village of Bassæ, near Cotylion, in Arcadia, which was known as the temple to Apollo Epicurus (the Preserver). Pausanias speaks of this as being next to that at Tagea, the finest temple in the Peloponnesus "from the beauty of its stone and the symmetry of its proportions." This temple is still a beautiful ruin, thirty-four of the original thirty-eight columns of the peristyle standing. The structure, which in the interior possessed two rows of columns in the Ionic order, was originally admirably planned for sculptural decoration and statuary and held many fine specimens of the handiwork of Phidias and his school. Some of the carvings of the frieze and other parts of the building, which are to be seen in the British Museum, are spoken of by Lübke as the boldest and most animated compositions among all that is preserved to us of the productions of Greek art.

On the southeast slope of the Acropolis Pericles caused to be erected a building which departed broadly from the prevailing rectangular construction of the time. In was oval on plan, Doric in order, and its portico was enclosed by thirty-two columns. The most original feature of the building, however, was the roof, which was constructed in the shape of a cone and was supported by rafters formed of the masts of the ships captured in the Persian wars. From just above the cornice of the drum there projected around the entire roof a row of windows which may possibly be credited with being the archetypes of our modern dormer windows. This building was called the Odeum, or, as it is now termed, the Odeon, and was devoted to music.

Cratinus, the comic poet, who had levelled his satire at Pericles when building the "Long Walls," found in the roof of the Odeon, the idea for the cone shape of which, by the way, it is claimed the architects borrowed from the pavilion of the King of Persia, another mark for his shafts of ridicule. He sings:

"As Jove, an onion on his head he wears; As Pericles, a whole orchestra bears; Afraid of broils and banishments no more, He tunes the shell he trembled at before."

The allusion to an onion by Cratinus is explained when it is remembered that on account of the peculiar, long shape of his head the poets of Athens called Pericles _Schinocephalos_, or squill-head, from _schinos_, a squill, or sea-onion. Another version of Cratinus's satire is given thus:

"So, we see here, Jupiter Long-pate Pericles appear, Since ostracism time he's laid aside his head, And wears the new Odeum in its stead."

Music received a considerable share of attention in the education of the Greeks, and such was the influence which it is said to have possessed over the physical as well as the mental nature of the people, that it was credited with being an antidote for many of the infirmities of the body as well as the mind. The Odeon was therefore an institution of considerable importance in Athens. Here Pericles conducted in person the musical contests between the Choruses which the wealthy citizens of Athens instituted, and awarded to the winners the tripod-trophies, which as marks of special honor they were permitted to place upon their monuments. A street in Athens was devoted almost entirely to these choragic monuments, many of which were architecturally most beautiful.

The architect of the Odeon of Pericles is not known, but after its destruction by Aristion in the Mithridatic war, it was rebuilt by Ariobarzanes II, Philopator, king of Cappadocia, in the original form, who employed for the purpose the brother Roman architects, Caius and Marius Stallius, together with a third architect by the name of Menalippus, who recorded their connection with the building upon the base of a statue which they erected in honor of their patron Ariobarzanes. It is said that on certain days this later Odeon was used as a grain market.

If in the Parthenon on the Acropolis the acme of Doric magnificence was reached by Ictinus and Callicrates, there was another temple located below the Acropolis, which by many is ranked as the peer of the Parthenon, in its perfection of Doric symmetry and grace. This was the building to which allusion has already been made as another example of the genius and skill of Mnesicles, the slave-architect of the Propylæa. It was dedicated to the founder of Athens, the adventurous Theseus, and stood not only as a temple in his honor, but as a mausoleum for his ashes.

Wordsworth, whose words of praise for the Propylæa have been quoted, is also enthusiastic in his admiration of this second example of the skill of the talented Mnesicles: "Such is the integrity of its structure and the distinctness of its details that it requires no description beyond that which a few glances might supply. Its beauty defies all; its solid yet graceful form is, indeed, admirable;

and the loveliness of its coloring is such that from the rich, mellow hue which the marble has now assumed it looks as if it had been quarried not from the bed of a rocky mountain, but from the golden light of an Athenian sunset."

Although the temple of Theseus was one of the more modest Athenian temples in point of size, it has always ranked as one of the most perfect of the Attic-Doric order, and stands to-day as one of the least dilapidated among all that have existed of the beautiful edifices of ancient Greece. Indeed, as it was supposed to have been begun before the Parthenon, or in the time of Cimon, it is claimed by some writers that Ictinus took it for his model, although the Parthenon was about twice as large.

The Theseum was surrounded by columns, six at the front and rear and thirteen on either flank. It was forty-five feet wide by one hundred and four feet long. The building material was Pentelican marble, which in the course of the centuries has taken on the soft yellowish tinge which Bishop Wordsworth refers to. Ornamental sculpturing was more sparingly employed than upon the Parthenon or some of the other structures of the time, but such as was used was so judiciously handled as to give the very noblest results. The sculpturing in the metopes of the frieze and on the pronaos was the work of Phidias.

It was built after the battle of Marathon, and, it would seem, after an awakening on the part of the Athenians to that high sense of obligation toward their early hero, Theseus, which had slumbered for centuries. It was due to the Delphic Oracle that his remains were brought back to Athens from their long banishment in the island of Scyros, and given honorable burial, the son of Miltiades being selected to execute the Oracle's decree. The occasion was made one of festivity and rejoicing, and the entombment in the beautiful new temple one of sacrifice and solemnity.

In closing this brief reference to the Theseum, the graceful lines from Haygarth's Greece, which so beautifully applaud it, may well be quoted:

"Here let us pause, e'en at the vestibule Of Theseus's fane—with what stern majesty It rears its pond'rous and eternal strength, Still perfect, still unchang'd, as on the day When the assembled throng of multitudes With shouts proclaim'd th' accomplish'd work and fell Prostrate upon their faces to adore Its marble splendor. How the golden gleam Of noonday floats upon its graceful forms, Tinging each grooved shaft, and storied frieze And Doric triglyph! How the rays amidst The op'ning columns glanc'd from point to point Stream down the gloom of the long portico; Where, link'd in moving mazes youths and maids Lead the light dance, as erst in joyous hour Of festival! How the broad pediment, Embrown'd with shadow frowns above and spreads Solemnity and reverential awe! Proud monument of old magnificence! Still thou survivest, nor has envious time Impair'd thy beauty, save that it has spread A deeper tint, and dimm'd the polished glare Of thy refulgent whiteness. Let mine eyes Feast on thy form, and find at every glance Themes for imagination, and for thought; Empires have fallen, yet art thou unchang'd; And destiny, whose tide engulphs proud man Has roll'd his harmless billows at thy base."

In the brilliant galaxy of great architects and sculptors of this age, none shines more deservedly conspicuous by reason of true merit and noble purpose than Polycletus of Argos, who is remembered more as a statuary than by reason of his achievements in architecture. He exercised his art between the years 452 and 412 B.C., and, like his distinguished contemporaries, Myron and Phidias, was a pupil of the Argive sculptor, Agelades. His celebrity has been compared to that of his most famous brother pupil, Phidias, for the reason that while Phidias gave the ideal standard in the portrayal of deities, Polycletus created for all ages the perfect canon of the human form in art. This he expressed in the figure of a youth holding in his hand a spear, which was called the Doryphorus. In this figure the sculptor laid down the rules of universal application with regard to the proportions of the human body in its mean standard of height, breadth of chest, length of limbs and so on. Socrates, according to Xenophon, went so far as to place Polycletus on a level as a statuary, with Homer, Sophocles and Xeuxis in their respective arts.

A similar anecdote to that told of Phidias, when he listened to the criticisms of the public upon his colossal statue of the Olympian Zeus, is also related of Polycletus. He is said to have made two statues, one of which he perfected according to his own ideals, and the other he exhibited to the public and altered according to the suggestions volunteered. In due time he exhibited both publicly side by side. The one he had himself made was universally admired, while that which he had changed to suit the popular fancy was condemned. "You yourself," he exclaimed, "made the statue you abuse, I, the one you admire."

One of his most celebrated works was the chryselephantine statue of Hera, executed in his old age to rival the Athene and Zeus by Phidias. Strabo considered that this statue equalled in beauty those of Phidias, though it was surpassed by them in costliness and size. In the respect that Polycletus followed the Homeric description of Hera, and presented the goddess clothed from her waist down, he may be said to have followed the precedent of Phidias; in other respects, however, he drew upon his own fancy. Juno was seated upon a golden throne; her head was crowned with a garland on which were worked the Graces and the Hours; in one

hand she held the symbolical pomegranate and in the other a sceptre surmounted by a cuckoo, a bird sacred to Hera on account of having herself been changed into that form by Zeus.

As an architect Polycletus will be found as the designer of the theatre at Epidaurus, where was also located the beautiful temple dedicated to Æsculapius, and which Pausanias pronounced to be superior in symmetry and elegance to every other in Greece and Rome. It was capable of accommodating twelve thousand spectators, and its ruins, as well as those of the white marble circular Tholus, by the same artist, are still to be seen in an unusual condition of preservation.

Among the other architects who have been variously mentioned as having pursued their profession toward the close of this century, but who can hardly take equal rank with those already alluded to, may be mentioned Eupolinus, an Argive artist, who rebuilt the great Heræum at Mycenæ after its destruction by fire in the year 423 B.C., the entablature of which was ornamented with sculptures representing the wars of the gods and giants and the Trojan wars; Cleœtas, who was one of the assistant architects under Phidias, and whose chief claim to distinction is based upon his construction of the starting place in the Olympian Stadium, and Democopus Myrilla, who built the theatre at Syracuse. Vitruvius also speaks of an architect and author of about this time—namely, Silenus—who wrote on the Doric order.

It is difficult to close this chapter, in which but very superficial reference has been made to the architectural lights of the golden age of art in Greece, without glancing back at the magnificent city of Athens, the grand product of much of their creative skill, with feelings of regret that with all her numerous and noble monuments, dedicated to gods and men, there is not one that bears the imprint of its creator. We see in this glance forest-like colonnades of glittering white columns; we see the House of the Five Hundred Senators, the Tholus, the Hall of Hermæ, the Agora, the Pnyx, “where the Athenian orator spoke from a block of bare stone;” the Stoic Hall, in which philosophy was taught; the Prytaneum, where the loved laws of Solon were preserved; the Lyceum, with its hundred columns from Lydia; the Theatre of Bacchus and the Mausoleum of Tolus. We see temples innumerable, the grandest of all those to Jupiter and Theseus; but others of fascinating merit, those of Ceres and of Cybele and of Mars, and of Vulcan, of Venus, of Æacus, of the Dioscuri, of Hercules, of Diana Agrotera, of Bacchus Lunnæus, of Æsculapius, of Eumenides, and that to Glory, erected with the booty from the glorious field of Marathon, wherein stood the Venus of Phidias; and we see the Acropolis towering above all, lending other magnificent architectural triumphs to the ensemble; and although we see slabs among them “inscribed with the records of Athenian history, with civil contracts and articles of peace, with memorials of honors awarded to patriotic citizens or munificent strangers,” we find no monument, whether in the time of Pericles or later, inscribed with the name of Ictinus, or Hippodamus, or Callicrates, or the poor slave, Mnesicles, who was saved by Minerva to be forgotten by man.

[Illustration: Decoration]

FOOTNOTES:

[3] The decoration referred to was the work of the distinguished painter Protogenes.

CHAPTER VII.

LATER GREEK ARCHITECTS.

The first architect as well as artist of decided merit who arose to historic distinction at the beginning of the later Attic school, or that which followed immediately upon the school of Phidias, and one of the first to treat the Corinthian idea, then flowering into favor with originality and artistic skill, was the deserving and accomplished Scopas. Reference has already been made to this artist in connection with the temple of Diana at Ephesus, for which, it is said, he furnished the most beautiful of all the numerous columns with which that temple was enriched. This statement is made without prejudice to the great Praxiteles, who was contemporaneous with Scopas, and who excelled him as a statuary, if he did not compete with him as an architect.

A mistake of Pliny, which assigned Scopas to an earlier age, has finally been corrected, and it has been settled that the period when he exercised his art was between the years 395 and 350 B.C. Scopas was a native of Paros, a subject island of Athens, and sprung from a family which for several generations before his advent into the world had practised the plastic arts. His descendants also walked in the same artistic paths of life for many generations. Like Polycletus, with whom he is most favorably compared, the architectural side of his career was greatly eclipsed by that which displayed his genius as a sculptor.

His statues were numerous, and fortunately many of them still exist scattered in various European museums and galleries. Among such of his works considered the most interesting is the well-known series of figures representing the destruction of the sons and daughters of Niobe. In the time of Pliny these statues stood in the temple of Apollo Socianus at Rome, and it was then a question whether they were the works of Scopas or Praxiteles. In fact, many of the former's finest efforts have been attributed to the latter artist. Of this group Schlegel says: "In the group of Niobe there is the most perfect expression of terror and pity. The upturned looks of the mother, and mouth half open in supplication, seem to accuse the invisible wrath of Heaven. The daughter clinging in the agonies of death to the bosom of her mother, in her infantile innocence can have no other fear than for herself; the innate impulse of self-preservation was never represented in a manner more tender or affecting. Can there on the other hand be exhibited to the senses a more beautiful image of self-devoting, heroic magnanimity than Niobe, as she bends her body forward that, if possible, she may alone received the destructive bolt? Pride and repugnance are melted down in the most ardent maternal love. The more than earthly dignity of the features is the less disfigured by pain, as from the quick repetition of the shocks she appears, as in the fable, to have become insensible and motionless. Before this figure, twice transformed into stone, and yet so inimitably animated—before this line of demarcation of all human suffering the most callous beholder is dissolved in tears."

Another highly esteemed work of Scopas, which Pliny says stood in the shrine of Cneius Domitius in the Flaminian circus in Rome, represented Achilles conducted to the island of Leuce by the divinities of the sea. It consisted of figures of Neptune, Thetis and Achilles surrounded by Nereids sitting on dolphins and other large fish, and attended by Tritons and sea monsters. In the opinion of Pliny, these figures alone would have been sufficient to have immortalized the artist, even if they had cost the labor of his entire life.

His statues of Venus, are, after all, perhaps the most remarkable of his works in sculpture. One of these statues, if not the original, is supposed to have been the prototype of one of the most celebrated and beautiful portrayals of that charming deity in the world to-day. Another to which Pliny gives particular prominence was that in which the goddess is presented nude and which was found in the temple of Brutus Callaicus in Rome. This statue, he adds, "would have conferred renown upon any other city, but at Rome the immense number of works of art and the bustle of daily life in a great city distracted the attention of men." It is probably this work of art, which is thought by some to have been superior to that by Praxiteles, which, with some modifications, is credited with being the model after which Cleomenes fashioned the celebrated Venus de Medicis. Pausanias and Pliny mention also other portrayals of Venus by Scopas, but it is left to Waagen and some other critics to ascribe the celebrated statue of Aphrodite, in the Louvre in Paris, and known as the Venus de Milo, to this great sculptor and architect.

It is foreign to the purpose, however, to devote too much space to this side of the art life of Scopas, but in treating of his connection with the magnificent mausoleum which Artemesia erected at Halicarnassus, to her husband, Mausolus, king of Caria, it will be argued doubtless that the work of this artist on that famous mortuary monument, which ranked as one of the seven winders of the world, was more in the line of a decorative sculptor than of an architect.

In this undertaking Scopas was associated with three other architectural sculptors—namely, Bryaxis, Timotheus and Leocarus—all of whom were Athenians. Each took as his special work the decoration of one side of the building, Scopas choosing the east or principal façade. The north and south sides had a width of about sixty-three feet; the east and west were not quite so wide.

Before outlining further the principal characteristics of the building, it is only fair to say that the professional architects to whom is due the credit for the plan of the structure were Phileus, an Ionian whose name Vitruvius spells in a variety of ways, and Satyrus, whose native city is not given, but who, according to the same authority, wrote a description of the mausoleum. Phileus was also an author on architecture, having written a volume on the Ionic temple of Athene Polias at Priene, of which he was the designer, and which was one of the most renowned buildings in Asia Minor, and a treatise on the mausoleum, which was also located in that part of the globe. As for Satyrus, whatever may have been the other public buildings of which he was the architect, there is no record.

The mausoleum had a total height of one hundred and forty feet, and in general appearance combined orientalism in tomb-structure with the perfections of Grecian architectural grace and elegance. The tomb was contained within a rectangular substructure. Above was an Ionic peristyle temple with nine columns on each side and eleven at the ends. The frieze was elaborately carved and decorated, and the roof, which was pyramidal in form, gave the oriental cast to the entire building. At the apex of the roof was a colossal marble quadriga, in which a statue of the deceased king Mausolus appeared. It is said that in the sculptures and carvings of the different sides the respective artists strove to rival each other, and that although queen Artemesia died before the tomb was finished the four artists were so interested and absorbed in their work that they determined to complete it at their own risk.

Up to the twelfth century after the Christian era this grand tomb stood in a fairly good state of preservation, but soon after fell to pieces, and was used from that time as a quarry by the Knights of St. John, from which they took stone for the castles they built on the site of the old Greek Acropolis. Later still much of the marble was taken to repair their fortifications, and it is even said to make lime, showing to what ignominious uses the very greatest of architectural glories may finally come. However, some of the carvings have been redeemed from the fortification walls and unearthed from other places in Budrun, the modern Halicarnassus, to find a final resting place, let it be hoped, in the British Museum. These rescued pieces of marble, of which there are perhaps sufficient to reconstruct a quarter of the whole frieze, though they are not continuous, are pronounced by competent judges to be specimens of the work of the different artists, but there is no means of determining which of them, if any, came from the chisel of Scopas.

The temple of Athene Alea at Tegea in Arcadia, often a sanctuary for fugitives from Sparta, was an architectural creation of Scopas, which it would appear belonged to him exclusively. Of all the temples in the Peloponnesus this is said by Pausanias to have been the largest as well as the most magnificent. That observant traveller, however, must have been carried away somewhat by his enthusiasm over its architectural attractions in ascribing to it such great size, as its dimensions were not more than one hundred and sixty-four by seventy feet, being very much smaller than other Grecian temples.

The temple which Scopas built was not the first to the goddess to occupy the same site, but followed a very much more ancient one, which was destroyed by fire in the year 394 B.C. The tendency to introduce the Corinthian order, which followed after the Peloponnesian wars, and which continued to grow as Greece became more and more intermixed with Roman ideas, is here early displayed. The columnar arrangement of the temple was unusual; for the outside the Ionic style was used, there being six columns at each end and fourteen on the sides; but on the inside the Doric order was employed surmounted by the Corinthian. Both pediments of the building were sculptured by Scopas or from his designs under his immediate supervision. The pediment over the front portico portrayed the chase of the Calydonian boar, and that in the rear the battle of Telephus with Achilles; both being, according to Pausanias, very animated compositions. The statue of the goddess Athene Alea, contained in the cell, was carried off by the Emperor Augustus and placed at the entrance of his new forum in Rome. Some fragments of the pedimental sculptures have been discovered and placed in the British Museum.

To Scopas, in co-operation with Praxiteles, is also attributed the graceful and beautiful Choragic monument of Lysicrates, at one time called “the lantern of Demosthenes,” from the mistaken supposition that the great orator used it as a study—a very strange use when it is remembered that the little structure possessed neither doors nor windows. In its day this monument was the pride of the street of Tripods, and it still stands one of the best preserved evidences of the taste and skill of its designers.

In this monument the Corinthian style of decoration is displayed in its perfection of grace, better, perhaps, than in any other structure of that early time which is known to us. Stuart describes it as follows: “The colonnade was constructed in the following manner: six equal panels of white [Pentelic] marble, placed contiguous to each other on a circular plan, formed a continued cylindrical wall, which of course was divided from top to bottom into six equal parts by the junctures of the panels. These columns projected somewhat more than half their diameters from the surface of the cylindrical wall, and the wall entirely closed up the intercolumination. Over this was placed the entablature and the cupola, in neither of which any aperture was made, so that there was no admission to the inside of this monument, and it was quite dark.”

The “flower,” or crowning ornament of the monument, was a particularly graceful and beautiful arrangement of acanthus leaves and volutes, and the roof was worked out with great delicacy and originality in the form of a thatch of laurel leaves and Vitruvian scrolls. If there was any apportionment of the work on this monument between Scopas and Praxiteles, it would be interesting to know what it was.

Of the other architectural sculptors associated with Scopas in the adornment of the tomb of Mausolus none is mentioned as having had any other connection with architecture in a similar way, but all were statuaries of distinction and high merit, who executed works in marble or bronze, or both, that gave them prominence in their art. Among other works by Bryaxis were five colossal statues in the island of Rhodes, of which the celebrated “colossus of Rhodes,” however, was not one, and also a statue of Apollo, which was destined for the temple of Daphnis near Antiochus. The story is related that Julian the Apostate wished to render to this figure peculiar worship and homage, but was prevented from so doing by a miraculous destruction of the temple and statue by fire. Clement of Alexandria asserts that Bryaxis was the artist of many works ascribed to Phidias.

As to the share which Timotheus took in the decoration of the mausoleum there is dispute among the Greek authorities, some ascribing his work to Praxiteles; but there does not seem to be any just foundation for the supposition that the sculpturing on the

south side of the tomb was by any other hand than that of Timotheus. As one of the great statuaries of the later Attic school he was also among the most prominent, his figure of Artemis being deemed worthy to be placed by the side of the Apollo of Scopas, and the Latona of Praxiteles in the temple which Augustus erected to Apollo on the Palatine. Other statues of conspicuous merit are also ascribed to him by Pausanias and Pliny.

Leochares, the last of the quartette, was also inferior only to Scopas and Praxiteles in his school of art. He was particularly skilful with portrait-statues, the most successful of which were those of Philip of Macedon, Alexander his son, Amyntas, Olympias and Eurydice, all of which were made of ivory and gold, and were placed in the Phillippeion, a circular building in the Altis at Olympia, erected by Philip in celebration of his victory at Chæroneia. But the _chef d'œuvre_ of Leochares was a bronze statue of the rape of Ganymede. Pliny says of this work that the eagle seemed to be sensible of what he was carrying and to whom he was bearing the treasure, taking care not to hurt the boy through his dress with his talons. The original statue was frequently copied both in marble and on gems, several of which copies are still extant: one in the Museo Pio-Clementino, another in the library of St. Mark in Venice, and still another figures in Stuart's Athens, as an alto-relievo found among the ruins of Thessalonica.

[Illustration: Decoration]

CHAPTER VIII.

THE ALEXANDRIAN ERA AND ROMAN SPOLIATION.

That epoch in the art life of the Hellenic people associated with the influences arising out of the career and conquests of Alexander the Great, which we have now reached, was one scarcely inferior in interest to that of the time of Pericles. Overflowing as was the great Macedonian leader's love of art and great as was his ambition to leave behind him lasting monuments that should fittingly stand for the artistic culture of his time, still, for reasons arising partly out of his own career and partly from the ever-changing impulses of human feeling and taste, the art culture of his time must bow to the superiority of that of the time of Pericles, if, in respect to those other features of his leadership and accomplishment, to which history gives a superior rank, his genius is eclipsed by none in the chronicles of civilization.

Alexander's short life, so active in conquest and war, and so much of it passed away from European associations or even the influences of colonial Greece, necessarily gave him little time for indulgence in the arts at home, while it permitted him to manifest it to some considerable extent in founding cities and rearing temples in foreign lands. To this self-imposed banishment, accompanied, as it was, by large armies brought from Greece and her colonies, and the intermixing of her people with foreigners of new tastes and habits of mind, may be attributed that change of art feeling at home which began to assert itself about this time. On the other hand, however, its effect was beneficial to the conquered countries in introducing a more elevated art standard than had existed within them before.

Personally, Alexander manifested a keen appreciation of the arts; whether founded upon the same sincerity as that which appeared more natural to the character of Pericles is a question; but we find that Praxiteles, Lysippus and Apelles, the great artists of his time, were no less publicly honored or more highly flattered than were Phidias or Polycletus in the days of Pericles. It is related as an evidence of Alexander's enthusiasm for art, that he compensated Apelles for his celebrated portrait of him by ordering that the artist's reward should be _measured out in gold_ instead of being _counted_, an order which perhaps quite as much illustrated the theatrical impulses of which he could be guilty as the calm expression of a genuine appreciation.

Even had Alexander been spared, and had returned to Greece to continue a long life of usefulness to his people, instead of having been cut off in his prime at Babylon, although he might have done much more for art than he did, still he could not have accomplished for it what had been attained by Pericles. This may be argued from his birth, schooling and the stronger trend of his mind, which led in very different directions. The Macedonian had not certainly the traditions of art culture in his veins, as was the case with the more polished Athenian, and being fonder of the dazzlement of pomp and show, natural to a leader who from infancy had been almost continuously associated with the accoutrements and regalia of armies, it is not likely that whatever he might have accomplished for art more than that which he actually did, would have manifested that purity of ideal, as well as refinement of execution which so marked and dignified the work of Pericles.

As there is always some time which must elapse before the tide, having reached its flood, turns once more to slowly ebb, so was there a time to be expressed in a few years when the plastic arts of Greece, reaching their highest development in the age of Pericles, remained stationary, before ebbing away to so-called Roman degeneracy, and the mixed influence of various

comparatively uncultured nationalities.

The Alexandrian epoch marks the beginning of this turning-point. The decadence took almost as many successive generations to the time when Corinth was sacked by the Romans in 146 B.C., and the Italian soldiers cast their dice upon the pictures of Aristides, as it had taken to advance in the earlier ages of Greece, to the time when the chryselephantine statues of Zeus and Athene, by Phidias, were the recognized perfect standards of godlike majesty and beauty, and the Doryphorus of Polycletus was accepted as the criterion of human grace and proportion.

Of course the standard by which the perfection of architectural dignity and purity can be measured is largely one of individual taste and preferment, as is sometimes evidenced by the conflicting judgments of the best critical authorities, but if we accept the conclusions of centuries of the highest criticism, we must be prepared to concede that the arts to which we refer reached their zenith as stated. However, the expression, Roman degeneracy, is much too severe a one, if taken in other than a comparative sense; for, whatever Grecian architecture may have lost in ideal æstheticism by reason of Roman interference, it must be granted the Romans that their own evolution in the appreciation of the arts and the accomplishments of architecture resulted in a magnificence which, when compared with our own time, gives them rank second only to the Greeks, from whom they borrowed so much, and whom they did not scruple to rob of nearly all their portable art treasures. “Among the innumerable monuments of architecture constructed by the Romans,” says Gibbon, “how many have escaped the notice of history, how few have resisted the ravages of time and barbarism! And yet even the majestic ruins that are still scattered over Italy and the provinces would be sufficient to prove that those countries were once the seat of a polite and powerful empire. Their greatness alone or their beauty might deserve our attention; but they were rendered more interesting by two important circumstances, which connect the agreeable history of the arts with the more useful history of human manners. Many of these works were erected at private expense, and almost all were intended for public benefit.”

But the burnishing of the Romans to the high polish which they finally attained in the arts was a slow process, and one which met with many interruptions, according as their rulers were individually affected by a love of the artistic—a fact which in itself would show that art was not an inherent quality in the Roman nature to the like degree that it was in that of the Greek. To admire the Grecian æsthetic culture was at first considered an evidence of effeminacy, and even Cato exclaimed against the arts not seventeen years after the taking of Syracuse. The Consul Mummius, in 146 B.C., some hundred years later, after the battle which resulted in the capture of Corinth, proved very conclusively that he had very little appreciation of the merit of the treasures he found there, for he not only destroyed a great many, but shipped to Rome many more, for the simple reason that, recognizing how much they were prized by the Corinthians, he wisely saw that they might be useful in Rome. This sacking of Grecian cities was quite popular, and the Roman generals, in their conquests, seemed to strive which should bring away to Rome the greatest number of statues and pictures. The elder Scipio despoiled Spain and Africa, Flamius Sylla and Mummius exported shiploads of the art of Greece, Æmilius despoiled Macedonia, and Scipio the younger, when he destroyed Carthage, transferred to Rome the chief ornaments of that city.

In fact, the Roman generals were remarkable as art pilferers, using the spoils not alone to adorn their public buildings and institutions, but in some instances their private houses and palaces as well. It is related of Scaurus that he embellished his temporary theatre, erected for a few days’ use, with no less than three thousand statues. He also returned to Rome with all the pictures of Sicyon, one of the most eminent schools of painting in Greece, on a pretence that they would compensate for a debt due the Roman people. From this habit of drawing on foreigners it finally came to pass that private citizens took the fever and entered upon the luxury. None was earlier in the field than the Luculli, particularly Lucius Lucullus. Julius Cæsar was personally a great collector, his hobby being gems, while his successor, Augustus, displayed an acute interest in Corinthian vases.

Augustus did much for the architectural adornment of Rome, and his much-quoted remark to the effect that he found Rome a city of bricks and left it one of marble, was, to a great degree, true. In fact, Augustus manifested an æsthetic nature in many respects. Spence says, speaking of the arts, that “the flavor of Augustus, like a gentle dew, made them bud forth and blossom; and the sour reign of Tiberius, like a sudden frost, checked their growth, and killed all their beauties.” Men of genius were flattered, courted and enriched under Augustus, as they were some four hundred years’ earlier in Athens under Pericles, with the result that Vergil, Horace, Ovid and other poets of the greatest merit sprung forward. Rome became in this age the seat of universal government also, its wealth was enormous, its architectural decorations numerous and splendid, and even its common streets were decked with some of the finest statues in the world. Other great architectural epochs of Rome were those of the time of Trojan and Hadrian. But as evidence of the intermittent character of her art development, very little was realized, as very little could be expected under the reigns of such monsters as Tiberius, Caligula and Nero. To Nero, however, we must accord some little credit in having built a very

remarkable architectural composition, although undertaken for no public benefit, but to satisfy his own profligate vanity. His “Golden Palace,” built under the direction of the architects Celer and Severus, the most eminent of their time, was ranked as the most “stupendous” structure of its kind in all Italy. The palace was built after the conflagration during which Nero is supposed to have amused himself with a violin. Tacitus tells us that it was ornamented in every part with “pearls, gems and the most precious materials,” especially gold, which was used in reckless profusion. In the centre of a court adorned with a portico of three rows of lofty columns, each row a mile long, stood a colossal statue of that colossal sensualist and wicked monarch, which was one hundred and twenty feet in height. Vespasian tore down the whole of this piece of architectural vanity, restored the land which it had occupied and by which it was surrounded to the people from whom it had been stolen, and erected in its place the great public Coliseum and the magnificent Temple of Peace.

In alluding to the public palaces of amusement, Curio, a Roman Prætor, some few years before the Christian era, is said to have built two wooden theatres close together, which turned on pivots. During the day they were turned away from each other, and different plays were performed in each; then, with all the spectators, they were turned together, forming an amphitheatre in which combats took place. The zeal of the Roman architects to win popular favor by something novel and striking was often very great. In Pompey’s theatre water was made to run down the aisles, between the seats, in order to refresh spectators in the heat of summer.

But that the Roman architects were not always as careful in the inspection of the buildings under their supervision as they should have been, and, like some of our modern architects, permitted their works to be used when in an unsafe condition, is shown from the unfortunate catastrophe which resulted in the unexpected tumbling to pieces of the theatre of Fidenæ near Rome. This accident happened in the reign of Tiberius, and the name of the architect who suffered banishment for his neglect was Attilius. The theatre was built of wood, and out of fifty thousand people who were injured in the collapse twenty thousand are said to have died.

Of all the Roman emperors none is more interesting to the student of Grecian architecture than Hadrian, who was a great admirer of Greece, seeking to introduce the Hellenic institutions and modes of worship in Rome, as well as the art, poetry and learning of Greece. He also undertook to restore Athens, which had suffered greatly during the four or five hundred years which had elapsed between his time and that of Pericles, to something of her former architectural grandeur. Pope’s couplet might have been Hadrian’s inspiration:

“You, too, proceed! make falling arts your care, Erect new wonders and the old repair.”

Indeed, he caused to be inscribed upon the Arch of Honor, which he erected in Athens, after the restoration, two inscriptions which, if not in the best of taste, were in harmony with their author’s self-love, of which he possessed no inconsiderable share. Upon that side of the arch which faced the ancient city he wrote: “This is Athens, the old city of Theseus,” and on that which fronted upon the new city of his restoration and adornment was inscribed: “This is the city of Hadrian, and not of Theseus.” In other words, the visitor was expected to make his own comparison and perhaps draw the conclusion intimated that Theseus was not, after all, to be compared with the Roman Hadrian.

Hadrian’s particular penchant was architecture, and his predominant vices were vanity and jealousy, both of which were manifested in his practice of that art. The magnificent villa which he erected at Tiber, where he spent his declining years, and the ruins of which even now cover a space equal to a large town, would indicate this, as well as the grandiose mausoleum which towered high above the banks of the Tiber at Rome, and which is now depleted of much of its statuary and ornamentation, the Christian church of Saint Angelo. The treatment which he accorded Trajan’s great architect, the accomplished Apollodorus, is still another evidence of his vanity.

Hadrian, like Louis I. of Bavaria, found delight in practising personally the profession of architecture, and drew plans of buildings, which the people thought was unbecoming a prince. Possibly this objection was raised to discourage their ruler rather than the more truthful one that his plans were not up to the high standard of his time. However that may be, he insisted upon their being executed, and it is said was rather pleased if the architects found fault with them. But this was not the case with Apollodorus, whether because of what he had accomplished for his predecessor Trajan, or because of professional jealousy.

Apollodorus was the architect of the Trajan column, composed of only twenty-four stones, although one hundred and twenty-eight Roman feet in height, and the square which surrounded it, considered the most beautiful assemblage of buildings then known. The relief carvings which were wound spirally around the Trajan column like a ribbon, represented the incidents of the expedition against the Darians. The column supported a statue of Trajan, which Pope Sextus V. substituted for one of Saint Peter. A greater absurdity can hardly be conceived than that of placing a peaceful apostle over the warlike representations of the Dacian war.

Apollodorus was also the architect and engineer of the great bridge which stretched across the Danube in lower Hungary, which was formed of twelve piers and twenty-two arches, said to have been the grandest use of the arch in such works. Each arch was sixty feet wide and one hundred and fifty feet high. The total height of the bridge was three hundred feet and its length a mile and a half. Hadrian destroyed this magnificent work, some say through fear of its use by barbarians, others through jealousy. Perhaps the circumstances attending the death of Apollodorus would point to the second reason as the true one.

Hadrian had made the drawings of the double temple of Venus at Rome, which he submitted to Apollodorus, doubtless for his commendation rather than his criticism. The architect saw at a glance that the sitting figures of the two goddesses, Roma and Venus, which the Emperor had introduced in the little temple, were out of proportion, and so large that if they stood up they would bump their heads against the roof, if they did not take it off entirely. He called the Emperor's attention to this fact with the result that Hadrian became very angry, or pretended to be so, and Apollodorus lost his head for his frankness.

The favorite architect of Hadrian was Detrianus, to whom he entrusted many of his most important undertakings. We find that he restored the Pantheon of Agrippa, the Basilica of Neptune, the Forum of Augustus and the Baths of Agrippina. As original works he designed the Mausoleum of Hadrian, to which we have already alluded; the bridge of Ælius, ornamented with its covering of brass, and supported by its forty-two columns, terminating at the top with as many statues, and the villa at Tivoli. He also erected many structures for his royal patron in Gaul, among which was the Basilica Plotina, the most superb building in that country, and again other buildings in England. The Roman wall from Eden in Cumberland to Tyne in Northumberland, a distance of eighty miles, which was built as a defence against the Caledonians, is attributed to Detrianus. In Greece he embellished the famous temple of Jupiter Olympus, and in Palestine he rebuilt Jerusalem, erected a theatre and various pagan temples out of the stone from the Jewish temples, and completed his sacrilege there by placing a statue of Jupiter on the spot where Christ rose from the dead, and one of Venus on Mount Calvary. A feat, however, which has perpetuated his fame quite as much as any other of his professional achievements was the removing of the colossal bronze statue of Nero, which stood in the court of the "Golden Palace." This difficult task he is said to have accomplished without changing the erect posture of the huge figure, which, it will be remembered, was one hundred and twenty-eight feet high, by the assistance of twenty-four elephants.

In returning once more to the Greek architects who have been left, while a rather garrulous ramble has been made into the architectural personality of Rome, it may be well not to attempt to do so at once, but to pause for a moment, since we are so far from the chronology of our subject, while the reader makes the acquaintance of two Hellenic artists who, in the time of Quintius Metellus, 147 B.C., found professional employment in Roman territory.

Metellus was one of the first Romans to favor magnificent architecture in his home capitol, and with the booty gathered in his Macedonian campaigns he erected two temples in Rome, said to have been the first temples built of marble in that city, one of which was dedicated to Jupiter Stator, and the other to the white-armed Juno. The interiors were profusely ornamented with the works of the great Grecian masters, Praxiteles, Polycletus and Dionysius figuring largely.

The names of the architects which Metellus brought or imported from Greece for this work were Saurus and Batrachus, who may possibly have been Ionians, inasmuch as they employed the Ionic order. These temples were restored in the Corinthian style, under Augustus, two hundred years later, by Hermodorus of Salamis, who was also the architect of the temple of Mars in the Flaminian Circus.

It is told of Saurus and Batrachus that they were so much pleased with their work that they asked for no reward other than the privilege of having their names inscribed on the temples. But as this honor was denied them, they resorted to expedient to effect the same end. As the name Saurus stood for lizard and Batrachus for frog, they carved lizards and frogs on the temples, and were comparatively satisfied. A rather absurd mistake occurred in respect to these two temples after they were completed. It seems that nothing remained to be done but to add the statues of Jupiter and Juno to each respectively; but by some strange oversight the figure of Jupiter was erected in the house of Juno, and that of Juno before the shrine of Jupiter. However, as the two deities were rather closely connected by marriage, the mistake was conveniently attributed to a whim of the gods and was not remedied.

[Illustration: Decoration]

CHAPTER IX.

THE ALEXANDRIAN ARCHITECTS.

The boldest, most ingenious and original architect who found favor in the sight of Alexander the Great was undoubtedly Dinocrates, who, like his august patron, was also a Macedonian, and to whom an allusion has already been made in connection with the temple of Diana at Ephesus.

[Illustration: DINOCRATES BEFORE ALEXANDER THE GREAT.]

His very introduction into the notice and attention of his distinguished fellow-countryman would tend to prove that Dinocrates was a person of expediency, if nothing else. Let Vitruvius tell the story: “Dinocrates, the architect, relying on the powers of his skill and ingenuity, while Alexander was in the midst of his conquests, set out from Macedonia to the army, desirous of gaining the commendation of his sovereign. That his introduction to the royal presence might be facilitated, he obtained letters from his countrymen and relations to men of the first rank and nobility about the king’s person, by whom, being kindly received, he besought them to take the earliest opportunity of accomplishing his wish. They promised fairly, but were slow in performing, waiting, as they alleged, for a proper occasion. Thinking, however, that they deferred this without just grounds, he took his own course for the object he had in view. He was, I should state, a man of tall stature, pleasing countenance and altogether of dignified appearance. Trusting to the gifts with which nature had endowed him, he put off his ordinary clothing, and, having annointed himself with oil, crowned his head with a wreath of poplar, slung a lion’s skin across his left shoulder, and, carrying a large club in his right hand, he sallied forth to the royal tribunal, at a period when the king was dispensing justice.

“The novelty of his appearance excited the attention of the people, and Alexander, soon discovering with astonishment the object of their curiosity, ordered the crowd to make way for him, and demanded to know who he was. ‘A Macedonian architect,’ replied Dinocrates, ‘who suggests schemes and designs worthy your royal renown. I propose to form Mount Athos into the statue of a man holding a spacious city in his left hand and in his right a huge vase, into which shall be collected all the streams of the mountain, which shall thence be poured into the sea.’

“Alexander, delighted at the proposition, made immediate inquiry if the soil of the neighborhood were of a quality capable of yielding sufficient produce for such a state. When, however, he found that all its supplies must be furnished by sea, he thus addressed Dinocrates: ‘I admire the grand outline of your scheme, and am well pleased with it; but I am of opinion he would be much to blame who planted a colony on such a spot. For as an infant is nourished by the milk of its mother, depending thereon for its progress to maturity, so a city depends on the fertility of the country surrounding it for its riches, its strength in population, and not less for its defence against an enemy. Though your plan might be carried into execution, yet I think it impolitic. I nevertheless request your attendance upon me, that I may otherwise avail myself of your ingenuity.’ From that time Dinocrates was in constant attendance on the king, and followed him into Egypt.”

Vitruvius does not explain why it was that Dinocrates singled out the curious costume, or rather lack of costume, which he did to attract the attention of Alexander. It was, in fact, the garb of an athlete. Among the early Greeks a professional athlete was regarded as a person of social distinction, and if a particularly successful one, a personage to whom a statue might be erected, or upon whom other honors might be conferred. In fact, the uniform of an athlete was, as a rule, a passport to the best society. Dinocrates undoubtedly knew this, and as he was seeking an _entré_ into the very highest court circles, he took not an extraordinary method of gaining it.

Mount Athos, which the architect proposed to take as a basis for what was really to be a gigantic statue of Alexander himself, was a pyramidal mountain, at the extreme end of the Acte peninsula, having an altitude of 6780 feet, and crowned with a cap of white marble, which Dinocrates undoubtedly had in mind to utilize for a helmet. The country surrounding the mountain was remarkable for its rural beauty, its woods and ravines, and its people for their longevity. No wonder that Alexander did not wish to disturb this peaceful neighborhood.

Alexander Pope, who has given us an admirable rhymed translation of the songs of Homer, seems to have been greatly impressed with the practicability of this remarkable idea of Dinocrates. Spence, the author of “Polymetis,” was once discussing the incident which Vitruvius relates with Pope, remarking that he could not see how the Macedonian architect could ever have carried his proposal into execution, when Pope at once replied: “For my part, I have long since had an idea how the thing might be done; and if anybody would make me a present of a Welsh mountain and pay the workmen, I would undertake to see it executed. I have quite formed it sometimes in my imagination: the figure must be in a reclining posture, because of the hollowing that would be necessary, and for the city’s being in one hand. It should be a rude, unequal hill, and might be helped with groves of trees for the eyebrows, and a wood for the hair. The natural green turf should be left wherever it would be necessary to represent the ground he reclines

on. It should be contrived so that the true point of view should be at a considerable distance. When you are near it, it should still have the appearance of a rough mountain, but at a proper distance such a rising should be the leg, and such another an arm. It would be best if there were a river, or rather a lake, at the bottom of it, for the rivulet that came through his other hand to tumble down the hill and discharge itself into the sea."

Mrs. Baillie, in her "Tour on the Continent," has also a comment to make on this proposition of Dinocrates and recalls the fact that a somewhat similar idea was advanced to Napoleon I. "It is somewhat singular," she says, "that Mr. Pope should have thought this mad project practicable, but it appears that there are still persons who dream of such extravagant and fruitless undertakings. Some modern Dinocrates had suggested to Bonaparte to have cut from the mountain of the Simplon an immense colossal figure, as a sort of Genius of the Alps. This was to have been of such enormous size that all the passengers should have passed between its legs and arms in a zigzag direction."

Another ingenious conception is attributed to Dinocrates in respect to the temple of Diana, which he erected in the city of Alexandria for Ptolemy Philadelphus, in memory of the sister-wife of that potentate, Arsinoë. This relationship, by the way, is said to have been the first ever formed, although it became quite common later in the time of the Ptolemies. Arsinoë was much beloved by her husband, who not only called an entire district in Egypt, Arsinoites, after her, but also gave her name to several cities within his realm. Her features are still preserved to us upon coins struck in her honor, and which represent her crowned with a diadem.

When Dinocrates received the commission to erect a temple to so highly esteemed and devotedly remembered a queen, he apparently set his ingenuity to work to give birth to a novelty that should not only please the king, but astonish his subjects. It finally matured in a proposition to roof the proposed temple with loadstones, in order that they might attract into the air an iron statue of Arsinoë. As the figure of the queen would thus appear suspended in the air without any apparent mundane reason, the inference could be drawn that it was by the divine will. Some authorities say that the entire inner walls of the temple were to have been lined with loadstones, so that the statue might appear suspended in the very centre of the cell, touching nothing. Fortunately, both Dinocrates and Ptolemy died before the project could be executed, otherwise they might have been witnesses to the miserable failure such a chimerical fancy must have proved if attempted, as any modern electrician will attest.

When at Ectabana with Alexander, Dinocrates had still another opportunity to display his resourceless originality, in directing the obsequies of Hephæstion, which were of a most extraordinarily elaborate nature, costing, it is recorded, 12,000 talents, or what would be equivalent to over $1,300,000. Hephæstion was a Macedonian and a close and warm friend of Alexander, accompanying the young king in a military capacity throughout most of his early foreign campaigns. So attached was Alexander to his friend that he not only showed him many marks of his personal esteem, but bestowed upon him in marriage Drypetis, the sister of his own bride, Statira. At Ectabana Hephæstion was attacked by a fever which had a fatal termination after an illness of seven days. Alexander's grief over the loss of his brother-in-law was violent and extreme, and is said to have found vent in the most extravagant demonstrations. He ordered general mourning throughout the entire empire, and Dinocrates to build a funeral pile and monument to him in Babylon, where the body had been conveyed from Ectabana, at a cost of $1,000,000.

But the richest occasion afforded Dinocrates to display to the fullest his great talents and genius was the laying out of the city which Alexander determined to found in Egypt, and which, bearing the conqueror's name, was destined to become the centre of the commercial activity of the new empire. This great city, which rapidly grew to be one of the most populous of ancient times, and which has maintained, if not its original share of industrial supremacy, at least an important existence throughout the ages that have elapsed from its nativity to the present time, we cannot resist thinking was probably as much the inspiration of Alexander's favorite architect, realizing its professional possibilities, as it was that of Alexander himself. Pliny informs us that Dinocrates died before he could give the city the full proportions which he had planned, but not certainly until its principal features were executed.

Strabo, the "squint-eyed" geographer, gives a more circumstantial account of the planning of the new city by Dinocrates and his powerful and ambitious patron. It must have been indeed an interesting sight to see the two Macedonians upon the plane which was selected for the site of the city, laying out the streets and avenues, marking the run of the walls that were to surround it, locating the different sites where were to stand the public buildings, parks, palaces and temples, and perhaps disputing and arguing over the questions that arose, as two such dominant intellects might very naturally be supposed to do.

The basis of the plan were two main streets crossing each other at right angles, each one hundred feet wide and lined with colonnades. The other streets were to run parallel to these. Near the centre of the proposed city was to be clustered the public buildings, the Museum and the Serna, which subsequently contained an alabaster coffin in which rested the remains of Alexander.

Alabaster, which the Greeks obtained from Thebes, was much used for mortuary purposes, as well as for columns and statues.

Plutarch also describes the planning of the city as follows: “As chalk-dust was lacking, they laid out their lines on the black, loamy soil with flour, first swinging a circle to enclose a wide space, and then drawing lines as chords of the arc to complete with harmonious proportions, something like the oblong form of a soldier’s cape. While the king was congratulating himself on this plan, on a sudden a countless number of birds of various sorts flew over from the land and the lake in clouds, and, settling upon the spot, devoured in a short time all the flour, so that Alexander was much disturbed in mind at the omen involved, till the augurs restored his confidence again, telling him the city he was planning was destined to be rich in resources and a feeder of the nations of men,” a prophecy which proved its truth in the fulfilment.

Dinocrates was not, however, the only architect employed in laying out so large a city, as might naturally be supposed, although he was, of course, the governing one. How many more there were it would be difficult to say, but there is record at least of two others, both probably employed by the rapacious and unscrupulous Cleomenes, whom Alexander left in Egypt as hyparch under Ptolemy Philadelphus. Olynthius is the name given of one of these architects and Parmenion of the other. The latter was entrusted more particularly with the superintendency of the works of sculpture, especially in the temple of Serapis, which, by the way, came to be called by his name, Pharmenionis. Bryaxis is also credited with statuary work there.

Upon the island of Pharos, which was joined to the city of Alexander by a wide mole, about three-quarters of a mile long, in which were two bridges over channels communicating between the eastern and western harbors, was built by Ptolemy Soter and his son in the year 282 B.C., a most famous lighthouse and a very glorious ancestor of such guardians of the coast as exist to-day.

This lighthouse was planned by Sostratus, another remarkable character in the architectural roll of honor of those early times. He was a native of Cnidus, a town in Caria in Asia Minor, to the south of Ionia and Lydia, celebrated also as the birthplace of several other men who rose to distinction in the early days of the Greek colonies as mathematicians and astronomers. Cnidus was almost equally remarkable in its possession of two famous works of the statuary’s art: one the figure of a lion carved from a single block of Pentelic marble, ten feet long by six feet wide, which was executed to commemorate the great victory of Caria; the other a statue of Venus by Praxiteles, which occupied one of the three temples to the goddess in that city. It is said that Nicomedes of Bithynia was so fascinated by the rare beauty of this figure that he offered to liquidate the debt of Cnidus, which was by no means a small one, if the citizens would cede the statue to him. They refused, however, to part with it at any price, esteeming it one of the glories of their city. Cnidus contained many beautiful architectural monuments, the ruins of which are still prominent.

Sostratus, the architect, was the son of Dexiphanes, and must not be mistaken for any one of several other artists of the same name who are conspicuously mentioned by the early writers. His first fame was acquired through his connection with the celebrated so-called hanging gardens which he built in his native country. They consisted of a series of porticos or colonnades supporting terraces, surrounding an enclosure, possibly the Agora of the city, and served as a promenade for the inhabitants. Pliny says that Sostratus was the first to erect anything of the kind. This statement may be excused, either because the hanging gardens of Sostratus differed widely from the well-known ones of Babylon, which antedated them by several hundred years, or because Pliny forgot for a moment those of Semiramis.

Strabo, who was probably right in his judgment, thinks that the greatest of Sostratus’s works was the towering lighthouse at Pharos, which he built at a cost of about $900,000, although from its size it would seem that it should have cost more. This colossal tower at once took its place among the seven wonders of the ancient world. It pierced the sky at a height of four hundred and fifty feet, or about one hundred and seventy-five feet above the towers of the Brooklyn Bridge and fifty feet above the torch with which the Goddess of Liberty illuminates the harbor of New York. But its height alone was not more marvellous than its other proportions, which were upon a most extravagant scale. The ground story was hexagonal, the sides alternately convex and concave, and each was one-eighth of a mile in length. The second and third stories were each of the same form, although decreasing in size; the fourth was square, flanked by four round towers, and the fifth or top story was circular. A grand staircase led through each story to the roof of the building, where every night massive fires were lighted, revealing the sea for a hundred miles.

When we consider that this colossal building was made entirely of wrought stone—when we reflect upon the amount of labor involved in its construction, its ponderous size and dizzy altitude—we cannot but marvel at the extraordinary breadth of conception manifested by its architect and builders and the tenacity with which they must have held to the completion of their huge undertaking. It is not to be wondered at that when Sostratus stood off and contemplated this mighty product of his imagination and genius, after its completion, he should have been actuated with the desire to have his name associated with it for all time, and

indelibly engraved somewhere upon its imperishable stone. The story is that Sostratus engraved an inscription upon one of the stones which he afterward covered with cement, and on the cement he inscribed the name of Ptolemy, knowing that in time the cement would decay and leave exposed the hidden writing upon the stone beneath. Strabo says that the concealed inscription read: “SOSTRATUS, THE FRIEND OF KINGS, MADE ME;” but Lucien gives it differently, thus: “SOSTRATUS OF CNIDUS, THE SON OF DEXIPHANES [that he might not be mistaken for any other Sostratus, doubtless], TO THE GODS THE SAVIORS FOR THE SAFETY OF MARINERS.”

Pliny does not share the opinion that the inscription was a concealed one, but speaks of the incident as a special instance of the magnanimity of Ptolemy, that he should not only have allowed the name of the architect to be inscribed upon the building, but that he should have also left its nature and language to the discretion of Sostratus. The words “Gods the Saviors,” he believes, referred to the reigning king and queen, with their successors, who were ambitious of the title “Soteros” or Savior.

It would be unfair, perhaps, to the great Grecian architects of the time of Alexander if Andronicus Cyrrhestes were to be classed among them, and Cyrrhestes also, having been a scientific character with a leaning toward astronomy, might with some justice feel aggrieved were he to know that he was to be considered in a category of professional men to which his calling was in no degree related. Still the little building which he designed and erected in Athens is such an interesting one, and has always held so prominent a place among the architectural treasures of the Attic city, that it might be regarded as an intentional oversight to leave him out in a book of this kind. Some authorities place this building as belonging to the time of Alexander the Great, others believe that it was erected at a later period, and one writer gives Andronicus an existence as late as 100 B.C.

This building, which Delambre speaks of as “the most curious existing monument of the practical gnomonics of antiquity,” has sometimes been called the “Tower of Æolus.” Let us see what Vitruvius has to say regarding the winds and the building: “Some have chosen to reckon only four winds: the East, blowing from the equinoctial sunrise; the South, from the noonday sun; the West, from the equinoctial sun-setting; and the North, from the Polar Stars. But those who are more exact have reckoned eight winds, particularly Andronicus Cyrrhestes, who on this system erected an octagon marble tower at Athens, and on every side of the octagon he has wrought a figure in relievo, representing the wind which blew against that side; the top of this tower he finished with a conical marble, on which he placed a brazen Triton, holding a wand in his hand; this Triton is so contrived that he turns with the wind, and always stops when he directly faces it, pointing his wand over the figure of the wind at that time blowing.”

It is in connection with his allusion to the tower of Cyrrhestes, and his description of how to construct a sun-dial, that Vitruvius gives some valuable hints as to the way the ancients laid out a city so that its streets were protected from the prevailing winds. He says: “Let a marble slab be fixed level in the centre of the space enclosed by the walls, or let the ground be smoothed or levelled, so that the slab may not be necessary. In the centre of this plane, for the purpose of marking the shadow correctly, a brazen gnomon must be erected. The shadow cast by the gnomon is to be marked about the fifth ante-meridional hour, and the extreme point of the shadow accurately determined. From the central point of the space whereon the gnomon stands, as a centre, with a distance equal to the length of the shadow just observed, describe a circle. After the sun has passed the meridian watch the shadow which the gnomon continues to cast till the moment when its extremity again touches the circle which has been described. From the two points thus obtained in the circumference of the circle describe two arcs intersecting each other, and through their intersection and the centre of the circle first described draw a line to its extremity: this line will indicate the north and south points. One-sixteenth part of the circumference of the whole circle is to be set out to the right and left of the north and south points, and drawing lines from the points thus obtained to the centre of the circle, we have one-eighth part of the circumference for the region of the north, and another eighth part for the region of the south. Divide the remainders of the circumference on each side into three equal parts, and the divisions or regions of the eight winds will be obtained; then let the directions of the streets and lanes be determined by the tendency of the lines which separate the different regions of the winds. Thus will their force be broken and turned away from the houses and public ways; for if the directions of the streets be parallel to those of the winds, the latter will rush through them with greater violence, since from occupying the whole space of the surrounding country they will be forced up through a narrow pass. Streets or public ways ought therefore to be so set out that when the winds blow hard their violence may be broken against the angles of the different divisions of the city, and thus dissipated.”

This tower still stands a fairly well-preserved ruin, and retains many of its original architectural features and decorations. There are two entrances through distyle porticos, the capitals of the columns presenting an original treatment of the Corinthian order. One of these entrances is on the northeast side and the other on the southwest. On the south side is a circular apsidical projection. This was probably originally used for a reservoir to hold the water brought from the spring Clepsydra, on the northwest of the Acropolis, which was employed as the power to run a clepsydra, or water-clock, taking its name, as may be inferred, from the spring. The

remains of this clock are still visible. The exterior of the building was also arranged as a sun-clock, having lines engraved upon the different sides, with gnomons above them, forming a series of sun-dials which indicated the time by shadows. Thus were the people of Athens kept publicly posted as to the time of day—by the sun when it shone, or by the water-clock when it was obscured by clouds.

The character of the architecture, the proportions of the building, as well as its secular uses, were all quite out of harmony with Grecian art and methods, and are essentially Roman. As a similar structure existed at one time in Rome, supposed to have been built by the same scientist, the thought is naturally suggested that Cyrrhestes may have been a Roman.

In closing this reference to the prominent architects of the disintegrating period of Grecian history, it would seem that it only remains to recall Philo, or Philon, as some of the writers have preferred to call him, once more, who flourished about 318 B.C. As there were several artists of his name who became conspicuous at about the same time, our Philo will be distinguished from the others in being a native Athenian.

The reader will probably remember that he has been already mentioned as the architect employed by Demetrius Phalerus, to build a portico of twelve Doric columns to the great temple of Ceres and Proserpine at Eleusis, originally erected by Ictinus; but his most ambitious work was probably the armory, so called, which he designed for Lycurgus in the Piræus, and which it is said was large enough to contain the arms for one thousand ships. He was also engaged in enlarging the port of Piræus, and was the architect of the white marble theatre at Athens, which was finished by Ariobarzanes, and many years afterward rebuilt by Hadrian. Vitruvius says that he also designed a number of Greek temples.

Philo must have been a man of considerable versatility, for it is related that in giving an account of his work at Piræus “he expressed himself with such precision, purity and eloquence that the Athenian people—excellent judges of those matters—pronounced him equally a fluent orator and an admirable architect.” He wrote also several works on the architecture of temples and one on the naval basin which he constructed in the Athenian port.

THE END.

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Transcriber’s Notes

pg 25 Changed: The Cyclopses, who belonged to Pelasgic times to: The Cyclopes, who belonged to Pelasgic times

pg 91 Changed: breaking out of the Poloponnesian war to: breaking out of the Peloponnesian war

pg 105 Changed: Hippodamus was one of the genuises of his day to: Hippodamus was one of the geniuses of his day

pg 113 Changed: and which yas called Splanchnoptes to: and which was called Splanchnoptes

pg 161 Changed: his professional acchievements was the removing to: his professional achievements was the removing

pg 172 Changed: which the Greks obtained from Thebes to: which the Greeks obtained from Thebes

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The Truth About the Tobacco Habit

T. Swann Harding

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THE TRUTH ABOUT THE TOBACCO HABIT

A young friend of mine of the trouser-wearing male sex recently developed a pain in his stomach. He decided to wait it out. But it was an indecent as well as an insidious sort of pain and finally persisted so long that he was driven to consult a physician for moral support. The physician said, “Do you smoke?” My friend said “Yes.” The physician said, “That’s it, of course. Quit smoking. Three dollars, please.” My friend went away, quit smoking, and the pain persisted. He returned to the doctor. He was now given a little silver nitrate. He went away, but he came back again. By that time the physician was really angry. He said, “You’ve smoked yourself into a nice stomach ulcer, you have. I’ll have to operate. I hate to but I have to.” Just then buckwheat cakes and sausage made my friend violently ill one day and he deleted them from his diet. The pain left and has not yet played a return engagement. He smokes more than ever now, but he throws away longer butts.

Another friend of mine classifying in the male sex which so far tends to avoid wearing trousers--much--went to a physician. She complained of a rash which she said afflicted her all winter. Fortunately for the physician she smoked energetically. He therefore told her to quit and called the next patient. Since she knew that she smoked in summer as well as in winter she did not quit but, by chance, consulted a scientific nutrition investigator. There was no reason for this; she did it irrationally and by pure inadvertance. But he asked, “Do you eat anything in winter that you do not eat in summer?” And she at first said, “No,” because that is the most natural answer to make under the circumstances. Then later, after a half an hour’s cross-examination, she said, “Yes, oatmeal.” He said, “Try cutting that out for a while.” So she conquered this craving, but continued to smoke, and the rash departed for parts unknown. She had an idiosyncrasy for oatmeal proteins just as some people have for strawberry or egg proteins, and her rash was thus caused.

In a moment of more violent perversity I went not long ago to a lecture advocating ruthless war on tobacco. In spite of the success women have just had in smoking anti-cigarette reformers into comas, the speaker, Daniel H. Kress, M. D., was President of the Anti-Cigarette Alliance. Since he was a regular doctor in active practice I had a right to expect the presentation of a scientific case against tobacco.

This gentleman, who is personally one of the most delightful old souls in the world, actually completed his lecture without ever once citing a scientific authority, without once grounding upon irrefutable scientific fact and without departing widely from the most trivial and childish sort of argument from analogy. Thus he stated that a famous war hero did not smoke. Wilson did not smoke. Hughes does not smoke. The inmates of reform schools all smoke. Smokers are physically and mentally unsafe!

This may all be true for all I can prove to the contrary, but what of it? Many war heroes smoke. Grant certainly did. Small, defective and generally backward children normally spring from parents who underfeed them, who are themselves defective in heredity and who neglect to instruct their children in any essential matters. Can you prove that smoking alone either stunted them or put them in the reform school? You cannot. Criminals are predominantly religious according to their professions of faith. Did Christianity make them criminals? If smokers are mentally unsafe may I fervently declaim--God help research!

You hear it said that the children of smoking mothers are inferior. Are they? How can it be proven? As a matter of fact no scientific experiment could possibly be carried on to prove this, for statistics, being riddled by all sorts of idiosyncrasies and unknowns, are grossly unscientific. To prove it you might have the same mother have two children at separate times by the same father, smoking while she bore one and abstaining for the control child. But that would prove nothing. Each child is a unique individual arising from a unique chromosome mixture. The mother and father would of necessity be older in the one case than in the other. Nourishment and other environmental conditions would inevitably vary. The experiment is impossible. Yet until such an experiment becomes possible we are merely voicing opinions when we say that smoking causes inferior children. The actual cause may be any of a thousand other and extraneous factors.

When you consider how very often tobacco smoking is mentioned therapeutically and how universally it seems to be assumed that it is deleterious to health it is rather disconcerting to discover so little reliable scientific work to confirm this prevalent viewpoint. In fact practically no comprehensive, systematic work has been done by scientific research to prove that smoking is exceedingly harmful to the human system. Like so many other human preconceptions this assumption rests largely upon faith. To the acutely prejudiced non-smokers smoking seems so utterly perverse that it surely must be physically injurious.

A rational esthetic case could be made out against certain women smoking. True, the modern woman so sedulously apes the other sex that to deprive her of her cigarette is simply to deprive her gracelessly of her masculinity. We should never do that. But the spectacle of a really pretty, effeminate woman smoking is nevertheless an esthetic affront. Nothing the average man can do could make him look very much worse than he does naturally so even this slight objection does not apply bisexually.

But we have wandered, and I am of course at fault, having set out laudably to lead our thought procession. In my search of the scientific literature the nearest thing to an authority I came across was perhaps Sir Humphrey Rolleston, Baronet, K. C. B.; F. R. C. P. and M. D. of Cambridge, England, physician to King George V in his late 1928 illness. He discusses “The Medical Aspects of Tobacco” in such staid British medical journals as _The Lancet_ and _The Practitioner_. He reviews every possible lesion that might spring from tobacco smoking, and they are many--quite as many indeed as may spring from over eating artichokes or drinking three gallons of well-water daily. He sets himself flatly against animal experimentation in this matter because this cannot possibly take idiosyncrasies into account, and reminds us that humans are both highly individualized and exceedingly complex.

Rolleston then remarks that cigarettes are less invidious than pipes or cigars because cigarette smoke is more air diluted. He finds a wide diversity of opinion as to the harmfulness of tobacco; he doubts that it ever affects the nervous system greatly and believes that coffee and tea usually produce the heart symptoms attributed to smoking and that a latent venereal disease accounts for much smoker’s cancer. He doubts also that dilation of the esophagus, dilation of the stomach, acid stomach and nervous dyspepsia are often due to tobacco while he commends the mildly laxative properties of a pipe after breakfast.

Finally our baronet says, and the medical journal sustains him editorially, that in view of the universality of the habit of tobacco smoking the rarity of the organic lesions that can be traced out as undoubtedly due to that habit, beyond all question, is little less than surprising. This, I should say, is the woodpile Ethiopian. It is one thing for a physician to lean back and say cut down on tobacco, coffee, fried stuff and pastry. It is quite another for him to prove scientifically that these indulgences have undeniably caused the patient’s present low physical estate.

D. T. Barry, F. R. C. S. and M. D. of the Physiological Department, University College, Cork, is not very far off when he writes: “The physiological effects of tobacco, as our present knowledge reveals them, are not sufficiently deleterious to counter-balance the benign influence of the drug in other respects. It may be abused, of course, but so may food, and this latter form of abuse is, in my opinion, responsible for greater evils than those resulting from the abuse of tobacco.”

In this connection another authority, Armstrong-Jones, remarks that tobacco smoking in moderation is not injurious to adults but is a valuable sedative. It contributes to calm thought and efficient mental functioning. Worst of all he casually remarks that cigarette smoking, preferably without a holder, is the least injurious form of tobacco indulgence. Even allowing for the fact that the gentleman has seen some of the less comely holders I have witnessed in my time, his statements give pause.

Of course Earp’s well-known studies at Antioch College, Ohio, did indicate that non-smokers showed an intellectual superiority over smokers, but whether these things were cause and effect or mere harmless concomitants who knows? Many very eminent intellectual giants smoked excessively. Perhaps they would have achieved absolute omnipotence or omniscience had they been non-smokers. Again, who knows?

It is significant that Earp's non-smokers showed no physical superiority over his smokers; that is, it is interesting when you remember that the American university is an institution of athletic training wherein some intellectual education is offered to the feeble-bodied as a consolation prize. Intelligence tests are not affected by smoking, the non-smokers ranking just as high after smoking as before they had ever touched the vile weed. Finally, the correlation between the length of a student's indulgence in tobacco and his scholarship is so negligible as to indicate that there can be no chronic cumulative poisoning from tobacco.

Laymen do not realize how difficult it is to trace a diseased condition to a specific cause even when bacteria abound, as is not the case in smoking. For instance certain bacteria so closely resemble each other that even experts are hard put to tell them apart. Diphtheria germs possess such a dead ringer. Real diphtheria cultures were once sent out to clinical laboratories along with other cultures containing no diphtheria germs, but germs so closely resembling them that the laboratories involved returned all sorts of results. Some reported that the actual diphtheria cultures contained no diptheria germs at all; others that some of the germs simulating diphtheria in appearance were positively the real thing. So a tooth or a tonsil may contain a germ so similar to those found at the seat of secondary infection that they are indistinguishable, yet the germ may be harmless in one case and virulent in the other.

Certainly it is unlikely that we carry virulent germs about in teeth and tonsils for long years. For one thing they get acclimated to us and can change their murderous habits. For another we get used to them. This organism of ours is an hospitable sort of thing. The body tends to adjust in neighborly fashion to germs upon long acquaintance, or familiarity breeds contempt, just as it adjusts to morphine, to opium, to over-eating, to the corrosive harness oils now sold as bootleg whiskey and to tobacco, of course. Perhaps long acquaintance ripens into real friendship and mutual aid.

Nicotine is the active agent in tobacco. Mendenhall tells us that tobacco sometimes stimulates and sometimes depresses the bodily sensory mechanism, depending largely upon the state of fatigue prevalent at the moment. When stimulation occurs the effect is precisely that of a certain portion of high potential rest, for in this case, says our authority, tobacco has rested us artificially.

Certain work seems to prove quite clearly that tobacco slows down the gastric motility as well as pepsin and rennin secretion. At least it produced such results on certain individuals, although the majority of mankind may be immune for all we know. This would slow down digestion, but it takes considerable smoking to accomplish such a result even with the susceptible, and one cigarette after a meal, even a cigar, would scarcely be sufficient. It has also been stated in scientific journals that tobacco _may_ play an etiologic role in gastric neurosis, in gastritis, in ulcer and cancer of the stomach and, likewise, in mouth or throat carcinoma.

But, putting your mind rigidly to the task, can you readily think of anything from hot soup to worry that has not at some time by some person been accused of causing these conditions? Why is this? Holding a clay pipe in the mouth may cause mouth cancer; holding an ordinary pipe might; continuously holding a roughened stick there might also, with tobacco never involved. How do these anti-tobacco ideas arise?

Why are we told that so many things cause ulcer, cancer, kidney trouble, heart lesions or high blood pressure? Why are there so many theories of evolution or of creation, or of salvation for that matter? Why are there so many and such diverse theories of economic and political betterment? Why are there such varied schools of treatment often imposing diametrically opposed procedures to combat the very same maladies? Why do men differ so widely in their hypotheses about government, religion, tobacco, women? Simply because nobody as yet knows anything positively definite about these matters, and just so long as this condition of inspired ignorance persists, so long will infinitely varied opinions be inevitable.

In chemistry, in physics and in bacteriology, for instance, we do possess certain definite knowledge and we can rightfully cite certain facts. In sociology, in politics and in economics, we possess certain dogmas or beliefs and we can pardonably express certain theories or opinions--so long as we candidly admit their opinionative status. But when we get beyond a certain definite point in any science, even in physics and chemistry, we begin to hypothecate just like an economic determinist or an anti-vivisectionist or a religious fundamentalist, people who are habitually beyond this point of separating fact from belief anyway. We begin to express our opinions vociferously, to dress them up in moral overcoats, and to justify them just because we do lack certain scientific knowledge.

Thus we can go to the scientific work and find an investigator saying that very large quantities of tobacco smoke will paralyze the gastric contractile power. All right. But this very same investigator also sagely adds that small amounts of the smoke will actually stimulate this very gastric contractility and urge along digestion. Or we can go to the _Journal of the American Medical Association_, the highest current medical authority in the United States. We find a query by some doctor on cigarette smoking and

we read the reply. Authority completely absolves cigarette papers from blame for poison. It adds that any cigarette smoker is safer from harm than a tobacco smoker of any other sort. For one thing he actually smokes less tobacco. If he nervously smokes many cigarettes he throws away longer and longer unused portions and thus keeps his consumption at about the same figure.

The Laryngoscope should be an authority on throat conditions as it is the publication of throat specialists. We find in here a statement to the effect that from a medical or laryngeal point of view there is no reason why anybody should give up tobacco or alcohol if it does them no very apparent harm. This is because the use of both in moderation by millions proves the harmlessness of the habit which is, in fact, often actually beneficial.

You can go further than that. If you want to be really mean you can find an authority to state that visual acuity is increased by smoking. When non-smokers smoked for they first time they saw better than they did before smoking. The sight of habitual smokers was unaffected by an additional smoke. They had already smoked themselves into the best possible eye-sight. This may be unreliable testimony. Far be it from me to judge it. The point is that it is quite as reliable as any of the testimony advanced against the tobacco habit.

In short we are here in a region where exact scientific investigation has not yet established reliable criteria of judgment. We cannot cite irrefutable facts. We can only express opinions and opinions are usually grounded in prejudice. Physicians tend normally to prohibit, but they rarely prohibit judiciously because, under our present chaotic medical system, they cannot afford to make a sound, thorough-going clinical examination of every patient and must regard medicine as an art--_i. e._, fall back upon empiricism.

As for prejudice, it amounts to little. Cromwell and his Puritans smoked excessively. About 1840 women smoked outrageous stogies and cumbersome pipes so shamelessly that men were alarmed and vigorous caricatures satirized them in the periodicals of the day. Early in the Victorian era smoking was all but a lost art. Today it is again in ascendency, yet human depravity has remained at about one level throughout.

In an editorial upon the subject during 1925 _The Journal of the American Medical Association_ especially emphasized the fact that variations in human susceptibility and tolerance were factors as yet little understood. Extreme caution in generalization was wisely advised on such subjects as the harm inherent in tobacco smoking, and the reader was admonished that over-indulgence in turnips or parsnips, or even in water, would turn out a great deal worse than he might anticipate on immature consideration.

This factor of human individualization is rightly coming to the front in medical literature today. Advances in biological chemistry constantly attest the fact that each human individual is unique chemically. What Smith can do with impunity Jones can only do with a prospect of sudden death. This is not a superficial matter, but one deep seated in the cellular structure of the human body, a thing going back through ages of inheritance via the complex and ill-understood chromosome. More and more it is being realized that routine diets, prescriptions and prohibitions will not do in all cases--in fact are actually unsafe and dangerous in many.

For all we definitely know today with positive assurance we cannot deny the proposition that tobacco smoking is probably beneficial to many people. Not long ago everybody was urged to go in for bran because we all sadly needed roughage. Bran would cure constipation and a thousand routine diets spattered the press. It was all very well, except that constipation persisted. Today it is realized that nervous and psychic factors have much more to do with constipation than diet and the parade has set in that direction now. In fact some authorities declare that these rough diets have actually had fatal consequences in certain instances where a smooth diet was required.

But medical science really does not know sufficient about the positive, absolutely undeniable effects of tobacco smoking upon human beings to parade in any direction as yet without painful danger of finding itself hopelessly bogged in error at some date in the near future.

DEBUNKING “DENICOTINIZED” TOBACCO

Some years ago it was quite evident that the cigarette was doomed. Groups of well desiccated females, assisted by large droves of impotent he-virgins, met together, assailed the “filthy weed,” and determined to abolish it by vituperation if not by legislation. Tobacco manufacturers began to feel vague worries, some States passed anti-cigarette laws and righteousness seemed about to triumph. Then came the war!

War is a great release. We all live pretty prosaic lives. Social conventions are harsh and unless we live in Philadelphia or Chicago it is not considered courteous, much less expedient, to go out and rob, kill and commit arson. War delights in that it releases these

crude desires which seem to be suppressed and lying potentially in wait in the most sedate of us. Men were released to rob, murder and commit arson and they did it with a vim and vigor which belies the idea that we are becoming a decadent and anemic race.

At the same time war had its disadvantages. A chap needed stimulation. He needed whiskey; he needed women; he needed cigarettes. He got them all and the dear, good Christian souls applied themselves so whole-heartedly to the good work of providing needful stimulation that natural smiles began to sprout on technical virgins, liquor ceased to draw the sex line and cigarettes were actually dispensed by the hands of Christian ladies and gentlemen. The tobacco industry was saved.

After the war women decided to continue doing what they had done during the war. They decided to retain “This Freedom.” Men decided they should not retain it. The Christians decided they should not retain it. It was against ethics, morals and law. The women retained their freedom and added to it. Among other things they smoked cigarettes so indefatigably that a consumption which had commenced to decline hopped to a point of unprecedented size.

Women are like that. Men are more civilized, have more modern bodies, are younger in an evolutionary sense and respect this nonsense called law. Women are much older physiologically--phylogenetically for that matter, if you really like long words. They adopt primitive means to accomplish their ends and primitive means are always effective. When they wanted to smoke they smoked and that was that.

At the same time, however, it is vaguely interesting to many people to know whether smoking is injurious. All sorts of ills have been laid to its door. But there is this to be said in its favor. In very many people smoking is undoubtedly the percussion cap which sets in motion a train of conditioned reflexes and enables them to work efficiently.

Watson has worked on these conditioned reflexes. Let the young baby have a rat. It is not afraid and will play with it happily. But some day produce a blinding flash of light or a loud noise just as you give it the rat and you have imbedded a conditioned reflex which may last its life. It will always fear rats. Watson holds that education should address itself to the job of making our conditioned reflexes of such nature that they are helpful rather than a hindrance.

Thus a certain man cannot think unless he plays with the keys in his pocket. That is the original stimulus which sets his benign conditioned reflexes in motion. Another smokes in order to think deeply. A third smokes and finds that it is laxative. Perhaps these men cannot either think or avoid constipation unless they smoke, and the probable reason is that the act of smoking is an original stimulus which automatically sets in motion a long series of conditioned reflexes of a benign character.

Yet there are people who do not want to run any risks. They want to avoid nicotine. Perhaps it is as well that they should. They therefore buy cigarettes or cigars or tobacco which have been “denicotinized.” To what extent do they succeed in avoiding the poison then? The Connecticut Agricultural Experiment Station Bulletin 295, a prosaic scientific-looking thing, pretty well explodes the bunk of these tobaccos and it calls a spade a spade. More power to the research agencies of the U. S. A. which dare be so outspoken. A brief analysis of the results shown seems in order.

Tobaccos were analyzed for nicotine and the percentage given is in all cases on a dry basis. First tested were several common brands of cigarettes. They ran as follows in nicotine. Take your pick hereafter when you buy--

Cigarette. Percent Nicotine. Egyptian Deities 1.28 Pall Mall 1.38 Philip Morris 1.40 Lucky Strike 1.88 Camel 2.21 Old Gold 2.17 Capstan Navy Cut 2.30 Chesterfield 2.53 Piedmont 2.89

Since not even physicians have had any idea how much nicotine common brands of cigarettes carried this alone is important. Now how did the “denicotinized” cigarettes line up? They ran as follows:

“Denicotinized” Percent Cigarette. Nicotine Sano 2.32 Cestrada Virginia 2.10 Dormy Turkish 1.19 Sackett 1.02

Next I shall list the cigars and the smoking tobacco analyzed--

Normal

Reyes de Espana 1.16 Manila 1.31 Knickerbocker 1.90

“Denicotinized”

Sano 1.07 O-Nic-O .72 Sackett .67

The smoking tobaccos tested ran--

Normal

Blue Boar Pipe 1.45 Weldon Slice 1.84 Hudson Bay Imperial 1.95 Gilbert's Mixture 2.09

"Denicotinized"

Dormy Smoking 2.26 Sackett .98 O-Nic-O .97

In short, the average for all brands tested stood 1.77 percent nicotine straight and 1.28 percent still in the "denicotinized" products. Seventy-two percent of the nicotine remains behind. The process is, like the process of removing caffeine from coffees, very largely bunk but it is bunk that makes the American people spend their money, as Barnum very well knew. A person can with considerable ease select an ordinary tobacco which is so near the nicotine content of the "denicotinized" varieties that he scarcely seems justified in paying the higher prices for the treated product.

Was ever a nation so neurotic over its health as ours? European observers are constantly amazed at the imbecile delight we show in all sorts of products especially treated to make them less toxic, more digestible, less harmful and more beneficial. Just tell an American that you have vacuum treated your coffee and have thereby removed some obscure organic compounds which normally tie his stomach in knots and he will faithfully believe you and buy it. Tell him you have taken the nicotine out of his cigarette and though 72 percent of it is still there he will buy. Tell him Grapenuts make his teeth sound and he will buy. Tell him that he can improve his health by standing on his head on a cake of ice in a blast furnace while somebody shoots a stream of liquid platinum in his left ear and you will find some fool to do it in America. Why are we such damned fools? I am not going to tell you. I don't know. But we are.

IS COFFEE DRINKING HARMFUL?

It is recorded in the annals of history that a certain doctor once told a certain patient to drink no coffee. Were you, perchance, the patient? I know I was. But why did the doctor say that? Because if we stopped there would be more coffee left for him?

It is also recorded that there once lived a certain Arab whose name comes down to us as Chadely. Chadely is reputed to have been the initial coffee drinker of the world and he drank an extract of the berry to combat a continual drowsiness which prevented him from attending punctually his religious devotions! In this others of the Mohammedan faithful rapidly followed him, and the habit might well be cultivated by certain church-going Christians with sedative pastors.

Now I am one of those most unfortunate persons over whom alcohol has no appreciable authority. I confess this with shame and deep humiliation. Right in this Prohibition Era when various nondescript alcoholic beverages are held in higher esteem than ever before in our history (for does not the lowliest shellac now become a sacred and inviolate symbol of a personal liberty we would not recognize in this collectivist country if we saw it?) I can drink one, two or even three glasses of high voltage and yet remain placid, neutral, passionless, taciturn and erect in posture. So far as I am concerned even the dynamic and remorseless cocktail of these days is just so much ill-tasting liquid. Isn't this tragic?

But I would not prohibit the sale, ingurgitation or even the flagrant abuse of these curiously synthesized beverages, or even of good alcohol drinks. Not for one single prohibitive instant. For I want my coffee and some day some bluenose wowser might seek to deprive me of the cup that really cheers me. For I can arise in the morning hopeless, misanthropic, pessimistic, with a strong suicidal impulse, a feeling of uselessness and a Calvinistic conviction of sin--yet one cup of good coffee completely reverses my emotions and stirs me to optimism, confidence, cheer and incipient exaltation. I can be induced to consider new fur coats and parlor rugs.

Or again, in the evening, I may have sunk into a mental stupor, becoming in fact so definitely subhuman that I can only listen to a radio or read a newspaper--but coffee at once changes the entire universe and suffuses me with self-satisfaction, energy, will power and complacency--jostles my brain cells rudely against each other and clicks out of them what little useful information there is in them. Indeed I strongly sympathize with any dull soul who momentarily sweeps aside the stagnant miasmas of toil, monotony and misery with a swig of ethyl alcohol--in varied disguise. Insensitive to alcohol I do exactly the same thing with caffeine.

It is a most curious matter upon which to meditate. The entire universe is not something static and permanently postulated by definition. It is not even what I made it a moment ago. It is what coffee makes me and makes me make it at this moment. Leaving

my entire environment, debts and all, and my complete mental and somatic equipment _in statu quo_ one dash of caffeine completely reorganizes the universe for me and as completely modifies my reaction thereto. The final test in any scientific experiment takes place when one variable factor accomplishes such results while all other factors remain completely unaltered. I know my coffee.

But of course this is a world wherein doctors sound solemn tocsins to pleasure. You go to them and they almost invariably admonish you to quit smoking tobacco and drinking coffee, to have your teeth pulled and your tonsils uprooted. Some years ago I myself suffered from chronic indigestion. I was on a meticulous diet which lacked meat and coffee and I was about ready to accuse coffee alone of all my indispositions. But I met a hardy old codger of eighty who drank eight cups of strong coffee daily and had but recently reduced his consumption from a normal dozen and his vigor, which he attributed to seventy years of strong coffee, greatly heartened me. I knew what the doctor would say. I didn't smoke. Teeth and coffee alone were left. So I went soberly to the expert in exodontia.

He at first demurred and insisted that I had no teeth meriting destruction. But I was desperate. I insisted. So he X-rayed around, finally selected an inoffensive and courteous molar and drew it. The shock or something proved beneficial. At least I had no more indigestion and even learned how to drink two cups of strong coffee and go to sleep on the draft. This is the final step in expert coffee drinking. When you can perform that feat and outwit your imagination you have come into the inner circle of The Sacred Coffee Drinkers' Conclave.

But I remained curious. I wondered why doctors said drink no coffee. I determined to find out something about this. Botany didn't get me very far. It simply declared "Coffee is the product of a rubiaceous plant indigenous to Abyssinia of the _genus_ coffea; there are about twenty-five known species, of which coffea Arabica is the most important commercially."

History was slightly more productive. It appeared coffee drinking was of respectable age and that the substance derived its name from K'hawah, or Kaffa, an Abyssinian Province, and that there it was employed as a stimulant for centuries before its introduction into Arabia. The Arab physician Khayes, who lived 850-922 A. D., wrote on coffee and knowledge of the plant arrived in Europe by the late sixteenth century. It is most interesting to remember that these Arabian Mohammedans used coffee as an anti-soporific during prolonged religious ceremonies. Yet the beverage at first underwent violent protest because strictly orthodox and conservative priests held it to be intoxicating and hence under the ban of the Koran.

At Constantinople certain dervishes also held that after roasting coffee had become a kind of coal which the Prophet had denounced as inedible. Thereupon the coffee houses were closed. But a lenient mufti later proved to the satisfaction of the faithful that roasted coffee was not coal and they were reopened.

The earliest European coffee houses were established, in fact, in Constantinople and in Venice. The first one appeared in England in 1650; out of it grew the Oxford Coffee Club in 1655 and from that sprang the Royal Society itself. But alas, convivial gatherings at coffee houses became of ill repute; wives complained they could not expect their husbands back from errands because they would loiter in coffee houses and kings declared that their subjects met at coffee houses, became garrulous and bespoke political rebellion. The current Volstead, Charles II, therefore, sought to suppress coffee drinking, but evidently Anglo-Saxons valued their liberties more then than now for the King had little success. Frederick the Great, fearing coffee drinking for the more thrifty reason that it caused too much money to leave his domain, boldly attributed sterility to indulgence in the berry and sought to restrict the use of coffee by a license system.

The medical profession came forward to denounce coffee for all sorts of sins. The English Dr. Pecoke accused it of causing leprosy. Dr. Duncan of Montpellier in 1706 wrote in opposition to all hot beverages while James the I actually composed a royal "Broadside Against Coffee." The kingly book contained this gem--

Confusion huddles all into one scene, Like Noah's arks, the clean and the unclean, For now, alas! the drink has credit got, And he's no gentleman who drinks it not.

Millingen in his "Curiosities of Medical Experiences," 1837, said that coffee in excess produced "feverish heat and a predisposition to apoplexy." But he did commend coffee and tea as beverages affording stimulus without producing intoxication. Francis Bacon declared that "coffee comforteth the heart and helpeth digestion" while Bach, to offset this, wrote his Cantata No. 211 of the "Secular Cantatas" to protest its use.

In 1792 Dr. Benjamin Moseley said doubt existed as to whether coffee was a tonic or a sedative, but believed that it had intrinsic food value. Every now and then individuals arise to denounce or to praise an article of diet or a diet system and to declare that all men should hear and follow because this idea was of benefit to them. Such statements can have no standing in science, even when made by a doctor and based upon his actual experiences with a few patients. The only possible way to find out whether coffee, say, is beneficial, or the reverse is to investigate the literature and try to poll the authorities each one of whom has examined large numbers of individual cases to see if any general statements can be hazarded. Even then we cannot make final conclusions but we can assay general trends.

Is coffee harmful then? What do physiologists, pharmacologists and medical men say? Coffee demonstrably enlivens the intellect, removes the sensation of fatigue and makes the subject feel more comfortable. These are gifts not to be sniffed out of court. But is coffee safe and harmless enough that we may dare indulge ourselves in this pleasant reaction in a world where the pleasant is so readily assumed to be _per se_ the invidious--and so often is actually so? The question is in dispute like most questions considered settled by many people. There is no more reason to conclude one way than the other in so far as average adults are concerned. All who say dogmatically “No coffee--it is very harmful” are as wrong as all who state the opposite of this.

In his “Personal and Community Health” C. E. Turner says coffee is not harmful to most adults in reasonable quantities. G. N. Stewart’s “Physiology” remarks that tea and coffee are safe stimulants because they have no bad after effects. Stewart also cautions against their abuse, but it may as well be stated at once that the question of abuse introduces an altogether new factor. Water and salt are absolutely necessary to life but the abuse of either is injurious. We can produce true water intoxications and salt eaten to excess can do us much harm. All articles of diet from parsnips and lamb chops to caffeine and alcohol can harm if abused and we should assume when speaking of them a sane, rational use and regard abuse as a harmful condition of a different order altogether.

As C. E. A. Winslow well says in his “Healthy Living”--“The fact that tea and coffee sometimes become tyrants does not mean that such drinks are necessarily bad.”

In one thing medical authorities do agree, however, coffee and tea are not beverages for children. Moralists to the contrary notwithstanding, this is again beside the point when we are considering the reasonable use of coffee by adults. Adults and children are essentially different animals using their food intake differently--the one for upkeep and repair the other for new construction as well as upkeep and repair. They differ basically in metabolism. They have different metabolic rates and different expenditures of energy. The child is turning food into flesh and bone and blood at a much greater rate than a fully-grown adult organism is ever required to do. Diets which would amply sustain an adult may easily be detrimental to or deficient for young and growing children. We shall, then, restrict ourselves herein to the rational use of coffee by average adults. What can coffee, or its active principle caffeine, do to harm adults?

Caffeine definitely increases the force of the heart beat. Yet Wood, “Notice of Judgment Under the Food and Drugs Act No. 1455 1912,” says such an effect may be desirable since a slower rate and increased force induce cardiac efficiency. Heavy coffee drinking may produce a frequent, hard pulse and palpitations, but this again goes over into the territory of abuse.

Coffee tends both to dilate the vascular system and to constrict it, the net result being a mass movement of the blood without increased blood pressure. Coffee has repeatedly been suspected of damage to the heart and blood vessels but such suspicions are common in therapy and evidence is entirely lacking to prove this point scientifically. Suspicion is here probably no more legitimate than in many lay superstitions. While patients with definite heart trouble should avoid all stimulants the normal use of coffee by an adult cannot be said to have an insidious effect upon the heart and blood vessels.

While coffee is a diuretic it cannot be convicted of renal injury as yet. Indeed it is quite probable that the kidneys become accustomed to caffeine while A. R. Cushny (J. Pharmacol. & Experimental Therapy 4 363) declares that caffeine does not injure the kidneys even when given in large dosage over long periods.

But how about digestion? Years ago Fraser (J. of Anatomy & Physiology 184 13 1883) said that coffee and tea hindered the digestion of protein foodstuffs with the exception of ham and eggs! This very fortunate immunity renders the typical American dish a safe breakfast in any case. In general, however, observations _in vivo_ indicate that the amounts of the beverage usually taken have no evil effects upon digestion. Indeed some investigators have found a pronounced increase in gastric secretion following tea and coffee.

Hutchinson in his “Food and Dietetics” says that the digestive disturbance caused by such infused beverages is negligible in health. Others have held that the aromatic constituents of coffee, or the “empyreumatic oil,” upset digestion. There may be some reason for this; at least certain individuals tolerate much better coffee from which these substances have been removed.

Caffeine is of course a stimulant to the central nervous system, particularly that part of it intimately associated with the gastric function. How far is its use as such a cerebral stimulant advisable? Like all stimulants this will result in greater fatigue on excessive usage. But as “The Medical Review of Reviews” once said, “When tea and coffee are made moderate in strength and partaken of in sober quantities they are gentle stimulants and their effect upon the nervous system is salutary.” A too constant reliance on coffee as a goad may of course result in nervous irritability.

Coffee speeds up the metabolism, increases the body heat and heat elimination, and perhaps urges us on to greater activity. But, as the English pharmacologist Dixon remarks in his “Manual of Pharmacology,” “Caffeine decidedly facilitates the performance of all forms of physical work.” Yet certain athletes are reported to have had their performances injured by coffee drinking, while Osborn holds that coffee interferes with the best muscular efforts. Take Hobson’s choice here, you have an authority either way and we do love some one to give our opinions an affidavit. It may be observed that coffee also increases the rate and depth of our respiration.

The following gracefully and euphoniously named aromatics have been found in roasted coffee--pyrol, quinol, methylamin, acetone, furfuryl alcohol, a derivative of saligenin, phenols, valeric acid, pyridin and trimethylamin. You are no doubt much surprised and edified to know that. Some of these compounds are toxic, but they occur in coffee in amounts far too small to be dangerous to health. Some have accused these formidably named derivatives of bad effects but the work existing shows caffeine to be the only coffee constituent of importance in its physiological effects. It is agreed that caffeine is very rapidly changed by the body into less active substances and disposed of, so there can be no cumulative effect even of that. In old age, as in youth, coffee, like other stimulants, should be used in moderation if at all.

As a whole then what can we conclude about the use of coffee by adults? Science has not found it harmful when taken in non-excessive amounts. Heart patients, neurotics, the young and the aged should avoid it. It has not been proven to cause pathological changes in the heart, blood vessels or kidneys. It is a valuable cerebral stimulant and antidote for mental fatigue, lacking as it does the bad effects of most stimulants. It also stimulates respiration and speeds up the metabolism, while its effects on digestion cannot be said to be definitely deleterious. Tea, because of its tannin content, is probably worse than coffee gastrically. Finally caffeine is rapidly oxidized and has no cumulative poisonous effect.

Most important of all we must remember that individuals differ. They are constructed of different proteins and have cellular and glandular processes differing from individual to individual. What one can do with impunity another will find bringing him nearer to the undertaker daily. In this as in all other matters dietetic common sense and sound judgment in appraising our own state of health and the reactions of our organism to various stimuli will always surpass slavish subservience to systems or morbid efforts to avoid all harm and achieve an impossible all good.

Then if we are to drink coffee let us consider momentarily how best to make it. One basic fact stands out--freshly ground coffee is best. Ground coffee loses its flavor on standing. It also loses its content of carbon dioxide. These two factors are definitely related but exactly how and why we do not know.

In considering coffee-making precise scientific methods are everything. Our mothers, more energetic than the decadent women of today, made their own bread. They often appraised various flours by such rude methods and declared this brand better than that. How much could they have known about it? Did they keep every factor constant except the flour when making their tests? You know they did not.

Go into the laboratory in the U. S. Bureau of Chemistry, where flour bought by the government is tested, and what do you see? You see an apparatus enabling the investigator to make bread from that flour holding every factor constant except the flour. All other materials used are precisely the same and all materials are carefully weighed. The dough is kneaded mechanically and timed exactly. Fermentation takes place in a cabinet at a constant temperature and for a definite time for all loaves. The same holds for the time and temperature of baking. The loaves are cooled just alike on wire meshes for the same time. They are weighed and their volumes measured. Then the investigator positively knows which flour makes the best loaf of bread and the government buys that flour for its hospitals and penitentiaries.

It is exactly the same with coffee. To test coffees they must be infused in very precise ways. How is it done? In the first place pulverized coffee must pass a 30 mesh sieve and be like fine cornmeal, medium ground coffee must pass a 10 mesh sieve and be like steel cut; coarsely ground coffee must pass an 8 mesh sieve and appear like the rude, home ground bean of our childhood.

Then boiling, boiling with egg, percolation and filtration must be tried on each by precise methods. A 40c. Mocha-Java coffee may be used with 12 grams of coffee and 240 cc. of water, except in the case of percolation which requires 480 cubic centimeters of water for 12 grams of coffee. In boiling with egg 10 grams of egg white were added. The infusion must be governed precisely.

Boiling takes place in a seamless white enamel pot, cold water being poured over the coffee, the whole brought to a boil and boiling continued for three minutes; the infusion then stood five minutes and was ready. It was strained through cheese cloth. Percolation was carried out in the usual manner with an ordinary percolator, the water being cold at the start and boiling being continued for five minutes. In filtration a wire strainer was put across the top of the pot covered with a piece of tennis flannel upon which the coffee lay. Boiling water was poured through once.

The brews were tested hot, for strength, color, and flavor by various people who did not know the methods of preparation. Six degrees of strength were observed with specific gravities of the brew by test as shown in the table--

Very weak 1.0045 Specific Gravity Weak 1.0055 Specific Gravity Moderately strong 1.0060 Specific Gravity Standard 1.0065 Specific Gravity A little too strong 1.0070 Specific Gravity Much too strong 1.0080 Specific Gravity

The specific gravity was taken on the cold brew and a standard, 1.0065 was selected for further tests. The following table indicating condition of coffee, method of brew, weight of coffee used and cost per cup is of considerable interest--

S. G. 1.0065 Cost Condition Method Weight Coffee per cup of infusion Grams cents

Pulverized Boiling 12.05 .63 Pulverized Percolated 12.78 .71 Pulverized Boiled with egg 12.85 1.05 Pulverized Filtered 12.31 .72 Medium Boiling 15.89 .83 Medium Percolated 22.94 1.29 Medium Boiled with egg 16.71 1.29 Medium Filtered 30.00 1.73 Coarse Boiling 19.79 1.03 Coarse Percolated 27.52 1.54 Coarse Boiled with egg 21.27 1.56

Hence it is apparent that pulverizing is the most efficient method of grinding. The best brew is made by filtration. Boiling with egg is second best while plain boiling and percolation are the poorest of all. In general, strength and color of the brew are quite independent of the blend and price but depend upon the grind. The flavor, however, varies markedly with the coffee brand and price. Java, Sumatra and Bogota give weaker infusions under the same conditions than do Mocha and Santos. The order of preference for flavor stood--Java, Sumatra, Santos, Bogota and Mocha. It was also observed that coffee which had stood long after grinding gave an infusion of a lower specific gravity and hence of impaired strength.

The effect of adding sugar and cream to coffee is not well understood. Some assert that the fat of cream and the fats of the coffee bean form indigestible compounds, but there is scarcely sufficient experimental evidence to justify this. The tannin compounds in coffee are apparently not precipitated, as has frequently been stated, by the addition of sugar and cream. Testing a centrifuged cream from a beverage coffee gave no appreciable evidence of tannin while the remaining coffee infusion gave the normal positive tests for tannin. It is certainly true, however, according to one authority that black coffee without any additional substances, with the possible exception of a portion of sugar, is the most beneficial form of the beverage.

Transcriber’s Note:

Words and phrases in italics are surrounded by underscores, _like this_; those in bold are surrounded by equal signs, =like this=. Obvious printing errors, such as partially printed letters and punctuation, were corrected. Three misspelled words were corrected.

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The magic lantern and its management

comte Th. Du Moncel

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Transcriber’s Note: Italics are enclosed in _underscores_. Additional notes will be found near the end of this ebook.

THE TELEPHONE, MICROPHONE, & PHONOGRAPH

THE TELEPHONE THE MICROPHONE & THE PHONOGRAPH

BY COUNT DU MONCEL

MEMBRE DE L’INSTITUT

AUTHORISED TRANSLATION WITH ADDITIONS AND CORRECTIONS BY THE AUTHOR

WITH 70 ILLUSTRATIONS ON WOOD

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THE TELEPHONE,

_&c._

HISTORY OF THE TELEPHONE.

Strictly speaking, the telephone is merely an instrument adapted for the transmission of sound to a distance, and this idea of transmitting sound is as old as the world itself. The Greeks made use of means which might effect it, and there is no doubt that these means were sometimes used for the pagan oracles. But such transmission of sound was within somewhat narrow limits, and certainly did not exceed those of a speaking-tube. Mr. Preece considers that the earliest document in which this transmission of sound to a distance is distinctly formulated, dates from 1667: he refers to a paper by one Robert Hooke, who writes to this effect: ‘It is not impossible to hear a whisper at a furlong’s distance, it having been already done; and perhaps the nature of the thing would not make it more impossible, though that furlong should be ten times multiply’d. And though some famous authors have affirm’d it impossible to hear through the thinnest plate of Muscovy glass; yet I know a way, by which ’tis easie enough to hear one speak through a wall a yard thick. It has not yet been thoroughly examin’d how far otacousticons may be improv’d, nor what other wayes there may be of quickning our hearing, or conveying sound through other bodies than the air; for that is not the only medium I can assure the reader, that I have, by the help of a distended wire, propagated the sound to a very considerable distance in an instant, or with as seemingly quick a motion as that of light, at least incomparably quicker than that which at the same time was propagated through the air; and this not only in a straight line or direct, but in one bended in many angles.’

This plan for the transmission of sound is the principle of the string telephones which have attracted attention for some years, and it remained in the stage of simple experiment until 1819, when Sir Charles Wheatstone applied it to his magic lyre. In this instrument, sounds were transmitted through a long strip of deal, with one end in connection with a sounding board: one step more led to the use of the membrane employed in string telephones. It would be difficult to say with whom this idea originated, since it is claimed, as if beyond dispute, by several telephone-makers. If we may believe some travellers, it has long been used in Spain for the correspondence of lovers. However this may be, it was not to be found among the scientific appliances of some years ago, and it was even supposed by many persons that the cord consisted of an acoustic tube of slender diameter. Although the instrument has become a child's toy, it has great scientific importance, for it proves that vibrations capable of reproducing speech may be extremely minute, since they can be mechanically transmitted more than a hundred yards.

From the telegraphic point of view, however, the problem of transmitting sounds to a distance was far from being solved in this way, and the idea of applying electricity to this mode of transmission naturally arose as soon as the wonderful effects of electric telegraphy were observed, that is, in the years subsequent to 1839. A surprising discovery made in America by Mr. Page, in 1837, and afterwards investigated by MM. Wertheim, De la Rive, and others, must also have led up to it: for it was observed that a magnetic bar could emit sounds when rapidly magnetised and demagnetised, and these sounds corresponded with the number of currents which produced them. Again, the electric vibrators devised by MM. Macaulay, Wagner, Neef, etc., and adapted to produce musical sounds, between 1847–1852, by MM. Froment and Pétrina, showed that the problem of transmitting sounds to a distance was not insoluble. Yet, up to 1854, no one had ventured to admit the possibility of transmitting speech by electricity, and when M. Charles Bourseul published in that year a paper on the electric transmission of speech, the idea was regarded as a fanciful dream. I confess that I myself thought it incredible, and when I produced the paper in the first edition of my account of the applications of electricity, published in 1854, I felt bound to add that the scheme seemed more than doubtful. Yet, as the paper was thoughtfully written, I had no hesitation in publishing it, affixing the signature of CH. B. Events justified this daring idea, and although it did not include the only principle which could lead to the reproduction of articulate sounds, yet it was the germ of the fertile invention which has made the names of Graham Bell and Elisha Gray famous. For this reason I will again quote M. Charles Bourseul's paper.

'After the telegraphic marvels which can reproduce at a distance hand-writings, or even more or less complicated drawings, it may appear impossible to penetrate further into the region of the marvellous. Yet we will try to advance a few steps further. I have, for example, asked myself whether speech itself may not be transmitted by electricity--in a word, if what is spoken in Vienna may not be heard in Paris. The thing is practicable in this way:--

'We know that sounds are made by vibrations, and are adapted to the ear by the same vibrations which are reproduced by the intervening medium. But the intensity of the vibrations diminishes very rapidly with the distance: so that it is, even with the aid of speaking-tubes and trumpets, impossible to exceed somewhat narrow limits. Suppose that a man speaks near a moveable disk, sufficiently flexible to lose none of the vibrations of the voice, that this disk alternately makes and breaks the currents from a battery: you may have at a distance another disk, which will simultaneously execute the same vibrations.

'It is true that the intensity of the sounds produced will be variable at the point of departure, at which the disk vibrates by means of the voice, and constant at the point of arrival, where it vibrates by means of electricity; but it has been shown that this does not change the sounds. It is, moreover, evident that the sounds will be reproduced at the same pitch.

'The present state of acoustic science does not permit us to declare _à priori_ if this will be precisely the case with syllables uttered by the human voice. The mode in which these syllables are produced has not yet been sufficiently investigated. It is true that we know that some are uttered by the teeth, others by the lips, and so on; but this is all.

'However this may be, observe that the syllables can only reproduce upon the sense of hearing the vibrations of the intervening medium: reproduce precisely these vibrations, and you will reproduce precisely these syllables.

'It is, at all events, impossible in the present condition of science to prove the impossibility of transmitting sound by electricity. Everything tends to show, on the contrary, that there is such a possibility. When the application of electro-magnetism to the transmission of messages was first discussed, a man of great scientific attainments treated the idea as utopian, and yet there is now direct communication between London and Vienna by means of a simple wire. Men declared it to be impossible, but so it is.

'It need not be said that numerous applications of the highest importance will immediately arise from the transmission of speech by electricity. Any one who is not deaf and dumb may use this mode of transmission, which would require no apparatus, except an electric battery, two vibrating disks, and a wire. In many cases, as for example in large establishments, orders might be transmitted

in this way, although transmission by electricity will not be used while it is necessary to go from letter to letter, and to make use of telegraphs which require use and apprenticeship. However this may be, it is certain that in a more or less distant future, speech will be transmitted by electricity. _I have made some experiments in this direction_: they are delicate, and demand time and patience, but _the approximations obtained_ promise a favourable result.'

This description is certainly not full enough to enable us to discern from it the arrangement which would lead to the solution of the problem, and if the vibrations of the disk at the receiving station were to follow from making and breaking the current at the sending-station, under the influence of vibrations caused by the voice, they would only produce musical, and not articulate sounds. Yet the idea was magnificent, as Mr. Preece said, even when he thought it impossible to realise it. Besides, it is easy to see that M. Bourseul himself was not deceived as to the difficulties of the problem, as far as articulate sounds are concerned, for he points out, as we have seen, the difference existing between the simple vibrations which produce musical sounds, and the complex vibrations which cause articulate sounds; but, as he justly said: 'Reproduce at the one end of the line the vibrations of air caused at the other, and speech will be transmitted, however complex the mechanism may be by which it is effected.' We shall presently see how the problem was solved, and it is probable that some attempts had already enabled M. Bourseul to anticipate the solution of the question; but there is nothing in his paper to show what were the means he proposed, so that the discovery of the electric transmission of speech cannot reasonably be ascribed to him, and we do not understand why we should be reproached for having at that time failed to appreciate the importance of a discovery which seemed to be then only within the range of fancy.

It was not until 1876 that the problem of the electric transmission of speech was finally solved, and the discovery has lately given rise to an interesting controversy as to priority between Mr. Elisha Gray, of Chicago, and Mr. Graham Bell, on which we must say a few words.

As early as 1874 Mr. Elisha Gray was occupied with a system of musical telephone, which he wished to apply to manifold telegraphic transmissions, and the investigations which he made, in order to establish this system under the best possible conditions, gave him a glimpse of the possibility of transmitting articulate words by electricity. While carrying on his experiments on the telegraphic system, he arranged in fact, about the 15th January, 1876, a system of _speaking telephone_, and he deposited the specification and drawings in the American Patent Office, in the form of a _caveat_ or provisional specification. The deposit was made on the 14th February, 1876: on the very same day, Mr. Graham Bell also deposited, in the American Patent Office, a request for a patent in which he spoke of an instrument of the same kind, but with special application to simultaneous telegraphic transmissions by means of a telephonic apparatus; and the few words which could, in this specification, refer to a telephone with articulate sounds, applied to an instrument which, by Mr. Bell's own admission, had not produced any satisfactory results. In Mr. Gray's _caveat_, on the contrary, the application of the instrument to the electric transmission of speech alone is indicated, the description of the system is complete, and the drawings which accompany it are so exact, that a telephone made from them would work perfectly: this was proved by Mr. Gray himself, when, some time afterwards, he finished his instruments, which differed in no respect from the one described in Mr. Bell's statement as worked by a battery. On these grounds Mr. Elisha Gray would certainly have obtained the patent, if the expiration of his _caveat_ had not been the result of an omission of form in the Patent Office, which, as we know, decides the priority of inventions in America. An action on the ground of this omission has lately been brought against Mr. Bell, in the Supreme Court of the American Patent Office, to set aside the patent granted to him. If Mr. Gray did not appeal before, it was because he was then wholly occupied with experiments on the system of harmonic telephone, applied to telegraphic communication, and he had no time to attend to the matter.

However this may be, Mr. Bell did not begin to give serious attention to the speaking telephone until he had obtained his patent, and his efforts were soon crowned with success: a few months later, he exhibited his speaking telephone at Philadelphia, which has from that time attracted so much public attention, and which, when perfected in a practical point of view, reached Europe in the autumn of 1877 under the form we know.

To complete this summary account of the telephone, we ought to say that since its success a good many claims of priority have arisen, as if by enchantment. Mr. John Camack, of English origin, has among others claimed the invention of the telephone, not merely relying on the description he gave of the instrument in 1865, but on the drawings he executed; he even adds, that if he had not lacked means for its construction, this would have been the date of the discovery of the telephone. A similar pretension has been put forward by Mr. Dolbear, a fellow countryman of Mr. Bell, of whose claim we shall speak presently.

Signor Manzetti, of Aosta, says the same thing, asserting that his telephonic invention was described in several newspapers of 1865, among others in 'Le Petit Journal,' of Paris, on the 22nd November, 1865; 'Il Diritto' at Rome, 16th July, 1865; 'L'Echo

d’Italia,’ New York, 9th August, 1865; ‘L’Italia,’ Florence, 10th August, 1865; ‘La Comuna d’Italia,’ Genoa, 1st December, 1865; ‘La Verità,’ Novara, 4th January, 1866; ‘Il Commercio,’ Genoa, 6th January, 1866. It is true that no description of the system was given, and that the journals in question only asserted that experiments had been made, which proved that the practical solution of the problem of transmitting speech by electricity became possible by this system. At any rate M. Charles Bourseul must still have the credit of the priority of the idea, and, in our opinion, all claims made after the fact only merit slight consideration.

Before considering Bell’s telephone, and the different modifications which have been applied to it, it seems worth while, in order to make the reader perfectly familiar with these kinds of instruments, to study the electro-musical telephones which preceded it, and especially that of M. Reiss, which was made in 1860, and became the starting point of all the others. We shall find that these instruments have very important applications, and that telegraphy will probably be one day much advanced by their use.

MUSICAL TELEPHONES.

Telephone of M. Reiss.--This telephone is, as far as the reproduction of sound is concerned, based upon Mr. Page’s discoveries in 1837, and, as regards electric transmission, it is based on the vibrating membrane of which Mr. L. Scott made use in his phonautograph, in 1855. This instrument is composed, like telegraphic systems, of two distinct parts, a sender and a receiver, as represented in fig. 1.

[Illustration: FIG. 1.]

The sender was virtually composed of a sounding box K, having on its upper surface a large circular opening, across which a membrane was stretched, and in its centre there was fitted a thin disk of platinum _o_, above which a metallic point _c_ was fixed, and this, together with the disk, constituted the contact-breaker. On one face of the sounding-box K, there was a sort of speaking-tube, for the purpose of collecting the sound, and directing it to the interior of the box, in order that it might then react upon the membrane. Part of the box K is broken away in the plate, in order that the different parts of which it is made may be seen.

The rods _a_, _c_, which support the platinum point _b_, are in metallic contact with a Morse key _t_, placed on the side of the box K, and with an electro-magnet A, which belongs to a telegraphic system, intended to exchange the signals required to start the action of the two instruments at their respective stations.

The receiver consists of a sounding-box B, on which rest two supports _d_, _d_, bearing an iron rod of the thickness of a knitting needle. An induction coil of insulated wire _g_ is wound round this rod, and the whole is enclosed by the lid D, which concentrates the sound already increased by the sounding-box: for this purpose the box is provided with two openings below the coil.

The circuit is completed through the primary of this coil by the two terminals 3 and 4, and a Morse key _t_ is placed at the side of box B, in order to exchange signals.

In order to work this system, the speaking instrument should be placed before the opening T, and this instrument may be a flute, a violin, or even the human voice. The vibrations of air occasioned by these instruments cause the telephonic membrane to vibrate in unison, and the latter, rapidly moving the platinum disk _o_ to and from the point _b_, causes a series of breaks in the current, which are repeated in the iron wire _d d_, and transformed into metallic vibrations, of which the number is equal to that of the sounds successively produced.

According to this mode of action, the possibility of transmitting sounds with their relative value becomes intelligible: but it is equally clear that sounds thus transmitted will not have the _timbre_ of those which produce them, since the _timbre_ is independent of the number of vibrations, and it must be added that the sounds produced by M. Reiss’s instrument were as shrill as those of a child’s penny trumpet, and by no means attractive. The problem of transmitting musical sounds by electricity was, however, really solved, and it can be said with truth that an air or a melody could be heard at any given distance.

The invention of this telephone dates, as we have seen, from 1860, and Professor Heisler speaks of it in his treatise of technical physics, published at Vienna in 1866; he even asserts, in the article which he devotes to the subject, that although the instrument was still in its infancy, it was capable of transmitting vocal melodies, and not merely musical sounds. The system was afterwards perfected by M. Van der Weyde, who, after reading the account published by M. Heisler, sought to make the box of the sender more sonorous, and to strengthen the sounds produced by the receiver. He writes as follows in the ‘American Scientific Journal:’

‘In 1868, I caused two telephones to be made, similar to those I have described, and I exhibited them at a meeting of the Polytechnic Club of the American Institute. The transmitted sounds were produced at the farthest extremity of the Cooper Institute, quite outside the hall in which the audience sat: the receiver was placed on a table in the hall itself. The vocal airs were faithfully reproduced, but the sound was rather weak and nasal. I then tried to improve the instrument, and I first obtained stronger vibrations in the box K by causing reverberation from the sides of the box, by means of hollow partitions. I next intensified the sounds produced by the receiver, by introducing several iron wires into the coil, instead of one. These improvements were submitted to the meeting of the American Association for the Advancement of Science, which was held in 1869, and it was considered that the invention contained the germ of a new method of telegraphic transmission which might lead to important results.’ This opinion was soon afterwards justified by the discoveries of Bell and Elisha Gray.

Messrs. Cecil and Leonard Wray’s Telephone.--This system, represented in figs. 2 and 3, is simply an improvement on that of M. Reiss, with the object of intensifying the effects produced. The sender is provided with two membranes, instead of one; and its receiver, instead of being formed of a single iron wire covered with a magnetising coil, is composed of two distinct coils H, H′ (fig. 2), placed in the same straight line, and within which are two iron rods. These rods are fastened by one of their ends to two copper disks A, B; these disks are maintained in a fixed position by screws I, I′, and the two other extremities of the rods, between the coils, are opposite each other, not touching, but divided by a very small interval. The instrument is set upon a sounding-box, in which there is a hole T in the space corresponding to the interval between the coils: these coils communicate with four terminals, which are connected with the electric current in such a way that the adjacent poles of the two rods are of opposite polarity, thus forming a single magnet, divided in the centre. It seems that by this arrangement the sound produced becomes much more distinct.

[Illustration: FIG. 2.]

[Illustration: FIG. 3.]

The form of the sender also is somewhat different from the one we have previously described: the upper part, instead of being horizontal, is rather inclined, as it appears in fig. 3, and the opening E through which the sound has to communicate with the vibrating membrane, occupies a great part of the upper surface of the box, which consequently appears to be somewhat oblique. The second membrane G, which is of caoutchouc, forms a sort of partition which divides the box in two, starting from the upper end of the opening: the inventor states that this will protect the outer membrane D from the breath and other injurious effects, while increasing the force of the vibrations produced on the first membrane, as in a drum. The contact-breaker itself also differs from the one in M. Reiss’s instrument. The platinum disk _b_ is only placed in circuit by means of two slender wires of platinum or steel, which are immersed in two small cups, filled with mercury, and connected with the circuit. In this way, the movements of the membrane D are free, and its vibration is rendered more easy.

The circuit is also broken by a little platinum point resting on a lever with a spring-joint, K H, which is above the disk: one end of the lever, which is fixed below a kind of Morse key M I, makes it possible to close the circuit with the hand, so as to give the signal for setting the apparatus to work.

Electric Harmonica.--Long before M. Reiss’s invention, and consequently still longer before that of Mr. Elisha Gray, I mentioned a sort of electric harmonica, and described it as follows in the first edition of my ‘Exposé des applications de l’Electricité,’ published in 1853:--

‘The power possessed by electricity to set metallic plates in motion and cause their vibration has been used for the production of distinct sounds, which can be combined and harmonised; but in addition to this purely physical application, electro-magnetism has come to the aid of certain instruments, such as pianos, organs, &c., rendering them capable of being played at a distance. So that this extraordinary force may be turned to account in arts which are apparently the least susceptible of any application of electricity.

‘We have already spoken of M. de la Rive’s contact-breaker. It is, as we know, an iron disk, soldered to a steel spring, and maintained in a fixed position opposite to an electro-magnet by another spring in connection with one branch of the current. As the other branch, after passing into the wire of the electro-magnet, terminates in the iron disk itself, the electro-magnet is only active at the moment when the disk touches the terminal spring; at the moment of leaving it, the magnetism ceases, and the iron disk returns to its normal position, and then leaves it again. In this way a vibration is produced, rapid in proportion to the small size of the vibrating disk, and to the greatness of the force produced by the approach of the disk to the electro-magnet.

‘In order to increase the acuteness of the sounds, one or other of these expedients must be employed. The simplest way is to use a screw which can be tightened or relaxed at pleasure, and which in this manner removes the vibrating disk to a greater or less distance from the electro-magnet. This is the case in M. Froment’s instrument, and by this means he has obtained sounds of extraordinary acuteness, although not unpleasant to the ear.

‘M. Froment has not applied the apparatus to a musical instrument, but it is evident that it would be easy to do so; it would only be necessary to make the notes of a key-board act on metallic levers, of a length corresponding to the position required by the disk for the vibration of different tones. These different levers, resting on the disk, would act as a point of contact, but the point would vary in position, according to the touch.

‘If the current were constant, such an instrument would certainly have many advantages over the pipe instruments which are in use, since the vibration might be prolonged at will in the case of each note, and the sounds would be softer; unfortunately the irregular action of the battery makes it difficult in practice. These kinds of instruments are therefore only used as a means of regulating by ear the force of the battery, a much more convenient regulator than the rheometers, since it is possible to estimate by them the variations of the battery during an experiment without any distraction of the mind.’

In 1856 M. Pétrina, of Prague, invented an analogous arrangement, to which he gave the name of electric harmonica, although, strictly speaking, he had not thought of it as a musical instrument. This is what I have said on the subject in vol. iv. of the second edition of my ‘Exposé des applications de l’Electricité,’ published in 1859:--

‘The principle of this instrument is similar to that of Neef’s rheotome, in which the hammer is replaced by slender rods, whose vibrations produce a sound. Four of these rods are placed side by side, and when moved by keys, and arrested by levers, produce combined sounds of which the origin may be easily shown.’

It is true that nothing is said in this passage of the capability possessed by these instruments of being played at a distance; but this idea was quite legitimate, and German periodicals assert that it was accomplished by M. Pétrina even before 1856. It was the result of what I said at the outset: ‘that electro-magnetism may come to the aid of certain instruments, such as pianos, organs, &c., _in order to enable them to be played at a distance_,’ and I also pointed out the expedients employed for the purpose, and even for setting them at work, under the influence of a small musical box. I did not, however, ascribe importance to the matter, and it is only by way of historical illustration that I speak of these systems.

Telephone by Mr. Elisha Gray, of Chicago.--This system, invented in 1874, is in reality only an instrument of the nature of those which preceded it, but with important modifications, which made it possible to apply it usefully to telegraphy. In an early model, he made use of an induction coil, with two helices, one over the other: the contact-breaker, which was vibrating, was multiple, and so arranged as to produce vibrations numerous enough to emit sounds. These sounds may, as we have seen, be modified by this arrangement, according to the mode in which the instrument is adjusted, and if there are a certain number of such contact-breakers side by side, with vibrating disks so ordered as to produce the different notes of the scale on several octaves, it becomes possible, by a combination of certain notes, to execute on this new kind of instrument a piece of music such as may be produced by an harmonium, an accordion, or any other instrument with blowers. The contact-breakers are set in motion by means of the primary current of the induction coil, as it circulates through one or other of the electro-magnets of these contact-breakers, actuated by the lowering of the notes of a key-board connected with them, and the secondary currents which arise in the coil, in consequence of the interruptions in the primary currents, transmit the corresponding vibrations to a remote receiver. There is an analogy between this instrument and the telephones of which we have already spoken by Reiss and Wray, but the effect is increased by Mr. Gray’s modifications.

We represent in fig. 4 the arrangement of the first system. The vibrators are A and A′, the key-board M and M′, the induction coil B, and the receiver C. This receiver consists, as we see, of a simple electro-magnet N N′: above its poles there is a metal cylindrical case C, of which the bottom is made of iron, to serve as an armature. This box, like a violin, is pierced with two holes in the form S, to serve as a sounding-board; and Mr. Elisha Gray has ascertained that the molecular motion which takes place in the magnetic core and its armature, under the influence of alternate magnetisation and demagnetisation, sufficed to produce vibrations corresponding to the velocity of these alternations, and to emit sounds which became audible when they were magnified by the sounding-board.

[Illustration: FIG. 4.]

It is quite intelligible that the effect obtained in this system might be reproduced, if, instead of contact-breakers or electric rheotomes, mechanical contact-breakers were used at the sending station, so arranged as to furnish the requisite number of breaks in the current which communicates the vibrations of the different notes of the scale. In this way also it would be possible to dispense with the induction coil, by causing the current which has been broken by the mechanical contact-breaker to react upon the receiver. Mr. Elisha Gray has moreover made a different arrangement of this telephonic system, which he has applied to telegraphy for simultaneous electric transmissions, of which we shall speak presently.

If we may believe Mr. Elisha Gray, the vibrations transmitted by the secondary currents would be capable, by the intervention of the human body, of causing the sounds to be reproduced at a distance by conducting disks, which vibrate readily, and are placed on a sounding-box. In this way musical sounds may be evoked from copper cylinders placed upon a table, from a metallic disk fastened to a kind of violin, from a membrane stretched on a drum, or from any other resonant substance, by touching any of these objects with one hand, while holding the end of the line with the other. These sounds, of which the quality must vary with the substance touched, would reproduce the transmitted note with the precise number of vibrations which belong to it.[1]

Mr. Varley's Telephone.--This is, strictly speaking, merely a musical telephone of the same kind as that of Mr. Gray, but the arrangement of the receiver is original and interesting. This part of the instrument essentially consists of a drum of large size (three or four feet in diameter), within which is a condenser formed of four sheets of tinfoil, divided by sheets of some insulating material, and with a surface of about half the size of the drum. The plates of the condenser are placed parallel to the membranes of the drum, and very little removed from its surface.

If an electric charge is communicated to one of the series of conducting plates of the condenser, those which correspond to it are attracted, and if they were movable they might communicate to the intervening strata of air a movement which, on reaching the membranes of the drum, might, by a series of charges in rapid succession, cause the membranes to vibrate, and thus produce sounds: these sounds would correspond to the number of charges and discharges which had occurred. Since these charges and discharges are determined by the contact of the two plates of the condenser, at the extremities of the secondary circuit of an induction coil, of which the primary circuit has been duly broken, it becomes evident that, in order to cause the drum to emit any given sound, it will be enough to produce the number of vibrations in the contact-breaker of the induction coil which are required for this sound.

The means employed by Mr. Varley to produce these interruptions are the same which are in use in several electrical instruments, and especially in chronographs--an electro-magnetic tuning-fork, regulated so as to emit the sound required. This tuning-fork may, by acting as contact-breaker, react on the primary current of the induction coil; if the number of the tuning-forks equals that of the musical notes which are to be transmitted, and if the electro-magnets which set them in motion are connected with the key-board of a piano, it would be possible to transmit a melody to a distance by this system, as well as by that of Mr. Elisha Gray.

The peculiarity of this system consists in the reproduction of sounds by the action of a condenser, and we shall presently see that this idea, adopted by Messrs. Pollard and Gamier, led to interesting results.

Singing Condenser of MM. Pollard and Garnier.--This instrument, which astonishes all who hear it, attracted public attention in London some time ago. It is difficult to say why its fame was not greater, since much attention has been bestowed on less curious instruments. It is a fact that we have been able, thanks to MM. Pollard and Garnier, to hear songs issue from a sort of copy-book, so as to become audible throughout the room. The songs thus reproduced are certainly not always perfectly true; yet when the person who sings into the sender is a musician, and understands how to make use of it, the condenser in question will emit sounds somewhat resembling those of the violoncello or the hautbois.

The singing instrument consists of a condenser K, formed of thirty sheets of paper, laid one over the other, from nine to thirteen centimètres in thickness: between these, twenty-eight sheets of tinfoil, from six to twelve centimètres thick, are intercalated, so joined as to form the two plates of the condenser. For this purpose the pair sheets are joined together at one end of the copy-book, and the odd sheets at the other end. This system is fastened to a stiff _carton_, after taking care to bind it with a strip of paper, and the sheets of tinfoil are joined to the two ends of the condenser by two copper rims D, D, which are provided with terminals for the circuit wire, and in this way the singing instrument is constructed. A somewhat heavy weight, placed upon the condenser to compress the sheets, does not in any way prevent it from working; and this vitiates the theory first put forward to explain its effects, that the sheets were moved by attraction.

[Illustration: FIG. 5.]

The sending instrument consists of a sort of telephone without a handle, E, of which the vibrating disk is formed of a very thin plate of tin. A cylindrical piece of carbon C is fastened to its centre, and is supported by another cylinder of the same material H. This rests on a transverse piece of wood A B, jointed on the side A, on the edge opposite to the box, by means of a regulating screw V. An arched spring R (the end of a watch spring) placed across this piece of wood gives it a certain elasticity beneath the pressure, and this elasticity is necessary in order that the instrument may act properly, and it thus becomes a sort of microphone with a diaphragm.

The tin plate is put into communication with one pole of a battery P, of six Leclanché cells, and the lower carbon cylinder H corresponds to the primary helix of an induction coil M, previously connected with the second pole of the battery: Finally, the two extremities of the secondary helix of the coil, _a_ and _b_, are in immediate connection with the two plates D, D, of the condenser.

This secondary helix should consist of twenty strands of wire No. 32, covered with silk, and the primary helix is made of five strands of wire No. 16. The length of the coil should not exceed seven centimètres and the diameter of the core of fine iron wire ought to be about one centimètre.

In order to produce song on the condenser, the sender must be so regulated that the two carbons C and H do not touch each other in their normal condition, but they should be so close that in singing the vibrations of the disk L L may effect the needful contacts. The adjustment can be easily made by the touch, and by uttering the same note until it is repeated by the condenser. If three notes, given in succession, are faithfully reproduced, the instrument may be assumed to be properly regulated, and, in order to make it work, it is enough to apply the mouth to the mouthpiece as it is applied to a reed pipe.

In order to obtain a satisfactory result, the disk of the instrument must be heard to vibrate, as in a _flûte à l'oignon_. Instead of carbons, contacts of platinum may be used; but when arranged as we have described, the instrument may be employed for several purposes, as we shall see presently. This instrument is made by MM. Chardin and Prayer. M. Janssens has made the system more portable by fastening the sender, represented in fig. 5, to a handle in which the induction coil is placed: the instrument then resembles an ordinary telephone, and the vibration of the diaphragm is made more easy by piercing two holes in it. On the side of the sending-box, above and below the diaphragm, there are binding screws in connection with the end of the handle, since the instrument may be used as an ordinary telephonic sender, and even as a telephonic receiver.

SPEAKING TELEPHONES.

We have seen that the telephones just described can only transmit musical sounds, since they can merely repeat simple vibrations, in greater or less number, it is true, but not in simultaneous combinations like those which reproduce articulate sounds. Up to the time of Mr. Bell's invention, the transmission of speech could only take place with the aid of acoustic tubes, or of the string telephones of which we have spoken. Although these instruments have no connection with the object of our study in this work, we have thought it necessary to say a few words about them, since they may sometimes be combined with electric telephones, and also represent the first stage of the invention.

String Telephones.--These instruments, which have flooded the cities of Europe for several years, since the date of the invention was 1867, are interesting in themselves, and we are surprised that they have not hitherto taken a place in the collections of physical science. They are made of two metal or cardboard tubes, in the form of a cylindrical cone: one end is closed by a tightly stretched membrane of parchment, in the centre of which the cord or string intended to connect the two cylinders is fastened by a knot. When two such tubes are connected in this way, and the cord is tightly stretched, as in fig. 6, it is only necessary to apply one tube to the ear, while another speaks into the opening of the other tube: the words spoken by the latter are instantly transmitted, and it is even possible to converse in quite an undertone. Under these conditions the vibrations of the membrane affected by the voice are mechanically transmitted to the other membrane by the string, which, as Robert Hooke declared in 1667, is a better transmitter of sound than the air. In this way it is possible to communicate at a distance of 170 yards, and the size and nature of the cord have some influence. The sellers of these instruments say that the best results are obtained from silken cords, and the worst from those made of hemp. Cords of plaited cotton are usually employed for the sake of cheapness.

[Illustration: FIG. 6.]

In some patterns, the tubes are so arranged as to present, between the membrane and the mouth, a diaphragm pierced with a hole, and the instrument somewhat resembles a bell with its base bored and closed again a little above the parchment membrane;

but I have not observed that this pattern is decidedly superior to the others.

It has also been asserted that horn-shaped tubes of nickel silver are to be preferred, of which I am equally doubtful. At any rate, these instruments have produced unexpected results; and although their practical use is very limited, they are interesting from a scientific point of view, and are instructive toys for children.

Mr. Millar, of Glasgow, declares that the effect produced by these telephones depends very much on the nature of the string, the way in which it is attached, and the way in which the membrane is fastened to the mouthpiece.

Improvements made in the String Telephone.--The amazing effects of the Bell telephones have lately brought the string telephones, which were only regarded as children's toys, again into fashion. Since they have made it possible to transmit to several persons the words reproduced by an electric telephone, means have been sought for combining them usefully with the latter, and the best mode of making them speak on a string presenting several angles has been sought for: it has been shown that, under the usual conditions, these instruments only speak distinctly when the string is stretched in a right line. To solve this problem, it occurred to M. A. Bréguet to make use of a sort of tambourine for the supports, with the string passed through their centre; the sound conveyed by that part of the string which is in connection with the speaking-horn causes the membrane of the tambourine to vibrate, which again communicates the vibration to the next portion of string. In this way the angles may be multiplied at will, and the string may be supported throughout the length compatible with this kind of telephone, which does not exceed 112 yards.

M. A. Bréguet has also invented a system of relays to accomplish the same object. He makes the strings terminate in two membranes which close the two openings of a brass cylinder. The sounds reproduced on one of these membranes react upon the other, which vibrates under its influence, as if it were affected by the voice. The cylinder then acts as an ordinary acoustic tube, and its form may be varied at pleasure.

M. A. Badet, on February 1, 1878, succeeded in making string telephones in an analogous way, and he used parchment stretched upon frames which acted as resonant boards. The string was fixed in the centre of the membrane, and made with it the angle desired.

Several scientific men, among others Messrs. Wheatstone, Cornu, and Mercadier, have long been occupied about these ways of transmission by wire, and Messrs. Millar, Heaviside, and Nixon have lately made some interesting experiments, on which we must say a few words. Mr. Millar ascertained that by means of a telegraphic wire, stretched and connected by two copper wires with two vibrating disks, musical sounds might be conveyed to a distance exceeding 160 yards, and that by stretching these wires through a house, and connecting them with mouth-and-ear holes in different rooms, communication between them became perfectly easy.

For the vibrating disks he employed wood, metal, or gutta-percha, in the form of a drum, with wires fixed in the centre. The sound seems to become more intense in proportion to the thickness of the wire.

Messrs. Heaviside and Nixon, in their experiments at Newcastle-on-Tyne, have ascertained that the most effective wire was No. 4 of the English gauge. They employed wooden disks ■ inch in thickness, and these may be placed in any part of the length of the wire. When the wire was well stretched and motionless, it was possible to hear what was said at a distance of 230 yards, and it seems that Mr. Huntley, by using very thin iron diaphragms, and by insulating the line wire on glass supports, was able to transmit speech for 2,450 feet, in spite of the zigzags made by the line on its supports.

Mr. Graham Bell's Electric Telephone.--Telephonic instruments were at this stage when Bell's telephone was shown at the Philadelphia Exhibition of 1876. Sir William Thompson did not hesitate to call it 'the wonder of wonders,' and it instantly attracted universal attention, although there was at first much incredulity as to its genuineness. This telephone, in fact, reproduced articulate words, a result which surpassed all the conceptions of physicists. In this case it was no longer a conception, to be treated as visionary until there was proof to the contrary: the instrument spoke, and even spoke so loudly that it was not necessary to apply the ear. Sir William Thompson spoke to this effect on the subject at the meeting of the British Association at Glasgow in September 1876:--

'In the department of telegraphs in the United States I saw and heard Mr. Elisha Gray's electric telephone, of wonderful construction, which can repeat four despatches at the same time in the Morse code, and, with some improvements in detail, this instrument is evidently capable of a fourfold delivery. In the Canadian department I heard "To be or not to be? There's the rub," uttered through a telegraphic wire, and its pronunciation by electricity only made the rallying tone of the monosyllables more

emphatic. The wire also repeated some extracts from New York papers. With my own ears I heard all this, distinctly articulated through the slender circular disk formed by the armature of an electro-magnet. It was my fellow-juryman, Professor Watson, who, at the other extremity of the line, uttered these words in a loud and distinct voice, while applying his mouth to a tightly stretched membrane provided with a small piece of soft iron, which executed movements corresponding to the sound vibrations of the air close to an electro-magnet introduced into the circuit. This discovery, the wonder of wonders in electric telegraphy, is due to a young fellow-countryman of our own, Mr. Graham Bell, a native of Edinburgh and now naturalised in New York.

'It is impossible not to admire the daring invention by which we have been able to realise with these simple expedients the complex problem of reproducing by electricity the tones and delicate articulations of voice and speech; and it was necessary, in order to obtain this result, to find out the means of varying the intensity of the current in the same proportion as the inflections of the sound emitted by the voice.'

If we are to believe Mr. Graham Bell, the invention of the telephone was not due to a spontaneous and fortunate conception: it was the result of his long and patient studies in acoustic science, and of the labours of the physicists who preceded him.[2] His father, Mr. Alexander Melville Bell, of Edinburgh, had studied this science deeply, and had even succeeded in representing with great ingenuity the adaptation of the vocal organs for the emission of sound. It was natural that he should instil a taste for his favourite studies into his son's mind, and they made together numerous researches in order to discover the relations which exist between the different elements of speech in different languages, and the musical relations of vowels. It is true that several of these researches had been made by M. Helmholtz, and under more favourable conditions; but these studies were of great use to Mr. Bell when he was afterwards occupied with the telephone, and Helmholtz's experiments, which he repeated with one of his friends, Mr. Hellis of London, concerning the artificial reproduction of vowels by means of electric tuning-forks, launched him into the study of the application of electricity to acoustic instruments. He first invented a system of an electric harmonica with a key-board, in which the different sounds of the scale were reproduced by electric diapasons of different forms, adapted to different notes, and which, when set in motion by the successive lowering of the keys, could reproduce sounds corresponding to the notes touched, just as in an ordinary piano.

He next, as he tells us, turned his attention to telegraphy, and thought of making the Morse telegraphs audible by causing the electro-magnetic organ to react on sounding contacts. It is true that this result had already been obtained in the sounders used in telegraphy, but he thought that by applying this system to his electric harmonica, and by employing such an intensifying instrument as Helmholtz's resonator at the receiving station, it would be possible to obtain through a single wire simultaneous transmissions which should be due to the action of the voice. We shall see presently that this idea was realised almost at the same time by several inventors, among others by M. Paul Lacour, of Copenhagen, Mr. Elisha Gray, of Chicago, and Messrs. Edison and Varley.

Mr. Bell's study of electric telephones really dates from this time, and he passed from complex to simple instruments, making a careful study of the different modes of vibration which arise from different modes of electric action. The following is an abstract, with the omission of more technical details, of the paper read by Mr. Bell to the Society of Telegraphic Engineers, London, October 31, 1877.

If the intensity of an electric current is represented by the ordinates of a curve, and the duration of breaks in the current by the abscissæ, the given curve may represent the waves of the positive or negative current respectively, above and below the line of X, and these waves will be more or less accentuated, just as the transmitted currents are more or less instantaneous.

If the currents which are interrupted to produce a sound are quite instantaneous in their manifestation, the curve represents a series of isolated indentations, as we see in fig. 7; and if the interruptions are so made as only to produce differences of intensity, the curve is presented under the form of fig. 8. Finally, if the emissions of current are so ordered that their intensity alternately increases and diminishes, the curve takes the form represented in fig. 9. In the first case, the currents are _intermittent_; in the second, _pulsatory_; in the third case, they are _undulatory_.

[Illustration: FIG. 7.]

[Illustration: FIG. 8.]

[Illustration: FIG. 9.]

These currents are necessarily positive or negative, according to their position above or below the line _x_, and if they are alternately reversed, the curves present the form given in fig. 10, curves which essentially differ from the first, not merely in the

different form of the indentations, but especially in the suppression of the extra current, which is always found in the pulsatory and undulatory currents.

[Illustration: FIG. 10.]

The two former systems of currents have long been in use for the electric transmission of musical sounds, of which we have an interesting example in Reiss's telephone already described. But Mr. Bell claims to have been the first to employ the undulatory currents, which made it possible to solve the problem of transmitting speech.[3] In order to estimate the importance of this discovery, it will be enough to analyse the effects produced with these different systems of currents when several notes of varying pitch are to be combined.

Fig. 7 shows a combination in which the styles _a_, _a′_, of two sending instruments cause the interruption of the current from the same battery B, so that the given vibrations should be between them in the relation of a tierce major, that is in the relation of four to five. Under such conditions, the currents are intermittent, and four contacts of _a_ are produced in the same space of time as the five contacts of _a′_, and the corresponding electric intensities will be represented by the indentations we see in A^2 and in B^2: the combination of these intensities A^2 + B^2 will produce the indentations at unequal intervals which may be observed on the third line. It is evident that although the current maintains a uniform intensity, there is less time for the breaks when the interrupting styles act together than when they act separately, so that when there are a number of contacts effected simultaneously by styles working at different degrees of velocity, the effects produced will have the effect of a continuous current. The maximum number of distinct effects which can be produced in this way will, however, greatly depend on the relation which exists between the durations of the make and break of the current. The shorter the contacts are, and the longer the breaks, the more numerous will be the effects transmitted without confusion, and _vice versâ_.

By the aid of pulsatory currents the transmission of musical sounds is effected in the way indicated in fig. 8, and it is seen that when they are produced simultaneously, the result A^2 + B^2 is analogous to that which would be produced by a continuous current of minimum intensity.

In the case of undulatory currents the result is different, but in order to produce them it is necessary to have recourse to inductive effects, and fig. 9 indicates the manner in which the experiment should be made. In this case, 'the current from the battery B is thrown into waves by the inductive action of iron or steel reeds M, M, vibrated in front of electro-magnets _e_, _e_, placed in circuit with the battery: A^2 and B^2 represent the undulations caused in the current by the vibration of the magnetised bodies, and it will be seen that there are four undulations of B^2 in the same time as five undulations of A^2. The resultant effect upon the main line is expressed by the curve A^2 + B^2, which is the algebraical sum of the sinusoidal curves A^2 and B^2. A similar effect is produced when reversed undulatory currents are employed, as in fig. 10, where the current is produced by the vibration of permanent magnets united upon a circuit, without a voltaic battery.

'It will be understood from figs. 9 and 10 that the effect of transmitting musical signals of different pitches simultaneously along a single wire is not to obliterate the vibratory character of the current, as in the case of intermittent and pulsatory currents, but to change the shapes of the electrical undulations. In fact, the effect produced upon the current is precisely analogous to the effect produced in the air by the vibration of the inducing bodies M, M′. Hence it should be possible to transmit as many musical tones simultaneously through a telegraph wire as through the air.'

[Illustration: FIG. 11.]

After applying these principles to the construction of a telegraphic system for multiple transmissions, Mr. Bell lost no time in making use of his researches to improve the vocal training of deaf mutes. 'It is well known,' he said, 'that deaf mutes are dumb merely because they are deaf, and that there is no defect in their vocal organs to incapacitate them from utterance. Hence it was thought that my father's system of pictorial symbols, popularly known as visible speech, might prove a means whereby we could teach the deaf and dumb to use their vocal organs and to speak. The great success of these experiments urged upon me the advisability of devising methods of exhibiting the vibrations of sound optically, for use in teaching the deaf and dumb. For some time I carried on experiments with the manometric capsule of Koenig, and with the phonautograph of Léon Scott. The scientific apparatus in the Institute of Technology in Boston was freely placed at my disposal for these experiments, and it happened that at that time a student of the Institute of Technology, Mr. Maurey, had invented an improvement upon the phonautograph. He had succeeded in vibrating by the voice a stylus of wood about a foot in length which was attached to the membrane of the phonautograph, and in this way he had been enabled to obtain enlarged tracings upon a plane surface of smoked glass. With this apparatus I succeeded in

producing very beautiful tracings of the vibrations of the air for vowel sounds. Some of these tracings are shown in fig. 11. I was much struck with this improved form of apparatus, and it occurred to me that there was a remarkable likeness between the manner in which this piece of wood was vibrated by the membrane of the phonautograph and the manner in which the _ossiculæ_ of the human ear were moved by the tympanic membrane. I determined therefore to construct a phonautograph modelled still more closely upon the mechanism of the human ear, and for this purpose I sought the assistance of a distinguished aurist in Boston, Dr. Clarence J. Blake. He suggested the use of the human ear itself as a phonautograph, instead of making an artificial imitation of it. The idea was novel, and struck me accordingly, and I requested my friend to prepare a specimen for me, which he did. The apparatus, as finally constructed, is shown in fig. 12. The _stapes_ was removed, and a stylus of hay about an inch in length was attached to the end of the _incus_. Upon moistening the _membrana tympani_ and the _ossiculæ_ with a mixture of glycerine and water, the necessary mobility of the parts was obtained; and upon singing into the external artificial ear the stylus of hay was thrown into vibration, and tracings were obtained upon a plane surface of smoked glass passed rapidly underneath. While engaged in these experiments I was struck with the remarkable disproportion in weight between the membrane and the bones that were vibrated by it. It occurred to me that if a membrane as thin as tissue paper could control the vibration of bones that were, compared to it, of immense size and weight, why should not a larger and thicker membrane be able to vibrate a piece of iron in front of an electro-magnet, in which case the complication of steel rods shown in my first form of telephone, could be done away with, and a simple piece of iron attached to a membrane be placed at either end of the telegraphic circuit?

[Illustration: FIG. 12.]

‘For this purpose I attached the reed A (fig. 13) loosely by one extremity to the uncovered pole _h_ of the magnet, and fastened the other extremity to the centre of a stretched membrane of goldbeaters’ skin _n_. I presumed that upon speaking in the neighbourhood of the membrane _n_, it would be thrown into vibration and cause the steel reed A to move in a similar manner, occasioning undulations in the electrical current that would correspond to the changes in the density of the air during the production of the sound; and I further thought that the change of the intensity of the current at the receiving end would cause the magnet there to attract the reed A′ in such a manner that it should copy the motion of the reed A, in which case its movements would occasion a sound from the membrane _n′_ similar in _timbre_ to that which had occasioned the original vibration.

[Illustration: FIG. 13.]

[Illustration: FIG. 14.]

‘The results, however, were unsatisfactory and discouraging. My friend Mr. Thomas A. Watson, who assisted me in this first experiment, declared that he heard a faint sound proceed from the telephone at his end of the circuit, but I was unable to verify his assertion. After many experiments attended by the same only partially successful results, I determined to reduce the size and weight of the spring as much as possible. For this purpose I fastened a piece of clock spring, about the size and shape of my thumbnail, firmly to the centre of the diaphragm, and had a similar instrument at the other end (fig. 14); we were then enabled to obtain distinctly audible effects. I remember an experiment made with this telephone, which at the time gave me great satisfaction and delight. One of the telephones was placed in my lecture-room in the Boston University, and the other in the basement of the adjoining building. One of my students repaired to the distant telephone to observe the effects of articulate speech, while I uttered the sentence, “Do you understand what I say?” into the telephone placed in the lecture-hall. To my delight an answer was returned through the instrument itself, articulate sounds proceeded from the steel spring attached to the membrane, and I heard the sentence, “Yes, I understand you perfectly.” It is a mistake, however, to suppose that the articulation was by any means perfect, and expectancy no doubt had a great deal to do with my recognition of the sentence; still, the articulation was there, and I recognised the fact that the indistinctness was entirely due to the imperfection of the instrument. I will not trouble you by detailing the various stages through which the apparatus passed, but shall merely say that after a time I produced the form of instrument shown in fig. 15, which served very well as a receiving telephone. In this condition my invention was exhibited at the Centennial Exhibition in Philadelphia. The telephone shown in fig. 14 was used as a transmitting instrument, and that in fig. 15 as a receiver, so that vocal communication was only established in one direction.

[Illustration: FIG. 15.]

‘The articulation produced from the instrument shown in fig. 15 was remarkably distinct, but its great defect consisted in the fact that it could not be used as a transmitting instrument, and thus two telephones were required at each station, one for transmitting and one for receiving spoken messages.

‘It was determined to vary the construction of the telephone, and I sought by changing the size and tension of the membrane, the diameter and thickness of the steel spring, the size and power of the magnet, and the coils of insulated wire around their poles, to discover empirically the exact effect of each element of the combination, and thus to deduce a more perfect form of apparatus. It was found that a marked increase in the loudness of the sounds resulted from shortening the length of the coils of wire, and by enlarging the iron diaphragm which was glued to the membrane. In the latter case, also, the distinctness of the articulation was improved. Finally, the membrane of goldbeaters’ skin was discarded entirely, and a simple iron plate was used instead, and at once intelligible articulation was obtained. The new form of instrument is that shown in fig. 16, and, as had been long anticipated, it was proved that the only use of the battery was to magnetise the iron core of the magnet, for the effects were equally audible when the battery was omitted and a rod of magnetised steel substituted for the iron core of the magnet.

‘It was my original intention, and it was always claimed by me, that the final form of telephone would be operated by permanent magnets in place of batteries, and numerous experiments had been carried on by Mr. Watson and myself privately for the purpose of producing this effect.

[Illustration: FIG. 16.]

‘At the time the instruments were first exhibited in public the results obtained with permanent magnets were not nearly so striking as when a voltaic battery was employed, wherefore we thought it best to exhibit only the latter form of instrument.

‘The interest excited by the first published accounts of the operation of the telephone led many persons to investigate the subject, and I doubt not that numbers of experimenters have independently discovered that permanent magnets might be employed instead of voltaic batteries. Indeed one gentleman, Professor Dolbear, of Tufts College, not only claims to have discovered the magneto-electric telephone, but I understand charges me with having obtained the idea from him through the medium of a mutual friend.

[Illustration: FIG. 17.]

‘A still more powerful form of apparatus was constructed by using a powerful compound horseshoe magnet in place of the straight rod which had been previously used (see fig. 17). Indeed the sounds produced by means of this instrument were of sufficient loudness to be faintly audible to a large audience, and in this condition the instrument was exhibited in the Essex Institute, in Salem, Massachusetts, on February 12, 1877, on which occasion a short speech shouted into a similar telephone in Boston, sixteen miles away, was heard by the audience in Salem. The tones of the speaker’s voice were distinctly audible to an audience of 600 people, but the articulation was only distinct at a distance of about 6 feet. On the same occasion, also, a report of the lecture was transmitted by word of mouth from Salem to Boston, and published in the papers the next morning.

[Illustration: FIG. 18.]

‘From the form of telephone shown in fig. 16 to the present form of the instrument (fig. 18) is but a step. It is in fact the arrangement of fig. 16 in a portable form, the magnet N S being placed inside the handle, and a more convenient form of mouthpiece provided.

‘And here I wish to express my indebtedness to several scientific friends in America for their co-operation and assistance. I would specially mention Professor Peirce and Professor Blake, of Brown University, Dr. Channing, Mr. Clarke, and Mr. Jones. It was always my belief that a certain ratio would be found between the several parts of a telephone, and that the size of the instrument was immaterial; but Professor Peirce was the first to demonstrate the extreme smallness of the magnets which might be employed. The convenient form of mouthpiece shown in fig. 17, now adopted by me, was invented solely by my friend Professor Peirce.’

[Illustration: FIG. 19.]

Another form of transmitting telephone exhibited in Philadelphia, intended for use with the receiving telephone (fig. 15), is represented by fig. 19.

A platinum wire attached to a stretched membrane completed a voltaic circuit by dipping into water. Upon speaking to the membrane, articulate sounds proceeded from the telephone in the distant room. The sounds produced by the telephone became louder when dilute sulphuric acid, or a saturated solution of salt, was substituted for the water. Audible effects were also produced by the vibration of plumbago in mercury, in a solution of bichromate of potash, in salt and water, in dilute sulphuric acid, and in pure water.

Mr. Bell goes on to say:

‘I have found also that a musical tone proceeds from a piece of plumbago or retort carbon when an intermittent current of electricity is passed through it, and I have observed the most curious audible effects produced by the passage of reversed intermittent currents through the human body. A rheotome was placed in circuit with the primary wires of an induction coil, and the fine wires were connected with two strips of brass. One of these strips was held closely against the ear, and a loud sound proceeded from it whenever the other slip was touched with the other hand. The strips of brass were next held one in each hand. The induced currents occasioned a muscular tremor in the fingers. Upon placing my forefinger to my ear a loud crackling noise was audible, seemingly proceeding from the finger itself. A friend who was present placed my finger to his ear, but heard nothing. I requested him to hold the strips himself. He was then distinctly conscious of a noise (which I was unable to perceive) proceeding from his finger. In this case a portion of the induced currents passed through the head of the observer when he placed his ear against his own finger; and it is possible that the sound was occasioned by a vibration of the surfaces of the ear and finger in contact.

‘When two persons receive a shock from a Ruhmkorff’s coil by clasping hands, each taking hold of one wire of the coil with the free hand, a sound proceeds from the clasped hands. The effect is not produced when the hands are moist. When either of the two touches the body of the other, a loud sound comes from the parts in contact. When the arm of one is placed against the arm of the other, the noise produced can be heard at a distance of several feet. In all these cases a slight shock is experienced so long as the contact is preserved. The introduction of a piece of paper between the parts in contact does not materially interfere with the production of the sounds, but the unpleasant effects of the shock are avoided.

‘When an intermittent current from a Ruhmkorff’s coil is passed through the arms, a musical note can be perceived when the ear is closely applied to the arm of the person experimented upon. The sound seems to proceed from the muscles of the fore-arm and from the biceps muscle. Mr. Elisha Gray[4] has also produced audible effects by the passage of electricity through the human body.

‘An extremely loud musical note is occasioned by the spark of a Ruhmkorff’s coil when the primary circuit is made and broken with sufficient rapidity; when two rheotomes of different pitch are caused simultaneously to open and close the primary circuit, a double tone proceeds from the spark.

‘A curious discovery, which may be of interest to you, has been made by Professor Blake. He constructed a telephone in which a rod of soft iron, about six feet in length, was used instead of a permanent magnet. A friend sang a continuous musical tone into the mouthpiece of a telephone, like that shown in fig. 17, which was connected with the soft iron instrument alluded to above. It was found that the loudness of the sound produced in this telephone varied with the direction in which the iron rod was held, and that the maximum effect was produced when the rod was in the position of the dipping-needle. This curious discovery of Professor Blake has been verified by myself.

‘When a telephone is placed in circuit with a telegraph line, the telephone is found seemingly to emit sounds on its own account. The most extraordinary noises are often produced, the causes of which are at present very obscure. One class of sounds is produced by the inductive influence of neighbouring wires and by leakage from them, the signals of the Morse alphabet passing over neighbouring wires being audible in the telephone, and another class can be traced to earth currents upon the wire, a curious modification of this sound revealing the presence of defective joints in the wire.

‘Professor Blake informs me that he has been able to use the railroad track for conversational purposes in place of a telegraph-wire, and he further states that when only one telephone was connected with the track the sounds of Morse operating were distinctly audible in the telephone, although the nearest telegraph-wires were at least forty feet distant; and Professor Peirce has observed the most curious sounds produced from a telephone in connection with a telegraph-wire during the aurora borealis.’

Mr. Bell went on to describe instances in which airs sung or played upon a musical instrument are transmitted by a telephone, when it is not known whence they come; but the strongest proof of the extraordinary sensibility of this instrument consists in its becoming possible by its means to transmit speech through bodies which might be supposed to be non-conductors. Thus communication with the earth through the human body can be made in spite of the intervention of shoes and stockings; and it may even be effected if, instead of standing on the ground, the person stands on a brick wall. Only hewn stone and wood are a sufficient hindrance to communication, and if the foot touches the adjoining ground, or even a blade of grass, it is enough to produce electric manifestations.

Mr. Bell says in conclusion:

‘The question will naturally arise, Through what length of wire can the telephone be used? In reply to this, I may say that the maximum amount of resistance through which the undulatory current will pass, and yet retain sufficient force to produce an audible sound at the distant end, has yet to be determined; no difficulty has, however, been experienced in laboratory experiments in conversing through a resistance of 60,000 ohms, which has been the maximum at my disposal. On one occasion, not having a rheostat at hand, I may mention having passed the current through the bodies of sixteen persons, who stood hand in hand. The longest length of real telegraph line through which I have attempted to converse has been about 250 miles. On this occasion no difficulty was experienced so long as parallel lines were not in operation. Sunday was chosen as the day on which it was probable other circuits would be at rest. Conversation was carried on between myself in New York, and Mr. Thomas A. Watson in Boston, until the opening of business upon the other wires. When this happened the vocal sounds were very much diminished, but still audible. It seemed, indeed, like talking through a storm. Conversation, though possible, could be carried on with difficulty, owing to the distracting nature of the interfering currents.

‘I am informed by my friend Mr. Preece that conversation has been successfully carried on through a submarine cable, sixty miles in length, extending from Dartmouth to the Island of Guernsey, by means of hand telephones.’

[Illustration: FIG. 20.]

Mr. Elisha Gray’s Share in the Invention of the Telephone.--We have seen that if Mr. Bell was the first to construct the speaking telephone in a practical form, Mr. Gray had at the same time conceived the idea of an instrument also capable of reproducing speech, and the description given of it in his _caveat_ was so precise that if it had been made from his design, it would have acted perfectly. This was, in fact, afterwards proved by him. In order that our readers may judge from their own knowledge of the share which should be ascribed to Mr. Elisha Gray in the invention of the telephone, we reproduce in fig. 20 the drawing which accompanied the _caveat_ in question.

The sender, as we see, is composed of a sort of tube, closed at its lower end by a membrane to which a platinum wire is fixed; this wire dips into a liquid of moderate conducting power, and an electrode made of platinum, in communication with a battery, is fixed at the bottom of the vessel containing the liquid. The receiver is composed of an electro-magnet, of which the armature is fixed to the centre of a membrane, stretched on a kind of resonator or ear-trumpet which is held to the ear, and the two instruments are united by the line wire as we see in the plate.

Under these conditions, the undulatory currents necessary for the reproduction of speech were obtained in a mode analogous to that pointed out by Mr. Bell in his specification, that is, by the variations of resistance in the liquid layer interposed between the platinum wires of the transmitter; and their action, exerted on an electro-magnet, of which the armature was fixed on the diaphragm of the resonator, was produced under more favourable conditions than in Mr. Bell’s specification (see fig. 13), since that gentleman regards this arrangement (represented in fig. 14) as an important improvement on his first conception.

The whole importance of the invention rests on the intervention of undulatory currents, which, as we have seen, are indispensable for the reproduction of speech, and it concerns us to know whether it was Mr. Bell or Mr. Gray who first declared their importance; for in both the specifications deposited on February 14, 1876, the use of undulatory currents was declared to be indispensable. Mr. Gray asserts that he had recognised their importance for the transmission of combined sounds as early as 1874; but Mr. Bell believes that the undulatory currents mentioned by Mr. Gray at that time were only currents analogous to those he had designated under the name of pulsatory currents, which we have represented in fig. 8. We have seen that since these currents only represent the abrupt elevations and depressions of intensity, they are unfit for the reproduction of articulate sounds, which, on the contrary, demand that the variations of intensity should result from successive efforts, in exact correspondence with all the inflections of the sonorous vibrations effected by the voice. Mr. Bell’s claim to priority on this question has been recognised by the American Patent Office, since he has been placed in possession of the patent. However this may be, Mr. Gray’s telephonic system was complete, and we see in it, as we have already said, the origin of the battery telephones, which have recently produced such important results. Let us now consider the relation which this system bears to Mr. Bell’s.

The Bell system, as we have seen, although making use of a battery in the first instance, only obtained the diminution and increase of electric force necessary for the articulation of words by means of induction currents produced by the movements of an armature of soft iron, currents of which the intensity was consequently due to the range and inflections of these movements. The battery only intervened in order to communicate magnetic force to the inducer. This use of induced currents in telephonic transmissions was already of great importance, since various experiments subsequently made have proved their superiority to voltaic currents for this

purpose. But experience soon convinced Mr. Bell that a powerful inductive apparatus worked by a battery was not only unnecessary for the action of this apparatus, but that a permanent magnet, very small and weak, would provide sufficient currents. This discovery, in which, as we have seen, Mr. Peirce had some share, was of great importance, since it became possible to reduce the size of the instrument considerably, so as to make it portable and adapted for sending and receiving; and it was shown that the telephone was the most sensitive of all instruments in revealing the action of currents. If, therefore, Mr. Bell was not the first to employ the successful mode of transmitting articulate words, it must be said that he sought, like Mr. Gray, to solve the problem by means of undulatory currents, and that he obtained these currents by the effect of induction, a system which, as soon as it was perfected, led to the important results with which we are all acquainted. If he had only given to the astonished world an instrument capable of reproducing speech telegraphically, his fame would be great; for this problem had hitherto been regarded as insoluble.

Mr. Gray's claims to the invention of the telephone are given in the following summary from a very interesting work, entitled 'Experimental Researches on Electro-harmonic Telegraphy and Telephony:'

'1. I was the first to discover the means of transmitting compound sounds and variable inflections through a closed circuit by means of two or more electric waves.

'2. I assert that I was the first to discover and utilise the mode of reproducing vibrations by the use of a magnet receiver constantly supplied with electric action.

'3. I also assert that I was the first to construct an instrument consisting of a magnet with a circular diaphragm of magnetic substance, supported by its edge at a little distance from the poles of a magnet, and capable of being applied to the transmission and reception of articulate sounds.'

It is a curious fact, worth recording here, that Mr. Yates, of Dublin, in 1865, when trying to improve Reiss's telephone, realised to a certain extent Mr. Gray's conception of the liquid transmitter; for he introduced into the platinum contacts of Mr. Reiss's instrument a drop of water which adapted it for the reproduction of articulate sounds. However, no notice was then taken of this result.

EXAMINATION INTO THE FUNDAMENTAL PRINCIPLES ON WHICH BELL'S TELEPHONE IS BASED.

Although the preceding account would suffice to make the principle of Bell's telephone intelligible to persons acquainted with electric science, this would not be the case with the majority of our readers, and we therefore think it necessary to enter into some details as to the source of the electric currents which are employed in telephonic transmissions. These details seem to us the more necessary, since many persons still believe that Bell's telephones are not electric, because they do not require a battery, and they are often confounded with string telephones, so that the difference of price between Bell's instruments and those hawked in the streets seems astonishing.

Without defining what is meant by an electric current, which would be too elementary, we may say that electric currents can be produced by different causes, and that, in addition to those which are due to batteries, strong currents are also produced by the force exerted by magnets on a conducting circuit properly arranged. Such currents are called induction currents, and are used in Bell's telephone. In order to understand how they are developed under these conditions, it will be enough to examine what takes place when the pole of a magnet is brought near to, and withdrawn from, a closed circuit. To do this, let us suppose a copper wire attached to a galvanometer in the form of a circle, and that one pole of a permanent magnet is directed towards the centre of the circle. Now observe what happens:

1. At the moment when the magnet approaches an electric current arises, causing the galvanometer to deviate to one side. This deviation will be great in proportion to the extent of the movement, and the tension of the current will be great in proportion to the abruptness of the movement. The current will however be only instantaneous.

2. At the moment when the magnet is withdrawn, a fresh current of the same nature will arise, but it will appear in an opposite direction from the former. It will be what is called a direct current, because it is in the same direction as the magnetic current of the magnet which produces it, while the other current is called _inverse_.

3. If, instead of advancing or withdrawing the magnet by means of a single movement, it is advanced in jerks, a succession of currents in the same direction is produced, of which the existence can be ascertained by the galvanometer when there is a sufficient interval between the movements, but when the intervals are very slight the currents are interfused; and since inverse effects take place when the magnet is moved in a contrary direction, the needle of the galvanometer follows the movements of the

magnet, and to a certain extent stereotypes them.

4. If, instead of reacting on a simple closed circuit, the magnet exerts its force on a considerable number of circumvolutions of this circuit, that is, on a bobbin of coiled wire, the effects will be considerably increased, and they will be still greater if there be a magnetic core within the bobbin, since the inducing action will then be more effectually exerted throughout the bobbin. As the magnetic core, when it is magnetised and demagnetised under the influence of its approach to or withdrawal from the inducing magnet, is subject to the reaction from all the fluctuations which occur in the movements of the magnet, the induced currents which ensue are perfectly defined.

5. If, instead of a movable magnet, we suppose it to be fixed in the centre of the coil, the induced currents of which we have spoken may then be determined by modifying its force. In order to do so, it is enough that an iron armature should react upon its poles. When this armature is brought close to one of the poles, or to both at once, it acquires force, and produces an inverse current, that is, a current in the direction which would have corresponded to an approach of the magnet to the closed circuit. On its withdrawal the inverse effect is produced; but in both cases the induced currents correspond with the extent and direction of the movements accomplished by the armature, and consequently they may reproduce its movements by their effects. If this armature is an iron plate, which vibrates under the influence of any sound in this disposition of the electro-magnetic system, the alternate movements of the plate will be transformed into the induced currents, and these will be stronger or weaker, more or less definite, according to the range and complexity of the vibrations: they will, however, be undulatory, since they will always result from successive and continuous movements, and will consequently be in the conditions which, as we have seen, are required for the transmission of speech.

As for the action produced upon the receiver, that is, on the instrument for reproducing speech, it is somewhat complex, and we shall have occasion to speak of it presently; but we can get a general impression of it, if we consider that the effects produced by the induced currents of variable intensity, which traverse the coil of the electro-magnetic system, must determine, by the magnetisations and demagnetisations which ensue, the vibrations of the armature disk; these vibrations, more or less amplified and defined, exactly represent those of the disk before which the speaker stands, and can only be obtained from them. The effects are, however, in reality more complex, although they are produced under analogous conditions, and we shall have more to say about them when we come to speak of the experiments made with the telephone. It must meanwhile be observed that, for the reproduction of speech, it is not necessary that the magnetic core should be of soft iron, since the vibratory effects may follow from differential as well as from direct magnetisation.

ORDINARY ARRANGEMENT OF THE BELL TELEPHONE.

The arrangement most generally adopted for the telephone is the one represented in fig. 21. It consists of a kind of circular wooden box, fitted to the extremity of a handle M, which is also of wood, and contains the magnetic bar N S. This bar is fixed by means of a screw _t_, and is so arranged as to be moved forward and backward by tightening or loosening the screw, a condition necessary in order to regulate the instrument. At the free extremity of the bar the magnetic coil B is fixed; this must, according to MM. Pollard and Garnier, be made of wire No. 42, so as to present a considerable number of spirals. The ends of this coil generally terminate at the lower end of the handle in two copper rods _f_, _f_, which traverse its length, and are fastened to two binding-screws l, l′, where the line wires C, C are fixed. In the instruments made by M. Bréguet there are, however, no binding-screws, but a little twist, made of two flexible wires covered with gutta-percha and silk, is fastened to the two rods. A wooden cap is screwed to the end of the handle, and the twist passes through a hole made in this cap, so that there is no inconvenience in working the instrument. By laying hold of the ends of the wire twist with pliers it is possible to join them to the circuit. This instrument is represented in fig. 22.

[Illustration: FIG. 21.]

By another arrangement, the wires of the coil end immediately in the binding-screws which are placed below the wooden box, but this arrangement is inconvenient.

Above the pole of the magnetic bar is placed the iron vibrating plate L L, which is coated either with black or yellow varnish, with tin or blue oxide, but which must always be very thin. This plate is in the form of a disk, and by its rim, resting on a caoutchouc ring, it is firmly fixed to the circular edges of the wooden box, which is for this purpose made in two pieces. These pieces are adjusted to each other, either by screws or by spirals cut in half the thickness of the wood. This disk ought to be as near as possible to the polar end of the magnet, yet not so near as to produce contact between the two by the vibrations of the voice. Finally, the mouthpiece R

R′ (fig. 21), which is in form of a wide funnel, terminates the upper part of the box, and should be so arranged as to leave a certain space between the disk and the edges of the hole V, which is open in its centre. The size of the box should be so calculated as to permit of its acting as a sounding-box, without however provoking echoes and a confusion of sounds.

[Illustration: FIG. 22.]

When the instrument is properly made, it will produce very marked effects; and M. Pollard, one of the first Frenchmen to take up the study of telephones, has written as follows on the subject:

‘The instrument which I have prepared gives results which are truly astonishing. In the first place, when considering the resistance, the introduction into the circuit of five or six persons does not sensibly diminish the intensity of sounds. On putting an instrument to each ear, the sensation is precisely the same as if the correspondent were speaking some yards behind. The intensity, the clearness, the purity of tone are irreproachable.

‘I can speak to my colleague in quite an undertone, scarcely breathing as I may say, and persons placed within two yards of me will be unable to catch a single word of our conversation.

‘On the part of the receiver, if anyone raises his voice to call me, I hear the call in all parts of my office, at least when silence prevails there; at any rate, when I am seated at my table with the instrument some yards off, I can always hear the call. In order to increase the intensity of sound, I fitted the mouthpiece with a copper horn of conical shape, and under these conditions words spoken in my bureau two or three yards from the mouthpiece can be heard at the other end of the line; from my station, a little more than a yard from the tube, I can hear and speak to my colleague without effort.’

In using the ordinary Bell telephone, it is necessary to speak distinctly before the mouthpiece of the telephone which is handled, while the listener placed at the corresponding station keeps the mouthpiece of the receiver to his ear. These two instruments form a closed circuit with the two wires which connect them, but one is enough to make the transmission perfect, if care is taken to place both instruments in connection with the earth, which thus takes the place of the second wire. M. Bourbouze asserts that the intensity of sound in the telephone is much increased by employing this expedient, but we believe that this increase depends upon the conditions of the circuit, although he asserts that the fact can be proved in a circuit not exceeding eighty yards.

For practical purposes it is necessary to have two telephones at each station, so as to hold one to the ear while speaking through the other, as in fig. 23. It is also much more easy to hear with a telephone applied to each ear, in which case they are held as in fig. 24. In order not to fatigue the arms, an arrangement has been made by which they are held before the ears by a strap and spring which goes round the head.

[Illustration: FIG. 23.]

The sending power of the telephone varies with different voices. Mr. Preece asserts that shouting has no effect, and that, in order to obtain a favourable result, the intonation must be clear, the articulation distinct, and the sounds emitted must resemble musical sounds as much as possible.

Mr. Wilmot, one of the electricians employed by the Post Office, says that he has been able to make himself heard on circuits through which no other voices were audible. The vowel sounds are most readily transmitted, and among other letters _e_, _g_, _j_, _k_, and _q_ are always repeated more imperfectly. The ear requires practice, and the faculty of hearing varies in a surprising degree in different people. Singing is very distinctly heard, as well as wind instruments, especially the cornet-à-piston, which, when played in London, was heard by thousands of people in the Corn Exchange at Basingstoke.

[Illustration: FIG. 24.]

According to Mr. Rollo Russell, it is not necessary to isolate the circuit of a telephone when the distance is relatively slight; thus, with a circuit of about 430 yards, it is possible to use a simple copper wire, laid on the grass, without destroying the telephonic transmission from a small musical box, as long as the two wires do not touch each other. Transmission took place, even when the circuit was buried in moist earth for a length of thirty-five yards, or immersed in a well for a length of forty-eight yards. The words transmitted under such conditions did not differ from those transmitted by an isolated circuit.

The telephone may be heard at the same moment by several listeners, either by connecting the wires which unite the telephones in correspondence (near the receiving telephone) with branch wires of other telephones, which may be done up to the number of five

or six, in short circuits; or by means of a little sounding-box closed by two thin membranes, one of which is fixed on the vibrating disk. When a certain number of acoustic tubes are connected with the membrane, Mr. M'Kendrick asserts that several people can hear distinctly.

Telephones may also transmit speech to different stations simultaneously, by inserting them on the same circuit, and experiments made at New York showed that five instruments placed in different parts of the same telegraphic line could be made to speak in this way. In the telephonic experiments made on the canal lines in the department of the Yonne, it was ascertained that on a wire seven miles and a half in length, on which several telephones were placed at varying distances, three or four persons were able to converse with each other through the telephones, and each could hear what the other was saying. The questions and answers could be understood, even in crossing. It was also possible, by placing a telephone on a second wire, a little over five miles in length, and half a yard distant from the other, to hear the conversation exchanged on the first wire by following it to a distance not exceeding a mile and a quarter. Even the different voices of the two speakers could be distinguished.

Since the telephone made its appearance in Europe, several inventors have asserted that they are able to make a telephone speak so as to be audible in all parts of a large hall. It has been shown that this was accomplished by Mr. Bell, and in this respect we do not see that those who have attempted to improve the telephone have attained results of greater importance. It is certain that the ordinary telephone can emit musical sounds which become perfectly audible in a tolerably large room, while the instrument is still attached to the wall. We should also remember the results obtained by MM. Pollard and Garnier in the experiments made at Cherbourg to connect the mole with the _Préfecture Maritime_.

The mole at Cherbourg is, as we know, a kind of artificial island thrown up before the town in order to make an anchorage. The forts which have been constructed on the mole are connected by submarine cables with the military port and with the _Préfecture Maritime_. On one occasion, after making experiments in the Préfet's study on one of the cables applied to a telephone, several persons were talking together in the room, and were much surprised to hear the bugle sound the retreat, the sound appearing to come from one part of the room. It was found, on examination, that the telephone hung to the wall was occupied with this performance. On enquiry, it appeared that one of the manipulators on the mole station had amused himself by sounding the bugle before the telephone on that station. The mole is more than three miles from Cherbourg, and the _Préfecture Maritime_ is in the centre of the town. Yet these telephones had been roughly made in the dockyard workshops; and we have here another proof of the small amount of accuracy required for the successful working of these instruments.

[Illustration: FIG. 25.]

Telephones of various construction on the Bell model are to be seen at M. C. Roosevelt's, Mr. Bell's agent in Paris, 1, Rue de la Bourse. They are, for the most part, constructed by M. Bréguet, and the model in the greatest request, exclusive of the one we have described, is the great square model, with a horseshoe magnet enclosed in a flat box, and a horn on its upper side, which serves as a mouthpiece. This system is represented in fig. 25, and it has been neatly constructed at Boston under the best conditions. In this new model, made by Mr. Gower, the magnet is composed of several plates terminated by magnetic cores of iron, to which the coils are fixed, and the whole is covered with a thick layer of paraffin. The sounds thus reproduced are much stronger and more distinct. Mr. Gower, who is now Mr. Roosevelt's partner, has made considerable improvements in the different forms of Mr. Bell's instrument. There is one model in the form of a snuff-box, in which the magnet is twisted into a spiral, so as to maintain its length in a circular form. The pole, which is in the centre of the spiral, is furnished with an iron core, to which the induction coil is fastened, and the cover of the snuff-box supports the vibrating disk as well as the mouthpiece: this model is represented in fig. 26. In another model, called the mirror telephone, the preceding arrangement is fitted on to a handle like the glass of a portable mirror, and there is a mouthpiece on one of the lateral faces, so that the speaker uses the instrument as if he were speaking before a chimney screen.

[Illustration: FIG. 26.]

Mr. Bailey has different models of telephones worked by a battery or by the Edison carbon of which we shall speak presently, and these, as well as the telephones by Messrs. Gray and Phelps, are more successful in conveying sound on a long line of wire.

DIFFERENT ARRANGEMENTS OF TELEPHONES.

The prodigious results attained with the Bell telephones, which were at first discredited by many scientific men, necessarily provoked, as soon as their authenticity was proved, innumerable researches on the part of inventors, and even of those who were

originally the most incredulous. A host of improvements and modifications have consequently been suggested, which are evidently not without interest, and must now be considered by us.

BATTERY TELEPHONES.

The Edison Telephone.--One of the earliest and most interesting improvements made in the Bell telephone is that introduced by Mr. Edison in the early part of the year 1876. This system is indeed more complicated than the one we have just considered, since it requires a battery, and the sending instrument differs from the receiving instrument; but it is less apt to be affected by external causes, and transmits sound to a greater distance.

The Edison telephone, like Mr. Gray's, which we have already had occasion to mention, is based upon the action of undulatory currents, determined by the variations in the resistance of a conductor of moderate conducting power, which is inserted in the circuit, and the vibrations of a diaphragm before which the speaker stands react upon it. Only, instead of employing a liquid conductor, which is practically useless, Mr. Edison has attempted to use semi-conducting solid bodies. Those which were most suitable from this point of view were graphite and carbon, especially the carbon extracted from compressed lamp-black. When these substances are introduced into a circuit between two conducting plates, one of which is moveable, they are capable of modifying the resistance of the circuit almost in the same proportion as the pressure exerted upon them by the moveable plate,[5] and it was seen that, in order to obtain the undulatory currents necessary for the production of articulate sounds, it was enough to introduce a disk of plumbago or of lamp-black between the vibrating plate of a telephone and a platinum plate placed in connection with the battery. When the telephone disk is placed in circuit, its vibrations before the disk of carbon produce a series of increasing and decreasing pressures, thus causing corresponding effects in the intensity of the transmitted current, and these effects react in an analogous manner on the undulatory currents determined by induction in the Bell system. In order to obtain good results, however, several accessory arrangements were necessary, and we represent in fig. 27 one of the arrangements made in this part of Mr. Edison's telephonic system.

[Illustration: FIG. 27.]

In this figure a section of the instrument is given, and its form greatly resembles that of Bell. L L is the vibrating disk; O′ O, the mouthpiece; M, the opening to the mouthpiece; N N N, the case for the instrument, which is, like the mouthpiece, made of ebonite, and below the disk it presents a rather large cavity, and a tubular hole which is scooped in the handle. In its upper part this tube terminates in a cylindrical rim, furnished with a worm on which is screwed a little rod with a ridge on its inner side, and the rheostatic system is placed within this tube. The system consists, first, of a piston E, fitted to the end of a long screw E F, and the turning of the button will move the piston up or down within a certain limit. Above this piston there is fitted a very thin platinum plate A, connected by a flexible chain and a wire with a binding-screw P′. Another plate B, exactly similar, is connected with the binding-screw P, and the carbon disk C is placed between these two plates. This disk is composed of compressed lamp-black and petroleum, and its resistance is one _ohm_, or 110 yards, of telegraphic wire. Finally, an ebonite disk is fastened to the upper platinum plate, and an elastic pad, composed of a piece of caoutchouc tube G, and of a cork disk H, is interposed between the vibrating plate L L and the disk B, in order that the vibrations of the plate may not be checked by the rigid obstacle formed by the whole rheostatic system. When these different parts are in position, the instrument is regulated by the screw F, and this is easily done by screwing or unscrewing it until the receiving telephone gives out its maximum of sound.

[Illustration: FIG. 28.]

In another model, represented in fig. 28, which has produced the best results in the distinctness with which sounds are transmitted, the vibrating plate L L is supported on the disks of the secondary carbon conductor C by means of a little iron cylinder A, instead of the caoutchouc pad, and the pressure is regulated by a screw placed below _e_. The mouthpiece E of the instrument is more prominent, and its opening is larger. Finally, the instrument, which is cased in nickel silver, is without a handle. The rigid disk _b_, resting on the first platinum plate _p_, is of aluminium instead of ebonite.

[Illustration: FIG. 29.]

The receiving telephone somewhat resembles that of Mr. Bell, yet it presents some differences which can be understood from the examination of fig. 29. The magnet N S is horseshoe in form, and the magnetising coil E only covers one of the poles, N: this pole is precisely in the centre of the vibrating plate L L, while the second pole is near the edge of this plate. The size of the plate itself is considerably reduced: its superficies is about the same as that of a five-franc piece, and it is enclosed in a kind of circular groove,

which keeps it in a definite position. In consequence of this arrangement the handle of the instrument is of solid wood, and the vacant space for the electro-magnetic system is somewhat larger than in the Bell model; but an arrangement is made for subduing the echo, and there is a kind of sounding-box to magnify the sound. It is evident that the relation which the electro-magnetic system bears to the vibrating disk must increase the sensitiveness of the instrument; for as the pole S is in close contact with the disk L L, the latter is polarised, and becomes more susceptible to the magnetic influence of the second pole N, which is separated from it by an interval not exceeding the thickness of a sheet of coarse paper. In Mr. Edison's two instruments, the receiver and sender, the upper part C C, corresponding to the vibrating disk, instead of being fixed by screws to the handle, is screwed on to the handle itself, which makes it much more easy to dismount the instrument.

Mr. Edison has varied the form of his instruments in many ways, and their cases have of late been made of metal with a funnel-shaped mouthpiece of ebonite.

When Mr. Edison had ascertained, as indeed Mr. Elisha Gray had done before him, that induced currents are more favourable to telephonic transmissions than voltaic currents, he transformed the currents from the battery which passed through his sender into induced currents by making them pass through the primary circuit of a carefully insulated induction coil; the line wire was then put into communication with the secondary wire of the coil. We shall afterwards describe some experiments which show the advantages of this combination: for the present we can only point out the fact, for it is now an integral quality of almost all the systems of battery telephones.

Edison's Chemical Telephone.--The curious and really useful effects produced by Mr. Edison with his _electro-motograph_ prompted, about the beginning of the year 1877, his idea of applying the principle of this instrument to the telephone for the reproduction of transmitted sounds; and he obtained such interesting results that the author of an article on telephones, published in the 'Telegraphic Journal,' August 15, 1877, put forward this invention as one of the finest of the nineteenth century. It certainly appears to have given birth to the phonograph, which has lately become famous, and has so much astonished men of science.

To understand the principle of this telephone, we must give some account of Mr. Edison's electro-motograph, discovered in 1872. This instrument is based upon the principle that if a sheet of paper, prepared with a solution of hydrate of potash, is fastened on a metallic plate which is united to the positive pole of a battery, and if a point of lead or platinum connected with the negative pole is moved about the paper, the friction which this point encounters ceases after the passage of the current, and it is then able to slide as if upon a mirror until the current is interrupted. Now, as this reaction may be effected instantaneously under the influence of extremely weak currents, the mechanical effects produced by these alternations of arrest and motion may, by a suitable arrangement of the instrument, determine vibrations in correspondence with the interruptions of current produced by the transmitter.

In this system the telephonic receiver consists of a resonator and a drum mounted on an axis and turned by a winch. A paper band, wound upon a reel, passes over the drum, of which the surface is rough, and a point tipped with platinum, and fitted to the end of a spring which is fixed in the centre of the resonator, presses strongly on the paper. The current from the battery, first directed on the spring, passes by the platinum point through the chemical paper, and returns by the drum to the battery. On turning the winch, the paper moves forward, and the normal friction which is produced between the paper and the platinum point pushes the point forward, while producing by means of the spring a tension on one side of the resonator; but since the friction ceases at each passage of the current through the paper, the spring is no longer drawn out, and the resonator returns to its normal position. Since this double effect is produced by each vibration made in the sender, a series of vibrations takes place in the resonator, repeating those of the sender, and consequently the musical sounds which affected the sender are reproduced to a certain extent. According to the American journals, the results produced by this instrument are astonishing: the weakest currents, which would have no effect on an electro-magnet, become perfectly efficacious in this way. The instrument can even reproduce with great intensity the highest notes of the human voice, notes which can hardly be distinguished by the use of electro-magnets.

The sender nearly resembles the one we have previously described, except that, when it is used for musical sounds, a platinum point is employed instead of the disk of carbon, and it ought not to be in constant contact with the vibrating plate. According to the 'Telegraphic Journal,' it consists simply of a long tube, two inches in diameter, having one end covered with a diaphragm formed of a thin sheet of copper, and kept in its place by an elastic ring. A small platinum disk is riveted to the centre of the copper diaphragm, and a point of the same metal, fitted with a firm support, is adjusted before the disk. When the singer stands before the diaphragm, its vibration causes it to touch the platinum point, and produces the number of breaks in the current which corresponds to the vibration of the notes uttered.

The experiments lately made in America, in order to decide on the merits of various telephonic systems, show that Mr. Edison's telephone gives the best results. The 'Telegraphic Journal,' May 1, 1878, states that on April 2 Mr. Edison's carbon telephone was tested between New York and Philadelphia on one of the numerous lines of the West Union. The length of the line was 106 miles, and ran parallel to other wires almost throughout its length. The effects of induction caused by telegraphic transmissions through the adjacent wires were enough to make speech inaudible through the other telephones, but they had no influence on Edison's telephone, which was worked with a battery of two cells and a small induction coil, and Messrs. Batchelor, Phelps, and Edison were able to converse with ease. Mr. Phelps' magnetic telephone, which is considered to be the most powerful of its kind, did not afford such good results.

In the experiments made between the Paris Exhibition building and Versailles, the jury commission was able to ascertain that the results were equally favourable.

Telephones by Colonel Navez.--Colonel Navez of the Belgian Artillery, inventor of the well-known balistic chronograph, has endeavoured to improve the Edison telephone by employing several disks of carbon instead of one. He considers that the variations of electric resistance produced by carbon disks under the influence of unequal pressure depend chiefly on their surface of contact, and he consequently believes that the more these surfaces are multiplied, the greater the differences in question will be, just as it happens when light is polarised through ice. He adds that these disks act well by their surfaces of contact, since, if they are separated by copper disks, the speech reproduced ceases to be articulate.[6]

I am not surprised to learn that Colonel Navez has found a limit to the number of carbon disks, for the reproduction of speech in this system is due both to the greatness of the differences of resistance in the circuit, and to the intensity of the transmitted current. If therefore the instrument's sensitiveness to articulate sounds is increased by increasing the number of imperfect contacts in the circuit, the intensity of the transmitted sounds is diminished, and thus sounds lose their power. There is consequently a limit to be observed in the number of carbon disks placed upon each other; and it depends on the nature of the imperfect contacts which are employed, and on the tension of the electric generator.

In order to stop the unpleasant musical vibrations which accompany telephonic transmissions, Colonel Navez employs for the vibrating plate of the sender a silver-plated copper disk, and for the vibrating plate of the receiver an iron disk lined with brass and soldered together. He also employs caoutchouc tubes with mouthpieces and ear-tubes for the transmission and reception of sound, and these instruments are placed level on a table. For this purpose the magnetised bar of the receiving telephone is replaced by two horizontal magnets, acting through a pole of the same nature on a little iron core which carries the coil, and which is placed vertically between the two magnets. He necessarily makes use of a small Ruhmkorff coil to transform the electricity of the battery into induced electricity.

[Illustration: FIG. 30.]

[Illustration: FIG. 31.]

Figs. 30 and 31 represent the two parts of this telephonic system. The carbon battery is in C (fig. 30), the vibrating disk in L L, and the mouthpiece E, fitted to a caoutchouc tube T E, corresponds at the lower end to the vibrating disk. The carbon battery is placed in metallic contact with the circuit by a platinum rod E C, and the vibrating disk also communicates with the circuit through a binding-screw. In the receiving telephone (fig. 31) the upper part is arranged much as in the ordinary telephones, except that, instead of a mouthpiece, the instrument is fitted with an ear-tube T O. The two horseshoe magnets, A, A, which communicate a uniform polarity to the iron core N, support the induction coil B. The two terminals of this receiver are connected with the supplementary wire of the induction coil, and the two terminals of the sender are connected with the two ends of the primary of this coil, and with the battery which is inserted in the circuit near this instrument.

The Pollard and Garnier Telephones.--The battery telephone made by MM. Pollard and Garnier differs from the foregoing in this particular: it simply employs two points of graphite, mounted in metallic porte-crayons, and these points are directly applied against the vibrating plate with a pressure which must be regulated. Fig. 32 represents the arrangement adopted, which, however, may be infinitely varied.

L L is the vibrating tin plate, above which is the mouthpiece E, and P, P′ are the two graphite points with their porte-crayons. There is a screw on the lower part of the porte-crayons which is fixed in a hole pierced in a metallic plate C C, and by this means the pressure of the pencils against the disk L L can be regulated. The metallic plate C C is made in two pieces, placed side by side, but

insulated from each other, so that they may be placed in communication with a cylindrical commutator, and by its means the circuit can be arranged in different ways. Since the commutator consists of five sheets, the transition from one combination to another is instantaneous, and these combinations are as follows:

1. The current enters by the pencil P, passes into the plate, and so to line.

2. The current enters by the pencil P′, passes into the plate, and so to line.

3. The current comes simultaneously by the two pencils P and P′, goes into the plate, and thence to line.

4. The current comes by the pencil P, goes thence to the plate, then into the pencil P′, and so to line.

[Illustration: FIG. 32.]

By this means there are two elements of combination, which may be employed separately, or by coupling them for tension or quantity.

When the pencils are properly regulated and give a regular transmission of equal intensity, the effects produced in the transition from one combination to another may be easily studied, and it has been ascertained: first, that in a short circuit there is no appreciable change, whatever be the combination employed; secondly, that when the circuit is long, or of great resistance, the tension arrangement is the best, and this in proportion to the length of the line.

This telephonic system, like the two preceding ones, requires an inducing machine to transform voltaic into induced currents: we shall presently speak of this important accessory of these instruments.

Besides this arrangement, MM. Pollard and Garnier have employed the one we have represented in fig. 5, which has given better results. We shall see presently that it can be used as the receiving organ of sounds. In each case the two carbons must be placed in contact, and subjected to a certain initial pressure, which should be regulated by the screw fitted to the support of the lower carbon.

As for the receiving telephone, the arrangement adopted by MM. Pollard and Garnier is the same as Bell’s, except that they employ tin plates and helices of greater resistance. This resistance ranges in fact from 100 to 125 miles. ‘We have always held,’ these gentlemen say, ‘that whatever may be the resistance of the outer circuit, there is an advantage in increasing the number of spirals, even when using wire No. 42, which is the one we prefer.’

[Illustration: FIG. 33.]

M. Hellesen’s Reaction Telephone.--M. Hellesen believed that the vibrations produced by the voice on the carbon of a telephonic sender would be magnified if the moveable part of the rheotome were subjected to an electro-magnetic action resulting from the vibrations themselves, and he has contrived a sender, which is based on the principle shown in fig. 33, and which has the merit of forming in itself the inducing apparatus intended to transform the voltaic currents employed. This instrument is composed of a vertical iron tube, supported on a magnetic bar N S, and surrounded by a magnetising coil B B, above which is fixed an inducing helix of fine wire I I, communicating with the circuit. Within the tube there is a lead pencil C, held by a porte-crayon which can be raised or lowered by means of a screw V fixed below the magnetic bar. Finally, above this pencil, there is an iron vibrating plate L L, with a platinum point in communication with the battery in its centre; the local circuit communicates with the pencil by means of the magnetising helix B, and for this purpose one end is soldered to the iron tube.

From this arrangement it follows that the vibrations of the plate L L, at the moment when it comes nearest to the pencil, tend to become greater in consequence of the attractive force exerted on the plate, and as the pressure of the lead pencil is increased, it increases the differences of resistance which result from it, and consequently causes greater variations in the intensity of the transmitted currents.

Reaction Telephone of Messrs. Thomson and Houston.--The telephonic arrangement we have described has lately been adopted by Mr. Elihu Thomson and Mr. Edwin J. Houston, who, on June 21, 1878, two months after M. Hellesen explained his system to me,[7] published an article in ‘The English Mechanic and World of Science’ about an instrument very similar to that of M. Hellesen.

In their instrument, the current, which passes through a body of moderately conducting capacity, acts on an electro-magnet provided with an induction coil, and this electro-magnet reacts on the diaphragm, in order to increase the range of its vibrations, and to create at the same moment two electric actions in the same direction: the only difference lies in the arrangement of the contact of this indifferent conductor with the vibrating plate. Instead of a simple contact effected by pressure between this plate and a carbon pencil, a fragment of the same substance with a sharpened point is fixed on the vibrating plate, and it dips into a drop of mercury which has been poured into the receptacle made for it at the upper end of the electro-magnet. In other respects, the arrangement of the instrument is that of an ordinary telephone, and the iron rod of the electro-magnet represents the magnetised bar of the Bell telephone. The inventors assert that this instrument can be used both as a sender and receiver, and it is in the following manner that it is worked in each case.

When the instrument is transmitting, the morsel of carbon dips more or less into the mercury, and consequently differences are produced in the surfaces of contact, according to the range of vibrations made by the plate; the current varies in intensity in proportion to this range, and induced currents in the induction coil result from these variations; the induced currents react on the receiving telephone, as in Bell's instrument, and are further strengthened by those which are produced electrically by the movement of the diaphragm before the induction coil, and the iron of the electro-magnet.

When the instrument is used as a receiver, the usual effects are displayed, for since the iron of the electro-magnet is magnetised by the current, its conditions are precisely those of the ordinary Bell telephone, and the induced currents reach it in the same manner, only with greater intensity. Messrs. Thomson and Houston assert that their system has produced excellent results, and that by it the sound of the voice is much less altered than in other telephones.

Telephones with batteries and liquid senders.--We have seen that in 1867 Mr. Gray conceived the idea of a telephonic system based on the differences of resistance effected in a circuit completed by a liquid, when the layer of liquid interposed between the electrodes varies in thickness under the influence of the vibrations of the telephonic plate which is in communication with one of these electrodes. This system has since been the subject of study by several inventors, among others by MM. Richemond and Salet; and I give some of the accounts which have been published respecting their researches.

Another telephone for the reproduction of articulate sounds, which M. Richemond terms the _electro-hydro telephone_, has been recently patented in the United States. It resembles that of Mr. Edison in some respects, but instead of making use of carbon disks to modify the resistance of the circuit, water is employed, and this water is placed in communication with the circuit and battery by means of two platinum points, one of which is fixed on the metallic diaphragm which vibrates under the influence of the voice. As the vibrations of the diaphragm transport the point which is attached to it to different parts of the interpolar layer of liquid, they diminish or increase the electric resistance of this layer, and cause corresponding variations in the intensity of the current traversing the circuit. The receiving telephone is of the usual kind. (See 'Telegraphic Journal,' September 15, 1877.)

M. Salet writes: 'I thought it would be interesting to construct a telephone in which there should be absolute solidarity in the movements of the two membranes, and for this purpose I have availed myself of the great resistance of liquids. Mr. Bell had already obtained some results by attaching to the vibrating membrane a platinum wire communicating with a battery, and dipping more or less into a metallic vessel, itself connected by the line with the receiving telephone and containing some acidulated water. I have substituted for the platinum wire a small aluminium lever supporting a disk of platinum, and at a very slight distance from it there is a second disk in connection with the line. The vibrations of the membrane, tripled or quadrupled in their range, are not altered in form, thanks to the small size and light weight of the lever: they cause variations in the thickness of the liquid layer traversed by the current, and consequently in its intensity, and these variations cause corresponding differences in the attractive force of the receiving electro-magnet. Under its influence the receiving membrane executes movements which are identical with those of the sending membrane. The sound transmitted is very distinct, and its _timbre_ is perfectly maintained, a result which might have been anticipated. The consonants, however, are not so clearly pronounced as those transmitted by Mr. Bell's instrument. This inconvenience is most apparent when the lever is heavy, and might easily be obviated. The electrolysis also produces a continual murmur, but this does not interfere with the distinctness of the sound.

'Since on this system the voice is not required to _produce_, but only to _direct_ the electric current generated by a battery, the intensity of the sound received might in theory be increased at pleasure. I have in fact been able to make the receiver emit very powerful sounds, and I think that this advantage greatly counterbalances the necessity of employing a battery, and a somewhat delicate sending instrument. Unfortunately it can only be used for moderate distances. Assuming that any displacement of the transmitting membrane increases the resistance to a degree equivalent to five or six hundred yards of wire: if the line is five

hundred yards long, the intensity of the current will be reduced by one half, and the receiving membrane will take up a fresh position, considerably differing from the first; but if the line is three hundred miles in length, the intensity of the current will only be modified by a thousandth part. An immense battery must therefore be employed in order that this variation may be translated by a sensible change in the position of the receiving membrane.' (See 'Comptes Rendus de l'Académie des Sciences,' February 18, 1878.)

M. J. Luvini, in an article inserted in 'Les Mondes,' March 7, 1878, has suggested a system of rheotome by means of a current, for battery telephones, which, although complicated, possibly offers some advantages, since it produces currents alternately reversed. In this system, the vibrating disk of the sender, which should be in a vertical position, reacts on a moveable horizontal wire, turned back at a right angle, and supporting on each of its branches two platinum points which dip into two bulbs, filled with a liquid of moderate conducting capacity. The two branches of this wire, insulated from each other, are placed in communication with the two poles of the battery, and the four cups into which the platinum wire dips communicate inversely with the line and the earth by means of platinum wires immoveably fixed in the cups. It follows from this arrangement, that when the distances are duly regulated between the fixed and moveable wires, two equal currents will be opposed to each other across the line circuit when the diaphragm is motionless; but as soon as it vibrates, the respective distances of the wires will vary, and it follows from this that there will be a differential current, of which the intensity will correspond with the extent of the displacement of the system, or with the range of vibrations, and the direction will vary with the movements above or below the line of the nodes of vibration. In this way the advantage of the induced currents is obtained.

Telephones with a battery and voltaic arcs.--In order to obtain variations of resistance of still greater sensitiveness than is the case with liquids or pulverised substances, the idea has been suggested of employing conductors of heated gas, and several arrangements of battery telephones have been made in which the circuit was completed by a stratum of air, separating the vibrating disk from a platinum point, which serves to excite an electric discharge of high tension. Under these conditions, the stratum of air becomes the conductor, and the intensity of the current which traverses it corresponds to its thickness. This problem has been solved, either by means of voltaic currents of high tension, or by a Ruhmkorff coil.

The former system was arranged by M. Trouvé, and he writes as follows on the subject in the journal 'La Nature' of April 6, 1878: 'A metallic vibrating membrane forms one of the poles of a high tension battery; the other pole is fastened before the disk by a micrometer screw which can be adjusted so as to vary the distance from the disk according to the tension of the battery, but without ever coming in contact with it. The distance must not in any case exceed that to which the discharge of the battery can extend. Under these conditions, the membrane which vibrates under the influence of the waves of sound has the effect of constantly modifying the distance between the two poles, and thus of continually varying the intensity of the current: consequently the receiving instrument (a Bell telephone, or telephone with an electro-magnet) is subjected to magnetic variations, corresponding to the variations of the current which affect it, and this has the effect of making the receiving instrument vibrate at the same moment. This kind of telephonic instrument relies, therefore, on the possibility of varying within wide limits the resistance of the outer circuit of a high-tension battery, in which the poles are not in contact. In order to vary the conditions of this resistance, it is also possible to interpose some vapour or other medium, such as air, or gas of greater or less rarity.'

M. Trouvé thinks that he was successful with his battery of small disks, moistened with sulphate of copper and sulphate of zinc, arranging these elements, to the number of five or six hundred, in glass tubes of small diameter. It is well known that it is unnecessary for the elements to be of large size in order to obtain tension currents.

M. de Lalagade has suggested an analogous mode by employing for the formation of the arc a current of which the tension is increased by inserting a strong electro-magnet into the circuit. This electro-magnet acts on a Hughes magnet in order to produce induction currents capable of making the receiving instrument act. M. de Lalagade says that a Bunsen battery, or one of six cells with bichromate of potash, will be enough to produce a continuous voltaic arc between the vibrating plate of a telephone and a platinum point which is sufficiently remote to avoid contact. It is necessary, however, to begin with a contact, in order to produce the formation of this arc. In M. de Lalagade's system, the vibrating plate should have in its centre a small platinum plate, in order to obviate the oxidising effects of the spark. The inventor asserts that sounds transmitted in this way, and reproduced in a telephone of which the electro-magnetic system is set upon a sounding-box, will have greater intensity than the sounds transmitted by an ordinary telephone, and the speaker will appear to be close to the ear.

Mercury Telephones.--These systems are based on the physical principle discovered by M. Lippmann, that if a layer of acidulated water is placed above mercury, and connected with it by an electrode and wire, every mechanical action which exerts

pressure on the surface of the mercury, and alters the form of its meniscus, will cause an electric reaction, capable of producing a current with a force which corresponds to the mechanical action exerted. Conversely, every electric action produced on the circuit of such a system will occasion a displacement of the meniscus, and consequently its movement, which will be more marked in proportion to the smallness of the tube in which the mercury is placed, and to the greatness of the electric action. This electric action may result from a difference of potential in the electric condition of the two extremities of the circuit, which communicate with the electric source employed, or with some electric generator.[8]

[Illustration: FIG. 34.]

In accordance with these effects, it is intelligible that if two tubes T T, pointed at the end, and containing mercury, are plunged into two vessels V V (fig. 34) containing acidulated water and mercury, and metallic wires, P P, Q Q, are used, first to connect the columns of mercury in the tubes, and secondly the layers of mercury at the bottom of the two vessels, the tubes being a little removed from the surface of the mercury in the vessels, we shall then have a metallic circuit, completed by two electrolytes, one of which will be subjected to the mechanical or electrical effects produced in the other. If two vibratory plates B B are placed above the tubes, and one of these is caused to vibrate, the other will reproduce these vibrations, influenced by the vibratory movements communicated by the corresponding column of mercury. The vibrations themselves will be in connection with the electrical discharges resulting from the movements of the column of mercury in the first tube, which are mechanically produced. If an electric generator is introduced into the circuit, the effect which we have just analysed will be caused by modifications in the potential of this generator, in consequence of electro-capillary effects. But if no generator is employed, the action will result from electric currents determined by the electro-capillary attraction itself. In the latter case, however, the instrument must be more delicately made, in order to obtain more sensitive electric reaction, and M. A. Bréguet describes his instrument as follows.

‘The instrument consists of a tube of thin glass, a few centimètres in length, containing alternate drops of mercury and acidulated water, so as to constitute so many electro-capillary elements, connected in tension. The two ends of the tube are fused together, yet so as to allow a platinum wire to touch the nearest drop of mercury on each side. A small circle of thin deal is fixed at right angles to the tube by its centre, thus providing a surface of some extent, which can be applied to the ear when the instrument is a receiver, and to make the tube more mobile under the influence of the voice when the instrument is a sender. The following are the advantages offered by instruments of this construction:--

‘1. They do not involve the use of a battery.

‘2. The disturbing influence of the resistance of a long line is almost destroyed in these instruments, although it is still appreciable in the Bell telephone.

‘3. Two mercury telephones, coupled together as we described above, are absolutely correlative, in this sense, that even different positions in the equilibrium of the mercury in one of them produce different positions of equilibrium in the opposite instrument. It is therefore possible to reproduce at a distance, without a battery, not merely faithful indications of oscillatory movements, which is done by the Bell telephone, but also the exact image of the most general movements.’

Friction Telephones.--Mr. E. Gray has quite recently applied the principle of producing sounds by the friction of animal tissues to the construction of a speaking telephone which may be heard through a whole room, like the singing condenser. He obtains this result by means of clockwork, which causes the rotation of the metallic disk of which we have spoken (p. 23), and on which a piece of skin is so arranged as to produce friction. A carbon or liquid telephone is placed at the sending station, in such a way as to react on an induction coil, as in the systems of Edison, Navez, or Pollard, and speech is reproduced on the rotating disk, and is audible, as we have said, without the necessity of approaching the ear to the instrument.

The best arrangement of the metallic disk on which the animal tissue rubs is that of a cylindrical box, of which the outer lid is made of a thin sheet of zinc with a highly polished, slightly oxidised surface; for the agent of friction, glove-leather slightly moistened with acidulated water may be used, or a sinew of an ox, or skin taken from the ear or tail of a pig.

MODIFICATIONS INTRODUCED IN THE CONSTRUCTION OF THE BELL TELEPHONES.

The modifications which we have been considering relate to the principle of the instrument; those which we have now to consider are only modifications in the form and arrangement of the different organs which form the Bell telephone itself, and which have been designed with the object of increasing the intensity and distinctness of the sounds produced.

Telephones with several diaphragms.--When we remember that the induced currents caused in a magnet result from the vibratory movements of the diaphragm, and that these are produced by the vibrations of the stratum of air interposed between this diaphragm and the vocal organ, it necessarily follows that if these vibrations of the air react on several diaphragms, each attached to its electro-magnetic organ, several induced currents might be caused simultaneously, and if these were properly connected, their effects on the receiver would be so much the more intense, since the sounds produced would result from the combination of several sources of sound. Several inventors, starting from this argument, have planned instruments of varying ingenuity, which we will now describe, but without being able to declare who was the first to realise this idea. It is in fact so simple, that it probably suggested itself to the minds of several inventors at the same time, and we see that while M. Trouvé proposed this improvement in France in November 1877, it was tried in America and discussed in England, where indeed it was not expected to produce very favourable results. Mr. Preece wrote on the subject in a paper entitled 'On some Physical Points connected with the Telephone,' which was published in April 1878. He observes that all the attempts to improve the telephone have ended in disappointment and failure. One of the first attempts of the kind was made by Mr. Wilmot, who expected to obtain favourable results by augmenting the number of diaphragms, helices, and magnets, connecting the helices in a series, and causing them to act simultaneously, so as to increase the energy of the currents developed by the influence of the voice; but experience showed that when the instrument acted directly, the vibratory effect of each of the diaphragms decreased in proportion to their number, and the general effect remained the same as with a single diaphragm. Mr. Wilmot's instrument was made in the beginning of October 1877, and that of M. Trouvé was only an imitation of it.

On the other hand, we see that if the telephones with several membranes were not successful in England, this was not the case in America, for the telephones which experience has shown to give the best results in that country are those of Mr. Elisha Gray and Mr. Phelps, and these have several diaphragms. It is evident that there are details of construction in these instruments which may appear insignificant in theory, and which are notwithstanding very important from a practical point of view, and we believe that it is to this circumstance that instruments of this kind owe their success or failure. Thus, for example, it seems that the vibrations of air caused in the mouthpiece ought to be immediately directed on the surface of the diaphragms by means of distinct channels; it is necessary that the empty space round each diaphragm should be sufficiently limited to prevent echoes and interruptions, unless the case is so large that there is no danger of such effects. Above all, it is necessary that the organs should be fixed in some material unsusceptible of reverberation, and for this reason a preference is given to iron or ebonite. It is certain that when the instrument is properly made, its effects are superior to those of the Bell telephones, and it is asserted in the 'Telegraphic Journal' that experiments were made with one of these instruments before the Royal Society, in London, May 1, 1878, and that the intensity of sound was in proportion to the number of diaphragms. This instrument was designed by Mr. Cox Walker, of York, and possessed eight diaphragms. He considers that this is the arrangement which gives the best results.

[Illustration: FIG. 35.]

Mr. Elisha Gray's System.--Mr. Elisha Gray's last system, which we represent in fig. 35, is one of those which have given the best effects. It is made, as we see, of two telephones, side by side, to which correspond two tubes, issuing from a common mouthpiece E. One of these telephones is seen in section in the plate, the other in elevation, and they correspond to the two branches of a nickel-plated horseshoe magnet N U S, which may serve as a suspension ring. In that part of the plate which represents the section, the induction coil is shown in B, and the magnetic core, of soft iron, in A, which is screwed to the polar end of the magnet S; the vibrating plate is in L L, and, as we see, the tube of the mouthpiece terminates on its surface.

In another model there are four telephones side by side, instead of two, and the effects produced are still more marked.

Mr. Phelps's System.--This system is only deduced from the last, but there are two models of it. In the larger one, which makes it possible to hear as distinctly as if the person with whom conversation is held were speaking in a loud voice in the same room, the two telephones are placed parallel to each other, and so as to present their diaphragms vertically; the space between these two diaphragms is occupied by a vertical tube, terminating at its lower end in a horizontal tube corresponding to the centres of the two diaphragms, and on this tube the mouthpiece is fitted, which projects outside the box in which the instrument is enclosed. The induction coils, and the magnetic cores which traverse them, follow the axis of the system, and seem to constitute the axis of a wheel which is polarised by the poles of a horseshoe magnet, of which the position with reference to the surface of the diaphragms can be regulated by moveable screws. The appearance of the instrument somewhat resembles a gyroscope, resting by a horizontal axis on two shafts which issue from a flattened horseshoe magnet.

Above this system there is the electro-magnetic apparatus of the call-bell, in which there is nothing peculiar, and which is like the German alarums of which we shall speak at the end of this account. This instrument is remarkable for strength and clearness of sound, and especially for its freedom from the Punch and Judy voice so displeasing in other telephones.

Mr. Phelps's small model is in the form of an oblong or elliptical snuff-box, of which the two centres are occupied by two telephonic systems, influenced by the same magnet. This magnet is placed in a horizontal position below the snuff-box, and its poles correspond to the magnetic cores of the coils. These cores are made of iron tubes, split longitudinally in order to destroy irregular induction reactions, and the iron diaphragms rest on five spiral springs, which raise them above the magnetic system. On their other surface the diaphragms are provided with rings of some semi-elastic substance, which prevent the central vibrations of the disks from becoming complicated by those of their edges. The lid, hollowed out in very shallow cavities, is next placed upon the disks, and there are channels of communication in it to serve as a sounding-box. The mouthpiece corresponds to one of these cavities, and the other is closed by a small metallic stopper, which can be withdrawn to regulate the instrument when necessary. Since the vibrations of air are transmitted by the channels to both cavities, the two telephones act together, although at first sight only one of them seems to be required to produce the effect.

Mr. Phelps praises the simultaneous effects produced on the two instruments, which he ascribes, first, to the semi-elastic ring surrounding the rim of each disk, and acting as the hammer of the ear, that is, as a damper; then, to the longitudinal splits of the magnetic core, and lastly to the small size of the cavities left above the vibrating disks. The instrument is made of ebonite, grooved on the surface in order to give a better grasp to the hand.

Mr. Phelps has a new model, called _the crown telephone_, which is now in use in America, together with Mr. Edison's carbon sender. In it each of the two systems of the large model we have described is worked by six horseshoe magnets radiating round the magnetic core, and so arranged that the north poles correspond to this core, and the other poles to the circular rim of the diaphragm. In this way the magnetic field is considerably enlarged, and the sound much intensified.

In experiments recently made at Dr. Wells's church, New York, an assembly of three hundred people were able to hear speech and vocal or instrumental music distinctly in different parts of the hall.

Mr. Cox Walker's System.--This system, on which we have already said a few words, has exactly the arrangement of that by Mr. Elisha Gray. The magnets which act upon the diaphragms are horseshoe, and separate pipes, issuing from a common mouthpiece, direct the vibrations of air on the diaphragms. These, indeed, are only defined parts of one diaphragm, bounded in a circle by mouthpieces corresponding to the air-pipes, and sufficiently restricted on their edges to limit the field of vibration.

M. Trouvé's System.--M. Trouvé has simplified the arrangement of telephones with a double diaphragm, by designing the instrument so as to make Bell's bar magnet react by both poles at once on several disks. For this purpose, he employs a tubular magnet, and winds a helix throughout its whole length, as we see in fig. 36. This magnet is maintained in a fixed position in the centre of a small cylindrical box, of which the base is slightly funnel-shaped, thus acting as a mouthpiece and acoustic tube. It is consequently pierced in the centre with a hole larger at _a_, the station for speaking, than on the opposite side _b_. Between the base and the poles of the magnet there are two vibrating iron plates, M, M′, one of which, M, is pierced with a hole _a_ of the same diameter as the hollow part of the magnet, and consequently smaller than that of the mouthpiece. Finally, several other plates _n_, _n_, _n_, are ranged in parallel lines between these two plates, so that the magnet and its helix may pass through them.

[Illustration: FIG. 36.]

When anything is said before the mouthpiece _a_, the waves of sound encountering the edges of the plate M place it in vibration, and, continuing their passage inside the tubular magnet, they cause the plate M′ to vibrate at the same time as M. A double inducing action therefore takes place on the tubular magnet, and this is translated by the induced currents developed in the helix, which have greater energy since each of the plates intensifies the magnetic effects produced at the pole opposite to the one they influence, which is always the case with bar magnets when the inactive pole is provided with an armature. This advantage may even be obtained in the case of ordinary telephones, if the screw which holds the magnet is placed in contact with a mass of soft iron.

In M. Trouvé's arrangement, the induced currents therefore possess greater energy; but he adds that the sounds reproduced will also be strengthened by the multiplicity of vibratory effects, and by the enlargement of the magnetic effects, which results from a better arrangement of the magnets.

‘When the ear is placed at _a_,’ M. Trouvé writes, ‘it perceives immediately the sounds produced by the first plate M, and those of the second plate reach the ear through the interior of the magnet. This new arrangement is well adapted for an experimental comparison of the results produced by a telephone with a single membrane (a Bell telephone), and those produced by a telephone with several membranes. It is in fact enough to listen at the two faces of the telephone alternately, in order to perceive at once the difference of intensity in the sounds produced. Those collected at _a_, on the side of the pierced iron plate, appear manifestly doubled in intensity compared with those collected at _b_ on the side of the simple membrane which forms the ordinary telephone.

‘The difference is still more striking if, in transmitting or receiving a sound of invariable intensity through a multiple telephone, the unbroken membrane M′ is repeatedly prevented from vibrating.’

Before making this arrangement M. Trouvé had planned another, which he presented to the Académie des Sciences, November 26, 1877, and which we have glanced at in the beginning of this chapter. He describes it in these terms:--

‘In order to increase the intensity of the effects produced in the Bell telephone, I have substituted for the single membrane a cubic chamber, of which each face is, with one exception, formed of a vibrating membrane. Each of these membranes, put in vibration by the same sound, influences a fixed magnet, which is also provided with an electric circuit. In this way, by connecting all the currents generated by the magnets, a single intensity is obtained, which increases in proportion to the number of magnets influenced. The cube might be replaced by a polyhedron, of which the faces might be formed of an indefinite number of vibrating membranes, so as to obtain the desired intensity.’

M. Demoget’s System.--Several other systems of telephones with multiple membranes have been proposed. One of them, planned by M. Demoget, consists in placing before the vibrating disk of the ordinary Bell telephone, separated by the space of a millimètre, one or two similar vibrating disks, taking care to pierce in the centre of the first a circular hole of the same diameter as that of the bar magnet, and to pierce a larger hole in the second membrane. The inventor asserts that the distinctness as well as the intensity of sounds is increased in this way.

‘By this arrangement,’ says M. Demoget, ‘since the vibrating magnetic mass is larger in proportion to the magnet, the electro-motive force of the currents generated is increased, and consequently the vibrations of the disks of the second telephone are more perceptible.’

Mr. McTighe’s Telephone.--In this telephone, which has several diaphragms, there is a horseshoe magnet, and instead of placing the coils upon the poles, there is a single coil fastened to an iron core, which is inserted between wide polar appendices fitted to the two poles of the magnet. These appendices consist of thin plates, which act as vibrating plates.

Modifications in the arrangement of Telephonic Organs.--We see that the forms given to the Bell telephone are very varied, and this is still more the case with its constituent organs, without, however, producing any remarkable improvements. Mr. Preece observes that little has been gained by varying the size and strength of the magnets, and the best effects have been obtained by using the horseshoe magnets directed by Mr. Bell himself. The telephone was certainly introduced into Europe with the arrangement which is theoretically the best, although Mr. Bell is still occupied in improving it. This is also the opinion of M. Hellesen, who, like Mr. Preece, has made many experiments on this point; but this has not deterred several people from declaring that they have discovered the way of making a telephone speak so as to be audible to an assembly of people.

Of the different instruments made with this object, that of M. Righi seems to be the most important. It was lately tried with success at the Académie des Sciences, the Conservatoire des Arts et Métiers, and the Press pavilion of the Exhibition.

[Illustration: FIG. 37.]

The receiver is only a Bell telephone of large size, with a diaphragm of parchment L L (fig. 37), in the centre of which there is a sheet-iron disk F. This membrane is stretched on a large funnel E, which is fixed on a box C C, containing the electro-magnetic coil B: and the magnet N S, much larger than in the ordinary instruments, issues from the box, and serves as its support.

[Illustration: FIG. 38.]

The sender resembles the one represented in fig. 19, except that, instead of liquid, M. Righi employs plumbago mixed with powdered silver, and the platinum needle is replaced by a metallic disk D (fig. 38). The receiver I, which contains the powder, is supported on a spring R, which can be pushed up and down by a regulating screw V, and the whole is fitted into a box C C, and

supported on a foot P. The speaker places himself above the mouthpiece E, and the vibrations transmitted to the membrane L L cause the variations of resistance in I which are necessary for the transmission of speech, as in the Edison system. Two Bunsen cells are enough to set the instrument at work, and it will make the sound of a trumpet or flute audible throughout a room. Vocal music, which is less intense, is necessarily transmitted to a rather less distance, and words spoken in the natural voice are heard by those standing about two yards and a half from the instrument.

The maximum distance at which the instrument has been worked with the battery only is twenty-eight miles, the distance between Bologna and Ferrara, and for greater distances it is necessary to have recourse to induction coils.

In this case, an induction coil is introduced into the circuit at each station, and its primary wire is traversed by a current from the local battery, and so also is the sender, which is elsewhere connected with the receiver by a commutator. The secondary circuit of these coils is completed through the earth and line wire. From this arrangement it follows that the induced current which influences the receiver in correspondence, only produces its effect after a second induction, produced on the primary wire of the local coil, and it appears that this is a sufficient effect; but the advantage of this arrangement is, that it is possible to receive and transmit sounds without the aid of anything but the commutator.

Among other arrangements which have been suggested, we may mention one in which, instead of the bar magnet, a horseshoe magnet is used, with a vibrating plate placed between its poles. For this purpose the poles are tipped with iron, and one of them is pierced with a hole which corresponds to the mouthpiece of the instrument. The two branches of the magnet are also furnished with magnetising helices. When anything is spoken before the hole, the vibrating plate causes induced currents in the two helices: these currents would be of opposite direction if the poles were of like nature, but, since the magnetic poles are of contrary nature, they are in the same direction. The vibrating plate then acts like the two plates of M. Trouvé's instrument, which we have described above.

In another arrangement, lately made by Ader, the receiver is only an ordinary two-branched magnet, of which the armature is supported, at about two millimètres from its poles, by a glass plate to which it is glued, and the plate itself is fastened to two rigid supports. In order to hear it is only necessary to apply the ear to the plate. The sender is a moveable rod of iron or carbon, which rests on a fixed piece of carbon, with no pressure except its own weight, and it supports a concave disk, to which the speaker applies his mouth. These two parts are so arranged as to move horizontally, so that, when the instrument is suspended, the circuit is forcibly disconnected by the fact of its position, and is therefore closed until anyone takes it up to speak. Speech is well reproduced by this system, and may be transmitted to some distance if it is made on a larger scale.

Again, an anonymous inventor, in a little note inserted in 'Les Mondes,' February 7, 1878, writes as follows: 'Since the intensity of the currents produced in the telephone is in proportion to the mass of soft iron which vibrates before the pole of the magnet, and since, on the other hand, the plate is sensitive in proportion to its tenuity, I employ, instead of the ordinary plate, one reduced by nitric acid to the least possible thickness, and I fix it to a circle of soft iron, which keeps it stretched and forms part of the same substance. This circle is placed in a circular opening made inside the compartment. The intensity of a telephone is much increased when such a system replaces the ordinary plate, even at one end of the line.'

In order to obtain vibrating plates of extreme tenuity, M. E. Duchemin thought of employing very thin plates of mica, sprinkled with pulverised iron fixed to the plate by a layer of silicate of potash. The inventor asserts that it is possible to correspond in a low voice with the aid of this system; but it has this inconvenience, that the plate will be broken by speaking too loud.

Professor Jorgenson, of Copenhagen, has also made a Bell telephone which produces very intense sounds, and which has permitted him to observe some curious effects. In this instrument, the magnet is made in a mode analogous to Nicklès' tubular magnets. There is first a cylindrical magnet with a core of soft iron at its upper end, to which the coil is fitted; next, a magnetised tube, formed of a steel ring, which encloses the first magnetic system, and is connected with it by an iron tube. Finally, above the polar extremities of this system, there is the vibrating disk, with the same arrangement as that of ordinary telephones, and of which the superficies is large. If this plate is only a millimètre in thickness, the words spoken can be heard throughout a room; but the sounds lose their clearness when the ear is approached to the vibrating plate, the words are confused, and there is the reverberation which is observed on speaking in a place apt to produce echoes: the listener is, in fact, stunned by the sounds produced. On using a thicker plate--one, for example, of three or four millimètres--the telephone only produces the effect of the ordinary instruments, and it is necessary to apply the ear to it.

M. Marin Maillet, of Lyons, has suggested that the sounds reproduced by the telephone might be increased by reflecting them through a certain number of reflectors, which, by concentrating them in a focus on a resonator, would considerably enlarge them.

Since this idea was not accompanied by experiments, it can hardly be regarded as serious.

TELEPHONIC EXPERIMENTS.

Since Mr. Bell's experiments of which an account has been given in the early part of this work, much study has been given by men of science and inventors to the effects produced in this curious instrument, so as to ascertain its theory and deduce improvements in its construction. We will take a glance at these researches in succession.

Experiments on the Effects produced by Voltaic and Induced Currents.--The comparative study of the effects produced in the telephone by voltaic and induced currents was one of the first and most important. In 1873, as we have seen, Mr. Elisha Gray converted the voltaic currents, which he employed to cause the vibrations of his transmitting plate, into induced currents by means of an induction coil, such as Ruhmkorff's. The voltaic currents then traversed the primary helix of the coil, and the induced currents reacted on the receiving instrument, producing on its electro-magnetic system the vibrations excited at the sending station. When Mr. Edison designed his battery telephone, he had recourse to the same means to work his receiving telephone, since he had ascertained that induced currents were superior to voltaic currents. But this peculiarity of Mr. Edison's arrangement was not clearly understood from the descriptions which reached Europe, so that several persons believed that they had invented this arrangement--among others, Colonel Navez and MM. Pollard and Garnier.

Colonel Navez, in an interesting paper on the new telephonic system, presented to the Belgian Royal Academy, February 2, 1878, only suggests this arrangement as a mode of reproducing speech at a great distance; but he quotes no experiment which distinctly shows the advantages of this combination. Twenty days later, MM. Pollard and Garnier, unacquainted with Colonel Navez's researches, sent to me the results they had obtained by similar means, and these results appeared to me so interesting that I communicated them to the Académie des Sciences, February 25, 1878. In order that the importance of these results may be clearly understood, I will repeat the text of M. Pollard's letter, addressed to me on February 20, 1878:

'With the object of increasing the variations of electric intensity in the Edison system, we induce a current in the circuit of a small Ruhmkorff coil, and we fix the receiving telephone to the extremities of the induced wire. The current received has the same intensity as that of the inducing current, and consequently the variations produced in the current which works the telephone have a much wider range. The intensity of the transmitted sounds is strongly increased, and the value of this increase depends upon the relative number of spirals in the inducing and induced circuits. Our attempts to determine the best proportions have been laborious, since it is necessary to make a coil for each experiment; we have hitherto obtained excellent results with a small Ruhmkorff coil reduced to its simplest form, that is, without condenser or contact-breaker. The inducing wire is No. 16, and is wound in five layers; the induced wire is No. 32, and in twenty layers. The length of the coil is seven centimètres.

'The following is the most remarkable and instructive experiment: When setting the sender to work with a single Daniell cell, there is no appreciable effect at the receiving station, at least in the telephone which I have made, when it is in immediate connection with the circuit; after inserting the small induction coil, sounds become distinctly audible, and their intensity equals that of good ordinary telephones. Since the battery current is only moderately intense, the points of plumbago are not worn down, and the regulating apparatus lasts for a long while. When a stronger battery is used, consisting of six cells of bichromate of potash (in tension) or twelve Leclanché cells, sufficient intensity is obtained by the direct action to make sounds nearly as audible as in ordinary telephones; but when the induction coil is inserted, the sounds become much more intense, and may be heard at a distance of from fifty to sixty centimètres from the mouthpiece. Songs may, under such circumstances, be heard at a distance of several yards; but the relative increase does not appear to be so great as in the case of the single Daniell cell.'

On the other hand, 'Les Mondes,' March 7, 1878, contains an account of a series of experiments made by Signor Luvini, Professor of Physics at the Military Academy of Turin, which proved that the introduction of electro-magnets into the circuit which connects the two telephones sensibly increases the intensity of sound. The maximum effect is produced by placing one close to the transmitting, and the other close to the receiving telephone, and the introduction of other magnets is of no use. The inducing wire of a Ruhmkorff coil, when introduced into such a circuit, excited no sensible effects of induction in the induced circuit, and consequently could not set the telephone in connection with this circuit at work. But the current of a Clarke machine produces sounds resembling the beats of a drum, which are deafening when the ear is applied to the instrument: they become very faint, however, at the distance of a mètre. The currents of a Ruhmkorff machine are still more energetic, and the sound fills a whole room. By modifying the position of the lever of the coil, the sound passes through different tones, which are always in unison with the breaks of the current, at least up to a certain pitch.

This property of currents induced by the Ruhmkorff coil has enabled M. Gaiffe to obtain by their means a very simple mode of regulating telephones, so as to produce in them the maximum amount of sensibility. For this purpose he places the telephone he proposes to regulate in the circuit of an induction instrument with moveable helices and graduated intensities. The sounds which result from the vibrator are then reverberated from the telephone, and are audible at a distance from the instrument; by using a screw-driver, it is possible to adjust the screw to which the free end of the bar magnet of the instrument is fixed. It can be tightened or loosened, so as to advance or withdraw the other end of the magnet from the vibrating plate of the telephone, and the process is repeated until the maximum intensity of sound is obtained.

On the other hand, as the sounds given out by the two telephones in correspondence are intense in proportion to the degree of unison in the vibrations produced by them, it is necessary to select those which emit the same sounds for the same given note; and the mode we have just described may be employed with advantage, since it will be enough to observe what instruments give the same note in the condition of maximum sensibility, when regulated in the same way by the induction machine.

It is very important that the telephones in correspondence should be well matched, not only to ensure clear transmissions, but also with reference to the tone of voice of those who are to use it. The sound becomes more audible when the tone of voice corresponds to the telephonic tone; and for this reason some telephones repeat the voices of women and children better than those of men, and with others the reverse takes place.

The telephonic vibrations vary in different instruments, and these variations may be noted in the way we have indicated.

The advantages of induced currents in telephonic transmissions may be easily understood, if we consider that the variations of resistance in the circuit, resulting from the greater or less range in the vibrations of the transmitting plate, are of constant value, and can only manifest their effects distinctly in short circuits; consequently the articulate sounds which result from them can only be really appreciable in circuits of great resistance. According to Mr. Warren de la Rue's experiments (reported in the 'Telegraphic Journal,' March 1, 1878), the currents produced by the vibrations of the voice in an ordinary telephone represent in intensity those of a Daniell cell traversing 100 megohms of resistance (or 10,000,000 kilomètres); and it is plain that the simple question of greater or less intensity in the currents acting on the receiving telephone is not the only thing we have to consider. With an energetic battery, it is evident, in fact, that the differential currents will always be more intense than the induced currents produced by the action of the instrument. I myself am inclined to believe that induced currents owe the advantages they possess to the succession of inverse currents and their brief duration. These currents, of which M. Blaserna considers that the duration does not exceed 1/200 of a second, are much more susceptible than voltaic currents of the multiplied vibrations which are characteristic of phonetic vibrations, and especially since the succession of inverse currents which take place discharge the line, reverse the magnetic effects, and contribute to make the action more distinct and rapid. We cannot therefore be surprised that the induced currents of the induction coil, which can be produced under excellent conditions at the sending station, since the circuit of the voltaic current is then very short, are able to furnish results, not only more effective than the voltaic currents from which they take their origin, but even than the induced currents resulting from the action of the Bell telephone, since they are infinitely more energetic.

As for the effects produced by the currents of Bell telephones, which are relatively great when we consider their size, they are easily explained from the fact that they are produced under the influence of the vibrations of the telephone plate, so that their variations of intensity always maintain the same proportion, whatever may be the resistance of the circuit, and consequently they are not effaced by the distance which divides the two telephones.

Experiments on the part taken by the different telephonic organs in the transmission of speech.--In order to introduce all the improvements of which a telephone is capable, it is important to be quite decided as to the effects produced in the several parts of which it is composed, and as to the part taken by the several organs which are at work. To attain this object several men of science and engineers have undertaken a series of experiments which have produced very interesting results.

One of the points on which it was most important to throw light was that of ascertaining whether the vibrating plate used in their telephone receivers by Messrs. Bell and Gray is the only cause of the complex vibrations which reproduce speech, or if the different parts of the electro-magnetic system of the instrument all conduce to this effect. The experiments made by Mr. Page in 1837 on the sounds produced by the resonant electro-magnetic rods, and the researches pursued in 1846 by Messrs. de la Rive, Wertheim, Matteucci, &c., on this curious phenomenon, allow us to state the question, which is certainly more complex than it at first appears.

In order to start from a fixed point, it must first be ascertained whether a telephone can transmit speech without a vibrating plate. Experiments made by Mr. Edison[9] in November 1877, with telephones provided with copper diaphragms, which produced sounds, make the hypothesis credible; and it received greater weight from the experiments made by Mr. Preece and Mr. Blyth. The fact was placed beyond a doubt by Mr. Spottiswoode (see the 'Telegraphic Journal' of March 1, 1878), who assures us that the vibrating plate of the telephone may be entirely suppressed without preventing the transmission of speech, provided that the polar extremity of the magnet be placed quite close to the ear; and it was after this that I presented to the Académie des Sciences my paper on the theory of the telephone, which led to an interesting discussion of which I shall speak presently. At first the authenticity of these results was denied, and then an attempt was made to explain the sounds heard by Mr. Spottiswoode as a mechanical transmission of the vibrations, effected after the manner of string telephones; but the numerous experiments which have subsequently been made by Messrs. Warwick, Rossetti, Hughes, Millar, Lloyd, Buchin, Canestrelli, Wiesendanger, Varley, and many others, show that this is not the case, and that a telephone without a diaphragm can transmit speech electrically.

Colonel Navez himself, who had first denied the fact, now admits that a telephone without a diaphragm can emit sounds, and even, under certain exceptional conditions, can reproduce the human voice; but he still believes that it is impossible to distinguish articulate words.

This uncertainty as to the results obtained by the different physicists who have studied the matter shows that at any rate the sounds thus reproduced are not clearly defined, and that in physical phenomena, only appreciable to our senses, the appreciation of an effect so undefined must depend on the perfection of our organs. We shall presently see that this very slight effect can be largely increased by the arrangement adopted by Messrs. Bell and Gray, and we shall also see that, by a certain mode of magnifying the vibrations, it has been decisively proved that a telephone without a diaphragm can readily reproduce speech. I proceed to give the description of such a telephone, which was shown by Mr. Millar at the meeting of the British Association at Dublin in August 1878.

This instrument consists of a small bar magnet, three inches in length and 5/16 of an inch in width and thickness, and a copper helix (No. 30) of about six mètres in length is wound round the bar. It is fixed in a box of rather thick pasteboard, fitted above and below with two zinc plates, which render it very portable. With a telephonic battery sender and a single Leclanché cell, speech can be perfectly transmitted; the whistling of an air, a song, and even the act of respiration become audible. It seems also that the instrument can act without a magnet, merely with a piece of iron surrounded by the helix; but the sounds are then much fainter.

Signor Ignace Canestrelli obtained the same results by making one of the carbon telephonic senders react on a telephone without a diaphragm, by means of an induction coil influenced by two Bunsen cells. He writes as follows on the subject:

'With this arrangement I was able to hear the sound of any musical instrument on a telephone without a diaphragm: singing, speaking, and whistling were perfectly audible. Whistling could be heard, even when the telephone without a diaphragm was placed at some distance from the ear. In some cases, depending on the pitch of the voice, on the distance of the sending station, and on the joint pressure exerted by the carbons, I could even distinguish words.

'I finally discharged the currents of the transmitter into the coils of insulated copper wire with which the two poles of a magnet were provided. This magnet was placed on a musical box, made of very thin slips of wood, and on placing the ear at the opening of the box I obtained the same results as with the ordinary telephones without a diaphragm.'

M. Buchin, after repeating experiments of the same kind as the above, intimates that it is easy to hear the sounds produced by a telephone without a diaphragm, by introducing into the ear the end of an iron rod, of which the other end is applied to the active pole of the bar magnet of the telephone. (See 'Le Journal d'Electricité,' October 5, 1878.)

I repeat finally the account of some experiments made by Mr. Hughes and M. Paul Roy which are interesting from our present point of view.

1. If an armature of soft iron is applied to the poles of an electro-magnet, with its two branches firmly fixed on a board, and if pieces of paper are inserted between this armature and the magnetic poles, so as to obviate the effects of condensed magnetism; if, finally, this electro-magnet is connected with a speaking microphone, of the form given in fig. 39, it is possible to hear the words spoken in the microphone on the board which supports the electro-magnet.

2. If two electro-magnets are placed in communication with a microphone, with their poles of contrary signs opposite to each other, and if their poles are separated by pieces of paper, speech will be distinctly reproduced, without employing armature or diaphragm. These experiments are, however, delicate, and demand a practised ear.

3. If, instead of causing the current produced by a microphone to pass through the helix of a receiving telephone, it is sent directly into the bar magnet of this telephone in the direction of its axis--that is, from one pole to another--the words pronounced in the microphone may be distinctly heard. This experiment by M. Paul Roy indicates, if it is exact, that the electric pulsations which traverse a magnet longitudinally will modify its magnetic intensity. The experiment, however, demands verification.

Another point was obscure. It was important to know whether the diaphragm of a telephone really vibrates, or at least if its vibrations could involve its displacement, such as occurs in an electric vibrator, or in wind instruments which vibrate with a current of air. M. Antoine Bréguet has made some interesting experiments on the subject, which show that such a movement cannot take place, since speech was reproduced with great distinctness from telephones with vibrating plates of various degrees of thickness, and he carried the experiment so far as to employ plates fifteen centimètres in thickness.[10] When pieces of wood, caoutchouc, and other substances were laid upon these thick plates, the results were the same. In this case it cannot be supposed that the plates were moved to and fro. I have moreover ascertained, by placing a layer of water or of mercury on these plates, and even on thin diaphragms, that no sensible movement took place, at least when the induced currents produced by the action of speaking were used as the electric source. No ripples could be seen on the surface of the liquid, even when luminous reflectors were employed to detect them. And indeed it can hardly be admitted that a current not more intense than that of a Daniell element, which has traversed 10,000,000 kilomètres of telegraphic wire--a current which can only show deviation on a Thomson galvanometer--should be powerful enough to make an iron plate as tightly stretched as that of a telephone vibrate by attraction, even if we grant that the current was produced by laying a finger on the diaphragm.

Very nice photographic experiments do, however, show that vibrations are produced on the diaphragm of the receiving telephone; they are indeed excessively slight, but Mr. Blake asserts that they are enough to cause a very light index, resting on the diaphragm, to make slight inflections on a line which it describes on a register. Yet this small vibration of the diaphragm does not show that it is due to the effect of attraction, for it may result from the act of magnetisation itself in the centre of the diaphragm.[11] An interesting experiment by Mr. Hughes, repeated under different conditions by Mr. Millar, confirms this opinion.

If the magnet of a receiving telephone consists of two magnetised bars, perfectly equal, separated from each other by a magnetic insulator, and they are so placed in the coil as to bring alternately the poles of the same and of contrary signs opposite to the diaphragm, it is known that the telephone will reproduce speech better in the latter case than in the former. Now, if the effects were due to attraction, this would not be the case; for the actions are in disagreement when the poles of contrary signs are subjected to the same electric influence, while they are in agreement when these poles are of like signs.

On the other hand, it is known that if several iron plates are put together in order to form the diaphragm of the receiver, the transmission of sounds is much stronger than with a simple diaphragm; and yet the attraction, if it has anything to do with it, could only be exerted on one of the diaphragms.

It further appears that it is not merely the magnetic core which emits sounds, but that they are also produced with some distinctness by the helices. Signor Rossetti had already ascertained this fact, and had even remarked that they could be animated by a slight oscillatory movement along the bar magnet, when they were not fixed upon it. Several observers, among others M. Paul Roy, Herr Wiesendanger, and Signor Canestrelli, have since mentioned similar facts, which are really interesting.

‘If,’ writes M. Paul Roy, ‘a coil of fine wire, which is at the extremity of the bar magnet of a Bell telephone, receives the pulsatory currents transmitted by a carbon telephone, it is only necessary to bring the coil close to the ear in order to hear the sounds.

‘The sounds received in this way are very faint, but become much stronger if a piece of iron is introduced into the circuit coil. A magnet acts with still greater force, even when it consists of a simple magnetised needle. Finally, the sound assumes its maximum intensity when an iron disk is inserted between the ear and the coil.

‘By placing the end of the coil to the ear, and sending a current through it from the bar magnet, it is ascertained that the sound is at its minimum when the neutral line of the magnet is enclosed by the coil, and that it increases until attaining its maximum, when the magnet is moved until one of its poles corresponds to the coil.

‘This fact of the reproduction of sounds by a helix is universal. Every induction coil and every electro-magnet are capable of reproducing sound when the currents of the sender are of sufficient intensity.’

Signor Canestrelli writes as follows: ‘With the combination of a carbon telephone and one without diaphragm or magnet--that is, with only a simple coil--I was able to hear whistling through the coil, placed close to the ear. This coil was of very fine copper wire,

and the currents were produced through an induction coil by two Bunsen elements. The contacts of the telephone were in carbon, and it was inserted in the primary circuit.

‘I fastened the coil to the middle of a tightly stretched membrane which served as the base of a short metal cylinder. When a magnet was placed near this part of the coil, the sounds were intensified, and when I fixed the magnet in this position, I could hear what was said.

‘I afterwards substituted for the magnet a second coil, fastened to a wooden bar, and on causing the induced currents to pass into both coils at once I was able to hear articulate speech, although not without difficulty.

‘Under these latter conditions I found it possible to construct a telephone without a magnet, but it required a strong current, and it was necessary to speak into the sender in a special manner, so as to produce strong and concentrated sounds.’

Another very interesting experiment by M. A. Bréguet shows that all the constituent parts of the telephone--the handle, the copper rims, and the case, as well as the diaphragm and the electro-magnet--can transmit sounds. M. Bréguet ascertained this fact by the use of string telephones, which he attached to different parts of the telephone on which the experiment was made. In this way he was not only able to establish a correspondence between the person who worked the electric telephone and the one who was listening through the string telephone, but he also made several string telephones act, which were attached to different parts of the electric telephone.

These two series of experiments show that sounds may be obtained from different parts of the telephone without any very appreciable vibratory movements. But Signor Luvini wished for a further assurance of the fact, by ascertaining whether the magnetisation of any magnetic substance, followed by its demagnetisation, would involve a variation in the form and dimensions of this substance. He consequently caused a large tubular electro-magnet to be made, which he filled with a quantity of water, so that, when its two ends were corked, the liquid should rise in a capillary tube fitted to one of the corks. In this way the slightest variations in the capacity of the hollow part of the electro-magnet were revealed by the ascent or descent of the liquid column. He next sent an electric current of varying intensity through the electro-magnet, but he was never able to detect any change in the level of the water in the tube; although by this arrangement he could measure a change of volume of 1/30 of a cubic millimètre. It appears from this experiment that the vibrations produced in a magnetic substance under the influence of successive magnetisations and demagnetisations, are wholly molecular. Yet other experiments made by M. Canestrelli seem to show that these vibrations are so far sensible as to produce sounds which can be detected by the microphone. He writes as follows on the subject:

‘When the broken currents of an induction coil are discharged into a coil placed on a sounding-box, it is possible to hear at a little distance the sounds produced by the induced currents thus generated. On approaching the magnet to the opening of the coil, these sounds are intensified, and the vibrations of the magnet become sensible to the touch; this vibration might even be made visible by suspending the magnet inserted into the coil to a metallic wire, which is fitted to a membrane stretched on a drum, and the latter will then reproduce sounds. When the same magnet is suspended to a microphone, it is possible, with the aid of a telephone, to ascertain the same effects, which are then increased.’

We shall presently consider how these different deductions are to be interpreted, so as to render the true theory of the telephone intelligible; but, before doing so, we will mention some other experiments which are not without interest.

We have seen that the experiments of Messrs. Edison, Blyth, and Preece, show that sounds may be reproduced by a telephone with a diaphragm made of some unmagnetic substance, and they also show, which is still more curious, that these sounds may be transmitted under the influence of induced currents produced by these diaphragms when they are placed in vibration before the magnet. Messrs. Edison and Blyth had already adduced this fact, which was received with incredulity, but it has been confirmed by Mr. Warwick in an article published in the ‘English Mechanic.’ He writes that in order to act upon the magnet, so as to produce induced currents, something possessed of greater energy than gas must first be made to vibrate. It is not, however, necessary that this substance should be magnetic, for diamagnetic substances act perfectly.[12] Mr. Preece sought for the cause in the induced currents developed in any conducting body when a magnet is moved before it, currents which give rise to the phenomenon discovered by Arago and known by the name of magnetism by rotation. Yet these facts do not appear to us to be sufficiently well established to make the theory worthy of serious consideration, and it is possible that the effects observed resulted from simple mechanical transmissions.

To conclude the account of these experiments, we will add that Mr. W. F. Barrett thinks it somewhat difficult to define the mode of vibration of the diaphragm, since, while a certain amount of compression exerted on the iron destroys the sounds resulting from the peculiar effects of magnetisation, a still stronger compression causes them to reappear. It is certain that the question is full of obscurity, and demands great research: it is enough to have shown that the theory hitherto held is insufficient.

On the other hand, Colonel Navez considers that the intensity of sound reproduced in a telephone depends not only on the range of vibrations, but also on the vibrating surface and the effect it produces on the stratum of air which transmits the sound. (See paper by Colonel Navez in the 'Bulletin de l'Académie de Belgique,' July 7, 1878.)

Experiments on the Effects which result from Mechanical Shocks communicated to different parts of a Telephone.--If a piece of iron is applied to the screw which holds the magnet of the ordinary telephone, it is observed that the transmitted sounds are more distinct, owing to the force supplied to the active pole of the magnet; but at the moment when the piece of iron is applied to the screw a distinct noise is heard, which seems to be due to the mechanical vibrations caused in the magnet at the moment of the shock. M. des Portes, a lieutenant in the French navy, has lately made some interesting experiments on this class of phenomena. He has observed that if, in a telephonic circuit of 90 yards completed by the earth, the sending telephone is reduced to a simple magnet, provided with the coil which constitutes its electro-magnetic organ, and if this magnet is suspended vertically by a silken thread, with the coil above it, a blow struck upon the magnet, either by a copper rod or a piece of wood, will cause distinct sounds to be produced in the receiving telephone--sounds which will increase in intensity when the blow is struck close to the coil, and which will become still stronger, but less clear, if a vibrating plate of soft iron is placed in contact with the upper pole of the magnet.

When the striking instrument is made of iron, the sounds in question are more strongly marked than if it is of wood, and when the magnet has a vibrating disk applied to its active pole, a vibration of the disk takes place at the moment when the shock is heard.

If the striking body is a magnet, the sounds produced resemble those obtained when it is of iron, if the effect is produced between poles of the same nature; but if the poles are of contrary natures, a second noise is heard after each blow, which is produced by drawing away the magnet, and which appears to be a blow struck with much less force. The sound is of course increased if the magnet is provided with its vibrating disk.

If words are uttered on the vibrating disk of the sending telephone, when it is applied to the pole of the magnet, various sounds are heard on the receiving telephone, somewhat similar to those produced by vibrating one of the strings of a violin, and the sound made in withdrawing the disk from contact with the magnet is distinctly heard in the receiver.

The person who applies his ear to the vibrating disk of the sender when it is arranged as above, may hear the voice of anyone who speaks into the receiver, but cannot distinguish the words, owing, no doubt, to the condensed magnetism at the point of contact between the magnet and the vibrating disk, which slackens the magnetic variations and makes it more difficult for them to take place.

A coil is not necessary in order to perceive the blows struck upon the magnet with a rod of soft iron. It is enough to wind three turns of naked conducting wire, which acts as line wire, round one end of the magnet, and the sounds perceived cease, as in other experiments, when the circuit is broken, plainly showing that they are not due to mechanical transmission. It is a still more curious fact that if the magnet is placed in the circuit, so as to form an integral part of it, and if the two ends of the conducting wire are wound round the ends of the magnet, the blows struck upon the latter with the soft iron rod are perceived in the telephone as soon as one pole of the magnet is provided with a vibrating disk.

I have myself repeated M. des Portes' experiments by simply striking on the screw which, in ordinary telephones, fastens the magnet to the instrument, and I have ascertained that, whenever the circuit was complete, the blows struck with an ivory knife were repeated by the telephone: they were, it is true, very faint when the vibrating disk was removed, but very marked when the disk was in its place. On the other hand, no sound was perceived when the circuit was broken. These sounds were louder when the blows were struck upon the screw than when they were struck on the pole of the magnet itself above the coil: for this reason, that in the first case the magnet could vibrate freely, while in the second the vibrations were stifled by the fixed position of the bar magnet.

These effects may be to some extent explained by saying that the vibrations caused in the magnet by the shock produce undulatory displacements of the magnetised particles in the whole length of the bar, and that induced currents would, according to Lenz's law, result in the helix from these displacements--currents of which the force would increase when the power of the magnet was further excited by the reaction of the diaphragm, which acts as an armature, and also by that of the striking instrument when it

also is magnetic. Yet it is more difficult to explain M. des Portes' later experiments, and the effect may be produced by something more than the ordinary induced currents.

These are not the only experiments which show the effects produced under the influence of molecular disturbance of various kinds. Mr. Thompson, of Bristol, has observed that if a piece of iron and a tin rod placed perpendicularly on the iron are introduced into the circuit of an ordinary telephone, it is enough to strike the tin rod in order to produce a loud sound in the telephone. He has also shown that if the two ends of a bar magnet are enclosed by two induction coils which are placed in connection with the circuit of a telephone, and if the flame of a spirit lamp is moved below the magnet in the space dividing the two coils, a distinct sound is heard as soon as the flame exerts its influence on the bar magnet. This effect is undoubtedly due to the weakening of the magnetic force of the bar which is produced by the action of heat. I have myself observed that a scratching sound on one of the wires which connect the telephones is heard in both of them, at whatever point in the circuit the scratch is made. The sounds produced are indeed very faint, but they can be distinctly heard, and they become more intense when the scratch is made on the binding-screws of the telephone wires. These sounds cannot result from the mechanical transmission of vibrations, since they are imperceptible when the circuit is broken. From these experiments it appears that some sounds which have been observed in telephones tried on telegraph stations may arise from the friction of the wires on their supports--a friction which produces those very intense sounds which are sometimes heard on telegraphic wires.

Theory of the Telephone.--It appears from the several experiments of which we have spoken that the explanation generally given of the effects produced in the telephone is very imperfect, and that the transmission of speech, instead of resulting from the repetition by the membrane of the receiving telephone (influenced by electro-magnetism) of vibrations caused by the voice on the membrane of the transmitting membrane, is due to molecular vibrations produced in the whole electro-magnetic system, and especially on the magnetic core contained in the helix. These vibrations must be of the same nature as those which have been observed in resonant electro-magnetic rods by MM. Page, de la Rive, Wertheim, Matteucci, &c., and these have been employed in telephones by Reiss, by Cecil and Leonard Wray, and by Vanderweyde.

According to this hypothesis, the principal office of the vibrating plate consists in its reaction, in order to produce the induced currents when the voice has placed it in vibration, and by this reaction on the polar extremity of the bar magnet it strengthens the magnetic effects caused in the centre of the bar when it vibrates under the electro-magnetic influence, or at least when it is affected by the magnet. Since the range of these vibrations for a single note is great in proportion to the flexibility of the note, and since, on the other hand, the variations in the magnetic condition of the plate are rapid in proportion to the smallness of its mass, the advantage of employing, as Mr. Edison has done, very thin and relatively small plates is readily understood. In the case of transmission, the wider range of vibration increases the intensity of the induced currents transmitted. In the case of reception the variations in the magnetising force which produces the sounds are rendered clearer and more distinct, both in the armature membrane and in the bar magnet: something is gained, therefore, in each case. This hypothesis by no means excludes the phonetic effects of the mechanical and physical vibrations which may be produced in the armature plate under the influence of magnetisation and demagnetisation to which it is subjected, and these join their influence to that of the magnetic core.

What is the nature of the vibrations sent into the receiving telephone? This question is still obscure, and those who have studied it are far from being in agreement: as early as 1846 it was the subject of an interesting discussion between MM. Wertheim and de la Rive, and the new discoveries render it still more complex. M. Wertheim considers that these vibrations are at once longitudinal and transverse, and arise from attractions exchanged between the spirals of the magnetising helix and the magnetic particles of the core. M. de la Rive holds that in the case we are considering the vibrations are simply longitudinal, and result from molecular contractions and expansions produced by the different combinations assumed by the magnetic molecules under the influence of magnetisation and demagnetisation. This appears to us to be the most natural explanation, and it seems to be confirmed by the experiment made by M. Guillemin in 1846. M. Guillemin ascertained that if a flexible iron rod, surrounded by a magnetising helix, is kept in position by a vice at one end, and bent back by a weight at the other, it can be made to return instantly to its normal position by sending a current through the magnetising helix. This recovery can in such a case be due to nothing but the contraction caused by the magnetic molecules, which, under the influence of their magnetisation, tend to produce intermolecular attractions, and to modify the elastic conditions of the metal. It is known that when iron is thus magnetised it becomes as hard as steel, and a file makes no impression on its surface.

It is at any rate impossible to dispute that sounds are produced in the magnetic core, as well as in the armature, under the influence of intermittent electric action. These sounds may be musical or articulate; for as soon as the sender has produced the electric

action required, there is no reason why vibrations which are effected in a transverse or longitudinal direction should transmit the one more than the other. These vibrations may, as we have seen, be termed microscopic.

Signor Luvini, who shares our opinion of the foregoing theory, does not, however, think it wholly satisfactory, unless account is taken of the reaction caused by the bar magnet on the helix which surrounds it. ‘There cannot,’ he says, ‘be _action_ without _reaction_, and consequently the molecular action produced in the magnet ought to cause corresponding variations in the helix, and these two effects ought to contribute to the production of sounds.’ He supports this remark by a reference to Professor Rossetti’s experiment, of which we have spoken above.

We believe, however, that this double reaction of which Signor Luvini speaks is not indispensable, for we have seen that insulated helices can produce sounds; it is true that the spirals, reacting on each other, may be the cause of this.

The difficulty of explaining the production of sounds in an electro-magnetic organ destitute of armature caused the authenticity of the experiments we have described to be at first denied, and Colonel Navez started a controversy with us which is not likely to be soon terminated; yet one result of this controversy is that Colonel Navez was obliged to admit _that the sound of the human voice may be reproduced by a telephonic receiver without a disk_. But he still believes that this reproduction is so faint that it is not possible to recognise articulate words, and he maintains that the transverse vibrations of the disk, which are due to effects of attraction, are the only ones to reproduce articulate speech with such intensity as to be of any use.

It is certain that the articulation of speech requires a somewhat intense vibration which cannot easily be produced in a telephone without a diaphragm; for it must be remembered that in an instrument so arranged, the magnetic effects are reduced in a considerable ratio, which is that of the magnetic force developed in the magnet, multiplied by itself, and that so faint an action as that effected in a telephone becomes almost null when, in consequence of the suppression of the armature, it is only represented by the square root of the force which produced it. It is therefore possible that the sounds which are hardly perceptible in a telephone without a diaphragm become audible when the cause which provokes them is multiplied by itself, and when there are in addition the vibrations produced in the heart of the armature itself, influenced by the magnetisations and demagnetisations to which it is subjected.

In order to show that the action of the diaphragm is less indispensable than Colonel Navez seems to imagine, and that its vibrations are not due to electro-magnetic attractions, it will be enough to refer to Mr. Hughes’s experiments, which we have mentioned above. It is certain that if this were the effect produced, we should hear better when the two bar magnets present their poles of the same nature before the diaphragm, than when they present the poles of contrary natures, since the whole action would then converge in the same direction. Again, the more marked effects obtained with multiple diaphragms in juxtaposition completely exclude this hypothesis. It is, however, possible that in electro-magnetic telephones the iron diaphragm, in virtue of the rapid variations of its magnetic condition, may contribute to render the sounds clearer and more distinct; it may react in the way the tongue does; but we believe that the greater or less distinctness of the articulate sounds must be chiefly due to the range of vibrations. Thus Mr. Hughes has shown that the carbons of metallised wood employed in his microphonic speakers were to be preferred to retort carbons for the transmission of speech, for the very reason that they had less conductivity, so that the differences of resistance which result from differences of pressure are more marked, and consequently it is easier to seize the different degrees of vocal sounds which constitute articulate speech.

It must be clearly understood that what we have just said only applies to the Bell telephone, that is, to a telephone in which the electric currents have such a faint intensity that it cannot be supposed there is any external attractive effect. When these currents are so energetic as to produce such an effect, a transverse electro-magnetic vibration certainly takes place, which is added to the molecular vibration, and helps to increase the sounds produced. But it is no less true that this transverse vibration by attraction or by movement of the diaphragm is not necessary for the reproduction of sounds, whether musical or articulate.

We are not now concerned with the discussion of magnetic effects; there has been an advance in science since Colonel Navez started the controversy, and we must ask how his theory of the movements of the telephone diaphragm by attraction will explain the reproduction of speech by a receiving microphone destitute of any electro-magnetic organ, and I can assert that my experiments show that there can be no mechanical transmission of vibrations, since no sound is heard when the circuit is broken or deprived of its battery. Colonel Navez must therefore accept the molecular vibrations. This certainly gives us a new field for study; but it is because European men of science persist in remaining bound by incomplete theories that we have allowed the Americans who despise them to reap the glory of the great discoveries by which we have lately been astonished.

The experiments quoted above show that sounds may be reproduced not only by simple helices without an electro-magnetic organ, but also by the plates of a condenser, in spite of the pressure exerted upon them; and when we add to this the effects I have just pointed out, it may be supposed that vibrations of sound must result from every reaction between two bodies which has the effect of producing abruptly and at close intervals modifications in the condition of their electric or magnetic equilibrium. It is known that the presence of ponderable matter is necessary for the production of electric effects, and it is possible that the molecular vibrations of which I have spoken may be the result of molecular movements, due to the variations of the electric force which holds the molecules in a special condition of reciprocal equilibrium.

In conclusion, the theory of the telephone and microphone, considered as reproductive organs of speech, is still far from being perfectly clear, and it would be imprudent to be too positive on questions of such recent origin.

The theory of the electric transmission of sounds in electro-magnetic telephones is somewhat complex. It has been seen that they can be obtained from diaphragms of non-magnetic substance, and even from simple mechanical vibrations produced by shocks. Are we to ascribe them in the first case to the inductive reaction of the magnet on the vibrating plate, and in the second case to the movements of magnetic particles before the spirals of the helix? The matter is still very obscure; yet it is conceivable that the modifications of the inducing action of the magnet on the vibrating diaphragm may involve variations in the magnetic intensity, just as we can admit an effect of the same kind due to the approach and withdrawal of the magnetic particles of the spirals of the helix; M. Trève, however, believes that there is in the latter case a special action, which he has already had occasion to study under other circumstances, and he sees in the current thus caused the effect of the transformation of the mechanical labour produced amidst the magnetic molecules. The question is complicated by the fact that these effects are often produced by purely mechanical transmissions.

There is another point to consider, on which Colonel Navez has made some interesting remarks; that is, whether the effects in the receiver are stronger with permanent than with temporary magnets. In the first model of the telephone, exhibited by Mr. Bell at Philadelphia, the receiver was, as I have said, made of a tubular electro-magnet, furnished with a vibrating disk at its cylindrical pole; but this arrangement was abandoned by Mr. Bell, with the object, as he states in his paper, of rendering his instrument both a receiver and a sender.[13] Yet Colonel Navez maintains that the magnet plays an important part, and is even indispensable under the present conditions of its form. ‘It is possible,’ he says, ‘under certain circumstances, and by making the instrument in a special way, to make a Bell receiver speak without a permanent magnet, yet with an instrument of the usual construction the sound ceases when the magnet is withdrawn and replaced by a cylinder of soft iron. In order to restore the voice of the telephone, it is enough to approach the pole of a permanent magnet to the cylinder of soft iron. It follows from these experiments that a Bell telephone cannot act properly unless the disk is subjected to an initial magnetic tension obtained by means of a permanent magnet. It is easy to deduce this assertion from a consideration of the theory.’

The assertion may be true in the case of Bell telephones, which are worked by extremely weak currents, but when these currents are relatively strong, all electro-magnets will reproduce speech perfectly, and we have seen that M. Ader made a telephone with the ordinary electro-magnet which acted perfectly.

The action of the currents sent through the helix of a telephone can be easily explained. Whatever may be the magnetic conditions of the bar, the induced currents of different intensity which act upon it produce modifications in its magnetic state, and hence the molecular vibrations follow from contraction and expansion. These vibrations are likewise produced in the armature under the influence of the magnetisations and demagnetisations which are produced by the magnetic action of the core, and they contribute to the vibrations of the core itself, while at the same time the modifications in the magnetic condition of the system are increased by the reaction of the two magnetic parts upon each other.

When the bar is made of soft iron, the induced currents act by creating magnetisations of greater or less energy, followed by demagnetisations which are the more prompt since inverse currents always succeed to those which have been active, and this causes the alternations of magnetisation and demagnetisation to be more distinct and rapid. When the bar is magnetised, the action is differential, and may be exerted in either direction, according as the induced currents corresponding to the vibrations which are effected pass through the receiving coil in the same or opposite direction as the magnetic current of the bar. If these currents are in the same direction, the action is strengthening, and the modifications are effected as if a magnetisation had taken place. If these currents are of opposite direction, the inverse effect is produced; but, whatever the effects may be, the molecular vibrations maintain the same reciprocal relations and the same height in the scale of musical sounds. If the question is considered from the mathematical point of view, we find the presence of a constant, corresponding with the intensity of the current, which does

not exist in mechanical vibrations, and which may possibly be the cause of the peculiar tone of speech reproduced by the telephone, a tone which has been compared to the voice of Punch. M. Dubois Raymond has published an interesting paper on this theory, which appeared in 'Les Mondes,' February 21, 1878, but we do not reproduce it here, since his remarks are too scientific for the readers for whom this work is intended. We will only add that Mr. C. W. Cunningham asserts that the vibrations produced in a telephone cannot be manifested under precisely the same conditions as those which affect the tympanum of the ear, because the latter has a peculiar funnel-shaped form, which excludes every fundamental note, specially adapted to it, and this is not the case with the bars and magnetic plates which possess fundamental notes capable of greatly altering the half-tones of the voice. He considers the alteration of the voice observed in the telephone must be ascribed to these fundamental notes.

M. Wiesendanger's Thermophone.--M. Wiesendanger, in an article inserted in the 'English Mechanic and World of Science,' September 13, 1878, ascribes the reproduction of speech in certain telephones to vibratory movements resulting from molecular expansions and contractions produced by variations of temperature, and these variations would follow from the currents of varying intensity which are transmitted through the telephonic circuits. He was conscious of one objection to this theory, namely, that the movements of expansion and contraction due to heat are slowly produced, and consequently are not capable of substantial action, rapid enough to produce vibrations; but he considers that molecular effects need not take place under the same conditions as those which are displayed in the case of material substances.

M. Wiesendanger believes that this hypothesis will explain the reproduction of speech in the receiving microphones of Mr. Hughes, and that it may even be applied to the theory of the electro-magnetic telephone, if we consider that a magnetising helix, as well as a magnetic core, round which an electric current circulates, is more or less heated, according to the intensity of the current which traverses it, especially when the wire of the helix and the core are bad conductors of electricity and of magnetism. Pursuing this idea, M. Wiesendanger has sought to construct telephones in which calorific effects are more fully developed, and with this object he used very fine wire of German silver and platinum to make the coils. He ascertained that these coils could produce sounds themselves, and, to increase their intensity, he put them between disks of iron, or on tin tubes, placed on resonant surfaces close to the disks. In this way he says that he was able to make a good receiving telephone without employing magnets. He afterwards arranged the instrument in different ways, of which the two following are the most noteworthy.

In the first, the electro-magnetic system was simply formed by a magnetic disk with a helix wound round it, of which the wire was in connection with the circuit of a microphone, and which was fastened to the centre of the parchment membrane of an ordinary string telephone; the disk consisted of two iron plates separated by a carbon disk of smaller diameter, and the whole was so compressed as to form a solid mass.

In the second, the helix was wound on a tin tube, six inches long and five-eighths of an inch in diameter, which was soldered by merely a point to the centre of the diaphragm of an ordinary telephone.

The inventor asserts that the tube and diaphragm only act as resonators, and that the sounds produced by this instrument are nearly the same as those obtained from the ordinary string telephone: the tunes of a musical box were heard, and the reproduction of speech was perfect, both in intensity and in distinctness of sound; it even appeared that telephonic sounds were audible with the tin tube alone, surrounded by the helix. M. Wiesendanger says that 'these different receiving telephones show clearly that the diaphragm and magnet are not essential, but merely accessory, parts of a telephone.'

VARIOUS EXPERIMENTS MADE WITH THE TELEPHONE.

We must now consider a series of experiments which demonstrate the wonderful properties of the telephone, and which may also give some indication of the importance of the influences by which it is liable to be affected.

Experiments by M. d'Arsonval.--We have seen that the telephone is an extremely sensitive instrument, but its sensitiveness could scarcely be appreciated by ordinary means. In order to gauge it, M. d'Arsonval has compared it to the nerve of a frog, which has hitherto been regarded as the most perfect of all galvanoscopes, and it appears from his experiments that the sensitiveness of the telephone is two hundred times greater than that of the frog's nerve. M. d'Arsonval has given the following account of his researches in the records of the Académie des Sciences, April 1, 1878:

'I prepared a frog in Galvani's manner. I took Siemens' instrument of induction, used in physiology under the name of the chariot instrument. I excited with the ordinary pincers the sciatic nerve, and I withdrew the induced coil until the nerve no longer responded

to the electric excitement. I then substituted the telephone for the nerve, and the induced current, which had ceased to excite the latter, made the instrument vibrate strongly. I withdrew the induced coil, and the telephone continued to vibrate.

‘In the stillness of night I could hear the vibration of the telephone when the induced coil was at a distance fifteen times greater than the minimum at which the excitement of the nerve took place; consequently, if the same law of inverse squares applies to induction and to distance, it is evident that the sensitiveness of the telephone is two hundred times greater than that of the nerve.

‘The sensitiveness of the telephone is indeed exquisite. We see how much it exceeds that of the galvanoscopic frog’s leg, and I have thought of employing it as a galvanoscope. It is very difficult to study the muscular and nervous currents with a galvanometer of 30,000 turns, because the instrument is deficient in instantaneous action, and the needle, on account of its inertia, cannot display the rapid succession of electric variations, such as are effected, for example, in a muscle thrown into electric convulsion. The telephone is free from this inconvenience, and it responds by vibration to each electric change, however rapid it may be. The instrument is therefore well adapted for the study of electric tetanus in the muscle. It is certain that the muscular current will excite the telephone, since this current excites the nerve, which is less sensitive than the telephone. But for this purpose some special arrangement of the instrument is required.

‘It is true that the telephone can only reveal the variations of an electric current, however faint they may be; but I have been able, by the use of a very simple expedient, to reveal by its means the presence of a continuous current, also of extreme faintness. I send the current in question into the telephone, and, to obtain its variations, I break this current mechanically with a tuning-fork. If no current is traversing the telephone, it remains silent. If, on the other hand, the faintest current exists, the telephone vibrates in unison with the tuning-fork.’

Professor Eick, of Wurzburg, has also used the telephone for physiological researches, but in a direction precisely opposite to that explored by M. d’Arsonval. He ascertained that when the nerves of a frog were placed in connection with a telephone, they were forcibly contracted when anyone was speaking into the instrument, and the force of the contractions chiefly depended on the words pronounced. For instance, the vowels _a_, _e_, _i_ produced hardly any effect, while _o_ and especially _u_ caused a very strong contraction. The words _Liege still_, pronounced in a loud voice, only produced a faint movement, while the word _Tucker_, even when spoken in a low voice, strongly agitated the frog. These experiments, reminding us of those by Galvani, were necessarily based on the effects produced by the induced currents developed in the telephone, and they show that if this instrument is a more sensitive galvanoscope than the nerve of a frog, the latter is more susceptible than the most perfect galvanometer.

Experiments by M. Demoget.--In order that he might compare the intensity of the sounds transmitted by the telephone with the intensity of original sounds, M. Demoget placed two telephones in an open space. He held the first to his ear, while his assistant withdrew to a distance, constantly repeating the same syllable with the same intensity of tone in the second instrument. He first heard the sound transmitted by the telephone, and then the sound which reached him directly, so that comparison was easy, and he obtained the following results.

At a distance of 93 yards the original and the transmitted sounds were received with equal intensity, while the vibrating disk was about 5 centimètres from the ear. At this moment, therefore, the relative intensity was as 25 to 81,000,000. In other words, the sound transmitted by the telephone was only 1/3000000 of the emitted sound. ‘But,’ said M. Demoget, ‘since the stations at which we worked could not be regarded as two points freely vibrating in space, the ratio may be reduced by one half on account of the influence of the earth, and the sound transmitted by the telephone may be supposed to be 1,500,000 times weaker than that emitted by the voice.

‘Again, since we know that the intensity of the two sounds is in proportion to the square of the range of vibrations, it may be concluded that the vibrations of the two telephone disks were in direct proportion to the distance, that is, as 5 to 9,000, or that the vibrations of the sending telephone were eighteen hundred times greater than those of the receiving telephone. These latter may therefore be compared to molecular vibrations, since the range of those of the sending telephone was extremely small.

‘Without in any degree detracting from the merit of Bell’s remarkable invention,’ continues M. Demoget, ‘it follows from what I have said above that the telephone, considered as a sending instrument, leaves much to be desired, since it only transmits the 18/100 part of the original power; and if it has produced such unexpected results, this is due to the perfection of the organ of hearing, rather than to the perfection of the instrument itself.’

M. Demoget considers this loss of power which takes place in the telephone to be chiefly owing to the eight transformations in succession to which sound is subjected before reaching the ear, setting aside the loss due to the electric resistance of the line, which might in itself suffice to absorb the whole force.

In order to estimate the force of the induced currents which act upon a telephone, M. Demoget has attempted to compare them with currents of which the intensity is known, and which produce vibrations of like nature and force: for this purpose he has made use of two telephones, A and B, communicating through a line 22 yards in length. He placed a small file in slight contact with the vibrating disk of the telephone A, and caused friction between the file and a metallic plate: the sound thus produced was necessarily transmitted by the telephone B, with an intensity which could be estimated. He then substituted a battery for the telephone A, and the file was introduced into the circuit by connecting it with one of the poles. The current could only be closed by the friction of the file with the plate, which had a spring, and was in communication with the other end of the circuit. In this way broken currents were obtained, which caused vibration in the telephone B, and produced a sound of which the intensity varied with the strength of the battery current. In this way M. Demoget endeavoured to find the electric intensity capable of producing a sound similar to that of the telephone A, and he ascertained that it corresponded in intensity to that produced in a small thermo-electric battery formed of an iron and a copper wire, two millimètres in diameter, flattened at the end, and soldered to the tin: the faint current produced by this battery only caused a short wire galvanometer to deviate two degrees.

This estimate does not appear to us to unite so many conditions of accuracy as to enable us to deduce from it the degree of sensitiveness possessed by a telephone, a sensitiveness which the experiments of Messrs. Warren de la Rue, Brough, and Peirce show to be much greater. Mr. Warren de la Rue, as we have seen, used Thomson's galvanometer, and compared the deviation produced on the scale of this galvanometer with that caused by a Daniell cell traversing a circle completed by a rheostat: he ascertained that the currents discharged by an ordinary Bell telephone are equivalent to those of a Daniell cell traversing 100 megohms of resistance, that is, 6,200,000 miles of telegraphic wire. Mr. Brough, the Director of Indian Telegraphs, considers that the strongest current which at any given moment causes a Bell telephone to work does not exceed 1/1000000 of the unit of current, that is, one Weber, and the current transmitted to the stations on the Indian telegraphic line is 400,000 times as strong. Finally, Professor Peirce, of Boston, compares the effects of the telephonic current with those which would be produced by an electric source of which the electro-motive force should be 1/200000 part of a volt, or one Daniell cell. Mr. Peirce justly remarks that it is difficult to estimate the real value of these kinds of currents at any precise sum, since it essentially varies according to the intensity of the sounds produced on the transmitting telephone; but it may be affirmed that it is less than the 1/1000000 part of the current usually employed to work the instruments on telegraphic lines.

Signor Galileo Ferraris, who has recently published an interesting treatise on this question in the 'Atti della Reale Accademia delle Scienze di Torino' (June 13, 1878), states that the intensity of the currents produced by the ordinary Bell telephone varies with the pitch of the sound emitted.

Experiments by M. Hellesen, of Copenhagen.--In order to estimate the reciprocal effects of different parts of a telephone, M. Hellesen has made telephones of the same size with three different arrangements which act inversely to each other. The first was of the ordinary form, the second like that of Bell's first system, that is, with a membrane supporting a small iron armature on its centre, instead of a vibrating disk, and the third telephone consisted of a hollow cylindrical magnet, with the vibrating disk fixed to one of its poles, and the disk was adapted to move before a flat, snail-shaped spiral, of which the number of spirals equalled those of the two other helices. In this last arrangement, the induced currents resulting from the vibrations of the voice might be assimilated to those which follow from the approximation and withdrawal of the two parallel spirals, one of which should be traversed by a current. It is this last arrangement which Mr. Bell has adopted as producing the best effects, and it is rare in the history of discoveries that an inventor hits at once on the best arrangement of his instrument.

Experiments by M. Zetsche.--There are always a few perverse minds, impelled by a spirit of contradiction to deny evidence, and thus they attempt to depreciate a discovery of which the glory irritates them. The telephone and the phonograph have been the objects of such unworthy criticism. It has been said that electric action had nothing to do with the effects produced in the telephone, and that it only acted under the influence of mechanical vibrations transmitted by the conducting wire, just as in a string telephone. It was in vain to demonstrate to these obstinate minds that no sound is produced when the circuit is broken, and in order to convince them M. Zetsche has made some experiments to show, from the mode in which sound is propagated, that it is absurd to ascribe the sound produced in a telephone to mechanical vibration. He wrote to this effect in an article inserted in the 'Journal Télégraphique,' Berne, January 25, 1878:

‘The correspondence by telephone between Leipzig and Dresden affords another proof that the sounds which reproduce words at the receiving station are due to electric currents, and not to mechanical vibrations. The velocity with which sound is transmitted by vibrations on the wire, in the case of longitudinal undulations, may be estimated at three miles one furlong a second, so that the sound ought to traverse the distance from Leipzig to Dresden in 25 seconds. The same time ought to elapse before receiving the answer. Consequently there should be an interval of more than three-quarters of a minute allowed for each exchange of communication, which is by no means the case.’

Experiments which may be made by anyone.--We will conclude this chapter, devoted to the account of the different experiments made with the telephone, by the mention of a singular experiment, which, although easily performed, has only been suggested a few months ago by a Pennsylvanian newspaper. It consists in the transmission of speech by a telephone simply laid on some part of the human body adjacent to the chest. It has been asserted that any part of the body will produce this effect, but according to my experience, I could only succeed when the telephone was firmly applied to my chest. Under such conditions, and even through my clothes, I could make myself heard when speaking in a very loud voice, from which it appears that the whole of the human body takes part in the vibrations produced by the voice. In this case, the vibrations are mechanically transmitted to the diaphragm of the sending telephone, not by the air, but by the body itself acting on the outside of the telephone.

THE MICROPHONE.

The microphone is in fact only the sender of a battery telephone, but with such distinctive characteristics that it may be regarded as an original invention which is entitled to a special name. The invention has lately given rise to an unfortunate controversy between its inventor, Mr. Hughes, and Mr. Edison, the inventor of the carbon telephone and the phonograph--a controversy which has been embittered by the newspapers, and for which there were no grounds. For although the scientific principle of the microphone may appear to be the same as that of Mr. Edison’s carbon sender, its arrangement is totally different, its mode of action is not the same, and the effect required of it is of quite another kind. Less than this is needed to constitute a new invention. Besides, a thorough examination of the very principle of the instrument must make us wonder at Mr. Edison’s claim to priority. He cannot in fact regard as his exclusive possession the discovery of the property possessed by some substances of moderate conductivity of having this power modified by pressure. In 1856, and often subsequently, as for example in 1864, 1872, 1874, and 1875, I made numerous experiments on this point, which are described in the first volume of the second edition of my ‘Exposé des applications de l’Electricité,’ and also in several papers presented to the Académie des Sciences, and inserted in their _Comptes rendus_. M. Clarac again, in 1865, employed a tube made of plumbago, and provided with a moveable electrode, to produce variable resistances in a telegraphic circuit. Besides, in Mr. Edison’s telephonic sender, the carbon disk, as we have seen, must be subjected to a certain initial pressure, in order that the current may not be broken by the vibrations of the plate on which it rests, and consequently the modifications of resistance in the circuit which produce articulate sounds are only caused by greater or less increase and diminution of pressure, that is, by differential actions. We shall presently see that this is not the case with the microphone. In the first place, the carbon contact is effected in the latter instrument on other carbons and not with platinum disks, and these contacts are multiple. In the second place, the pressure exerted on all the points of contact is excessively slight, so that the resistances can be varied in an infinitely greater ratio than in Mr. Edison’s system; and for this very reason it is possible to magnify the sounds. In the third place, a microphone can be made of other substances besides carbon. Finally, no vibrating disk is needed to make the microphone act; the simple medium of air is enough, so that it is possible to work the instrument from some little distance.

We do not therefore see the grounds for Mr. Edison’s assertions, and especially for the way in which he has spoken of Messrs. Hughes and Preece, who are well known in science and are in all respects honourable men. I repeat my regret that Mr. Edison should have made this ill-judged attack on them, since it must injure himself, and is unworthy of an inventor of such distinction. If we look at the question from another point of view, we must ask Mr. Edison why, if he invented the microphone, he did not make us acquainted with its properties and results. These results are indeed startling, since the microphone has in so short a time attracted general attention; and it is evident that the clear-sighted genius of this celebrated American inventor would have made the most of the discovery if it were really his. The only justification for Mr. Edison’s claim consists in his ignorance of the purely scientific discoveries made in Europe, so that he supposed the invention of the microphone to be wholly involved in the principle which he regards as his peculiar discovery.

In Mr. Hughes’s instrument which we are now considering, the sounds, instead of reaching the receiving stations much diminished, which is the case with ordinary telephones, and even with that of Mr. Edison, are often remarkably increased, and it is for this

reason that Mr. Hughes has given to this telephonic system the name of Microphone, since it can be employed to discover very faint sounds. Yet we must add that this increase really takes place only when the sounds result from mechanical vibrations transmitted by solid substances to the sending instrument. The sounds propagated through the air are undoubtedly a little more intense than in the ordinary system, but they lose some of their force, and therefore it cannot be said that in this case the microphone has the same effect upon sounds as the microscope has on objects on which light is thrown. It is true that with this system it is possible to speak at a distance from the instrument, and I have even been able to transmit conversation in a loud voice, when standing at a distance of nine yards from the microphone. When close to the instrument, I was also perfectly able to make myself heard at the receiving station while speaking in a low voice, and even to send the sounds to a distance of ten or fifteen centimètres from the mouthpiece of the receiving telephone by raising the voice a little; but the increase of sound is not really very evident unless it is produced by a mechanical action transmitted to the standard of the instrument.

Thus the steps of a fly walking on the stand are clearly heard, and give the sensation of a horse's tread; and even a fly's scream, especially at the moment of death, is said by Mr. Hughes to be audible. The rustling of a feather or of a piece of stuff on the board of the instrument, sounds completely inaudible in ordinary circumstances, are distinctly heard in the microphone. It is the same with the ticking of a watch placed upon the stand, which may be heard at ten or fifteen centimètres from the receiver. A small musical box placed upon the instrument gives out so much sound, in consequence of its vibratory movements, that it is impossible to distinguish the notes, and in order to do so it is necessary to place the box close to the instrument, without allowing it to come in contact with any of its constituent parts. It therefore appears that the instrument is affected by the vibrations of air, and the transmitted sounds are fainter than those heard close to the box. On the other hand, the vibrations produced by the pendulum of a clock, when placed in communication with the standard of the instrument by means of a metallic rod, are heard perfectly, and may even be distinguished when the connection is made by the intervention of a copper wire. A current of air projected on the system gives the sensation of a trickle of water heard in the distance. Finally, the rumbling of a carriage outside the house is transformed into a very intense crackling noise, which may combine with the ticking of a watch, and will often overpower it.

Different Systems of Microphones.--The microphone has been made in several ways, but the one represented in fig. 39 is the arrangement which renders it the most sensitive. In this system, two small carbon cubes, A, B, are placed one above the other on a vertical wooden prism; two holes are pierced in the cubes to serve as sockets for a spindle-shaped carbon pencil, that is, with the points fined off at the two ends, and about four centimètres long: if of a large size, the inertia will be too great. One end of this pencil is in the cavity of the lower carbon, and the other must move freely in the upper cavity which maintains it in a position approaching to that of instable equilibrium, that is, in a vertical position. Mr. Hughes states that the carbons become more effective if they are steeped in a bath of mercury at red heat, but they will act well without undergoing this process. The two carbon cubes are also provided with metallic contacts which admit of their being placed in connection with the circuit of an ordinary telephone in which a Leclanché battery has been placed, or one, two, or three Daniell cells, with an additional resistance introduced into the circuit.

[Illustration: FIG. 39.]

In order to use this instrument, it is placed on a table, with the board which serves to support it, taking care to deaden any extraneous vibrations by interposing between this board and the table several folds of stuff so arranged as to form a cushion, or, which is better, a belt of wadding, or two caoutchouc tubes: what is said by a person standing before this system is immediately reproduced in the telephone, and if a watch is placed on the stand, or a box with a fly enclosed in it, all its movements are heard. The instrument is so sensitive that words said in a low voice are most easily heard, and it is possible, as I have already said, to hear the speaker when he is standing nine yards from the microphone. Yet some precautions are necessary in order to obtain good results with this system, and besides the cushions placed beneath the instrument to guard it from the extraneous vibrations which might ensue from any movements communicated to the table, it is also necessary to regulate the position of the carbon pencil. It must always rest on some point of the rim of the upper cavity; but as the contact may be more or less satisfactory, experience alone will show when it is in the best position, and it is a good plan to make use of a watch to ascertain this. The ear is then applied to the telephone, and the pencil is placed in different positions until the maximum effect is obtained. To avoid the necessity of regulating the instrument in this way, which must be done repeatedly by this arrangement, MM. Chardin and Berjot, who are ingenious in the construction of telephones on this pattern, have added to it a small spring-plate, of which the pressure can be regulated, and which rests against the carbon pencil itself. This system works well.

[Illustration: FIG. 40.]

M. Gaiffe, by constructing it like a scientific instrument, has given the instrument a more elegant form. Fig. 40 represents one of his two models. In this case, the cubes or carbon dice are supported by metallic holders, and the upper one E is made to move up and down a copper column G, so as to be placed in the right position by tightening the screw V. In this way the carbon pencil can be made to incline more or less, and its pressure on the upper carbon can be altered at pleasure. When the pencil is in a vertical position, the instrument transmits articulate sounds with difficulty, on account of the instability of the points of contact, and rustling sounds are heard. When the inclination of the pencil is too great, the sounds are purer and more distinct, but the instrument is less sensitive. The exact degree of inclination should be ascertained, which is easily done by experiment. In another model M. Gaiffe substitutes for the carbon pencil a very thin square plate of the same material, bevelled on its lower and upper surfaces, and revolving in a groove cut in the lower carbon. This plate must be only slightly inclined in order to touch the upper carbon, and under these conditions it transmits speech more loudly and distinctly.

I must also mention another arrangement, devised by Captain Carette of the French Engineers, which is very successful in transmitting inarticulate sounds. In this case the vertical carbon is pear-shaped, and its larger end rests in a hole made in the lower carbon; its upper and pointed end goes into a small hole made in the upper carbon, but so as hardly to touch it, and there is a screw to regulate the distance between the two carbons. Under such conditions, the contacts are so unstable that almost anything will put an end to them, and consequently the variations in the intensity of the transmitted current are so strong that the sounds produced by the telephone may be heard at the distance of several yards.

[Illustration: FIG. 41.]

Fig. 41 represents another arrangement, devised by M. Ducretet. The two carbon blocks are at D D′, the moveable carbon pencil is at C, the telephone at T, and the binding screws at B B′. An enlarged figure of the arrangement of the carbons is given on the left. The arm which holds the upper carbon D is fastened to a rod, bearing a plate P′, of which the surface is rough, and a little cage C′, made of wire netting, can be placed upon the plate, so as to enable us to study the movements of living insects.

When speech is to be transmitted with a force which can make the telephone audible in a large room, the microphone must have a special arrangement, and fig. 42 represents the one which Mr. Hughes considers the most successful, to which he has given the name of _speaker_.

[Illustration: FIG. 42.]

In this new form, the moveable carbon which is required to produce the variable contacts is at C, at the end of a horizontal bar B A, properly balanced so as to move up and down on its central point. The support on which the bar oscillates is fastened to the end of a spring plate in order that it may vibrate more easily, and the lower carbon is placed at D below the first. It consists of two pieces laid upon each other, so as to increase the sensitiveness of the instrument, and we represent the upper piece at E, which is raised so as to show that when it is desired only one of these carbons need be used. For this purpose the carbon E is fastened to a morsel of paper, which is fixed to the little board and contributes to the articulation. A spring R, of which the tension can be regulated by the screw _t_, serves to regulate the pressure of the two carbons. Mr. Hughes recommends the use of metallised charcoal prepared from deal.[14] The whole is then enclosed in a semi-cylindrical case H I G, made of very thin pieces of deal, and the system is fixed, together with another similar system, in a flat box, M J L I, which, on the side M I, presents an opening before which the speaker stands, taking care to keep his lower lip at a distance of two centimètres from the bottom of the box. If the two telephones are connected for strength, and if the battery employed consists of two cells of bichromate of potash, it is possible to act so strongly on the current, that, after traversing an induction coil only six centimètres long, a telephone of Bell’s square model can be made to speak, so as to be heard from all parts of a room; a speaking tube, about a yard long, must indeed be applied to it. Mr. Hughes asserts that the sounds produced by it are nearly as loud as those of the phonograph, and this is confirmed by Mr. Thomson.

M. Boudet de Paris has lately invented a microphone speaker of the same kind, with which it is possible to make a small telephone utter a loud sound. An induction coil, influenced by a single Leclanché cell, must be employed.

Suppose that a very small carbon rod with pointed ends is placed at the bottom of a box, of about the size of a watch. One end of the rod rests against a morsel of carbon, which is fastened to a very thin steel diaphragm, placed before a mouthpiece which acts as a lid to the box, and is screwed above it. Next suppose that a small piece of paper, folded in two, in the shape of the letter V, is fixed above that part of the carbon in contact with the carbon of the diaphragm. This constitutes the instrument, and in order to work it, it must be held in a vertical position before the mouth, at a distance of about three centimètres, and it is necessary to speak in the ordinary tone. If the telephone is placed in direct communication with this instrument, it will send the voice to a distance. Without

employing a Leclanché cell, the voice may be heard at the distance of ten yards, if one of the carbons used for the phonograph is placed before the mouthpiece of the telephone.

In this system, the sensitiveness of the instrument is entirely due to the slightness of the contact between the two carbons, and the slight elasticity of the folded paper constitutes the contact. Perhaps the paper itself has some influence; at any rate the most delicate spiral spring is incapable of producing the same effect, and it is necessary to suspend the instrument vertically, in order that the weight of the moveable carbon may not affect it. It can be regulated by depressing or elevating that part of the paper which rests on the carbon rod.

Although it is possible to work all telephones with this instrument, some are more effective than others. The mouthpiece must be concave, and the diaphragm must be close to its rim, and must be made of a particular kind of tin. The ordinary diaphragm does not act well, and M. Boudet de Paris has tried several, so as to obtain the maximum effect.

It is certain that when the instruments are as well regulated as those which the inventor has deposited with me, their results are really surprising. It is even possible, by using several microphones at the sending station, to obtain the reproduction of duets, and even of trios, with remarkable effect.

With this kind of microphone speaker M. Boudet de Paris is able to transmit speech into a snuff-box telephone, merely consisting of a flat helix of wire, placed before a slightly magnetised steel plate, and without insertion of a magnetic core. A single Leclanché cell was enough. An experiment of the same nature was tried in England, but it was found necessary to use six Leclanché cells.

[Illustration: FIG. 43]

[Illustration: FIG. 44.]

The microphone may also be made of morsels of carbon pressed into a box between two metallic electrodes, or enclosed in a tube with two electrodes represented by two elongated fragments of carbon. In the latter case the carbons ought to be as cylindrical as possible, and those made by M. Carré for the Jablochkoff candles are very suitable. Fig. 43 represents an instrument of this kind which M. Gaiffe arranged for me, and which, as we shall see, serves as a thermoscope (fig. 44). It is composed of a quill filled with morsels of carbon, and those at the two ends are tipped with metal. One of these metal tips ends in a large-headed screw which, by means of its supports A B, is able to press more or less on the morsels of carbon in the tube, and consequently to establish a more or less intimate contact between them. When the instrument is properly regulated, speech can be reproduced by speaking above the tube. It is therefore a microphone as well as a thermoscope. Mr. Hughes has remarked one curious fact, namely, that if the different letters of the alphabet are pronounced separately before this sort of microphone, some of them are much more distinctly heard than others, and it is precisely those which correspond to the breathings of the voice.

A microphone of this kind may be made by substituting for the carbon powders of more or less conductivity, or even metal filings. I have shown in my paper on the action of substances of moderate conductivity, that such power varies considerably with the pressure and the temperature; and as the microphone is based on the differences of conducting power which result from differences of pressure, we can understand that these powders may be used as a means of telephonic transmission. In a recent arrangement of this system Mr. Hughes has made the powder adhere together with a sort of gum, and has thus made a cylindrical pencil which, when connected with two electrodes which are good conductors, can produce effects analogous to those we have just described. As I have said, it is possible to use metal filings, but Mr. Hughes prefers powdered charcoal.

Mr. Blyth states that a flat box, about 15 inches by 9, filled with coke, and with two tin electrodes fixed to the two ends, is one of the best arrangements for a microphone. He says that three of these instruments, hung like pictures against the wall of a room, would suffice, when influenced by a single Leclanché cell, to make all the sounds produced in a telephone audible, and especially vocal airs. Mr. Blyth even asserts that a microphone capable of transmitting speech can be made with a simple piece of coke, connected with the circuit by its two ends, but it must be coke: a retort carbon, with electrodes, will not act.

It is a remarkable property of these kinds of microphones that they can act without a battery, at least when they are so arranged as to form a voltaic element for themselves, and this can be done by throwing water on the carbons. Mr. Blyth, who was the first to speak of this system, does not distinctly indicate its arrangement, and we may assume that his instrument did not differ from the one we have already described, to which water must have been added. In this way, indeed, I have been able to transmit not only the ticking of a watch and the sounds of a musical box, but speech itself, which was often more distinctly expressed than in an ordinary microphone, since it was free from the sputtering sound which is apt to accompany the latter. Mr. Blyth also asserts that

sounds may be transmitted without the addition of water, but in this case he considers that the result is due to the moisture of the breath. Certainly much moisture is not required to set a voltaic couple in action, especially when a telephone is the instrument of manifestation. The ordinary microphone may be used without a battery, if the circuit in which it is inserted is in communication with the earth by means of earthen cakes; the currents which then traverse the circuit will suffice to make the tickings of a watch placed upon the microphone perfectly audible. M. Cauderay, of Lausanne, in a paper sent to the Académie des Sciences, July 8, 1878, informs us that he made this experiment on a telegraphic wire which unites the Hôtel des Alpes at Montreux with a _châlet_ on the hill--a distance of about 550 yards.

The Microphone used as a Speaking Instrument.--The microphone can not only transmit speech, but it can also under certain conditions reproduce it, and consequently supply the place of the receiving telephone. This seems difficult to understand, since a cause for the vibratory motion produced in part of the circuit itself can only be sought in the variations in intensity of the current, and the effects of attraction and magnetisation have nothing to do with it. Can the action be referred to the repulsions reciprocally exerted by the contiguous elements of the same current? Or are we to consider it to be of the same nature as that which causes the emission of sounds from a wire when a broken current passes through it, so that an electric current is itself a vibratory current, as Mr. Hughes believes? It is difficult to reply to these questions in the present state of science; we can only state the fact, which has been published by Messrs. Hughes, Blyth, Robert Courtenay, and even by Mr. Edison himself. I have been able to verify the fact myself under the experimental conditions indicated by Mr. Hughes, but I was not so successful in the attempt to repeat Mr. Blyth's experiments. This gentleman stated that in order to hear speech in a microphone it would be enough to use the model made from fragments of carbon, as we have described, to join to it a second microphone of the same kind, and to introduce into the circuit a battery consisting of two Grove elements. If anyone then speaks above the carbons of one of the microphones, what is said should be distinctly heard by the person who puts his ear to the other, and the importance of the sounds thus produced will correspond with the intensity of the electric source employed. As I have said, I was unable by following this method to hear any sound, still less articulate speech; and if other experiments had not convinced me, I should have doubted the correctness of the statement. But this negative experiment does not in fact prove anything, since it is possible that my conditions were wrong, and that the cinders which I employed were not subject to the same conditions as Mr. Blyth's fragments of coke.

[Illustration: FIG. 45.]

With respect to Mr. Hughes's experiments, I have repeated them with the microphone made by MM. Chardin and Berjot, using that by M. Gaiffe as the sender, and I ascertained that with a battery of only four Leclanché cells, a scratch made on the sender, and even the tremulous motion and the airs played in a little musical box placed on the sender, were reproduced--very faintly, it is true--in the second microphone; in order to perceive them, it was enough to apply the ear to the vertical board of the instrument. It is true that speech was not reproduced, but of this Mr. Hughes had warned me; it was evident that with this arrangement the instrument was not sufficiently sensitive.

A different arrangement of the microphone is required for the transmission and the reproduction of speech by this system, and a section of the one which Mr. Hughes found most successful is given in fig. 45. It somewhat resembles Mr. Hughes's microphone speaker, placed in a vertical position, and the fixed carbon is fastened to the centre of the stretched membrane of a string telephone. The ear or mouth tube is at A, the membrane at D D, the carbon just mentioned at C: this carbon is of metallised charcoal prepared from deal, and so also is the double carbon E, which is in contact with it and is fastened to the upper end of the little bar G I. The whole is enclosed in a small box, and the pressure exerted on the contact of the two carbons is regulated by a spring R and a screw H. The tube of the telephone serves as an acoustic tube for the listener, and Mr. Hughes's speaker, described above, acts as sender. It is hardly necessary to say that the two instruments are placed at each end of the circuit, that the carbons are connected with the two poles of a battery of one or two cells of bichromate of potash, or two Bunsen or six Leclanché cells, and the two instruments are connected by the line wire. Under such conditions, conversation may be exchanged, but the sounds are always much less distinct than they are in a telephone.

I was able to ascertain this fact with a roughly made instrument brought from England by Mr. Hughes. MM. Berjot, Chardin, and de Méritens, who were also present at the experiments, were able with me to hear speech perfectly, and I have since successfully repeated the experiment alone, but it does not always succeed, and under its present conditions the instrument has no importance in a scientific point of view. It is evident that the instrument can dispense with any support, and the little box then forms the handle of the instrument; in this case the two binding screws are placed at the end of this handle, as in a telephone. The microphone speaker with a disk, represented in fig. 5, which acts as sender to the singing condenser, can be used, when properly regulated, as

a receiving microphone. M. Berjot has obtained good results from a little instrument of the same kind as that in fig. 45, but with a metal diaphragm, and the microphonic system consists of a cylindrical piece of carbon resting on a small disk of the same substance, which is galvanised and soldered to the diaphragm. The whole is enclosed in a small round box, with its upper part cut in the form of a mouthpiece.

It seems that all microphone senders with disks can reproduce speech more or less perfectly; it is a question of adjusting and refining the carbon points of contact. A weak battery, consisting of a single Leclanché cell, is better for these instruments than a strong battery, precisely because of the effects of oxidation and polarisation, which are so energetically produced at these points of contact when the battery is strong.

The effects of the microphone receiver explain the sounds, often very intense, produced by the Jablochkoff candles when they are influenced by electro-magnetic machines. These sounds always vibrate in unison with those emitted by the machine itself, and they result, as I have already shown, from the rapid magnetisations and demagnetisations which are effected by the machine. These effects, observed by M. Marcel Deprez, were particularly marked in M. de Méritens' first machines.

Other Arrangements of Microphones.--An arrangement such as we have just described has been employed by M. Carette to form an extremely powerful microphone speaker. The only difference is that the stretched membrane is replaced by a thin metallic disk: he fastens one of the carbons to the centre of this disk, and applies to it the other carbon, which is pointed, and held by a _porte-carbon_ with a regulating screw, so that the pressure which takes place between the two carbons may be regulated at pleasure. By this arrangement speech may be heard at a distance from the telephone. In other respects it resembles the telephone sender represented in fig. 5.

M. de Méritens has executed the system represented, fig. 45, on a large scale, forming the tube A B of a zinc funnel a yard in length, and in this way he has been able to magnify the sounds, so that a conversation held in a low voice, three or four yards from the instrument, has been produced in a telephone with more sonorous distinctness. The instrument was placed on the floor of the apartment, with the opening of the funnel above, and the telephone was in the cellars of the house.

The form of the microphone has been varied in a thousand ways, to suit the purposes to which it was to be applied. In the 'English Mechanic and World of Science,' June 28, 1878, we see the drawings of several arrangements, one of which is specially adapted for hearing the steps of a fly. It is a box, with a sheet of straw paper stretched on its upper part; two carbons, separated by a morsel of wood, and connected with the two circuit wires, are fastened to it, and a carbon pencil, placed crosswise between the two, is kept in this position by a groove made in the latter. A very weak battery will be enough to set the instrument at work, and when the fly walks over the sheet of paper it produces vibrations strong enough to react energetically on an ordinary telephone. The instrument must be covered with a glass globe. When a watch is placed on the membrane, with its handle applied to the morsel of wood which divides the two carbons, the noise of its ticking may be heard through a whole room. Two carbon cubes placed side by side, and only divided by a playing-card, may also be used instead of the arrangement of carbons described above. A semicircular cavity, made in the upper part of the two carbons, in which are placed some little carbon balls, smaller than a pea and larger than a mustard seed, will make it possible to obtain multiple contacts which are very mobile and peculiarly fit for telephonic transmissions. This arrangement has been made by Mr. T. Cuttriss.

Several other arrangements of microphones have been devised by different makers and inventors, such as those of Messrs. Varey, Trouvé, Vereker, de Combettes, Loiseau, Lippens, de Courtois, Pollard, Voisin, Dumont, Jackson, Paterson, Taylor, &c., and they are more or less satisfactory. The instruments of MM. Varey, Trouvé, Lippens, and de Courtois are the most interesting, and we will describe them.

M. Varey's microphone consists of a sounding box of deal, mounted in a vertical position on a stand, and two microphones are arranged on either side of it, with vertical carbons united for tension. A small Gaiffe cell of chloride of silver, without liquid, is applied to the standard of the instrument, and is enough to make it work perfectly. This system is extremely sensitive.

M. Trouvé's microphones, represented in figs. 46, 47, 48, are extremely simple, so that he is able to sell them at a very moderate price. They generally consist of a small vertical cylindrical box, as we see in the figure, with disks of carbon at its two ends, which are united by a carbon rod, or by a metallic tube tipped with carbon. This rod or tube turns freely in two cavities made in the carbons, and the box, while acting as a sounding box, becomes at the same time a prison for the insects whose movements and noises are the objects of study.

[Illustration: FIG. 46.]

These boxes may be suspended on a cross-bar (fig. 47) by the two communicating wires, so as to be completely insulated. In this case the ticking of a watch placed upon the board, friction, and external shocks are hardly heard, but on the other hand the sound vibrations of the air alone are transmitted, and they acquire great distinctness. We have often repeated these experiments, and have always found that the tones of the voice were perfectly preserved.

The model represented fig. 48 is still more simple, and appears to be the latest development of this kind of instrument. It consists of a stand and a disk united by a central rod. The upper disk moves round the central rod, and permits the vertical carbon to assume any inclination which is desired. It is evident that the instrument will become less sensitive when the carbon is more oblique.

[Illustration: FIG. 47.]

We must also mention a very successful microphone devised by M. Lippens. It is a slightly made box, like that of M. Varey, and on its opposite faces there are applied, on two frames left empty for the purpose, two thin plates of hardened caoutchouc, in the centre of which inside the box, two carbons are fastened, and on their outer surface a half-sphere is hollowed.

[Illustration: FIG. 48.]

The interval between the two carbons hardly amounts to two millimètres, and a carbon ball is inserted into the two cavities which form its spherical case. This ball is supported by a spiral spring which can be extended more or less by means of a wire wound on a windlass which is fixed above the instrument, like the spring of an electric telegraph instrument. By means of this spring, the pressure of the carbon ball against the sides of the cavity which contains it can be regulated at pleasure, and the sensitiveness of the instrument and its capacity for transmitting speech can be adjusted. Under these conditions, the vibrations of the caoutchouc plates directly affect the microphone, and the currents of air have no influence on it, so that the effects are more distinct. It is so sensitive that it is best for the speaker to place himself at the distance of at least 50 centimètres from the instrument. M. Lippens' instrument is a pretty one, mounted on a wooden stand, which is neatly turned.

In order to put an end to the sputtering usual in microphones, it occurred to M. de Courtois to prevent any cessation of contact between the carbons by keeping them close together, and to effect the variations of resistance necessary for articulate sounds by making them slide over each other, so as to insert a shorter or longer portion of the carbon in the circuit. For this purpose a vibrating disk is placed in a vertical position in a rigid frame, and a small conducting rod, terminated by a pointed carbon, is applied to it, with this carbon point resting on another flat piece of carbon placed below it. Influenced by the vibrations of the disk, the carbon point moves to and fro, effecting more or less extensive contacts with the lower carbon, and thus producing variations of resistance which almost correspond to the range of vibrations on the disk.

Experiments made with the Microphone.--I must now mention the interesting experiments which led Mr. Hughes to the invention of the remarkable instrument of which we have spoken, as well as those undertaken by other scientific men, either from a scientific or a practical point of view.

Believing that light and heat can modify the conductivity of bodies, Mr. Hughes went on to consider whether sound vibrations, transmitted to a conductor traversed by a current, would not also modify this conductivity by provoking the contraction and expansion of the conducting molecules, which would be equivalent to the shortening or lengthening of the conductor thus affected. If such a property existed, it would make it possible to transmit sounds to a distance, since variations in the conductivity would result from variations corresponding to the intensity of the current acting on the telephone. The experiment which he made on a stretched metal wire did not, however, fulfil his expectation, and it was only when the wire vibrated so strongly as to break, that he heard a sound at the moment of its fracture. When he again joined the two ends of the wire, another sound was produced, and he soon perceived that imperfect contact between the two broken ends of wire would enable him to obtain a sound. Mr. Hughes was then convinced that the effects he wished to produce could only be obtained with a divided conductor, and by means of imperfect contacts.

He then sought to discover the degree of pressure which it was most expedient to exert between the two adjacent ends of the wire, and for this purpose he effected the pressure by means of weights. He ascertained that when the pressure did not exceed the weight of an ounce on the square inch at the point of connection, the sounds were reproduced with distinctness, but somewhat imperfectly. He next modified the conditions of the experiment, and satisfied himself that it was unnecessary to join the wires end to end in order to obtain this result. They might be placed side by side on a board, or even separated (with a conductor placed

crosswise between them), provided that the conductors were of iron, and that they were kept in metallic connection by a slight and constant pressure. The experiment was made with three Paris points, and arranged as it appears in fig. 49, and it has since been repeated under very favourable conditions by Mr. Willoughby Smith with three of the so-called rat-tail files, which made it possible to transmit even the faint sound of the act of respiration.[15]

[Illustration: FIG. 49.]

He afterwards tried different combinations of the same nature, which offered several solutions of continuity, and a steel chain produced fairly good results, but slight inflections, like those caused by the _timbre_ of the voice, were not reproduced, and he tried other arrangements. He first sought to apply metallic powders to the points of contact; powdered zinc and tin, known in commerce under the name of white bronze, greatly increased the effects obtained; but they were unstable, on account of the oxidation of the contacts; and it was in seeking to solve this difficulty, as well as to discover the most simple means of obtaining a slight and constant pressure on the contacts, that Mr. Hughes was led to the arrangement, previously described, of carbons impregnated with mercury, and he thus obtained the maximum effect.[16]

Mr. Hughes considers that the successful effects of the microphone depend on the number and perfection of the contacts, and this is doubtless the reason why some arrangements of the carbon pencil in the instrument described above were more favourable than others.

In order to reconcile these experiments with his preconceived ideas, Mr. Hughes thought that, since the differences of resistance proceeding from the vibrations of the conductor were only produced when it was broken, the molecular movements were arrested by the lateral resistances which were equal and opposite, but that if one of these resistances were destroyed, the molecular movement could be freely developed. He considers that an imperfect contact is equivalent to the suppression of one of these resistances, and as soon as this movement can take place, the molecular expansions and contractions which result from the vibrations must correspond to the increase or diminution of resistance in the circuit. We need not pursue Mr. Hughes's theory further, since it would take too long to develope it, and we must continue our examination of the different properties of the microphone.[17]

Carbon, as we have said, is not the only substance which can be employed to form the sensitive organ of this system of transmission. Mr. Hughes has tried other substances, including those which are good conductors, such as metals. Iron afforded rather good results, and the effect produced by surfaces of platinum when it was greatly subdivided was equal, if not superior, to that furnished by the mercurised carbon. Yet since the difficulty of making instruments with this metal is greater, he prefers the carbon, which resembles it in being incapable of oxidation.

We have already said that the microphone may be used as a thermoscope, in which case it must have the special arrangement represented in fig. 43. Under these conditions, heat, reacting on the conductivity of these contacts, may cause such variations in the resistance of the circuit that the current of three Daniell cells will be annulled by approaching the hand to the tube. In order to estimate the relative intensity of the different sources of heat, it will be enough to introduce into the circuit of the two electrodes A and B, fig. 43, a battery P, of one or two Daniell cells, and a moderately sensitive galvanometer G. For this purpose one of 120 turns will suffice. When the deviation decreases, it shows that the source of heat is superior to the surrounding atmosphere; and conversely, that it is inferior when the deviation increases. Mr. Hughes says that the effects resulting from the intervention of sunshine and shadow are shown on the instrument by considerable variations in the deviations of the galvanometer. Indeed it is so sensitive to the slightest variations of temperature that it is impossible to maintain it in repose.

I have repeated Mr. Hughes's experiments with a single Leclanché cell, and for this purpose I employed a quill, filled with five fragments of carbon, taken from the cylindrical carbons of small diameter which are made by M. Carré for the electric light. I have obtained the results which are mentioned by Mr. Hughes, but I ought to say that the experiment is a delicate one. When the pressure of the fragments of carbon against each other is too great, the current traverses them with too much force to allow the calorific effects to vary the deviation of the galvanometer, and when the pressure is too slight, the current will not pass through them. A medium degree of pressure must therefore be effected to ensure the success of the experiment, and when it is obtained, it is observed that on the approach of the hand to the tube, a deviation of 90° will, after a few seconds, diminish, so that it seems to correspond with the approach or withdrawal of the hand. But breathing produces the most marked effects, and I am disposed to believe that the greater or less deviations produced by the emission of articulate sounds when the different letters of the alphabet are pronounced separately, are due to more or less direct emissions of heated gas from the chest. It is certain that the letters which

require the most strongly marked sounds, such as A, F, H, I, K, L, M, N, O, P, R, S, W, Y, Z, produce the greatest deviations of the galvanometric needle.

In my paper on the conductivity of such bodies as are moderately good conductors, I had already pointed out this effect of heat upon divided substances, and I also showed that after a retrograde movement, which is always produced at once, a movement takes place in an inverse direction to the index of the galvanometer when heat has been applied for some instants, and this deviation is much greater than the one which is first indicated.

In a paper published in the 'American Scientific Journal,' June 28, 1878, Mr. Edison gives some interesting details on the application of his system of a telephonic sender to measuring pressures, expansions, and other forces capable of varying the resistance of the carbon disk by means of greater or less compression. Since his experiments on this subject date from December 1877, he again claims priority in the invention of using the microphone as a thermoscope; but we must observe that according to Mr. Hughes's arrangement of his instrument, the effect produced by heat is precisely the reverse of the effect described by Mr. Edison. In fact, in the arrangement adopted by the latter, heat acts by increasing the conductivity acquired by the carbon under the increased pressure produced by the expansion of a body sensitive to heat: in Mr. Hughes's system, the effect produced by heat is precisely the contrary, since it then acts only on the contacts, and not by means of pressure. Therefore the resistance of the microphone-thermoscope is increased under the influence of heat, instead of being diminished. This contrary effect is due to the division of some substance which is only a moderate conductor, and I have shown that under such conditions these bodies, when only slightly heated, always diminish the intensity of the current which they transmit. I believe that Mr. Edison's arrangement is the best for the thermoscopic instrument, and makes it possible to measure much less intense sources of heat. Indeed he asserts that by its aid the heat of the luminous rays of the stars, moon, and sun may be measured, and also the variations of moisture in the air, and barometric pressure.

This instrument, which we give fig. 50, with its several details, and with the rheostatic arrangement employed for measuring, consists of a metallic piece A fixed on a small board C, and on one of its sides there is the system of platinum disks and carbons shown in fig. 28. A rigid piece G, furnished with a socket, serves as the external support of the system, and into this socket is introduced the tapering end of some substance which is readily affected by heat, moisture, or barometric pressure. The other extremity is supported by another socket I, fitted to a screw-nut H, which may be more or less tightened by a regulating screw. If this system is introduced into a galvanometric circuit _a, b, c, i, g_, provided with all the instruments of the electric scale of measure, the variations in length of the substance inserted are translated by greater or less deviations of the galvanometric needle, which follow from the differences of pressure resulting from the lengthening or shortening of the surface capable of expansion which is inserted in the circuit.

[Illustration: FIG. 50.]

The experiments on the microphone made in London at the meeting of the Society of Telegraphic Engineers on May 25, 1878, were wonderfully successful, and they were the subject of an interesting article in the 'Engineer' of May 31, which asserts that the whole assembly heard the microphone speak, and that its voice was very like that of the phonograph. When the meeting was informed that these words had been uttered at some distance from the microphone, the Duke of Argyll, who was present, while admiring the important discovery, could not help exclaiming that this invention might have terrible consequences, since, for instance, if one of Professor Hughes's instruments were placed in the room in Downing Street, in which Her Majesty's ministers hold their cabinet council, their secrets might be heard in the room in which the present meeting took place. He added that if one of these little instruments were in the pocket of Count Schouvaloff, or of Lord Salisbury, we should at once be in possession of the secrets for which all Europe was anxiously waiting. If these instruments were able to repeat all the conversations held in the room in which they stood, they might be really dangerous, and the Duke thought that Professor Hughes, who had invented such a splendid yet perilous instrument, ought next to seek an antidote for his discovery. Dr. Lyon Playfair, again, thought that the microphone ought to be applied to the aërophone, so that by placing these instruments in the two Houses of Parliament, the speeches of great orators might be heard by the whole population within five or six square miles.

The experiments lately made with the microphone at Halifax show that the Duke of Argyll's predictions were fully justified. It seems that a microphone was placed on a pulpit-desk in a church in Halifax, and connected by a wire about two miles long with a telephone placed close to the bed of a sick person, who was able to hear the prayers, the chanting, and the sermon. This fact was communicated to me by Mr. Hughes, who heard it from a trustworthy source, and it is said that seven patients have subscribed for the expense of an arrangement by which they may hear the church services at Halifax without fatigue.

The microphone has also lately been applied to the transmission of a whole opera, as we learn from the following account in the 'Journal Télégraphique,' Berne, July 25, 1878:--

'A curious micro-telephonic experiment took place on June 19 at Bellinzona, Switzerland. A travelling company of Italian singers was to perform Donizetti's opera, "Don Pasquale," at the theatre of that town. M. Patocchi, a telegraphic engineer, took the opportunity of making experiments on the combined effects of Hughes's carbon microphone as the sending instrument, and Bell's telephone as the receiver. With this object he placed a Hughes microphone in a box on the first tier, close to the stage, and connected it by two wires, from one to half a millimètre in thickness, to four Bell receivers, which were placed in a billiard-room above the vestibule of the theatre, and inaccessible to sounds within the theatre itself. A small battery of two cells, of the ordinary type used in the Swiss telegraphic service, was inserted in the circuit, close to the Hughes microphone.

'The result was completely successful. The telephones exactly reproduced, with wonderful purity and distinctness, the instrumental music of the orchestra, as well as the voices of the singers. Several people declared that they did not lose a note of either, that the words were heard perfectly; the airs were reproduced in a natural key, with every variation, whether _piano_ or _forte_, and several amateurs assured M. Patocchi that by listening to the telephone they were able to estimate the musical beauty, the quality of the singers' voices, and the general effect of the piece, as completely as if they had been among the audience within the theatre.

'The result was the same when resistances equivalent to 10 kilomètres were introduced into the circuit, without increasing the number of cells in the battery. We believe that this is the first experiment of the kind which has been made in Europe, at least in a theatre, and with a complete opera; and those who are acquainted with the delicacy and grace of the airs in "Don Pasquale" will be able to appreciate the sensitiveness of the combined instruments invented by Hughes and Bell, which do not suffer the most delicate touches of this music to be lost.'

Although experiments with the microphone are of such recent date, they have been very various, and among other curious experiments we learn from the English newspapers that the attempt has been made to construct an instrument on the same principle as the telephone, which shall be sensitive to the variations of light. It is known that some substances, and particularly selenium, are electrically affected by light, that is, that their conductivity varies considerably with the greater or less amount of light which is shed upon them. If, therefore, a circuit in which a substance of this nature is inserted, is abruptly subjected to a somewhat intense light, the increase of resistance which results from it ought to produce a powerful sound in a telephone inserted in the circuit. This fact has been verified by experiment, and Mr. Willoughby Smith infers from it, as we have already suggested, that the effects produced in the microphone are due to variations of resistance in the circuit, which are produced by more or less close contacts between imperfect conductors.

In order to obtain this effect under the most favourable conditions, Mr. Siemens employs two electrodes, consisting of network of very fine platinum wire, fitting into each other like two forks, of which the prongs are interlaced. These electrodes are inserted between two glass plates, and a drop of selenium, dropped in the centre of the two pieces of network, connects them on a circular surface large enough to establish sufficient conductivity in the circuit. It is on this flattened drop that the ray of light must be projected.

APPLICATIONS OF THE MICROPHONE.

The applications of the microphone increase in number every day, and in addition to those of which we have just spoken, there are others of really scientific and even of practical interest. Among the number is the use which can be made of it as a system of relays for telegraphy, in science for the study of vibrations imperceptible to our senses, in medicine and surgery, and even in manufactures.

Its application to Scientific Research.--We have seen that several physicists, including Messrs. Spottiswoode, Warwick, Rossetti, Canestrelli, Wiesendanger, Lloyd, Millar, Buchin, and Blyth, have been able to hear what is said in a telephone which has no iron diaphragm, but it was so difficult to establish the fact that it has been often disputed. More certain evidence was desirable, and the microphone is an opportune agent for affording it.

The 'Telegraphic Journal' of September 1, 1878, observes that M. du Moncel, in order to claim the victory in his controversy with Colonel Navez, had still to show that the sounds which appeared to be inarticulate in telephones without a diaphragm might become intelligible if they were intensified. This has been done for him by the use of Mr. Hughes's microphone, and the following

experiments were made for the purpose.

1. If a magnetising coil, surrounding a bar of soft iron, is inserted in the circuit of a microphone, with a battery of three cells, the ticking of a watch and other sounds of the same kind may be heard on approaching the ear to the electro-magnet which has been thus constituted. It is true that these sounds are very faint when they are not amplified, but if the electro-magnet is fastened to a board, and a second microphone is fixed to the same board, the sounds produced by the electro-magnet are magnified, and become distinctly audible in the telephone which is placed in connection with this second microphone.

2. These sounds may be further amplified by resting one of the extremities of the core of the electro-magnet on one of the poles of a permanent magnet, which is fixed upon the board. Articulate speech may then be heard in the telephone which is placed in connection with the microphone resting on the board, and the point at issue between MM. Navez and Du Moncel is completely decided in this way: for the auxiliary microphone can only propagate and amplify the vibration of articulate sounds, which are communicated by the bar magnet of the coil to the board on which the two instruments are placed. In this way it would be possible to render articulate sounds perceptible to M. Navez, when transmitted by the bar magnet of a telephone without a diaphragm.

3. When a second bar magnet rests on the free pole of the electro-magnet, so as to present to it a pole of the same nature as the one with which it is already in communication--in a word, if a bar is placed between the two poles of a horseshoe electro-magnet, the effects are still more marked, and hence it may be assumed that the bar reacts as an armature, by concentrating the lines of magnetic force in the vicinity of the helix.

4. When the two poles of a horseshoe magnet are inserted together inside a coil, their effects are equally energetic, although by this arrangement one of the poles might be expected to neutralise the effect of the other: but the most important effects have been obtained by placing an armature of soft iron across the poles of the magnet which has been already inserted in the coil. Under these conditions articulate sounds are distinctly heard.

These experiments were confirmed by Mr. F. Varley, in a letter published in the ‘Telegraphic Journal’ of September 15, 1878, and among the fresh experiments mentioned by him, we will quote those which he made with an iron tube inserted in a helix, in which the two opposite poles of two bar magnets are introduced. These poles are only separated from each other by the interval of an inch, so that the centre of the iron tube may be strongly magnetised.

Mr. Varley says that this last arrangement reproduces the articulate sounds which issue from a sending microphone, and this experiment is more decisive than that of Professor Hughes, in which case it might be supposed that the bar magnet, resting on the polar end of an electro-magnetic bar, was only a modification of the disk in the Bell telephone, set in vibration by the alternate currents passing through the helix, and that these vibrations were communicated to the board, and became sensible when enlarged by the microphone. But such an objection cannot be alleged in the case of the arrangement described above, for since the sound is produced between the current passing into the helix and the magnetic current of the bar, it can only be the result of a vibration produced by a disturbance of the reciprocal relations subsisting between these two elements. Mr. Varley adds that these experiments confirm M. du Moncel’s researches, which have thrown considerable light upon the causes which are at work in the action of the speaking telephone, and with which we have hitherto been imperfectly acquainted.

Its application to Telephonic Relays.--In February 1878, I first began to consider the mode of forming telephonic relays, but I was checked by the discovery that there was no vibration in the receiving telephone, and I made the following communication on the subject to the Académie des Sciences on February 25:--‘If the vibrations of the disk in the receiving telephone were the same as those of the sending telephone, it is easy to see that if a telephone with a local battery, acting both as sender and receiver, were substituted for the receiving telephone, it might, by the intervention of the induction coil, act as a relay, and might therefore not only amplify the sound, but also transmit it to any distance. It is, however, doubtful whether the vibrations of the two corresponding disks are of the same nature, and if the sound be due to molecular contractions and expansions, the solution of the problem becomes much more difficult. Here is therefore a field for experiments.’ These experiments have been successfully made by Mr. Hughes, who acquainted me with them early in June 1878, and they led to the discovery of a most interesting system of microphonic relays.

On a wooden board of moderate size, such as a drawing board, he placed a microphone with a carbon brought to a fine point at each end, and fixed in a vertical position. One or more telephones were placed in the circuit, with their membranes facing the board, and a continuous sound was heard, sometimes resembling a musical note, sometimes the singing of boiling water in an oven; and the sound, which could be heard at a distance, went on indefinitely, as long as the electric force was exerted. Mr. Hughes explains this phenomenon in the following way.

The slightest shock which affects the microphone has the effect of sending currents, more or less broken, through the telephones, which transform them into sound vibrations, and since these are mechanically transmitted by the board to the microphone, they maintain and even amplify its action, and produce fresh vibrations on the telephones. Thus a fresh action is exerted on the microphone, and so on indefinitely. Again, if a second microphone, in connection with another telephonic circuit, be placed upon the same board, we have an instrument which acts as a telephonic relay, that is, it transmits to a distance the sounds communicated to the board, and these sounds may serve either as a call, or as the elements of a message in the Morse code, if a Morse manipulator is placed in the circuit of the first microphone. Mr. Hughes adds that he has made several very successful experiments with this system of instruments, although he only employed a Daniell battery of six cells without any induction coil. By fastening a pasteboard tube, 40 centimètres in length, to the receiving telephone, he was able to hear in all parts of a large room the continuous sound of the relay, the ticking of a watch, and the scratching of a pen upon paper. He did not try to transmit speech, since it would not have been reproduced with sufficient distinctness under such conditions.

Since this first attempt, Mr. Hughes has arranged another and still more curious system of microphonic relays, for which two microphones with vertical carbons are required. He places two microphones of this description on a board, and connects one of them with a third microphone, which acts as a sender, while the second is in communication with a telephone and a second battery: in this way the words uttered before the sender are heard in the telephone, without employing any electro-magnetic organ for the telephonic relay.

In August 1878, Messrs. Houston and Thomson likewise arranged a system of telephonic relays which only differs from that of Mr. Hughes in the particular of having the microphone fixed on the diaphragm of the telephone, and not on the board beside it. The system consists of three vertical microphones, which can be combined for tension or quantity, according to the conditions for which they are required. The model of this instrument was represented in the ‘Telegraphic Journal’ of August 15, 1878, to which we must refer our readers, if they wish for further information on the subject.

Its application to Medicine and Surgery.--The extreme sensitiveness of the microphone suggested its use for the observation of sounds produced within the human body, so that it might serve as a stethoscope for listening to the action of the lungs and heart. Dr. Richardson and Mr. Hughes are now busy in the attempt to carry out this idea, but so far the result is not very satisfactory, although they still hope to succeed. Meanwhile, M. Ducretet has made a very sensitive stethoscopic microphone, which we represent in fig. 51. It consists of a carbon microphone C P, with a simple contact, of which the lower carbon P is fitted to one of M. Marais’ tambourines with a vibrating membrane T. This tambourine is connected with another T′, by a caoutchouc tube, which is to be applied to the different parts of the body which demand auscultation, and which is therefore termed the _tambour explorateur_. The sensitiveness of the instrument is regulated by means of a counterpoise P O, which is screwed upon the arm of a bent lever, and to this the second carbon C is fixed. The extreme sensitiveness of M. Marais’ tambourines in transmitting vibrations is well known, and since their sensitiveness is further increased by the microphone, the instrument becomes almost too impressionable, since it reveals all sorts of sounds, which it is difficult to distinguish from each other. Such an instrument can only be of use when entrusted to experienced hands, and a special education of the organ of hearing is needful, in order to turn it to account.

[Illustration: FIG. 51.]

In a work lately published by M. Giboux on the application of the microphone to medicine, this stethoscopic system is rather severely criticised, and not without reason if, as M. Giboux asserts, it is only sensitive to the movements which take place on the surface of the body, and those which are internal are either lost or altogether changed in character. But without pronouncing on the improvements which may ultimately be made in the instrument, M. Giboux thinks that its most important use in medical practice consists in its allowing a certain number of students to observe with the professor the different sounds of the body, to study them with him in their different phases, and thus to profit more readily by his teaching. A microphonic circuit might bifurcate between several telephones, so that each person might hear for himself what is heard by others.

The most important application of the instrument to surgical purposes has lately been made by Sir Henry Thompson, aided by Mr. Hughes, for the examination of the bladder in cases of stone. It enables him to ascertain the presence and precise position of calculi, however small they may be. For the purpose of research, he uses a sound, made of a Maillechort rod, a little bent at the end, and placed in communication with a sensitive carbon microphone. When the sound is moved about in the bladder, the rod comes in contact with stony particles, even if they are no larger than a pin’s head, and friction ensues, producing in the telephone vibrations which can be easily distinguished from those caused by the simple friction of the rod on the soft tissues of the sides of the bladder. The arrangement of the instrument is shown in fig. 52. The microphone is placed in the handle which contains the

sound, and is the same as that given in fig. 42, but of smaller size, and the two conducting wires _e_ which lead to the telephone, issue from the handle by the end _a_ opposite to that _bb_ to which the sound _dd_ is screwed. As this instrument is not intended to reproduce speech, retort carbons instead of wood carbons may be used.

[Illustration: FIG. 52.]

Some deaf people, whose sense of hearing is not completely destroyed, have been able to hear by an expedient based upon the principle of the microphone. For this purpose two telephones, connected by a metallic crown, which is placed on the temples, are applied to the ears of the deaf person, and the telephones are placed in communication with a battery microphone, which hangs to the end of a double conducting wire. The deaf man keeps the microphone in his pocket, and presents it as an acoustic tube to the person who wishes to converse with him. Mr. Hughes's speaker, represented fig. 42, is the one used.

Various Applications.--The microphone may be used in many other ways, some of which are suggested in the 'English Mechanic' of June 21, 1878. The article states that by means of this instrument, engineers will be able to estimate the effects of the vibrations caused on old and new buildings by the passage of heavy loads; a soldier will be able to discover the enemy's approach when he is several miles off, and may even ascertain whether he has to do with artillery or cavalry; the approach of ships to the neighbourhood of torpedoes may be automatically heralded on the coast by this means, so that an explosion may be produced at the right moment.

It has also been proposed to use the microphone to give notice of an escape of gas in coal-mines. The gas, in escaping from between the seams of coal, makes a whistling noise, which might, with the aid of the microphone and telephone, be heard at the top of the shaft. Again, it has been suggested that the microphone might be used as a seismograph to reveal the subterranean noises which generally precede earthquakes and volcanic eruptions, and which would be much intensified by this instrument. It might even be of use to Signor Palmieri for his observations in the Vesuvius Observatory.

The microphone has also been used by Mr. Chandler Roberts to render the diffusion of gaseous molecules through a porous membrane sensible to the ear.

As might have been expected, the acclamation with which Mr. Hughes's invention was received led to the assertion of other claims to priority, and in addition to that of Mr. Edison, on which we have already given our opinion, there are several others, showing that if some microphonic effects were discovered at different times before the date of Mr. Hughes's discovery, they could not have been considered important, since they were not even announced. Among the number was that of Mr. Wentworth Lascelles Scott, specified in the 'Electrician' of May 25, 1878, and that of M. Weyher, presented to the Société de Physique, Paris, in June 1878. Another, made by M. Dutertre, is of somewhat greater importance, for his experiments were reported in the Rouen papers in February of the same year: yet there is no just ground for such claims, since the earliest date of his experiments is subsequent to the experiments first made by Mr. Hughes. These began early in December 1877, and in January 1878 they were exhibited to officials of the Submarine Telegraph Company, as Mr. Preece declared in a letter addressed to the several scientific men.

EXTERNAL INFLUENCE ON TELEPHONIC TRANSMISSIONS.

The obstacles which occur in telephonic transmissions proceed from three causes: 1. The intensity of sound is diminished by the loss of current in transmission--a loss which is much greater in the case of induced currents than in those received from a battery. 2. Confusion is caused by the influence of adjacent currents. 3. The induction from one wire to another. This last influence is much greater than is usually supposed. If two perfectly insulated wires are placed side by side, one in communication with the circuit of an electric bell, and the other with the circuit of a telephone, the latter will repeat the sounds of the bell with an intensity often great enough to act as a call without applying the instrument to the ear. MM. Pollard and Garnier, in their interesting experiments with the induced currents of the Ruhmkorff coil, have ascertained that in this way not merely sounds may be obtained which correspond with the induced currents resulting from the action of the primary current, but also those which result from the action of the secondary current on other helices, which are termed currents of the second order. These different reactions frequently cause the telephonic transmissions made on telegraphic lines to be disturbed by irregular sounds, arising from the electric transmissions on adjoining lines; but it does not appear that these influences altogether neutralise each other, so that conversation held in the ordinary way and a message sent in the Morse code may be heard simultaneously.

At the Artillery School, Clermont, a telephonic communication has been established, for the sake of experiments, between the school and the butts, which are at a distance of about eight miles. Another communication of the same kind has been established between the Clermont Observatory and the one at Puy-de-Dôme, which is nearly nine miles from the former. These two lines are carried on the same posts for a course of six miles, together with an ordinary telegraphic wire, and for a distance of 330 yards there are seven other such wires. The two telephonic wires are separated from each other by a space of 85 centimètres. The following facts have been observed under these conditions.

1. The school telephone is perfectly able to read off from their sound the Morse messages which pass through the two adjacent telegraph wires, and the ticking of the instrument does not at all interfere with the vocal communication of the telephone, nor render it inaudible.

2. The two adjacent telegraphic lines, although not in contact, confuse their messages together, and it has sometimes been possible to hear messages from Puy-de-Dôme at the school through the wire which runs to the butts, although the distance between the two lines is nowhere less than 85 centimètres.

These inconveniences have been in some degree remedied by inserting strong resistances in the circuit, or by putting the current to earth at some distance from the telephonic stations.

M. Izarn, Professor of Physics at the Lycée, Clermont, holds that telephonic electric currents may readily be turned aside by the earth, especially if in the course of their passage they encounter metallic conductors, such as gas or water pipes. He writes as follows on the subject, in a paper addressed to the Académie des Sciences, on May 13, 1878:--'I set up a telephone in the Clermont Lycée with a single wire, more than 50 yards in length, which crosses the court-yard of the Lycée, and goes from the laboratory, where it is suspended to a gas-burner, to a room near the porter's lodge, where it is suspended to another gas-burner. When I applied my ear to the telephone, I could distinctly hear the telegraphic signals, Morse or otherwise, which came either from the telegraph office at Clermont, or from the telephone office which was at work between the School of Artillery and the butts below Puy-de-Dôme, a distance of eight miles. I could overhear words, and especially the military orders issued at the butts for the purpose of being heard at the school. Yet my wire is perfectly independent of those used for signalling, and is even very remote from them; but as the wires of the telegraph office and of the School of Artillery go to earth at a little distance from the gas-pipes, it is probable that this phenomenon is caused by a diversion of the current produced in my wire, by means of the earth and the network of metal pipes.'

Mr. Preece made the same remark in his notice of 'some physical points connected with the telephone.' Again, we read in the 'Telegraphic Journal' of June 15, 1878, that in a telephonic concert transmitted from Buffalo to New York, the singers at Buffalo were heard in an office placed outside the telegraphic circuit in which the transmission was effected. On enquiry, it was ascertained that the wire through which the telephonic transmission took place, was at one point in its course close to the one which directly transmitted the musical sounds, but the distance between the two wires was not less than ten feet.

When the circuits are altogether metallic, there is much less risk of confusion, and M. Zetzche declares that sounds proceeding from other wires are in this case little heard, and then only momentarily, so that it is much more easy to hear with this arrangement than with the one in ordinary use. 'It is not,' he says, 'the resistances of the wire, but rather the diversions of the current near the posts, which interfere with telephonic correspondence on long lines above ground. This was proved by the following experiments:--I connected the telegraphic line from Dresden to Chemnitz with a line from Chemnitz to Leipzig (54 miles), which made a circuit of 103 miles, going to earth at its two extremities. There was no communication between Dresden and Leipzig, but Leipzig and Dresden could communicate with ease, in spite of the greater extent of line. I broke the connection with earth, first at Leipzig, then simultaneously at Leipzig and Dresden, and I observed the following effects. When insulation took place at Leipzig only, the telephone could be heard at the stations of Dresden, Riesa, and Wurzen; when the line was insulated at both ends, the communication was good between the two latter stations, but it was observed that at the intermediate station the words spoken at Wurzen were more distinctly heard than the words spoken at Riesa were heard at Wurzen. Since the distance from Wurzen to Leipzig is little more than half that from Riesa to Dresden, there are consequently nearly twice as many posts on the latter line, which carry the currents to earth, and hence I conclude that these diversions of current explain the possibility of conversing on an insulated line, and also why sounds are more distinctly heard at the Riesa station in consequence of the greater intensity of current still remaining on the line.'

Some vibrations also result from the action of currents of air on telegraphic wires, which produce the humming sound so well known on some lines, and these may also react on the telephone; but they are in this case generally mechanically transmitted, and they may be distinguished from the others, if the sounds which ensue are heard after the telephone is excluded from the circuit by a break with a short circuit and after the communication to earth established behind the telephone has been broken.

The induced reactions caused by the line wires on each other are not the only ones which may be observed on a telephonic circuit: every manifestation of electricity near a telephone may produce sounds of greater or less force. Of this we have already given a proof in M. d'Arsonval's experiments, and others by M. Demoget demonstrate the fact still more clearly. In fact, if a small bar magnet provided with a vibrator be placed before one of the telephones of a telephonic circuit, and the vibrating plate of the telephone be removed, in order to draw away the sound produced by the vibrator, its humming noise may be distinctly heard on the second telephone of the circuit; a noise which attains its maximum when the two extremities of the electro-magnet are at their nearest point to the telephone without a diaphragm, and it is at its minimum when this electro-magnet is presented to it along its neutral line. M. Demoget supposes that the action which is exerted in this instance is that of a magnet exerting two inducing actions which are opposite and symmetrical, with a field limited by a double paraboloid and with an axis, according to his experiments, which extended 55 centimètres beyond the magnetic core, and a vertical diameter of 60 centimètres. He believes that in this way it would be easy to telegraph on the Morse system, and that, in order to do so, it would only be necessary to apply a key to the inducing electro-magnet.

Mr. Preece points out three ways of overcoming the difficulty presented by the induced reactions caused by the wires on each other.

1. By increasing the intensity of the transmitted currents, so as to make them decidedly stronger than the induced currents, and to reduce the sensitiveness of the receiving telephone.

2. To place the telephonic wire beyond the range of induction.

3. To neutralise the effects of induction.

The first mode may be effected by Edison's battery system, and we have seen that it is very successful.

In order to put the second mode in practice, Mr. Preece says that it would be necessary to study the two kinds of induction which are developed on telegraphic lines: electro-static induction, analogous to that produced on submarine cables, and electro-dynamic induction, resulting from electricity in motion. In the former case, Mr. Preece proposes to interpose between the telephone wire and the other wires a conducting body in communication with the earth, capable of becoming a screen to the induction by itself absorbing the electro-static effects. He says that this might be accomplished by surrounding the telegraphic wires adjacent to the telephonic wire with a metallic envelope, and then plunging them in water. He adds that the effects of static induction are not completely destroyed in this way, since the substance used is a bad conductor, but they are considerably reduced, as he has proved by experiments between Dublin, Holyhead, Manchester, and Liverpool. In the second case, Mr. Preece admits that an iron envelope might paralyse the electro-dynamic effects produced by absorbing them, so that if insulated wires were employed, covered with an iron case, and communicating with the earth, the two induced reactions would be annulled. We will not follow Mr. Preece in his theory as to these effects--a theory which seems to us open to question, but we content ourselves with pointing out his proposed mode of attenuation.

In order to carry out the third expedient, it might be thought that it would be enough to employ a return wire instead of going to earth, for under such conditions the currents induced on one of the wires would be neutralised by those resulting from the same induction on the second wire, which would then act in an opposite direction; but this mode would only be successful when there is a very small interval between the two telephone wires, and they are at a considerable distance from the other wires. When this is not the case, and they are all close together, as in submarine or subterranean cables, consisting of several wires, this mode is quite inefficient. A small cable, including two conductors, insulated with gutta-percha, may be successfully carried through the air.

The use of two conductors has the further advantage of avoiding the inconvenience of stray currents on the line and through the earth, which, when the communications to earth are imperfect, permit the line current to pass more or less easily into the telephonic line.

In addition to the disturbing causes in telephonic transmission we have just mentioned, there are others which are also very appreciable, and among them are the accidental currents which are continually produced on telegraphic lines. These currents may

proceed from several causes, at one time from atmospheric electricity, at another from terrestrial magnetism, at another from thermo-electric effects produced upon the lines, at another from the hydro-electric reactions produced on the wires and disks in communication with the earth. These currents are always very unstable, and consequently they are likely, by reacting on the transmitted currents, to modify them so as to produce sounds upon the telephone. Mr. Preece asserts that the sound proceeding from earth currents somewhat resembles that of falling water. The discharges of atmospheric electricity, even when the storm is remote, produce a sound which varies with the nature of the discharge. When it is diffused and the clap takes place near at hand, Dr. Channing, of Providence, U.S., says that the sound resembles that produced by a drop of fused metal when it falls into water, or, still more, that of a rocket discharged at a distance: in this case it might seem that the sound would be heard before the appearance of the flash, which clearly shows that the electric discharges of the atmosphere only take place in consequence of an electric disturbance in the air. Mr. Preece adds that a wailing sound is sometimes heard, which has been compared to that of a young bird, and which must proceed from the induced currents which terrestrial magnetism produces in the metallic wires when placed in vibration by currents of air.

M. Gressier, in a communication made to the Académie des Sciences on May 6, 1878, has spoken of some of these sounds, but he is totally mistaken in the source to which he ascribes them.

‘In addition to the crackling sound caused by the working of telegraph instruments on the adjacent lines, a confused murmur takes place in the telephone, a friction so intense that it might sometimes be thought that the vibrating disk was splitting. This murmur is heard more by night than by day, and is sometimes intolerable, since it becomes impossible to understand the telephone, although nothing is going on in the office to disturb the sound. The same noise is heard when only one telephone is used. A good galvanometer inserted in the circuit reveals the presence of sensible currents, sometimes in one direction, sometimes in another.’

I studied these currents for a long time with the galvanometer, and made them the subject of four papers which were laid before the Académie des Sciences in 1872, and I am convinced that they have in general nothing to do with atmospheric electricity, but result either from thermo-electric or hydro-electric influence. They take place constantly and in all weathers on telegraph lines, whether these lines are insulated at one end, or in contact with the earth at both ends. In the first case, the polar electrodes of the couple are formed by the telegraph wire and the earth plate, generally of the same nature, and the intermediate conducting medium is represented by the posts which support the wire and the earth which completes the circuit. In the second case, the couple is formed in almost the same way, but the difference in the chemical composition of the ground at the two points where the earth plates are buried, and sometimes their different temperature, exert a strong influence. If only the first case be considered, it generally happens that on fine summer days the currents produced during the day are inverse to those which are produced by night, and vary with the surrounding temperature in one or the other direction. The presence or absence of the sun, the passage of clouds, the currents of air involve abrupt and strongly marked variations, which may be easily followed on the galvanometer, and which cause more or less distinct sounds in the telephone.

During the day, the currents are directed from the telegraph line to the earth plate, because the heat of the wire is greater than that of the plate, and these currents are then thermo-electric. During the night, on the other hand, the wire is cooled by the dew, which causes a greater oxidation on the wire than that which takes place on the plate, and the currents then become hydro-electric.

I say more about these currents because, in consequence of a mistaken belief as to their origin, it has been supposed that the telephone might serve for the study of the variations of the atmospheric electricity generally diffused through the air. Such an application of the telephone would, under these conditions, be not only useless, but also misleading, by inducing the study of very complex phenomena, which could lead to nothing more than I have already stated in my different papers on the subject.

Certain local influences will also produce sounds in the telephone. Thus the distension of the diaphragm by the moist heat of the breath, when the instrument is held before the mouth in speaking, causes a perceptible murmur.

From the electro-static reactions, so strongly produced on the submarine cables, in consequence of electric transmissions, it might be supposed that it would not be easy to hold telephonic correspondence through this kind of conductor, and, to ascertain the fact, an experiment was made on the cable between Guernsey and Dartmouth, a distance of sixty miles. Articulate speech, only a little indistinct, was, however, perfectly transmitted. Other experiments, made by Messrs. Preece and Wilmot, on an artificial submarine cable, placed in conditions analogous to those of the Atlantic cable, showed that a telephonic correspondence might be kept up at a distance of a hundred miles, although the effects of induction were apparent. At the distance of 150 miles, it was somewhat difficult to hear, and the sounds were very faint, as if some one were speaking through a thick partition. The sound diminished rapidly until

the distance of 200 miles was reached, and after that it became perfectly indistinct, although singing could still be heard. It was even possible to hear through the whole length of the cable, that is, for 3,000 miles, but Mr. Preece believed this to be due to the induction of the condenser on itself: he holds, however, that singing may be heard at a much greater distance than speech, owing to the more regular succession of electric waves.

Mr. Preece also made experiments on the subterranean telegraphs between Manchester and Liverpool, a distance of 30 miles, and found no difficulty in exchanging correspondence; and it was the same with the cable from Dublin to Holyhead, a distance of 67 miles. This cable had seven conducting wires, and when the telephone was connected with one of them, the sound was repeated through all the others, but in a fainter degree. When the currents of the telegraphic instruments passed through the wires, the induction was apparent, but not so great as to prevent telephonic communication.

ESTABLISHMENT OF A TELEPHONIC STATION.

Although the telephonic system of telegraphy is very simple, yet certain accessory arrangements are indispensable for its use. Thus, for example, an alarum call is necessary, in order to know when the exchange of correspondence is to take place, and information that the call has been heard is likewise necessary. An electric bell is therefore an indispensable addition to the telephone, and since the same circuit may be employed for both systems, if a commutator is used, it was necessary to find a mode of making the commutator act automatically, so as to maintain the simple action of the system which constitutes its principal merit.

MM. Pollard and Garnier's System.--With this object, MM. Pollard and Garnier devised a very successful arrangement last March, which employs the weight of the instrument to act upon the commutator.

For this purpose, they suspended the instrument to the end of a spring plate, fastened between the two contacts of the commutator. The circuit wire corresponds with this plate, and the two contacts correspond, the one with the telephone, the other with the bell. When the telephone hangs below the spring-support, that is, when it is not at work, its weight lowers the spring plate on the lower contact, and the communication of the line with the bell is established: when, on the other hand, the telephone is raised for use, the spring plate touches the higher contact, and communication is established between the line and telephone. In order to make the bell sound, it is only necessary to establish, on the wire which connects the line with the bell contact of the commutator, a breaker which can both join and break the current, and which communicates on one side with the contact of the bell, and on the other with its battery. The ordinary push of an electric bell will be sufficient, if it is supplied with a second contact, but MM. Pollard and Garnier wished to make this action also automatic, and consequently they devised the arrangement represented in fig. 53.

[Illustration: FIG. 53.]

In this system, as well as in those which have since been devised, two telephones are employed, one of which is constantly applied to the ear, and the other to the mouth, so as to make it possible to speak while listening. The telephones are supported by three wires, two of which contain flexible conductors, while the third only acts as a support.

Two of the four wires of the two telephones are connected with each other, and the other two are connected with the two binding screws of the commutator _t_, _t′_: the wires without conductors are suspended to the extremities of the two flexible plates _l_, _l′_, which correspond with earth and line.

When at rest, the weight of the telephones presses the two plates _l_, _l′_, on the lower contacts S, S′, but when the instruments are taken up these plates press against the higher contacts.

The two bell wires terminate on the lower contacts, those of the telephones on the higher contacts, and one of the poles of the battery is connected with the lower contact on the left S′, the other with the higher contact on the right T.

When at rest, the system is applied to the electric bell, and the current sent from the opposite station will follow the circuit L _l_ S S′ S′ _l′_ T, so that the call will be made. On taking up the two telephones, the circuit of the bell system is broken, and that of the telephones is established, so that the current follows the course L _l_ T _t t′_ T′ _l′_ T. If only one telephone is held at a time, the current is sent into the bell system of the opposite station, and follows the route + P S _l_ L T _l′_ T′ _t_ P --. In this way the three actions necessary for calling, corresponding, and enabling the corresponding instrument to give a call, are almost involuntarily made.

System by MM. Bréguet and Roosevelt.--In the system established by the Paris agents of the Bell company, the arrangement resembles the one just described, except that there is only one spring commutator, and the call is made with the push of an ordinary electric bell. A mahogany board is suspended from the wall, and on it are arranged, first, the ordinary electric bell system, with a sending push fixed below it; second, two forks supporting two telephones, one of which is fastened to the bar of a commutator, arranged as a Morse key. The two telephones are connected by two conducting wires, so arranged as to be capable of extension, and two of their four binding screws are in immediate connection with each other, and the other two with the earth, line, and battery, by means of the commutator, the sending push, and the bell system. The arrangement is shown in fig. 54.

[Illustration: FIG. 54.]

The commutator A consists of a metallic bar _a c_, bearing the suspension fork of one of the telephones F′ below its point of articulation: it ends in two pins _a_ and _c_, below which the two contacts of the commutator are fixed, and a spring compresses the lower arm of the bar, so as to cause the other arm to rest constantly on the higher contact. For greater security a steel tongue _a b_ is fastened to the lower end of the bar, and rubs against the small shaft _b_, which is provided with two insulated contacts, corresponding to those of the board. The bar is in communication with the line wire by means of the call-push, and the upper of the two contacts we have just described corresponds with one of the telephone wires which is inserted in the same circuit, while the other corresponds with the bell system S, which is in communication with earth. It follows from this arrangement, that when the right telephone presses its whole weight on the support, the bar of the commutator is inclined on the lower contact, and consequently the line is in direct communication with the bell, so that the call can be made. When, on the other hand, the telephone is removed from its support, the bar rests on the higher contact, and the telephones are connected with the line.

Pressure on the sending push serves to call the corresponding station: the connection of the line with the telephones is then broken, and it is established with the battery of the sending station, which sends its current through the bell of the corresponding station. In order to obtain this double effect, the contact spring of the sending push generally rests upon a contact fastened to a piece of wood shaped like a joiner's rule, which covers it in front, and below this spring there is a second contact, which communicates with the positive pole of the station battery. The other contact corresponds with the line wire, and a connection takes place between the earth wire and the negative pole of the station battery, so that the earth wire is common to three circuits:

1st. To the telephone circuit. 2nd. To that of the bell system. 3rd. To that of the local battery.

The second fork, which supports the telephone on the right, is fixed to the board, and is independent of any electric current.

It is clear that this arrangement may be varied in a thousand ways, but the model we have just described is the most practical.

Edison's System.--The problem becomes more complex in the case of battery telephones, since the battery must be common to both systems, and the induction coil must be inserted in two distinct circuits. Fig. 55 represents the model adopted in Mr. Edison's telephone.

[Illustration: FIG. 55.]

In this arrangement, there is a small stand C on the mahogany board on which the bases of the two telephones rest. The bell system S is worked by an electro-magnetic speaker P, which serves, when a Morse key is added to the system, for exchange of correspondence in the Morse code, if there should be any defect in the telephones, or to put them in working order. Above the speaker there is a commutator with a stopper D to adapt the line for sending or receiving, with or without the bell; and below the stand C the induction coil, destined to transform the voltaic currents into induced currents, is arranged in a small closed box E.

When the commutator is at reception, the line is in immediate correspondence either with the speaker or with the receiving telephone, according to the hole in which the stopper is inserted; when, on the other hand, it is at sending, the line corresponds to the secondary circuit of the induction coil. Under these conditions the action is no longer automatic; but since this kind of telephone can only be usefully employed for telegraphy, in which case those who work it are acquainted with electric apparatus, there is no inconvenience in this complication.

CALL-BELLS AND ALARUMS.

The call-bells applied to telegraphic service have been arranged in different ways. When the vibrating bells are in use, like those of which we have just spoken, it is necessary to use a battery, and the advantages offered by telephones with induced currents are

thus sensibly diminished. In order to dispense with the battery, the use of the electro-magnetic bell has been suggested.

In this case there are usually two bells, with a hammer oscillating between them, and a support formed of the polarised armature of an electro-magnet. The electro-magnetic instrument is placed below this system; it is turned by a winch, and sends the currents, alternately reversed, which are necessary to communicate the vibratory movement to the hammer, and this movement is enough to make the two bells tinkle. Below the winch of this electro-magnetic instrument there is a commutator with two contacts, which adapts the instrument for sending or receiving.

M. Mandroux has simplified this system, and has reduced it to small dimensions by the following arrangement. He fixes two magnetic cores, furnished with coils, on each of the two poles of a horseshoe magnet, composed of two bars connected by an iron coupler, and between the poles expanded by these four cores he inserts an armature, within which there is a steel spring fastened to one of these poles. In this way the armature is polarised, and oscillates under the influence of the reversed currents transmitted by an instrument of the same kind provided with an induction system. These oscillations may have the effect of producing the sound of a call-bell, and the induction system may consist of a manipulating key, fastened to a duplex system of armature, regularly applied to the magnetic cores, taken in pairs. On communicating a series of movements to this manipulator, a series of induced currents in an inverse direction are produced, which cause the armature of the corresponding station to act as we have already seen, and which may even, when necessary, furnish a series of Morse signals for a suitable manipulation. On account of the small size of this system, it might be applied to the telephonic service of the army.

The Bell Telephone Company in Paris has arranged another little call-system which is quite satisfactory and has the advantage of acting as a telephone at the same time. The model resembles the one we have termed a snuff-box telephone, and it has a button commutator by means of which the instrument is placed in communication with the electro-magnetic system of the instrument, or with a battery which is able to make the telephone vibrate with some force. To make a call, the button must be pressed, and the battery current is communicated to the corresponding instrument, which begins to vibrate when the call is made; and when notice is given of the receipt of the signal, the pressure on the button is removed, and it becomes possible to speak and receive as in ordinary telephones.

[Illustration: FIG. 56.]

M. de Weinhold's System.--M. Zetzche speaks highly of an alarum devised by Professor A. de Weinhold, which resembles that by M. Lorenz, represented in fig. 56. Its organ of sound consists of a steel bell T, from 13 to 14 centimètres in diameter, and toned to give about 420 double vibrations in a second. 'Its diameter and tone,' he says, 'are important, and any great departure from the rule laid down diminishes the effect. The opening of the bell is below, and it is fixed on a stand by its centre. A slightly curved bar magnet, provided at its two ends with iron appendices enclosed in a coil, traverses the stand. The bar magnet of the telephone also terminates in an iron appendix enclosed in a coil. In both cases the changes produced in the magnetic condition appear to be more intense than they are in magnets without appendices. The bar magnet is placed within the bell in the direction of one of its diameters, so that the appendices almost touch its sides.

'When the bell is struck on a spot about 90° from this diameter with a wooden clapper M, which acts with a spring, and is withdrawn by stretching the spring and then letting it go, as in a bell for the dinner-table, the vibrations imparted to it send currents into the coils, and these currents produce identical vibrations on the iron disk of the telephone, which are intensified by a conical resonator fitted to the telephone, so as to be easily heard some paces off. For ordinary use, the bell coil is broken into a short circuit by means of a metallic spring R, and consequently, when the bell is struck, the spring must be opened so as not to break the circuit. An instrument of the same kind has also been devised by Herr W. E. Fein at Stuttgardt.'

[Illustration: FIG. 57.]

[Illustration: FIG. 58.]

MM. Dutertre and Gouault's System.--One of the most ingenious solutions of the problem of making the telephone call has recently been proposed by MM. Dutertre and Gouault. Figs. 57 and 58 represent the opposite faces of the instrument. It consists of a kind of snuff-box telephone, like the one shown in fig. 26, and it is so arranged as to send or receive the call, according to the way in which it is placed on its stand, which is only an ordinary bracket fastened to the wall. When it is placed on the bracket so as to have the telephone mouthpiece on the outside, it is adapted for receiving, and can then give the call. When, on the other hand, its position on the bracket is reversed, it permits the other station to make the call, by producing vibrations on a vibrator under the

influence of a battery, and these vibrations reverberate in the corresponding instrument with sufficient force to produce the call. If the instrument is taken up, and the finger is placed on a small spring button, it may then be used as an ordinary telephone.

In this instrument, the magnet N S (fig. 57) is snail-shaped, like others we have mentioned, but the core of soft iron S, to which the coil E is fastened, can produce two different effects on its two extremities. On the one side, it reacts on a small armature which is fastened to the end of a vibrating disk C, fig. 58; the armature is placed against a contact fastened to the bridge B, and constitutes an electro-magnetic vibrator. For this purpose the bridge is in metallic communication with the coil wire, of which the other end corresponds with the line wire, and the spring C is mounted on an upright A, which also supports another spring D G acting on two contacts, one placed at G, and corresponding to the earth wire, the other at H, and connected with the positive pole of the battery. A small moveable button, which passes through a hole in the lid of the box, and projects beyond it, is fixed at G, and all this part of the instrument faces the bottom of the box. The upper part consists of the vibrating disk and the mouthpiece, so that the mechanism we have described is all mounted on an inner partition forming a false bottom to the box.

When the box rests upon its base, on the side shown in fig. 58, the button at G presses on the spring D G, and raises it so as to break the connection with the battery; the coil of the instrument is then united to the circuit, and consequently receives the transmitted currents, which follow this route: line wire, coil E, bridge B, spring C, spring D G, earth contact. If these currents are transmitted by a vibrator, they are strong enough to produce a noise which can be heard in all parts of a room, and consequently the call may be given in this way. If the currents are due to telephonic transmission, the instrument is applied to the ear, care being taken to put the finger on the button G, and the exchange of correspondence takes place as in ordinary instruments; but it is simpler and more manageable to insert a second telephone in the circuit for this purpose. When the box is inverted on its mouthpiece, and the button G ceases to press on the spring D G, the battery current reacts on the vibrator of the instrument, and sends the call to the corresponding station, following this route: I D A C B E, line, earth and battery; and the call goes on until the correspondent breaks the current by taking up his instrument, thus warning the other that he is ready to listen.

System of M. Puluj.--There is yet another call system, devised by M. Puluj. It consists of two telephones without mouthpieces, connected together, and with coils placed opposite the branches of two tuning-forks, tuned as nearly as possible to the same tone. A small metal bell is fixed between the opposite faces of the tuning-forks, and a wire stretched near them is provided with a small ball in contact with their branches. When the tuning-fork at the sending station is put in vibration by striking it with an iron hammer covered with skin, the tuning fork at the other station vibrates also, and its ball strikes upon the bell. As soon as the signal is returned by the second station, mouthpieces with iron diaphragms are fastened to the telephones, and the correspondence begins. It seems that, by the use of a resonator, the sound which reaches the receiving station may be so intensified as to become audible in a large hall, and the bell signal may be heard in an adjoining room, even through a closed door.

Mr. Alfred Chiddey's System.--This arrangement consists of a slender copper tube, eight inches long, and with an orifice of 1/30 of an inch, of which the lower end is soldered to the diaphragm of a telephone. A branch joint, to which an india-rubber tube is fitted, connects it with a gas jet, which is lighted and surrounded with a lamp shade, in such a way as to make it produce, under given conditions, sounds resembling those of the singing flames. A perfectly similar system is arranged at the other end of the line, in such a way that the sounds emitted in each case shall be precisely in unison. If the two systems are so regulated as not to emit sounds in their normal condition, they can be made to sing by causing a tuning-fork in the vicinity of one or the other to vibrate the same note, and then the corresponding flame will begin to sing, producing a vibration in the diaphragm of the telephone with which it is in correspondence, and hence will follow the vibration of the diaphragm of the other telephone, and consequently the vibration of the flame of the calling instrument. In this way the call signal may be made without the intervention of any battery.

APPLICATIONS OF THE TELEPHONE.

The applications of the telephone are much more numerous than might be supposed at the first glance. As far as the telegraphic service is concerned, its use must evidently be rather limited, since it cannot register the messages sent, and the speed of transmission is inferior to that of the improved system of telegraphs; yet in many cases it would be very valuable, even for a telegraphic system, since it is possible to work it without any special telegraphic training. The first comer may send and receive with the telephone, and this is certainly not the case even with the simplest forms of telegraphic instruments. This system is therefore already in use in public offices and factories, for communication in mines, for submarine works, for the navy, especially when several vessels manœuvre in the same waters, some towed by others; finally, for military purposes, either to transmit orders to different corps, or to communicate with schools of artillery and rifle practice. In America the municipal telegraphic service and that

of telegraphs limited to the area of towns are conducted in this way, and it is probable that this system will soon be adopted in Europe. Indeed, a service of this kind was established in Germany last autumn at the telegraph offices of some towns, and the London Post Office is now thinking of establishing it in England.

But, besides its use for the purposes of correspondence, the telephone can be useful to the telegraphic service itself by affording one of the simplest means of obtaining a number of simultaneous transmissions through the same wire, and even of being combined in duplex with the Morse telegraphs. Its applications in the microphonic form are incalculable, and the proverb which declares that 'walls have ears' may in this way be literally true. It is alarming to think of the consequences of such an indiscreet organ. Diplomatists must certainly redouble their reserve, and tender confidences will no longer be made with the same frankness. On this point we cannot think that much will be gained, but on the other hand the physician will probably soon make use of this invention to ascertain more readily the processes going on within the human body.

APPLICATION OF THE TELEPHONE TO SIMULTANEOUS TELEGRAPHIC TRANSMISSIONS.

The simultaneous transmission of several messages through the same wire is one of the most curious and important applications of the telephone to telegraphic instruments which can be made, and we have seen that it was this application which led Messrs. Gray and Bell to the invention of speaking telephones. The admiration which these instruments have excited has thrown the original idea into the background, although it has perhaps a more practical importance. We will now consider these systems.

An articulating telephone is not necessary in order to obtain simultaneous transmission: the musical telephones devised by MM. Petrina, Gray, Froment, &c., are quite sufficient, and a brief explanation of their principle will make this intelligible. Suppose that there are seven electro-magnetic vibrators at the two corresponding stations, which are tuned with the same tuning-fork on the different notes of the scale, and suppose that a key-board, resembling the Morse telegraph key, is arranged so that, by lowering the keys, electric reaction takes place on each vibrator: it is easy to see that these vibrators may be made to react in the same way on the corresponding vibrators of the opposite station; but they must be tuned on the same note, and the sounds emitted will continue while the keys are lowered. By keeping them down for a shorter or longer time, the long or short sounds which constitute the elements of telegraphic language in the Morse system may be obtained, and consequently an audible transmission becomes possible. Let us now suppose that a telegraphist accustomed to this mode of transmission is placed before each of the vibrators, and that they transmit different messages at the same moment in this way: the telegraphic wire will be instantaneously traversed by seven currents, broken and massed upon each other, and they might be expected to produce a medley of confused sounds on the vibrators at the receiving station; but since they each harmonise with the corresponding vibrator, they have no sensible influence except on those for which they are intended. The dominant sound may be made still more distinct by applying a Helmholtz resonator to each vibrator,[18] that is, an acoustic instrument which will only vibrate under the influence of the note to which it is tuned. In this way it is possible to select the transmitted sounds, and only to allow each _employé_ to hear that which is intended for him. Consequently, however confused the sounds may be on the receiving vibrators, the person to whom _do_ is assigned will only receive _do_ sounds, the person to whom _sol_ is assigned will only receive _sol_ sounds, so that correspondence may be carried on as well as if they had each a special wire.

In the mode we have described, this telegraphic system only admits of audible transmissions, and consequently cannot register messages. To supply this defect, it has been suggested to make the receiving vibrators react on registers, so arranging the latter that their electric organ may present such magnetic inertia, that, when it is influenced by the vibrations of sound, its effect may be maintained throughout the time of vibration. Experiments show that a Morse receiver, worked by the current of a local battery, will be enough for this purpose; so that if the musical vibrator is made to react as a relay, that is, on a contact in connection with the local battery and the receiver, the dots and dashes may be obtained on it which are the constituent elements of the Morse code.

On these principles, and considering that the musical spaces separating the different notes of the scale are such as may be easily distinguished by the resonator, seven simultaneous transmissions may be obtained on the same wire; but experience shows that it is necessary to be content with a much smaller number. Yet this number may easily be doubled by applying the mode of transmission in an opposite direction to the system.

Mr. Bell states that the idea of applying the telephone to multiple electric transmissions occurred simultaneously to M. Paul Lacour of Copenhagen, to Mr. Elisha Gray of Chicago, to Mr. Varley of London, and to Mr. Edison of New York; but there is some confusion here, for we have already seen, from reference to the patents, that Mr. Varley's system dates from 1870, that of M. Paul Lacour from September 1874, that of Mr. Elisha Gray from February 1875, and those of Messrs. Bell and Edison were still later. Yet

it appears from Mr. Gray's specification that he was the first to conceive and execute instruments of the kind. In fact, in a specification drawn up on August 6, 1874, he distinctly put forward the system we have described, and which is the basis of those of which we have still to speak. This specification was only an addition to two others made out in April and June 1874. Mr. Varley's system has only an indirect relation to the one we have described. It appears from what Mr. Bell said on the subject in a paper addressed to the Society of Telegraphic Engineers in London, that he himself only attaches a secondary interest to this invention.

He said that he had been struck with the idea that the greater or less duration of a musical sound might represent the dot and dash of the telegraphic alphabet, and it occurred to him that simultaneous telegraphic transmissions, of which the number should only be limited by the delicacy of the sense of hearing, might be obtained by suitable combinations of long and short sounds, and that these should be effected by a keyboard of tuning-forks applied to one end of a telegraphic line, and so arranged as to react electrically on electro-magnetic instruments striking on the strings of a piano. For this purpose it would be necessary to assign an employé to each of the keys for the service of transmission, and to arrange that his correspondent should only distinguish his peculiar note among all those transmitted. It was this idea, Mr. Bell adds, which led to his researches in telephony.

For several years he sought for the best mode of reproducing musical sounds at a distance by means of vibrating rheotomes: the best results were given by a steel plate vibrating between two contacts, of which the vibrations were electrically produced and maintained by an electro-magnet and a local battery. In consequence of its vibration, the two contacts were touched alternately, and the two circuits were alternately broken; the local circuit which kept the plate in vibration, and the other which was connected with the line, and reacted on the distant receiver, so as to effect simultaneous vibrations in it. A Morse key was placed in the latter circuit near the sending instrument, and when it was lowered, vibrations were sent through the line; when it was raised, these vibrations ceased, and it is easy to see that, by lowering the key for a longer or shorter time, the short and long sounds necessary for the different combinations of telegraphic language could be obtained. Moreover, if the vibrating plate of the receiving instrument were so regulated as to vibrate in unison with the sending instrument in correspondence, it would vibrate better with this sender than with another whose plate was not so adjusted.

It is evident that different sounds might be simultaneously transmitted with several plates by this arrangement of contact breaker, and that at the receiving station the sounds might be distinguished by each employé, since the one which corresponds to the fundamental note of each vibrating plate is reproduced by that plate. Consequently, the sounds produced by the vibrating plate of _do_, for example, will only be audible at the receiving station on the plate tuned to _do_, and the same will be the case with the other plates; so that the sounds will reach their destination, if not without confusion, yet with sufficient clearness to be distinguished by the employés.

Mr. Bell sums up the defects still existing in his system as follows:--1st. The receiver of the messages must have a good musical ear, in order to distinguish the value of sounds. 2nd. Since the signals can only take place when the transmitted currents are in the same direction, two wires must be employed in order to exchange messages on each side.

He surmounted the first difficulty by providing the receiver with an instrument which he called the vibrating contact breaker, and which registered automatically the sounds produced. This contact breaker was placed in the circuit of a local battery, which could work a Morse instrument under certain conditions. When the sounds emitted by the instrument did not correspond with those for which it had been tuned, the contact breaker had no effect on the telegraphic instrument: it only acted when the sounds were those which were to be interpreted, and its action necessarily corresponded to the length of the sounds.

Mr. Bell adds that he applied the system to electro-chemical telegraphs; but we need not dwell on this part of the invention, since, as we have said, it is no longer his special study.

System of M. Lacour of Copenhagen.--M. Lacour's system was patented on the 2nd September, 1874, but his experiments were commenced on the 5th June of the same year. Since M. Lacour believed that the vibrations would be imperceptible on long lines, his first attempts were made on a somewhat short line; but in November 1874 fresh experiments were made between Fredericia and Copenhagen on a line 225 miles in length, and it was ascertained that vibratory effects could be easily transmitted, even under the influence of a rather weak battery.

[Illustration: FIG. 59.]

In M. Lacour's system, the sending instrument is a simple tuning-fork, placed in a horizontal position, and one of its arms reacts on a contact breaker, which can produce precisely the same number of discharges of currents as there are vibrations of the

tuning-fork. If a Morse manipulator is inserted in the circuit, it is evident that if it is worked so as to produce the dots and dashes of the Morse alphabet, the same signals will be reproduced at the opposite station, and the signals will be manifested by long and short sounds, if an electro-magnetic receiver is connected with the circuit. This sender is shown fig. 59.

Fig. 60 represents M. Lacour's receiver. It consists of a tuning-fork F made of soft iron, not of steel like the sending tuning-fork, and each of its branches is inserted in the bobbin of an electro-magnetic coil C C; two distinct electro-magnets M M react close to the extremities of the fork, in such a way that the polarities developed on the two branches of the fork under the influence of the coils C C should be of contrary signs to those of the electro-magnets M M.

[Illustration: FIG. 60.]

If this double electro-magnetic system is inserted in a line circuit, it follows that, for each discharge of the transmitted current, a corresponding attraction of the branches of the tuning-fork will take place, and consequently there will be a vibration, producing a sound, if the discharges are numerous. This sound will naturally be short or long in proportion to the duration of the sender's action, and it will be the same as that of the tuning-fork in that instrument. Again, if one branch of the tuning-fork reacts on a contact P inserted in the circuit of the local battery communicating with a Morse receiver, traces will be produced on this receiver of length varying with the duration of the sounds, for the Morse electro-magnet will be so quickly affected by the successive breaks in the current that its armature will remain stationary throughout each vibration. 'I have not yet been able,' said M. Lacour in an address delivered before the Danish Academy of Science in 1875, 'to calculate the time necessary for the production of definite vibrations in the tuning-fork. Different factors have to be considered, but experiment has shown that the time which elapses before the local circuit is broken is such a small fraction of a second as to be almost inappreciable, even when the current is very weak.

'Since intermittent currents only affect a tuning-fork on condition that it vibrates in unison with the one which produces them, it follows that if a series of sending tuning-forks, tuned to the different notes of the scale, is placed at one end of a circuit, and if a similar series of electro-magnetic tuning-forks, in exact accordance with the first, is placed at the other end of the circuit, the intermittent currents transmitted by the sending tuning-forks will be added to each other without becoming confused, and each of the receiving tuning-forks will only be affected by the currents emitted by the tuning-fork in unison with it. In this way the combinations of elementary signals representing a word may be telegraphed simultaneously.'

M. Lacour enumerates the ways in which this system may be applied as follows: 'If the keys in connection with the sending tuning-forks are placed side by side, and are lowered in succession, or two or three together, it will be enough to play on the keys as on a musical instrument, in order that the air may be heard at the receiving station, or the signals transmitted simultaneously may each belong to a different message. This system will therefore allow the furthest station on a line to communicate with one or several intermediate stations, and _vice versa_, without disturbing the communication at other stations. In this way two stations can exchange signals, unperceived by the rest. The power of sending many signals at once affords a good means of improving the autographic telegraph. In the instruments now in use, such as those of Caselli and D'Arlincourt, there is only one tracing stylus, and this stylus must pass over the whole surface of the telegram in order to obtain a copy of it, but with the telephone a certain number of styli may be placed side by side in the form of a comb, and this comb need only be drawn in a certain direction to pass over the surface of the telegram. In this way a more faithful copy will be obtained in a shorter time.'

M. Lacour also observes that his system possesses a merit already pointed out by Mr. Varley, namely, that the instruments permit the passage of ordinary currents without revealing their presence, whence it follows that the accidental currents which often disturb telegraphic transmissions will have no effect on these systems.

M. Lacour began without applying an electro-magnetic system to his instrument in order to maintain the movement of the tuning-fork, but he soon saw that this accessory was indispensable, and he made the tuning-forks themselves electro-magnetic. It also occurred to him to convert the transmitted currents into pulsatory currents by inserting an induction coil in the circuit, which was also done by Mr. Elisha Gray. Finally, in order to obtain the immediate action of the tuning-forks and the immediate cessation of their action, he constructed them so as to reduce their inertia as much as possible. This was effected by inserting the two branches of the tuning-fork in the same coil and by lengthening its handle, and turning it back so that it might pass through a second coil, dividing into two branches and embracing the two vibrating branches, but without touching them. When a current traverses both coils, it produces, in the kind of horseshoe magnet formed by the two systems, opposite polarities which provoke a double reaction in the vibrating branches--a reaction by repulsion exerted by the two branches in virtue of the same polarity, and a reaction by attraction by the other two branches in virtue of their opposite polarities; and this double action is repeated by the

movements of a contact breaker applied to one of the vibrating branches of the tuning-fork.

[Illustration: FIG. 61.]

Mr. Elisha Gray's System.--According to the system originally patented, each sender, represented fig. 61, consists of an electro-magnet M M resting below a small copper tablet B S, in such a way that its poles pass through this tablet and are on a level with its upper surface. A steel plate A S is fixed above these poles; its tension can be regulated by means of a screw S; and another screw _c_ is placed on the plate, and is in electric communication with a local battery R′ by means of a Morse key. Below the plate A S there is a contact _d_ connected with the line wire L; this contact is met by the plate at the moment of its attraction by the electro-magnet, and breaks the current of a line battery P, which acts on the receiver of the opposite station. Finally, the electric communication established between the local battery R′ and the electro-magnet, as may be seen in the figure, produces vibrations in the steel plate A S at each lowering of the key, as in the case of ordinary vibrations--vibrations which, with a suitable tension of the plate and a given intensity of the battery R′, can produce a definite musical note. Moreover, since at each vibration the plate A S meets the contact, discharges of the line current take place through the line L, and react on the receiving instrument, causing it to reproduce exactly the same vibrations as those of the sending instrument.

[Illustration: FIG. 62.]

The receiving instrument represented fig. 62 exactly resembles the one we have just described, except that there is no contact _d_ below the vibrating plate A S, and the contact _c_, instead of communicating with the line wire, is in electric connection with a register E and a local battery P. It follows from this arrangement that when the plate A S vibrates under the influence of the broken currents passing through the electro-magnet M M, similar vibrations are sent through the register; but if the electro-magnetic organ of this register is properly regulated, these vibrations can only produce the effect of a continuous current, and hence the length of the traces left on the instrument will vary with the duration of the sounds produced. In this way the registration of the dashes and dots which constitute the signs of the Morse vocabulary will be effected.

If it is remembered that the plate A S vibrates under the influence of electro-magnetic attractions more readily in proportion to their approximation in number to the vibrations corresponding to the fundamental sound it can emit, it becomes clear that if this plate is tuned to the same note as that of the corresponding instrument, it will be rendered peculiarly sensitive to the vibrations transmitted by the sender, and the other vibrations which may affect it will only act faintly. Moreover, a resonator placed above the plate will greatly increase this predisposition; so that if several systems of this kind, tuned to different notes, produce simultaneous transmissions, the sounds corresponding to the different vibrations will be in a certain sense selected and distributed, in spite of their combination, into the receivers for which they are specially adapted, and each of them may retain the traces of the sounds emitted by adding the register, which may be so arranged as to act as an ordinary Morse receiver. Mr. Gray states that the number of sending instruments and independent local circuits may be equal to that of the tones and semitones of two or more octaves, provided that each vibrating plate be tuned to a different note of the scale. The instruments may be placed side by side, and their respective local keys, arranged like the keys of a piano, will make it easy to play an air combining notes and chords; there may also be an interval between the instruments, which may be sufficiently far from each other to allow the employés to work without being distracted by sounds not intended for them.

In a new arrangement, exhibited at the Paris Exhibition, 1878, Mr. Gray considerably modified the way of working the various electro-magnetic organs which we have just described. In this case, the plates consist of tuning-forks with one branch kept in continual vibration at both stations, and the signals only become perceptible by intensifying the sounds produced. This arrangement follows from the necessity of keeping the line circuit always closed for multiple transmissions of this nature, so as to react with pulsatory currents, which are alone able, as we have already seen, to retain the individual character of several sounds simultaneously transmitted.

[Illustration: FIG. 63.]

Under these conditions, the sender consists, as we see (fig. 63), of a bar tuning-fork, _a_, which is grooved for the passage of a runner, heavy enough to tune the fork to the desired note, and it oscillates between two electro-magnets _e_ and _f_ and two contacts I and G. The difference of resistance in the electro-magnets is very great: in the one _f_ the resistance is equal to 2¾ miles of telegraphic wire, in the other it does not exceed 440 yards. When electric communication is established as we see in the figure, the following effect takes place. Since the current of the local battery through the two electro-magnets is broken by the rest-contact of the Morse key H, the plate _a_ is subject to two contrary actions; but since the electro-magnet _f_ has more turns

than the electro-magnet _e_, its action is preponderant, and the plate is attracted towards _f_, and produces a contact with the spring G, which opens a way of less resistance for the current. Since the current then passes almost wholly through G, _b_, 1, 2, B, the electro-magnet is now able to act; the plate _a_ is then attracted towards _e_, and, by producing a contact on the spring I, it sends the current of the line B P through the telegraphic line, if the key H is at the same time lowered on the sending contact: if not, there will be no effect in this direction, but since the plate _a_ has left the spring G, the first effect of attraction by the electro-magnet _f_ will be repeated, and this tends to draw the plate again towards _f_. This state of things is repeated indefinitely so as to maintain the vibration of the plate, and to send out signals corresponding with these vibrations whenever the key H is lowered. The elastic nature of the plate makes these vibrations more easy, and it ought also to be put in mechanical vibration at the outset.

The receiver, represented fig. 64, consists of an electro-magnet M, mounted on a sounding-box C, and having an armature formed by a tuning-fork L L firmly buttressed on the box by a cross bar T. There is a runner P on the armature, sliding in a groove, which makes it possible to tune the vibrations of the tuning-fork to the fundamental note of the sounding-box C, which is so arranged as to vibrate in unison with it. Under these conditions, the box as well as the tuning-fork will act as an analyser of the vibrations transmitted by the currents, and may set the register at work by itself reacting on a breaker of the local current. To obtain this result, a membrane of gold-beater's skin or parchment must be stretched before the opening of the box, and a platinum contact must be applied to it, so arranged as to meet a metallic spring connected with any kind of register or a Morse instrument, when the membrane vibrates. As, however, in America the messages are generally received by sound, this addition to the system is not in use.

[Illustration: FIG. 64.]

The instrument is not only regulated by the runner P, but also by a regulating screw V which allows the electro-magnet M to be properly adjusted. The regulating system is made more exact by the small screw V, and the instrument is connected with the line by the binding screw B. Of course this double arrangement is necessary for each of the sending systems.

As I have already said, seven different messages might theoretically be sent at once in this way, but Mr. Gray has only adapted his instrument for four; he has, however, made use of the duplex system, which allows him to double the number of transmissions, so that eight messages may be sent at the same time, four in one direction, and four in another.

Mr. Hoskins asserts that this system has been worked with complete success on the lines of the Western Union Telegraph Company, from Boston to New York, and from Chicago to Milwaukee. Since these experiments were made, fresh improvements have rendered it possible to send a much larger number of messages.

Mr. Gray has also, aided by Mr. Hoskins, devised a system by which telephonic messages may be sent on a wire previously used for Morse instruments. Mr. Varley had already solved this problem, but Mr. Gray's system seems to have produced important results, and has therefore a claim to our attention. We do not, however, describe it here, since it is not within the lines marked out for us, and those who are interested in the subject will find all the necessary details in a paper inserted in the 'Journal of the Society of Telegraphic Engineers, London,' vol. vi.

Mr. Varley's System.--This system is evidently the earliest in date, since it was patented in 1870, and the patent describes the principle of most of the arrangements which have since been adopted by Messrs. Lacour, Gray, and Bell. It is based upon the use of his own musical telephone, which we have already described, but with some variations in its arrangement, which make it somewhat like the Reiss system.

It was Mr. Varley's aim to make his telephone work in conjunction with instruments with ordinary currents, by the addition of rapid electric waves, incapable of making any practical change in the mechanical or chemical capacity of the currents which serve for the ordinary signals, yet able to make distinct signals, perceptible to the ear and even to the eye. He says: 'An electro-magnet offers at first a great resistance to the passage of an electric current, and may consequently be regarded as a partially opaque body with respect to the transmission of very rapid inverse currents or of electric waves. Therefore, if a tuning-fork, or an instrument with a vibrating plate, tuned to a given note, be placed at the sending station, and so arranged as to be kept in constant vibration by magnetic influence, the current which acts upon it must be passed into two helices placed one above the other so as to constitute the primary helix of an induction coil: in this way it will be possible to obtain in two distinct circuits two series of rapidly broken currents, which will correspond to the two directions of the vibrations of the tuning-fork, and we shall also have the induced currents produced in the secondary helix by these currents, which may act on a third circuit. This third circuit may be placed in connection

with a telegraphic line previously used by an ordinary telegraphic system, if a condenser is applied to it, and in this way two different transmissions may be obtained simultaneously.'

[Illustration: FIG. 65.]

Fig. 65 represents the arrangement of this system. D is the vibrating plate of the tuning-fork designed to produce the electric contacts necessary to maintain it in motion. These contacts are at S and S′, and the electro-magnets which affect it are at M and M′. The induction coil is at I′, and the three helices of which it is composed are indicated by the circular lines which surround it. There is a Morse manipulator at A, another at A′, and the two batteries which work the system are at P and P′. The condenser is at C, and the telephone is at the end of the line L.

When the vibration of the plate D tends to the right, and the electric contact takes place at S′, the current of the battery P′, after traversing the primary helix, reaches the electro-magnets M M′, which give it an impulse in the contrary direction. When, on the other hand, it tends to the left, the current is sent through the second primary circuit, which will be balanced by the first. Consequently there will be a series of reversed currents in the induced circuit corresponding to the key A′, which will alternately charge and discharge the condenser C, thus sending into the line a corresponding series of electric undulations which will react on the telephone placed at the end of the line; and as the duration of the transmitted currents will vary with the time that the key A′ is lowered, a correspondence in the Morse code may be obtained in the telephone, while another correspondence is exchanged with the key A and the ordinary Morse receivers.

In order to render the vibratory signals visible, Mr. Varley proposes to use a fine steel wire, stretched through a helix and facing a narrow slit, to reproduce the vibrations. A light, which is intercepted by the wire, is placed behind the slit. As soon as a current passes, the wire vibrates and the light appears. A lens is placed so as to magnify the image of the luminous slit, and project it on a white screen while the wire is in vibration.

VARIOUS USES OF THE TELEPHONE.

Its domestic application.--We have seen that telephones may be used with advantage in public and private offices: they can be set up at a much less expense than acoustic tubes, and in cases where the latter would never be employed. With the aid of the calls we have described, they offer the same advantages, and the connection between the instruments is more easily concealed. The difference of price in establishing them is in the ratio of one to seven.

For this purpose electro-magnetic telephones are evidently the best, since they require no battery and are always ready to work. They are already in use in many Government offices, and it is probable that they will soon be combined with electric bells for the service of hotels and of large public and private establishments: they may even be used in private houses for giving orders to servants and porters, who may thus save visitors from the fatigue of a useless ascent of several storeys.

In factories, telephones will certainly soon replace the telegraphic communication which has already become general. They may not only be used for ordinary messages, but to call for help in case of fire, and they will become an integral part of several systems already established for this purpose.

In countries which have free telegraphic communication, the telephone has already replaced in great measure the private telegraph instruments which have hitherto been in use; and if the same privilege is extended to France, no other mode of correspondence will be used.

Its application to telegraphic service.--The advantage to be derived by the telegraphic service from the telephone is rather limited, since, as far as the speed of transmission is concerned, it is of less value than many of the telegraphic instruments now in use, and the messages which it produces cannot be registered. Yet in municipal offices not overburdened with messages they offer the advantage of not requiring a trained service. On longer lines their use would be of little value. The 'Berne Telegraphic Journal' has published some interesting remarks on this subject, of which the following is a summary.

1st. In order to send a message with the special advantages of the system, the sender ought to be able to address his correspondent without the intervention of an official. Those who are acquainted with the network of wires know this to be impossible. Intermediate offices for receiving messages are essential, and the public cannot be admitted to those set apart for sending and receiving; consequently the sender must deliver a written message.

2nd. If the message is written, the chief advantage of the instrument is lost, since it must be read and uttered aloud, which could not be done if expressed in a language with which the employés were unacquainted.

3rd. The instruments now in use at the telegraph offices can transmit messages more quickly than if they were spoken.

In Germany, however, a telephone service has been established in several telegraph offices, and its possible advantages are enumerated as follows in the official circular which created it:

‘The offices which will be opened to the public for the service of telephonic messages in Germany will be regarded as independent establishments; yet they will be in connection with the ordinary telegraph offices, which will undertake to send telephonic messages through their wires.

‘The transmission will take place as follows: The sending office will request the receiving office to prepare the instrument; as soon as the tubes are adjusted, the sending office will give the signal for despatching the verbal message.

‘The sender must speak slowly and clearly, without raising his voice; each syllable must be distinctly pronounced; the final syllables especially must be well articulated, and there must be a pause after each word, in order to give the receiver time to write it down.

‘When the telegram has been received, the employé at the receiving office must verify the number of words; then he must repeat through the telephone the whole message without pausing, so as to make sure that there is no mistake.

‘In order to ensure secrecy, the telephones are placed apart, where persons unconnected with the service cannot hear the verbal message, and the employés are forbidden to reveal to anyone the names of the correspondents.

‘The charge for telephonic messages, as for the ordinary telegraphic services, is at the rate of so much a word.’

The use of the telephone has also been suggested for verifying the perfect junction of telegraphic wires. It is certain that, if the junction is complete, no abnormal sounds will be heard, or only those which result from accidental currents; but if the junction is bad, the imperfect contacts which take place produce variations in electric intensity which are translated into the more or less marked sounds observed in the telephone.

M. Mauborgne, the electrician attached to the Northern Railway of France, has lately used the telephone instead of the galvanometer to ascertain the condition of the circuits in correspondence with the instruments in use for electric signals. The reactions produced on the galvanometer needle by the pieces of iron which are placed at the sides of the railway often make its indications uncertain, and a strong wind produces irregular movements in the instrument which interfere with observations. It was also necessary to place the galvanometer with due regard to the points of the compass, and to wait for the needle to settle, which involved loss of time. The operation is easily accomplished with the telephone, since the strokes of the call-bell are distinctly reproduced; it is made to ring by working the contacts which need verification, and in the same way the condition of the battery can be ascertained.

Application to military purposes.--Since the telephone was invented, numerous experiments have been made in different countries to ascertain whether it would be of use in military operations. These experiments have hitherto been only moderately satisfactory, on account of the noise inseparable from an army, which generally makes it impossible to hear the telephone, and every means of intensifying its sounds has been eagerly sought. It was at first supposed that the discovery of the microphone had solved the problem, and I received many enquiries from military schools on the subject, but I have not been able to see that anything has been gained from this point of view. The telephone is, however, of great use in schools of artillery and rifle practice. Now that firearms carry so far, it has become necessary to be informed by telegraph of the points hit on the target, in order to judge of the accuracy of aim, and for this purpose telegraphic targets were suggested; but telephones are much to be preferred, and they are now used with good effect.

If the telephone is unsuited for the service of the flying telegraph in the field, it may be of great use in the defence of towns, to transmit the orders of the commandant to different batteries, and even for the exchange of correspondence with captive balloons sent to hover over fields of battle.

In spite of the difficulties attending its use, the experiment was made by the Russians in the late war: the cable wire of communication was 500 or 600 yards long, and so light that it could be laid by one man. The ‘Telegraphic Journal’ of March 15, 1878, states that the bad weather did not interfere with the working of the instruments; but the noise made it difficult to hear, and it

was necessary to cover the head with a hood to intercept external sounds. This cannot be considered a satisfactory result, yet the telephone may be of great service to an army by intercepting the enemy's messages: a bold man, provided with a pocket telephone, who placed himself in a retired spot, might divert the current of the enemy's telegraphic wire into his telephone, and get possession of all his despatches, as we saw was the case at Clermont. He might even do this by diverting the current to earth or to a rail of the railway line. These are suggestions for future research, and it is probable that they may some day be turned to practical account.

Its application to the navy.--The telephone may be of the greatest use in naval matters, for the service of electro-semaphores, for island forts and ships at anchor. M. Pollard says that 'experiments made between the Préfecture Maritime at Cherbourg, the semaphores and the forts on the mole, demonstrate the advantage there would be in establishing telephones at these stations, since they would ensure an easy communication between the vessels of a squadron and the land they are approaching. By sinking small cables which come to the surface of the water along mooring chains, and terminate in buoys or cases which remain permanently in the harbour, the ships of war may in this way place themselves in communication with the Préfecture Maritime as they cast anchor, and, by temporarily connecting the vessels together with light cables, the admiral may communicate freely with the whole squadron.'

The telephone has been tried on board ship for transmitting orders, but without success, on account of the noise always going on in a vessel.

The telephone may be usefully applied to the service of submarine torpedoes. We have already seen how it may be applied in connection with the microphone, but it may also be used in firing the torpedoes after the exact position of the enemy's ship has been ascertained from two reconnaissances taken from different parts of the coast.

The telephone, again, makes it possible to verify the condition of torpedoes, and to ascertain if there is any fault in the circuit within the explosives. For this purpose a very weak current has been used, and a galvanometer is not always able to indicate the fault, while the extreme sensitiveness of the telephone will do so in the simplest way.

Captain M'Evoy, of the American Army, suggested a way of ascertaining, while on shore, the condition of torpedoes under water, by connecting the buoys which support them with the land by means of a telephonic line. By inserting, in the buoy which supports the torpedo, metallic disks, so arranged as to vibrate with every movement caused by the waves upon the buoy, a continuous noise will be heard in the telephone, after the circuit has been completed by the metallic disks; and the noise will go on as long as the disks continue to oscillate, and will cease as soon as the buoy is completely covered by the water. When it ceases, therefore, if not affected by some accidental cause, it may be supposed that the enemy's ship is passing over the buoy.

M. Trève, again, has shown that the telephone might be used with advantage for the telegraphic communication between vessels in tow, and M. des Portes has applied it with good effect to diving operations. In this instance, one of the glass panes in the helmet is replaced by a copper plate in which the telephone is framed, so that the diver need only make a slight movement of his head in order to receive or address communications to those in charge of the apparatus. With this system the keels of vessels may be examined, and an account given of their condition, without bringing up the divers, which has hitherto been necessary.

M. de Parville, the able and learned editor of the _Journal Scientifique_ and the science department of the _Journal des Débats_, has suggested a new and interesting application of the telephone. It concerns the possibility of making use of it to determine the precise position of the magnetic meridian, that is, the true direction of the magnetised needle.

For this purpose a Bell telephone is necessary, of which the magnetic core is formed of an iron rod a mètre in length, kept, by a suitable suspension, at nearly the same angle of inclination as a dipping-needle. This rod will be magnetised under the influence of terrestrial magnetism, and the telephone will be able to transmit the sounds produced by some sort of vibrator placed near its mouthpiece. These sounds will be strong in proportion to the degree of magnetisation of the bar; and if the telephone is turned round the horizon, keeping the bar at the same angle of inclination, the sounds transmitted to the receiving telephone will be greatest when the axis of the bar is in the plane of the magnetic meridian, and least when it is at 90°. It will therefore be possible to ascertain from the direction of the axis at the moment when the sounds are no longer heard, the exact inclination of the magnetic needle from north to south, for it will be given by the perpendicular to the line which is followed by the axis of the iron bar at that moment.

It is possible that, with this system, the disturbing influence on the magnetic needle of the mass of iron in iron-plated vessels might be almost destroyed, and a more exact orientation than that of the compass might be obtained. The same process may make it possible to estimate and measure the variations of terrestrial magnetism. M. de Parville has not himself tried to apply this system; but Mr. Blake's experiments, of which we spoke in an early part of this work, make it probable that it might be done with advantage.

Application to industry.--One of the earliest and most important applications of the telephone is that which was first made to the service of mines in England and America in the autumn of 1877. The great length of the galleries is well known, and had already involved the use of the electric telegraph for transmitting orders; but the miners did not understand how to work these instruments, and the service was ill performed. Thanks to the telephone, through which the first corner can send and receive a message, there is no longer any difficulty in the communication between the galleries and the surface of the mine.

The ventilation of mines can also be regulated by the aid of telephones. If one of these instruments is placed near a wheel kept in motion by the air which passes through the ventilating shaft, and another is placed in the inspector's office he can ascertain by the sound if the ventilation is duly carried on, and if the machine works regularly.

Application to scientific research.--M. d'Arsonval's experiments, which we have already mentioned, show that the telephone can be used as an extremely sensitive galvanoscope; but since it can only produce sounds under the influence of broken currents, the circuit on which the experiment is made must be divided at rather close intervals. It has been seen that it is not even necessary to insert the telephone in the circuit: it may be influenced, when at a distance, either immediately or by the induction of the broken current on a circuit placed parallel to the first, and the force of these effects may be increased by the reaction of a core of iron, round which the inducing circuit is wound. The drawback to this system is that the direction of the current is not ascertained, so that it cannot be used as a measuring instrument; but, on the other hand, it is so sensitive, so easy to arrange, and so inexpensive, that it might be of the greatest use as a galvanoscope.

Mr. Warren de La Rue has also made use of the telephone in his researches into the electric discharges of high-tension batteries, in order to follow the different phases of the discharge during the luminous phenomena which it produces. In this way he ascertained that when a condenser is placed in connection with a battery formed of a considerable number of insulated elements, and is gradually discharged through a Geissler tube, a dull and faint sound is heard in the telephone, as long as the stratifications of light appear to be perfectly stable; but the sound becomes considerably stronger, and sometimes even piercing, in proportion to the diffusion of these stratifications, and to their approach to the point of extinction: whence it is shown that the discharge of a battery into tubes in which a vacuum has been made is intermittent.

Mr. Spottiswoode has repeated the same experiments with the discharges of Holtz machines, and with large condensers, and he found that the most piercing sounds produced by the telephone coincided with the greatest development of the stratifications. These sounds, however, sometimes ceased for a moment. It was even possible to ascertain, from the intensity of the sounds produced, the differences of tension which might be manifested in the charge of the condenser and the slackening of the machine's motion, and the differences of intensity in these sounds might in some cases exceed an octave. The fall in the scale generally appeared in half-tones instead of gradually, and the introduction of resistances into the circuit modified the sounds very much: they might even be intensified by approaching the finger to the discharging tube.

From experiments made with the telephone between Calais and Boulogne, it appears that this instrument might be applied with advantage to the science of projectiles. In fact, in some artillery practice which took place on the shore at Boulogne, a telephone was placed close to the gun, and the explosion was heard at a distance of nearly two miles, where the projectile fell. It was possible to estimate its velocity by measuring the lapse of time between the moment when the projectile left the gun, and its fall. This calculation is usually made by observing the flash from the cannon's mouth; but in some cases, as in a fog or in practice at long ranges, the telephone may be usefully substituted for ocular observation. On the field of battle, an observer, provided with a telephone and placed on a hill, might rectify from a distance the aim of his battery, which is generally established in a sheltered and less elevated place.

THE PHONOGRAPH.

Mr. Edison's Phonograph, which has for the last year attracted so much attention, is an instrument which not only registers the different vibrations produced by speech on a vibrating plate, but reproduces the same words in correspondence with the traces registered. The first function of this instrument is not the result of a new discovery. Physicists have long sought to solve the problem

of registering speech, and in 1856 Mr. Leo Scott invented an instrument well known to physicists under the name of Phonautograph, which completely solved the difficulty: this instrument is described in all the more detailed treatises on physics. But the second function of the Edison instrument was not realised nor even mentioned by Mr. Scott, and we are surprised that this able inventor should have regarded Mr. Edison's invention as an injurious act of spoliation. We regret on his own account, since no one has wished to deprive him of the credit he deserves, that he should have published a pamphlet on the subject, couched in terms of such asperity, which proves nothing, and only states facts which were well known to all physicists. If any other person could claim the invention of the phonograph, at least in its most curious property of reproducing speech, it would certainly be M. Charles Cros; for in a sealed paper deposited at the Académie des Sciences, April 30, 1877, he pointed out the principle of an instrument by means of which speech might be reproduced in accordance with the marks traced on a register like that of the phonautograph.[19] Mr. Edison's patent, in which the principle of the phonograph is first indicated, is dated July 31, 1877, and he was still only occupied with the repetition of the Morse signals. In this patent Mr. Edison described a mode of registering these signals by means of indentations traced with a stylus on a sheet of paper wound round a cylinder, and this cylinder had a spiral groove cut on its surface. The tracings thus produced were to be used for the automatic transmission of the same message, by passing it again under a stylus which should react on a current breaker. In this patent, therefore, nothing is said of the registration of speech or of its reproduction; but, as the 'Telegraphic Journal' of May 1, 1878, observes, the foregoing invention gave him the means of solving this double problem as soon as it was suggested to him. If we may believe the American journals, this suggestion soon came, and it was the result of an accident.

In the course of some experiments Mr. Edison was making with the telephone, a stylus attached to the diaphragm pierced his finger at the moment when the diaphragm began to vibrate under the influence of the voice, and the prick was enough to draw blood. It then occurred to him that if the vibrations of the diaphragm enabled the stylus to pierce the skin, they might produce on a flexible surface such distinct outlines as to represent all the undulations produced by the voice, and even that the same outlines might mechanically reproduce the vibrations which had caused them, by reacting on a plate capable of vibrating in the same way as that which he had already used for the reproduction of the Morse signals. From that moment the phonograph was discovered, since there was only a step between the idea and its realisation, and in less than two days the instrument was made and tried.

This is an ingenious story, yet we would rather believe that the discovery was made in a more serious spirit. In fact, such an inventor as Mr. Edison, who had discovered the electro-motograph, and had applied it to the telephone, was already on the way to discover the phonograph, and we think too well of his powers to attach much credit to this American romance. Besides, Mr. Edison was well acquainted with Mr. Scott's phonautograph.

Mr. Edison's phonograph was only patented in January 1877. Consequently, when we look at the principle of the invention, M. Cros undoubtedly may claim priority; but it is a question whether the system described in his sealed paper, and published in the _Semaine du Clergé_, October 8, 1877, would have been capable of reproducing speech. Our doubt seems justified by the unsuccessful attempts of the Abbé Leblanc to carry out M. Cros' idea. When we have to do with such undulating and complex vibrations as those involved in the reproduction of articulate words, it is necessary that the stereotyping should in some sense be effected by the words themselves, and their artificial reproduction will necessarily fail to mark the slight differences which distinguish the delicate combinations of speech. Besides, the movements performed by a point confined to a groove that follows a sinusoidal curve cannot be effected with all the freedom necessary for the development of sounds, and the friction exerted on the two edges of the groove will often be of a nature to stifle them. A distinguished member of the Société de Physique, when I exhibited the phonograph to that society, justly said that Mr. Edison's whole invention consisted in the thin metallic sheet on which the vibrations are inscribed; this sheet permits the movements of the vibrating plate to be directly stereotyped, and thereby the problem is solved. It was necessary to find such an expedient, and it was done by Mr. Edison, who is therefore the inventor of the phonograph.

After M. Cros, and before Mr. Edison, MM. Napoli and Marcel Deprez attempted to make a phonograph, but with so little success that they believed at one time the problem to be insoluble, and threw doubts on Mr. Edison's invention when it was announced to the Société de Physique. They subsequently resumed their labours, and lead us to hope that they may eventually produce a phonograph of more perfect construction than that of Mr. Edison. We shall have more to say on this subject.

In conclusion, the mechanical reproduction of speech was first effected by Mr. Edison, and in so doing he has accomplished one of the most curious and important discoveries of our time, since it has shown that this reproduction was much less complicated than had been supposed. Yet the theoretical consequences of the discovery must not be exaggerated, since I do not consider it by any means proved that our theories on the voice are incorrect. There is in fact a great difference between the reproduction of a sound

which has been uttered, and the mode in which the same sound was produced. The reproduction may be easily effected, as M. Bourseul has remarked, as soon as a mode has been discovered of transmitting the vibrations of air, however complex they may be; but in order to produce the complex vibrations of speech by the voice, several special organs must be exercised--first, the muscles of the throat; secondly, the tongue, the lips, and even the teeth--and for this reason an articulating machine is necessarily very complex.

Surprise was expressed that the speaking machine, which was brought from America two years ago, and exhibited at the Grand Hôtel, Paris, was so extremely complicated, since the phonograph solved the problem in such a simple way. This is because the latter instrument only reproduces speech, while the former utters it, and the inventor of the speaking machine had to employ in his mechanism all the organs which are necessary in our organism for the reproduction of speech. The problem was infinitely more complex, and this invention has not attracted all the attention it deserved. We shall speak of it presently. We must now describe the phonograph and the different applications which have been, or which may be, made of it.

Description of Phonograph, and mode of using it.--The first and best known model of this instrument, which we represent in fig. 66, simply consists of a registering cylinder R, set in motion with the hand by a winch M, before which a vibrating plate is placed, furnished on its face with a telephone mouthpiece E, and on the reverse side with a tracing point. This tracing point, which is seen at _s_ in the section of the instrument given in fig. 68, is not fixed directly on the plate; it rests on a spring _r_, and a caoutchouc pad _c_ is placed between it and the vibrating disk. This pad is formed of the end of a tube which is designed to send the vibrations of the plate to the point _s_ without stifling them. Another pad _a_, placed between the plate L L and the rigid support of the point, moderates in some degree these vibrations, which, without this precaution, would generally be too powerful.

[Illustration: FIG. 66.]

The cylinder, of which the axis A A (fig. 66) is cut at one end like a screw, to enable it to make a lateral progressive movement simultaneously with the rotatory movement effected on itself, has on its surface a narrow screw-thread coinciding with that of the axis, and when the tracing point is inserted, it is able to pass along it for a distance corresponding to the time occupied in turning the cylinder. A sheet of tinfoil or of very thin copper is carefully applied to the surface of the cylinder, and it should be slightly pressed down upon it, so as to show a faint tracing of the groove, and to allow the point of the vibrating disk to be placed in a proper position. The point rests on the foil under a pressure which must be regulated, and for this purpose, as well as to detach the cylinder when it is desired to place or take away the tinfoil, there is the articulated system S N which sustains the support S of the vibrating disk. This system consists of a jointed lever in which there is a nut screw for the screw R. The handle N at the end of the lever allows the tracing system to be turned aside when the screw R is loosened. In order to regulate the pressure of the tracing point on the sheet of tinfoil, it is enough to turn the screw R loosely in its socket, and to tighten it as soon as the right degree of pressure is obtained.

This is the simple system by which speech can engrave itself on a plate in durable characters, and it works in the following manner.

[Illustration: FIG. 67.]

The speaker stands before the mouthpiece E, as before a telephone or an acoustic tube, and speaks in a strong, emphatic voice, with his lips pressed against the walls of the mouthpiece, as we see in fig. 67; at the same moment he turns the handle of the cylinder, which is provided with a heavy fly-wheel in order that the movement may be regular. Influenced by the voice, the plate L L begins to vibrate, and sets the tracing point at work, which presses on the tinfoil at each vibration, and produces a furrow whose depth varies along its course in correspondence with the unequal vibrations of the disk. The cylinder which moves at the same time presents the different parts of the groove of which we have spoken to the tracing point in succession; so that when the spoken sentence comes to an end, the design which has been pricked out, consisting of a succession of reliefs and depressions, represents the registration of the sentence itself. The first part of the operation is therefore accomplished, and by detaching the sheet from the instrument the words may be put away in a portfolio. We have now to see how the instrument is able to reproduce what has been so easily inscribed.

For this purpose it is only necessary to repeat the process, and the identical effect will be reproduced in an inverse sense. The tracing stylus is replaced at the end of the groove it has already traversed, and the cylinder is again set in motion. When the engraved track passes again under the point, it has a tendency to raise it and to impart to it movements which must necessarily be the repetition of those which first produced the tracing. The vibrating plate is obedient to these movements, and begins to vibrate, thus producing the same sounds, and consequently the same words; yet since there is necessarily a loss of power in this double

transformation of mechanical effects, the speaking tube C is attached to the mouthpiece E in order to intensify the effects. Under these conditions the words reproduced by the instrument may be heard in all parts of a hall, and it is startling to hear this voice--somewhat shrill, it must be admitted--which seems to utter its sentences from beyond the grave. If this invention had taken place in the middle ages, it would certainly have been applied to ghostly apparitions, and it would have been invaluable to miracle-mongers.

[Illustration: FIG. 68.]

As the height of the notes of the musical scale depends on the number of vibrations effected by a vibrating substance in a given time, speaking will be reproduced in a tone of which the pitch will depend on the velocity of rotation given to the cylinder on which the tinfoil is wound. If the velocity is the same as that which was used in registration, the tone of the words reproduced is the same as that in which they were uttered. If the velocity is greater, the tone is higher; if less, the tone is lower; but the accent of the speaker may always be recognised. Owing to this peculiarity the reproduction of songs is nearly always defective in instruments turned by the hand; they sing out of tune. This is not the case when the instrument is moved by a well-regulated system of clockwork, and in this way a satisfactory reproduction of a duet has been obtained.

The words registered on tinfoil can be often reproduced; but the sounds become fainter and more indistinct at each repetition, since the tracings in relief are gradually effaced. The reproduction on copper is more successful, but if intended to be permanent the sheets must be stereotyped, and in this case the instrument must be differently arranged.

An attempt has been made to obtain speech from the phonograph by taking the words registered inversely to their true direction. In this way the sounds obtained were necessarily quite unlike the words uttered; yet Messrs. Fleeming Jenkin and Ewing have observed that not only are the vowels unchanged by this inverse action, but consonants, syllables, and even whole words may be reproduced with the accent they would have if spoken backwards.

The sounds produced by the phonograph, although fainter than those of the voice which produced the registered tracing, are strong enough to react on the ordinary string telephone, and even on a Bell telephone; and as in this case the sounds do not go beyond the instrument, and can only be heard by the person who is using it, it is easy to ascertain that the sound has not been produced by trickery.

Mr. Edison presented his phonograph to the Académie des Sciences through me, March 11, 1878, and when his agent, M. Puskas, caused the wonderful instrument to speak, a murmur of admiration was heard from all parts of the hall--a murmur succeeded by repeated applause. A letter appeared in the newspapers from one of the persons present, in which he said that ‘the learned Academy, generally so cold, had never before abandoned itself to such enthusiasm. Yet some members of a sceptical turn of mind, instead of examining the physical fact, ascribed it to moral causes, and a report soon ran through the room which seemed to accuse the Academy of having been mystified by a clever ventriloquist. Certainly the spirit of ancient Gaul is still to be found among the French, and even in the Academy. One said that the sounds emitted by the instrument were precisely those of a ventriloquist. Another asked if the movements of M. Puskas’ face and lips as he turned the instrument did not resemble the grimaces of a ventriloquist. A third admitted that the phonograph might emit sounds, but believed that it was much helped by the manipulator. Finally, the Academy requested M. du Moncel to try the experiment, and as he was not accustomed to speak into the instrument, it was unsuccessful, to the great joy of the incredulous. Some members of the Academy, however, desiring to ascertain the real nature of the effects, begged M. Puskas to repeat the experiments before them in the secretary’s office under such conditions as they should lay down. M. Puskas complied with this request, and they were absolutely satisfied with the result. Yet others remained incredulous, and it was necessary that they should make the experiment for themselves before they accepted the fact that speech could be reproduced in so simple a way.’

The anecdote I have just related cannot be interpreted to the discredit of the Académie des Sciences, since it is especially bound to preserve the true principles of science intact, and only to accept startling facts after a careful examination. Owing to this attitude, all which emanates from the Academy can be received with complete confidence; and we cannot approve too highly of reserve which does not give way to the first impulse of enthusiasm and admiration.

The failure of my experiment at the Academy was simply due to the fact that I spoke at too great a distance from the vibrating disk, and that my lips did not touch the sides of the mouthpiece. Some days later, at the request of several of my colleagues, I made repeated trials of the instrument, and I soon succeeded in making it speak as well as the supposed ventriloquist; but I learned at the same time that practice is necessary to ensure success. Some words are reproduced more readily than others; those which include

many vowels and many _r_’s come out better than those which abound in consonants, and especially in _s_’s. It is therefore not surprising that, even in the case of an experienced manipulator like Mr. Edison’s agent, some of the sentences uttered by him are more audible than others.

The simultaneous repetition of several sentences in different languages by registering one over the other is one of the most surprising effects of the phonograph. As many as three different sentences have been obtained; but in order to distinguish them through the confused sounds which result from placing one over the other, it is necessary that different persons, giving special attention to a particular sentence, should thus separate them and understand their sense. Vocal airs may, in the same way, be registered over the word tracings, and in this case it is more easy to distinguish them.

There are several models of phonographs. The one represented in fig. 66 has been chiefly used for public experiments, but there is a small model, generally sold to the public, in which the cylinder is much longer, and serves at once for register and fly-wheel. This instrument gives good results, but can only be used for short sentences. In this model, as indeed in the other, the words are more easily registered by fastening a small tube in the form of a prolonged speaking-trumpet to the mouthpiece; the vibrations of the air are thus concentrated on the vibrating disk, and act with greater energy. The tenuity of the vibrating disk adds to the efficiency of the instrument, and the tracing point may be fitted directly to this disk.

[Illustration: FIG. 69.]

I need not describe particularly the phonograph which acts by clockwork. The instrument resembles the one represented fig. 66, except that it is mounted on a rather high table, to give room for the descent of the weight which moves the clockwork; the mechanism is applied directly to the axis of the cylinder, supplying the place of the winch, and is regulated by a small fly-wheel. The wheel used in an English system has been adopted, but we prefer that of M. Villarceau, which has small wings.

Since it is always difficult to fit the tinfoil to the cylinder, Mr. Edison has tried, with good success, to obtain the tracing on a plane surface of tinfoil, by means of the arrangement represented fig. 69. In this new model, the plate on which the tin or copper sheet is to be applied has a spiral grooving, of which one end corresponds to the centre of the plate, and the other to its outer edges. The plate is set in motion by a powerful system of clockwork, of which the velocity is regulated with reference to the length of the turns of the spiral. The vibrating disk is arranged as in the former instrument, and is placed above this plate; the tracing point may, by means of a movement of progression imparted to the system, follow the spiral groove from the centre of the plate to its circumference.

It must not be supposed that all the tinfoil used for phonographic registration is equally good. The foil must be of a definite thickness, and combined with a definite amount of lead. That which is used for wrapping chocolate, and indeed all foil of French manufacture, is too thin and too exclusively made of tin to produce good results, and M. Puskas was obliged to import some from America to continue his experiments. The relative proportion of lead and tin has not yet been defined, and the selection of foil has been made empirically; but as the use of the phonograph becomes more general, this proportion must be ascertained, and it may easily be done by analysing the composition of the foil which gives the best results.

[Illustration: FIG. 70.]

The arrangement of the tracing point is also of much importance for the successful action of the phonograph. It must be very slender and very short (not exceeding a millimètre in length), so as to register distinctly the smallest vibrations of the vibrating disk without deviating from the normal direction of the cylinder, which might be the case, if it were long, on account of the unequal friction exerted on the tinfoil. It must also be made of a metal which has no tendency to tear the metallic sheet. Iron appears to combine most of the conditions demanded.

The phonograph is still in its infancy, and it is probable that it may soon be enabled to register speech without the necessity of speaking into a mouthpiece. According to the newspapers, Mr. Edison has already discovered a way of collecting, without the aid of an acoustic tube, the sounds uttered at a distance of three or four feet from the instrument, and of printing them on a metallic sheet. From this there is only a step to the power of inscribing a speech uttered in a large hall at any distance from the phonograph; and if this step is taken, phonography may be substituted with advantage for shorthand. We add in a note the instructions given by M. Roosevelt to the purchasers of phonographs, so as to enable them to work the instrument.[20]

Considerations on the theory.--Although the explanation we have given will make the effects of the phonograph intelligible, it leads to a curious question which has greatly interested physicists--namely, how it is that the tracing made on so yielding a surface

as tin can, when retraced by the stylus, of which the rigidity is relatively great, produce a vibratory movement without being completely destroyed. To this we reply that the retracing is effected with such extreme rapidity that the effects of active force which are developed only manifest themselves locally, and that under these conditions the mechanical effects exerted are as energetic in soft as in hard substances. The curious experiment, related in so many books on physics, must be remembered, of a plank pierced when a candle serves as the projectile of a gun. The various accidents caused by the discharge of paper waddings must also be remembered. Under such conditions the motion imparted to the molecules which receive the shock has not time to be transmitted to the whole mass of the substance to which they belong, and these molecules are compelled to separate from it, or at any rate to produce, when the substance is capable of vibration, a centre of vibration which diffuses waves throughout its surface, and produces sounds.

Several scientific men, among others Messrs. Preece and Mayer, have carefully studied the form of the tracing left by the voice on the tinfoil of the phonograph, and they observe that it greatly resembles the outline of the singing flames so well shown by Herr Koenig's instruments. Mr. Mayer wrote on this subject in the 'Popular Science Monthly Review' of April 1878.

He said that he had been successful in reproducing a splendid tracing on smoked glass, which gave in profile the outline of the vibrations of sound registered on the tinfoil with their varying curves. For this purpose he fastened to the spring support of the tracing point of the phonograph a slender rod, terminating in a point, which pressed obliquely against the plate of smoked glass, and, since the latter was in a vertical position, a movement imparted to the rod enabled it to produce a sinusoidal tracing. By this arrangement, when the phonograph was at work, two systems of tracings were produced at the same moment, of which one was the profile of the other.

Mr. Mayer had not, at the time he wrote, been long enough in possession of the instrument to make many experiments with it, but from a study of some of its curves it appeared to him that the registered outlines bore a strong resemblance to those of Koenig's singing flames.

[Illustration: FIG. 71.]

Fig. 71 represents the tracing which corresponds to the letter _a_ when pronounced as in _bat_, in the three systems of registration. That corresponding to line A is an enlarged reproduction of the tracing left on the tinfoil; that corresponding to line B represents its profile on the sheet of smoked glass. Finally, line C shows the outline of Koenig's singing flames, when the same sound is produced quite close to the membrane of the register. It must be quite close, since the form of the tracing produced by a pointer attached to a vibrating membrane, when influenced by composite sounds, depends on the distance intervening between the membrane and the source of sound, and an infinite variety in the form of the tracing may be obtained by modifying the distance. In fact, when this distance is increased, the waves of sound which result from composite sounds react on the membrane at different moments of their emission. For example, if the composite sound is formed of six harmonics, the displacement of the source of vibration from the first harmonic by ¼ the length of a wave will respectively remove the second, third, fourth, fifth, and sixth harmonics ½, ¾, 1, 1¼, 1½ the length of a wave, and consequently the outline resulting from the combination of waves will no longer be the same as it was before the displacement of the source of sound, although the perception of the sounds remains the same in both cases. This principle is clearly demonstrated by Koenig's instrument, by lengthening and shortening an extensible tube, inserted between the resonator and the vibrating membrane, which is placed close to the flame; and this explains the disagreement of physicists as to the composition of vocal sounds which they have analysed by means of the singing flames.

Mr. Mayer adds that these facts further show that we cannot hope to read the impressions and tracings of the phonograph, which not only vary with the nature of the voice, but also with the different moments at which the harmonics of the voice are emitted, and with the relative differences in the intensities of these harmonics.

Notwithstanding this assertion, we reproduce (fig. 72) an extremely curious tracing sent to us by Mr. Blake, which represents the vibrations produced by the words 'Brown, University: how do you do?' They were photographed by means of an index fastened to a vibrating disk on which a ray of light was thrown. The word 'how' is particularly remarkable for the combined forms of the inflections of the vibrations.

Recent experiments seem to show that the more the vibrating membrane of the phonograph resembles the human ear in its construction, the better it repeats and registers the sound vibrations: it should be stretched, as far as possible, in the same way as the tympanum is stretched by the hammer of the ear, and moreover it should have the same form, since the vibrations of air are in this case much more effective.

[Illustration: FIG. 72.]

Mr. Edison considers that the size of the opening of the mouthpiece has considerable influence on the distinct articulation of speech. When the sounds are pronounced before the whole surface of the diaphragm, some hissing sounds are lost. They are, on the contrary, intensified when these sounds reach the diaphragm through a narrow orifice with sharp rims. If the opening is toothed on its flattened rims, the hissing consonants are delivered more clearly. Speech is reproduced more perfectly when the mouthpiece has a covering of some thickness, so arranged as to deaden the sounds arising from the friction of the tracing point on the tin.

Mr. Hardy has rendered the registration of phonographic tracings more easy by adding a small ebonite tube, resembling the mouthpiece of a wind instrument, to the mouthpiece of the phonograph.

USES OF THE PHONOGRAPH AND ITS FUTURE.

Mr. Edison has lately published in the 'North American Review' of May-June 1878 an article on the future of the phonograph, in which he himself discusses the different applications which may be made of this instrument. Without sharing all his anticipations, which appear to us to be very premature, we think that some extracts from his paper may be interesting.

'In order to furnish a basis on which the reader may take his stand ... a few categorical questions and answers are given upon the essential features of the principle involved.

'1. Is a vibrating plate or disk capable of receiving a complex motion which shall correctly represent the peculiar property of each and all the multifarious vocal and other sound waves?

'The telephone answers affirmatively.

'2. Can such complex movement be transmitted from such plate by means of a single embossing point attached thereto, to effect a record upon a plastic material, by indentation, with such fidelity as to give to such indentations the same varied and complex form? And if so, will this embossing point, upon being passed over the record thus made, follow it with such fidelity as to transmit to the disk the same variety of movement, and thus effect a restoration or reproduction of the vocal or other sound waves, without loss of any property essential to producing on the ear the same sensation as if coming direct from the original source?

'The answer to this may be summed up in a statement of the fact that ... the writer has at various times during the past weeks reproduced these waves with such degree of accuracy in each and every detail as to enable his assistants to read, without the loss of a word, one or more columns of a newspaper article unfamiliar to them, and which were spoken into the apparatus when they were not present. The only perceptible loss was found to be in the quality of the utterance, a non-essential in the practical application of the instrument. Indeed, the articulation of some individuals has been perceptibly improved by passage through the phonograph, the original utterance being mutilated by some imperfection of lip and mouth formation, and these mutilations corrected or eliminated by the mechanism of the phonograph.[21]

'3. Can a record be removed from the apparatus on which it was made, and replaced upon a second without mutilation or loss of effective power to vibrate the second plate?

'This is a mere mechanical detail, presenting no greater obstacle than having proper regard for the perfect interchangeableness of the various working parts of the apparatus--not so nice a problem as the manufacture of the American watch.

'4. What as to the facility of placing and removing the second sheet, and as to its transportation by mail?

'But ten or fifteen seconds suffice for such placing or removing. A special envelope will probably be required, the weight and form of which, however, will but slightly increase the cost of postage.

'5. What as to durability?

'Repeated experiments have proved that the indentations possess wonderful enduring power, even when the reproduction has been effected by the comparatively rigid plate used for their production. It is proposed, however, to use a more flexible plate for reproducing, which, with a perfectly smooth stone point--diamond or sapphire--will render the record capable of from fifty to one hundred repetitions, enough for all practical purposes.

'6. What as to duplication of a record and its permanence?

‘Many experiments have been made, with more or less success, in the effort to obtain electrotypes of a record, and the writer is informed that it has very recently been successfully accomplished. He can certainly see no great practical obstacle in the way. This, of course, permits of an indefinite multiplication of a record, and its preservation for all time.

‘7. What is the requisite force of wave impinging upon the diaphragm, and the proximity of the mouth to the diaphragm, to effect a record?

‘These depend in great measure upon the volume of sound desired in the reproduction. If the reproduction is to be made audible to an assembly, considerable force is requisite in the original utterance; if for the individual ear, only the ordinary conversational tone (even a whisper has been reproduced). In both cases the original utterances are delivered directly in the mouthpiece of the instrument. An audible reproduction may, however, be had by speaking at the instrument from a distance of from two to three feet in loud tone. The application of a flaring tube or funnel to collect the sound waves, and the construction of an especially delicate diaphragm and embossing point, &c., are the simple means which suggest themselves to effect this....

‘The foregoing presentment of the stage of development reached by the several essential features of the phonograph demonstrates the following _faits accomplis_:

‘1. The captivity of all manner of sound waves, hitherto designated as “fugitive,” and their retention.

‘2. Their reproduction with all their original characteristics, without the presence or consent of the original source, and after the lapse of any period of time.

‘3. The transmission of such captive sounds through the ordinary channels of commercial intercourse and trade in a material form, for purposes of communication.

‘4. Indefinite multiplication and preservation of such sounds, without regard to the existence or non-existence of the original source.

‘5. The captivation of sounds, with or without the knowledge or consent of the source of their origin...

‘The apparatus now being perfected in mechanical details will be the standard phonograph, and may be used for all purposes, except such as require special form of matrix, such as toys, clocks, &c., for an indefinite repetition of the same thing. The main utility of the phonograph being, however, for the purposes of letter-writing and other forms of dictation, the design is made with a view to its utility for that purpose.

‘The general principles of construction are, a flat plate or disk, with spiral groove on the face, worked by clockwork underneath the plate; the grooves are cut very closely together, so as to give a great total length to each length of surface--a close calculation gives as the capacity of each sheet of foil nearly 40,000 words. The sheets being but ten inches square, the cost is so trifling that but a hundred words might be put on a single sheet economically....

‘The practical application of this form of phonograph is very simple. A sheet of foil is placed in the phonograph, the clockwork set in motion, and the matter dictated into the mouthpiece without other effort than when dictating to a stenographer. It is then removed, placed in suitable form of envelope, and sent through the ordinary channels to the correspondent for whom it is designed. He, placing it upon his phonograph, starts his clockwork, and _listens_ to what his correspondent has to say.’

Since this paper by Mr. Edison appeared in June 1878, he has applied the phonograph to several other purposes, among which we may mention that of registering the force of sounds on railways, and especially on the metropolitan atmospheric railway in New York. The instrument which he has made for this purpose resembles that by Mr. Leo Scott, and bears the same name. It is described and represented in the ‘Daily Graphic’ of July 19, 1878, as well as the aerophone, the megaphone, and the microtasimeter, which is adapted for astronomical observations. We should exceed the limits laid down for this volume, if we were to give a more detailed account of these inventions.

M. Lambrigot, one of the officials on the telegraphic lines in France, and the author of various improvements in the Caselli telegraph, has shown me a phonographic system of his own invention in which it is reduced to its simplest form. He sent me the following description of his system.

‘The instrument consists of a wooden slab placed vertically on a stand and firmly fixed upon it. There is a round opening in the middle of the slab, covered by a tightly stretched sheet of parchment bearing a steel knife, which, like the tracing point of the

phonograph, is intended to trace the vibrations. A solid block rises from the stand to the middle of the slab, and supports a slide on which a runner can move in front of the slab. There is a strip of glass on this runner, of which one side is covered with stearine. When the runner is moved to and fro, the stearine comes in contact with the knife and takes the mould of its form, which is curved throughout.

‘A sound places the sheet of parchment in vibration, and imparts its movement to the knife, which traces various lines on the surface of the stearine.

‘The reproduction thus obtained on the strip of glass is subjected to the ordinary processes of metallisation. By galvanism a deposit of copper is obtained which reproduces the lines in an inverse way. In order to make the metallic plate speak, it is necessary to pass a point of ivory, wood, or horn lightly over the signs, and, by moving it more or less quickly, the different tones can be heard, just as they were spoken.

‘Since copper is relatively harder than lead, the copper plate on which the vibrations are traced will afford an unlimited number of reproductions. To obtain this result, a lead wire must be applied to the plate, and due pressure must be exerted on it. The wire is flattened and takes the impression of all the traces which then appear in relief. If the edge of a card is passed through this impressed tracing, the same sounds are produced as those which are obtained from the copper plate.’

M. Lambrigot suggests that the speaking plates might be useful in many ways: for example, they might make it easy to learn the correct pronunciation of foreign languages, since a sufficient number might be collected to make a sort of vocabulary which would give the accent of the words most in use in a given language.

By this simple process M. Lambrigot has been able to obtain a strong impression, within a copper groove, of the vibrations caused by the voice, and they are so distinctly engraved that whole sentences may be heard, if they are retraced by the sharpened point of a match. It is true that the reproduction is imperfect, and that those words are only to be distinguished which were previously known; but it is possible that better results will be obtained from improvements in the system, and at any rate the distinct impression of the vibrations of the voice on a hard metal is a really interesting discovery.

I have made one somewhat important observation in the working of the phonograph--namely, that if speech is registered on the instrument in a very hot room, and it is then carried to a colder room, the reproduction of speech is imperfect in proportion to the difference of temperature. This is probably owing to considerable modifications in the elasticity of the caoutchouc pad which is inserted between the tracing point and the vibrating disk: perhaps differences of expansion in the tinfoil have also some effect.

FABER’S AMERICAN SPEAKING MACHINE.

About two years ago the newspapers announced with some pomp that a speaking machine had reached Paris, which far surpassed Vaucanson’s duck, and which would attract general attention. Unfortunately the invention was not in the first instance brought forward with any scientific authority, and was soon relegated to take a place among the curiosities exhibited by conjurors. In a country so essentially critical and sceptical as France, there are always those who profess incredulity, and who will even resist evidence, and it was asserted that the machine only spoke because its exhibitor was an able ventriloquist. This is an old assertion which has lately been made with reference to the phonograph. Some scientific papers echoed the absurdity, and the speaking machine was so discredited that it is now unnoticed, although it is a most ingenious and interesting conception. When will our country be cured of the error of denying everything without due examination?

Since we ourselves only judge of things after having seriously considered them, we think it just to vindicate the truth as to Mr. Faber’s machine, and this can only be done by an exact description of it.

As I said in the last chapter, there is a great difference between the production and the reproduction of a sound, and a machine like the phonograph, adapted for the reproduction of sound, may differ essentially from a machine which really speaks. In fact, the reproduction even of articulate sounds may be very simple, as soon as we possess the means of stereotyping the vibrations of air necessary to transmit these sounds; but in order to produce them, and especially to emit the complex vibrations which constitute speech, it is necessary to set in motion a number of special organs, fulfilling more or less exactly the functions of the larynx, the mouth, the tongue, the lips, and even the nose. For this reason, a speaking machine is necessarily very complicated, and this is precisely the case with the machine we are now considering. Such a machine is not now made for the first time, and the Academy has lately been reminded of a speaking head which was in the possession of the philosopher Albertus Magnus in the thirteenth century, and which was destroyed by St. Thomas Aquinas as a diabolical invention.

Mr. Faber's speaking machine was exhibited two years ago at the Grand Hôtel, and may now be seen in the room adjoining M. Robert Houdin's theatre, the same room in which Mr. Giffard exhibited the telephone. It consists of three distinct parts: 1st, of a large bellows worked by a pedal, which produces the currents of air necessary for the production of sounds, and to some extent acts as the lungs; 2nd, a vocal instrument, consisting of a larynx accompanied by diaphragms of various forms to modify the sounds, of a mouth with caoutchouc lips and tongue, and of a tube with an outlet somewhat resembling the nasal cavities; 3rd, of a system of jointed levers and of pedals, terminating in keys like those of a piano.

The most interesting part of the machinery, of which we represent the principle fig. 73, is the vocal apparatus, which involved the severest study of physics in order to succeed in the production of articulate sounds. It consists, first, of a rather thick caoutchouc tube, within which there is a kind of whistle L, as in a clarionet. The whistle consists of a small caoutchouc cylinder with a longitudinal slit, and before this is placed a very thin ivory plate lined with caoutchouc. This plate is fixed at one end to the cylinder, and deviates slightly from it at its free end, so as to permit the current of air projected from the bellows S to penetrate between the two parts, and to cause the vibrations in the ivory plate necessary for the production of a sound. The extremity of the caoutchouc cylinder is closed on this side, and is fitted to an iron rod _t_ which comes out of the pipe, and is connected with a system of bars, corresponding to the keyboard of a piano, by which the force of sounds can be regulated. This force depends on the width of the opening between the tongue and the cylinder.

[Illustration: FIG. 73.]

The whistle, which plays the part of the larynx, is necessarily placed opposite the opening of the bellows, and a sort of tourniquet M is fastened to the opening itself, which is able to move on certain conditions, so that it may produce the rolling sound of _r_. This is done by fastening before the opening a diaphragm in which there is a somewhat wide and long slit, and this slit can be almost closed by a little bar of the same size M, revolving on a transverse axis which supports it by its centre. In its normal condition, this little bar is kept in a slanting position by cords attached to the keyboard, and the air ejected by the bellows readily traverses the slit in order to reach the larynx; but two dampers are fastened to the rods which transmit movement, with which the cords just mentioned are also connected. On lowering the notes of the key-board, the passage of air is contracted, and the little plate begins to oscillate and to press against a band of leather, producing by its vibration an action similar to that produced by the cricket. This little tourniquet only begins to act when the dampers are lowered by a pedal worked by the hand; and this is also the case with the iron rod _t_, which modifies the acuteness of the sounds passing through the larynx.[22]

Below the larynx tube, which is only five centimètres in length, there is another pipe G, also of caoutchouc, which terminates in a spherical cavity connected with the outer air by a caoutchouc tube I, slightly raised, and closed by a valve, of which the movements are regulated by a pedal worked by the keyboard. When the valve is open, the sounds emitted through the larynx are somewhat nasal.[23] The larynx communicates with the mouth through a square funnel-shaped pipe, to which six metallic diaphragms D are fastened; the diaphragms are placed in a vertical position behind each other, and have indentations on their lower end, which are intended to diminish more or less the orifice for the current of air, and to impede its passage with greater or less force. The diaphragms, which we represent separately fig. 74, are connected with the keyboard by jointed iron rods _t_, and, for the emission of most articulate sounds, several of the diaphragms are moved at the same moment and at different heights. We shall return to this subject.

[Illustration: FIG. 74.]

The mouth consists of a caoutchouc cavity O, somewhat resembling the human mouth, and forming a continuation to the channel we have just described. The tongue C, likewise modelled on the human tongue, is placed within the mouth, and connected with two jointed rods _t_, _t_, fastened to its two opposite ends, so as to enable the tongue to raise its tip, or touch the palate, in obedience to the notes of the keyboard. The lower caoutchouc lip A can also be more or less closed, according to the action of the keyboard on its special rod. Finally, a circular metallic piece E, following the shape of the mouth, is placed above the upper lip, with a small opening in it to admit of the pronunciation of the letter _f_.

The keyboard has fourteen notes, of different lengths, producing the following letters when lowered, _a_, _o_, _u_, _i_, _e_, _l_, _r_, _v_, _f_, _s_, _ch_, _b_, _d_, _g_. The longest corresponds to _g_, and the shortest to _a_. There are two pedals below the _g_ note and those of _b_ and _d_, corresponding with the opening of the tube which produces nasal sounds, and to the rod which regulates the opening of the larynx, and this makes it possible to obtain _p_, _t_, and _k_ from the notes _b_, _d_, _g_. The mechanical effects produced by lowering the different notes in succession are as follows:--

1. The _a_ note moves the first five diaphragms.

2. _o_ also moves these five diaphragms, but varies the pitch, and closes the mouth a little.

3. _u_ does the same, only further closing the mouth.

4. _t_ moves a single diaphragm, raises the tip of the tongue, and opens the mouth more widely.

5. _e_ moves six diaphragms, throws the tongue further back, and opens the mouth still more.

6. _l_ moves five diaphragms, sends the tongue against the palate, and further opens the mouth.

7. _r_ moves six diaphragms and the tourniquet, lowers the tongue, and somewhat closes the mouth.

8. _v_ moves five diaphragms, almost closes the mouth, and keeps the tongue down.

9. _f_ lowers the circular appendix of the upper lip, and almost entirely closes the mouth.

10. _s_ moves three diaphragms, half closes the mouth, and half raises the tongue.

11. _ch_ moves three diaphragms, keeps the mouth half closed, and further lowers the tongue.

12. _b_ moves five diaphragms, closes the mouth, and keeps the tongue completely down.

13. _d_ moves six diaphragms, keeps the mouth three parts closed, and raises the tongue a little.

14. _g_ moves five diaphragms, keeps the mouth three parts closed, and the tongue completely down.

_m_ is produced by lowering note _b_ and opening the valve of the pipe which gives nasal sounds.

_n_ is obtained by lowering note _d_ and opening the same valve.

_h_ is obtained from note _s_ by lowering the pedal which acts upon the larynx, and half closing it.

Since the other letters of the alphabet are compound sounds, they can be produced by combinations of the preceding letters.

Although the words pronounced by this machine are distinct, they are spoken in a uniform, drawling tone, which might, I should have thought, have excluded the idea of imposition. Some of them are indeed far from distinct, yet the results are not less remarkable; and when we consider the amount of study and experience which must have been applied to the combination of all these arrangements, it seems surprising that physicists have not given more attention to such an interesting machine.

As for the mechanical execution, it is impossible to admire too highly the simple and ingenious manner in which all the complicated movements of the different vocal organs have been connected with the keyboard, of which the mechanism has been so calculated as only to produce the precise action of the organ which is required for any given effect. For this purpose, the notes of the keyboard regularly increase in length, so as to produce at a single touch different mechanical effects on the rods which act upon the mechanism; and since most of the notes are required to react simultaneously on the whole mechanism, the rods which transmit the movement are fastened to a series of jointed levers which cross the notes of the keyboard at right angles. Pegs of different length are fastened to the notes at this junction, so as to produce the simultaneous action of the different organs of the machine.

The public will believe that the assertions of ventriloquism are unfounded when I add that I myself have made the machine speak.

APPENDIX.

The Perrodon System of Telephonic Alarum.--Captain Perrodon, of the French Artillery, has lately improved the system invented by MM. Dutertre and Gouault, by a self-acting call. For this purpose he has fastened a spring contact before the diaphragm, combined with the diaphragm and the electro-magnetic system so as to form a vibrator. The vibrations thus produced are strong enough to resound in an ordinary telephone, so as to make the call audible in spite of external noises.

The system has been arranged in different ways. In one arrangement, a small plate of tinfoil is glued to the outer surface of the diaphragm, and the end of the telephone coil wire is connected, below the inner surface of the mouthpiece, with a silver wire soldered to a spring plate, which constitutes the contact of the vibrator. This spring plate, slightly curved, is fixed below one of the

binding-screws of the telephone, and terminates at its free end in a regulating screw by which the interval between the contacts can be regulated, and the instrument can be arranged as a telephonic organ. To do this, the screw can be withdrawn, and inserted in a nut which establishes direct connection between the line and the telephone coil. It is easy to adapt an ordinary telephone to this system.

In another arrangement M. Courtot's mirror telephone has been employed, and a sort of spring pedal is inserted in the wood of the mouthpiece, which terminates in a bent silver wire, supporting an index adapted to make a contact with a square plate soldered to the diaphragm. The battery is placed in connection with the spring of the pedal, and one end of the telephone coil-wire communicates as before with the diaphragm. When a call is to be made, the pedal must be pressed, and the battery immediately communicates with the silver wire which, with the diaphragm, constitutes the vibrator, and an electric vibration is sent through the circuit, and produces the call. For receiving, the pedal is allowed to revert to its normal position, and the index of the pedal, touching the contact in connection with the diaphragm, establishes direct communication between the two telephones, while breaking the contact of the silver wire with the diaphragm, so that the battery cannot act.

It appears that experiments made at the musketry school at Orleans for a distance of 370 miles have been very successful.

M. Varey's Microphone Speaker.--M. Varey has recently arranged a successful microphonic speaker, in which the principle of the microphone represented in fig. 39 is maintained. The system of three vertical carbons is arranged inside a sort of snuff-box, of which the lid is made of a thin plate of mica, horn, or ebonite. The snuff-box is provided with two hinged arms, so that it may be placed in the most convenient position for speaking, and at the same time the sensitiveness of the instrument can be regulated. A small battery, consisting of two Gaiffe cells of chloride of silver, is placed in the pedestal on which the instrument stands, and sets the microphone at work without further trouble. In this way the speaker can be used like an ordinary telephone, and is not affected by vibrations of air. Only vibrations of sound react upon it.

Microphonic Speaker by Fitch.--Mr. Pope states that this speaker has produced excellent results in America. It is merely Edison's carbon telephone reduced to its simplest form. It consists of a small cylindrical box, which has a mouthpiece like the one represented fig. 28. The box contains two carbon disks of the same diameter as itself, and is lined with a kind of felt. Metal wires, inlaid in a groove scooped on the circumference of the carbons, place them in communication with the circuit and battery, and transmission takes place by means of the vibrations of the upper carbon, which is directly influenced by the voice without the intervention of any diaphragm. These vibrations, which can be freely developed in consequence of the elasticity of the felt pad which supports the lower carbon, produce on the surface of contact of the two carbons the modifications of intensity of current necessary for the reproduction of speech, in the same way as other microphones.

An induction coil is necessarily employed for a long circuit, and the effects of induction in the adjacent wires are modified by two rheostats introduced into the circuit at its two extremities.

Further remarks on the theory of the Telephone.--Following the example of a certain sceptic in the Académie des Sciences, Colonel Navez continues to maintain the theory first formed as to the mode in which the telephone acts, in spite of the clearest proofs of its insufficiency; but most scientific men who consider the question have come round to our opinion, and admit the concurrence of several causes in the reproduction of speech by this remarkable instrument. Mr. Fleeming Jenkin writes to this effect in the new edition of a treatise on Electricity and Magnetism.

He observes that a singular fact has been discovered by several persons, who have ascertained that not merely non-magnetic and non-conducting bodies can be substituted for the diaphragms of receiving telephones, but that they will act without a diaphragm at all. In this case it is evident that we have to do with the sounds discovered by Page, and that they are produced by the magnet itself, in which each molecular movement constitutes the source of the sound produced. This sound becomes articulate as soon as its increase and decrease can follow the increasing or decreasing action of the voice which produces it at the sending station. It is certain that when the transmitted currents are due to the action of the Bell diaphragm, the sounds due to the Page effects ought to correspond with those which would be given by iron diaphragms adapted to the receiving instruments; so that, when a telephone has an iron diaphragm, there are in fact two voices, that of the diaphragm, which is strong, and that of the magnet, which is weak. When a disk of wood is substituted for one of iron, it acts as a sounding board for the Page effect, and when the disk is of metal, induction is developed by the magnetic modifications, and tends to produce vibration, thus developing a third source of sound, which may be called the Ampère effect. Finally, a fourth source of sound may result from the induced effects produced in the wire itself in consequence of changes in the intensity of current. These sounds, first observed by M. de la Rive, have since been studied

by Mr. Fergusson of Edinburgh (vide ‘Telegraphic Journal’ of November 1, 1878).

Mr. Fleeming Jenkin’s opinion only differs from mine in his ascribing the energy of sound acquired by a telephone with an iron diaphragm to the preponderance of sounds in the latter, whereas I consider it to be chiefly due to the increase of energy in the whole magnetic system produced by the reaction of the two magnetic parts on each other. If the two effects could be taken singly, it is probable that the sounds produced by each of them separately would be similar, since in magnetic effects the reaction and action are equal. But as they are combined, it becomes difficult to assign to each the share which belongs to it in the general effect observed. Besides, it is quite possible that the sounds of the diaphragm may appear to be stronger and more distinct because it is nearer to the ear than the magnet, and because the effects of magnetisation and demagnetisation are then more easily produced in consequence of the mass of the magnetic body being smaller.

Mr. Fleeming Jenkin goes on to say that the question of the displacement of surface in the diaphragm and magnet is very complex, but that he thinks it impossible to deny the existence of such displacement, since the air which acts as the vehicle of sound between the ear and the source of sound is placed in vibration; yet this displacement maybe effected quite otherwise than by flexion. Suppose that the magnetic molecules of these bodies are drawn together by magnetisation, which tends to diminish the intermolecular space which separates them, the points of surface of the substance corresponding to these intervals will be elevated in a manner equivalent to a displacement of surface, and the effect of this will be the same as a flexion movement. At the moment of demagnetisation a depression instead of an elevation will take place, and the vibratory movements will thus be produced without any electro-magnetic attraction, and it is precisely these vibrations which Mr. Fleeming Jenkin terms molecular vibrations. He evidently does not mean that such attractions cannot take place: they may react, together with the molecular vibrations, when the electric force is capable of producing them. He adds that the reproduction of sounds by a condenser, by simple coils, and by a carbon microphone, has convinced him that the action just analysed requires generalisation.

We have recently seen an article by Mr. Hughes in the ‘Telegraphic Journal,’ Nov. 15, 1878, in which, to our surprise, he not only opposes all the theories he has hitherto held, but cites experiments which are quite inconclusive, since they were performed under conditions in which electro-magnetic effects must necessarily be displayed. He made use of voltaic currents produced by a battery of three Daniell cells. In order to estimate the transverse effects resulting in such a case from attraction, the experiments he mentions are wholly unnecessary: they may be felt with the hand. On the other hand, he has evidently forgotten that the currents employed in a Bell telephone have no influence on a very sensitive galvanometer.

M. Pollard’s Microphone.--This microphone, which has been arranged in several ways, essentially consists of a carbon rod kept in a horizontal position by a wire, and resting on two other vertical carbons. The upright of the arm which holds the wire can revolve together with this arm, and is thus able to regulate the pressure of the horizontal carbon on the two vertical carbons. It appears that this instrument is extremely sensitive, and that the regulation effected on the two contacts is better than when it is effected on one only. It is fair to add that M. Voisin previously sent me the sketch of a somewhat similar arrangement.

M. Dutertre has also made use of such an arrangement in what he calls the Dolmen microphone. Three pieces of coke in the form of a dolmen, that is, two uprights, supporting a third and horizontal carbon, are placed in circuit. M. Gouault has informed me that speech was well transmitted by this instrument, and it is, like that of Mr. Blyth, which succeeded it, of wonderful simplicity.

This microphone, as well as one composed of two pieces of lead-pencil placed in a watch-case, and connected by a piece of money, were exhibited to the Industrial Society at Rouen, February 1, 1878, of which an account was published in the Bulletin of that society.

M. Ader’s Electrophone.--M. Ader has recently constructed a remarkable telephonic instrument, which reproduces speech and song in a quite exceptional and simple way. It consists of a drum 15 centimètres in diameter, covered with parchment at one end only. Six small tin armatures, one centimètre in length and two millimètres in width, are fixed in the centre of the parchment in a circle six centimètres in diameter. Six microscopic electro-magnets, whose distance from the armatures can be regulated by a screw, are placed opposite the armatures within a wooden circle. The magnets are horseshoe, with branches 12 millimètres long and 4 millimètres in diameter, including the coils, and the magnetic core is 1½ millimètre thick. They are all in connection, and act simultaneously under the sole influence of the battery current. The sender is the same as that of M. Ader described before. With this instrument speech may be heard at a distance of six or seven yards, and songs are much more distinctly heard than in the singing condenser. Owing to the simplicity of the arrangement, the instrument is not costly.

The extraordinary effects of this telephone are due to the small size of the electro-magnets, which, as we believe, produce much more rapid magnetic effects than those of larger size. M. Ader has also made a small ordinary telephone based on this principle, of which the sounds are much stronger than in others.

Modification of Bell Telephone.--Mr. Gower has recently made a new system of telephone without a battery, which not only reproduces speech loudly enough to be heard at the distance of eight or nine yards from the instrument, but will also transmit it when the speaker is at a moderate distance from the sending instrument. In this latter case, indeed, the receiving telephone must be brought close to the ear. Although this double problem had already been solved by the use of telephones with microphonic senders, the results furnished by the instruments in question are still more curious, since they are obtained without batteries, and are even more distinct.

In this new system, which is only an improvement on Bell's square model, the horseshoe magnet is of a peculiar form, which renders it more powerful. It is formed of a kind of half-circle of magnetised steel, with its two ends turned back, so as to form a diameter of the circle, only this diameter is divided in the centre: so that the two poles of the magnet are placed one before the other, as in Faraday's electro-magnet. The poles are tipped with iron, terminating in front in two thin iron plates, on which are placed the electro-magnetic coils, which are oblong, and constitute the magnetic core. The diaphragm, thicker than the ordinary diaphragms, is of tin, and is fixed firmly to the edges of the circular box which encloses the whole, and which forms a kind of sounding-box. The box is made of copper, and the diaphragm is so firmly fastened to it as to become homogeneous with it, and to give out a sound when the box is touched, which is not the case in ordinary telephones. This is one of the conditions which make the instrument a better conductor of sound. The magnet is also much more powerful. It is magnetised by a current from a powerful Gramme machine, which acts upon it for almost twenty minutes. The instrument has, strictly speaking, no mouthpiece: the lid of the box which supports the diaphragm, and is separated from it by a space of two millimètres, has merely a hole bored in it above the centre of the diaphragm, and into this hole either a tin trumpet, 50 centimètres in length, is screwed, when the instrument is required to reproduce or transmit speech to a distance, or an acoustic tube when it is to be used like an ordinary telephone. The remarkable part of the system is that the instrument can itself give a very loud call by only breathing into it instead of speaking.

For this purpose a small oblong opening is made in the diaphragm at a half diameter from its centre, and behind this the reed of an harmonium is applied to a square copper plate fixed on the diaphragm itself. On using the bellows the expelled air passes through this little hole, and, on reaching the reed, sets it in vibration, and produces a sound of which the acuteness depends on the conditions of the vibrating plate. This addition to the diaphragm in no way alters its properties in the reproduction of speech, so that, after using the bellows, conversation may begin, and the receiving telephone repeats what is said after emitting a sound somewhat resembling the note of a bugle. The instrument is then provided with the speaking tube of which we have spoken.

Nothing can be more remarkable than this power of listening to conversation while seated in an armchair six or seven yards from the instrument, nor is it necessary to move in order to reply. The correspondent, indeed, must be close to the acoustic tube in order to speak and listen, and he must speak rather loud in order to be heard at any distance from the other station. But the listener receives the sounds so amplified that it might be supposed that a giant was speaking, and conversation held in a low tone may even be distinguished. These results are really extraordinary, and even to those familiar with such effects this incessant progress is surprising.

These results may be ascribed to the following causes:--

1. First, that the conditions of the magnet are better than those of ordinary instruments.

2. That the diaphragm is also thicker, larger, and better stretched.

3. That the box is of metal, and calculated to act as a sounding-box.

4. The speaking trumpet magnifies the sounds.

5. The acoustic tubes concentrate the sound waves on the centre of the diaphragm.

Note on some fresh Experiments with Telephones without any Diaphragm.

In a paper published March 4, 1878, I made some suggestions on the theory of the sounds produced in the telephone, and on the contradictory assertions of physicists as to the transmission of speech by ordinary telephones when devoid of diaphragm. These remarks induced M. Ader to undertake some experiments which not only demonstrate the truth of my opinion, but bring to light

some fresh facts which may be of great importance to acoustic science.

M. Ader has in fact not only succeeded in making a telephone without a diaphragm speak, but he has made it speak more loudly and with less alteration of the voice than we find to be the case with a small model of the ordinary telephone. No one, therefore, can now maintain that the sounds produced by the magnetic cores are so faint that they cannot be taken into account among the effects produced, and that it is at any rate impossible for them to reproduce articulate sounds.

To obtain this result, M. Ader reduced the size of the magnetic core to that of a simple iron wire, one millimètre in diameter, and he fastened it by one of its ends to a small wooden board. Under these conditions, it was enough to fasten a small helix of fine wire on this iron wire, and to apply the board to the ear in order to hear speech distinctly, with the aid of a microphonic speaker actuated by a voltaic current. But the range of sound was considerably increased if a mass of metal was applied to the free end of the iron wire: in this case it was possible to hear when the wooden board was removed to a distance of ten or fifteen centimètres from the ear.

If the wire is in contact with masses of metal at each end, the effect is further increased; but the two masses must not be in metallic communication with each other, and must be to some extent insulated by a more or less elastic medium. If the metallic masses are soldered to the wire, the effects are still greater.

M. Ader was also able to reproduce speech by using a simple coil without a magnetic core, but in this case the spirals must be open, and not pressed together. If they are steeped in gum, no sound is heard, but speech will become instantly audible if a wire or a magnetised needle is inserted in the coil, or even if a second metallic helix is placed in the circuit: always provided that one of the ends of these magnetic organs rests upon, or is fastened to, the board on which the coil is fixed.

M. Ader has likewise obtained a very distinct reproduction of speech at a distance of two or three yards from the instrument by inserting between the two stretched membranes of two tambourines a bent wire which acts as a spring and passes through an electro-magnetic coil. Under these conditions, magnetisation of the wire in a greater or less degree affects its elasticity and causes vibrations which are magnified by the membranes, and transmitted sounds are reproduced with intensity. Unfortunately articulate speech is less distinct with this system than with the one I described before.

M. Ader has often had occasion to make one curious remark, namely, that the _timbre_ of the voice and its high or low key varies with the degree of tension given to the wire; but if the fundamental note of the wire is deadened by pressing it between the fingers, the sounds reproduced then become dull and monotonous. They are also somewhat fainter.

Signor Carlo Resio has also observed that in a telephone sender the variations of intensity in the current correspond with the vibrations caused by speech, and these are reproduced by corresponding variations in a liquid column, which may thus act as a telephone receiver, and consequently may reproduce speech without any electro-magnetic organ, as in a microphone speaker. Under these conditions, however, a layer of water is inserted between the platinum electrodes and the surrounding air, and consequently this liquid layer must be put in vibration under the influence of varying intensities of current.

Mr. Edison has also now made a practical application of the chemical telephone we have mentioned before. The trials made with it have been very satisfactory, showing that sounds transmitted in this way can be heard in a large room.

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FOOTNOTES

[1] Mr. Gray, in an article inserted in the _Telegrapher_ of October 7, 1876, enters into full details of this mode of transmitting sounds by the tissues of the human body, and he gives the following as the conditions in which it must be placed to obtain a favourable result: 1. The electricity must be of a high tension, in order to have an effect perceptible to the ear.

2. The substance employed to touch the metallic plate must be soft, flexible, and a good conductor, up to the point of contact: it must then interpose a slight resistance, neither too great nor too small.

3. The disk and the hand, or any other tissue, must not only be in contact, but the contact must result from rubbing or gliding over the surface.

4. The parts in contact must be dry, so as to maintain the required degree of resistance.

[2] He cites the following names in his account of electric telephony:--Page, Marrian, Beatson, Gassiot, De la Rive, Matteucci, Guillemin, Wertheim, Wartmann, Janniar, Joule, Laborde, Legat, Reiss, Poggendorf, Du Moncel, Delezenne, Gore, &c. Vide Mr. Bell's paper, in the _Journal of the Society of Telegraphic Engineers_ in London, vol. vi. pp. 390, 391.

[3] This statement is disputed by Mr. Elisha Gray, owing, as we shall see, to a misunderstanding as to the word _undulatory_ current.

[4] _Elisha Gray._ Eng. Pat. Spec. No. 2646, Aug. 1874.

[5] This property has long been known, but not applied. In 1856, in the second edition of my _Exposé des applications d'Electricité_, I pointed them out in speaking of the contact-breakers. I also spoke of them in a paper on electro-magnets (published in the _Annales télégraphiques_, 1865), and in several articles laid before the _Académie des Sciences_ in 1872 and 1875 on the conductivity of filings and conducting powders. M. Clérac, in 1865, also used them to obtain variable resistances.

[6] In 1865 I was able to verify this observation when tightening the spirals of an electro-magnet on a naked wire. The greater the number of spirals under pressure, the more definite were the differences of resistance in the magnetising helix.

[7] M. Hellesen communicated the plan of his instrument to me on May 3, 1878, and his experiments were made in Copenhagen three weeks earlier.

[8] M. M. J. Page had already noticed that if a telephone is placed in the circuit of the primary helix of an induction coil, while the secondary helix of this instrument is placed in the circuit of one of M. Lippmann's capillary electrometers, a movement of the mercurial column of the electrometer takes place at each word, and this movement is effected towards the capillary end of the tube, in whatever direction the current is sent by the telephone. This is because the mercury always tends to move more rapidly at its capillary end than at the other extremity.

[9] Mr. Edison, in a letter written November 25, 1877, writes that he has made two telephones which act with copper diaphragms, based on Arago's effects of magnetism by rotation. He ascertained that a copper diaphragm might replace the iron plate, if its thickness did not exceed 1/32 of an inch. The effect produced is slight when the copper diaphragm is placed between two corresponding instruments; but when the sender only is furnished with the copper diaphragm, and the receiver is arranged as usual, communication becomes easy.

Mr. Preece repeated these experiments, but he only obtained very slight and indistinct effects: he consequently believes that they are of no practical use, although very interesting in theory.

[10] Mr. Bell had previously made a like experiment, which suggested to him that molecular vibrations had as much to do with the action of the telephone as mechanical vibrations.

[11] M. Bosscha, who has published in the _Archives néerlandaises_ an interesting paper on the intensity of electric currents in the telephone, says that the minimum intensity of currents necessary to produce a sound in a telephone by the vibration of its diaphragm may be less than 100/1000 of a Daniell element, and the displacement of the centre of the diaphragm would then be invisible. He was unable to measure exactly the range of movements produced in the diaphragm by the influence of the voice, but he believes it to be less than the thousandth part of a millimètre; and from this it follows that, for a sound of 880 vibrations, the intensity of the induced currents developed would be 0·0000792 of the unit of electro-magnetic intensity.

[12] Mr. Warwick describes his experiments as follows: 'The magnets employed were nearly of the usual size, 1½ inch in diameter, and nearly eight times as long. At first I employed iron disks, but I found them to be unnecessary. When I had discarded them, I tried several substances: first a thin disk of iron, which answered perfectly both for sender and receiver. A disk of sheet iron, about ■ of an inch in thickness, did not act so well, but all that was said was quite understood. In making experiments with the disks, I simply placed them above the instrument, without fixing them in any way: the wooden cover and the conical cavity were also laid aside, because the transmission and reception could be effected as well without them. This part of the instrument seems to be superfluous, since, when the disk is simply placed level to the ear, the sound seems to be increased by being brought nearer. Although iron acts better than anything, it appears that iron disks are not absolutely necessary, and that diamagnetic substances also act perfectly. I wished that my assistant, who was at some distance, and could not hear any direct sound, should continue his calculations. I took away the iron disk and placed across the instrument a wide iron bar, an inch thick. On applying my ear to it, I could hear every sound distinctly, but somewhat more faintly. A piece of copper, three inches square, was substituted for it:

although the sound was still distinct, it was fainter than before. Thick pieces of lead, zinc, and steel were alternately tried. The steel acted in almost the same way as the iron, and, as in the other cases, each word was heard faintly but distinctly. Some of these metals are diamagnetic, and yet the action took place. Some non-metallic substances were next tried; first a piece of window-glass, which acted very well. The action was faint with a piece of a wooden match-box; but on using pieces of gradually increasing thickness the sound was sensibly increased, and with a piece of solid wood, 1½ inch in thickness, the sound was perfectly distinct. I next replaced it by an empty wooden box, which acted very well. A piece of cork, ½ inch thick, acted, but somewhat faintly. A block of razor-stone, 2 inches thick, was placed upon the instrument; and, on applying the ear to it, it was quite easy to follow the speaker. I then tried to hear without the insertion of any substance, and, on applying my ear quite close to the coil and magnet, I heard a faint sound, and on listening attentively I understood all that was said. In all these experiments the sounds were perceived, but the sounds transmitted or attempted did not act precisely alike. The sound of a tuning-fork, placed on the iron disk itself or on the case of the instrument, was clearly heard: thin iron disks were more effective for articulate speech. With other substances, stone, solid wood, glass, zinc, &c., the sound of the tuning-fork was heard, whether it rested upon them, or the vibrating fork was held above them. These substances were not adapted for transmitting the sound of the voice. These were all laid aside, and the sounding instrument was held directly above the pole of the magnet: the sound was clearly heard, although there was nothing but air between the end of the magnet and the tuning-fork. The sound was perhaps less intense when the tuning-fork was held directly above the pole, than when it was at the end of the magnet. I next tried if my voice could be heard with this arrangement. The result was rather doubtful, but I think that some action must have taken place, for the tuning-fork was heard when it was simply vibrated near the pole. The effect of the voice can only have differed in the degree of intensity: it was too faint to be heard at the other extremity. I repeated these effects; I assured myself of them, and I succeeded in transmitting sounds distinctly on the pole without a disk, and, on the other hand, by applying my ear to the instrument, I was able to hear distinctly all that was said, although there was no disk.’

[13] These are his own words: ‘The articulation produced from the instrument was remarkably clear, but its great defect consisted in the fact that it could not be used as a sending instrument, and thus two telephones were required at each station, one for transmitting and one for receiving spoken messages.’

[14] These carbons are made by heating, in a temperature gradually raised to white heat, fragments of deal of a close fibre, which is enclosed in an iron tube or box hermetically sealed.

[15] Mr. Willoughby Smith varied this experiment by placing a packet of silk threads coated with copper on the disconnected ends of the circuit, which were arranged at right angles with each other. Under these conditions the instrument became so sensitive, that the current of air produced by a lamp placed above the system, caused a decided crackling noise in the telephone.

[16] Mr. Hughes observes on this subject that carbon is a valuable material for such purposes, since it does not oxidise, and its effects are greater when combined with mercury. He takes the prepared charcoal used by artists, brings it to a white heat, and suddenly plunges it in a bath of mercury, of which the globules instantly penetrate the pores of charcoal, and may be said to metallise it. He also tried charcoal coated with a deposit of platinum, or impregnated with chloride of platinum, but this was not more successful than the former method. If the charcoal of fir-wood is brought to a white heat in an iron tube, containing tin and zinc, or any other metal which readily evaporates, it is metallised, and is adapted for use if the metal is subdivided in the pores of charcoal and not combined with it. When iron is introduced into carbon in this way it is one of the most effective metals. The charcoal of fir-wood, in itself a bad conductor, may thus acquire great conducting power.

[17] Mr. Hughes remarks that the vibrations which affect the microphone, even in speaking at a distance from the instrument, do not proceed from the direct action of the sound waves on the contacts of the microphone, but from the molecular vibrations produced by it on the board which serves to support the instrument; he shows, in fact, that the intensity of sounds produced by the microphone is in proportion to the size of the surface of this board, and when the sending microphone is enclosed in a cylindrical case, its sensitiveness is not much diminished if the surface of the box enclosing the whole is sufficiently large. From this point of view he has sought to increase the sensitiveness of his instruments by fixing the frame on which the moveable parts of the sender and receiver revolve on a spring plate.

[18] Helmholtz’s resonator is based upon the principle that a volume of air contained in an open vase emits a certain note when placed in vibration, and that the height of the note depends on the size of the vase and of its opening. Helmholtz makes use of a globe with a large opening on one side and a small one on the other, and the small one is applied to the ear. If a series of musical notes take place in the air, the one which is in harmony with the fundamental note of the globe is intensified, and can be

distinguished from the rest. The same effect takes place when, on singing to a piano accompaniment, some strings are heard to vibrate more strongly than others, namely, those which vibrate in unison with the sounds emitted. The resonators are made in various ways; those most generally used are cases of different lengths which also serve as sounding-boxes.

[19] I give the text of M. Cros' sealed paper, opened by his request, at the Académie des Sciences, December 3, 1877:--'Speaking generally, my process consists in obtaining traces of the movement to and fro of a vibrating membrane, and in using this tracing to reproduce the same movements, with their intrinsic relations of duration and intensity, either on the same membrane or on one adapted to give out the sounds which result from this series of movements.

'It is therefore necessary that an extremely delicate tracing, such as may be obtained by passing a needle over a surface blackened by fire, should be transformed into a tracing, capable of sufficient resistance to guide an index which will transmit its movements to the membrane of sound.

'A light index is fastened to the centre of a vibrating membrane; it terminates in a point (a metallic wire or tip of a feather) which rests on a surface which has been blackened by fire. This surface forms part of a disk, to which the double action of rotation and rectilinear progression has been given. If the membrane is at rest, the point will trace a simple spiral; if the membrane vibrates, there will be undulations in the spiral, and these undulations will represent the precise movements of the membrane in their duration and intensity.

'By a well-known photographic process a transparent tracing of the undulations of the spiral can be represented by a line of similar dimensions on some resisting substance, tempered steel for example.

'When this is done, this resisting surface is placed in a turning machine which causes it to revolve and advance with a velocity and motion similar to those by which the registering surface was actuated. A metallic point if the tracing is concave, or a grooved index if it is in relief, is kept upon the tracing by a spring, and the index which supports this point is connected with the centre of the membrane which produces the sounds. Under these conditions, the membrane will be actuated not by the vibrating air, but by the tracing which guides the index, and the impulses will be precisely similar in duration and intensity to those to which the registering membrane was subjected.

'The spiral tracing represents equal successions of time by increasing or decreasing lengths. There is no inconvenience in this, since the turns of the spiral are very close together, if only the circumference of the turning circle is used; but then the central surface is lost.

'In all cases the tracing of the helix on a cylinder is much more satisfactory, and I am now trying to make this idea practicable.'

[20] Never make a contact between the stylus and the cylinder until the latter is covered with the tinfoil. Do not begin to turn the cylinder until assured that everything is in its place. Take care, when the stylus returns to the point of departure, to bring the mouthpiece forward. Always leave a margin of from five to ten millimètres on the left and at the beginning of the sheet of tinfoil; for if the stylus describes the curve on the extreme edge of the cylinder, it may tear the sheet or come out of the groove. Be careful not to detach the spring of the caoutchouc pad.

To fix the tinfoil, apply varnish to the end with a paint-brush; take this end between the finger and thumb of the left hand, with the sticky part towards the cylinder; raise it with the right hand and apply it quite smoothly to the cylinder; bring round the sticky end, and join them firmly.

To adjust the stylus and place it in the centre of the groove, bring the cylinder to the right, so as to place the stylus opposite the left extremity of the tinfoil; bring forward the cylinder gently and by degrees, until the stylus touches the tinfoil with force enough to imprint a mark. Observe if this mark is quite in the centre of the groove (in order to do this, make a mark with the nail across the cylinder), and if it is not, adjust the stylus to the right or left by means of the little screw placed above the mouthpiece. The depth of the impression made by the stylus should be ■ millimètre, just enough for it to leave a slight tracing, whatever the range of vibrations may be.

To reproduce the words, the winch must be turned with the same velocity as when they were inscribed. The average velocity should be about eighty turns a minute.

In speaking, the lips must touch the mouthpiece, and deep guttural sounds are better heard than those which are shrill. In reproducing, the tightening screw must be loosened and brought in front of the mouthpiece, the cylinder must be brought back to its

point of departure, the contact between the stylus and the foil must be renewed, and the cylinder must again be turned in the same direction as when the sentence was spoken.

To increase the volume of reproduced sound, a tube of cardboard, wood, or horn may be applied to the mouthpiece; it must be of a conical form, and its lower end should be rather larger than the opening of the mouthpiece.

The stylus consists of a No. 9 needle, somewhat flattened on its two sides by friction on an oiled stone. The caoutchouc pad which connects the plate with the disk serves to weaken the vibrations of the plate. If this pad should come off, heat the head of a small nail, apply it to the wax which fastens the pad to the plate or to the spring, so as to soften it; then press the caoutchouc lightly, until it adheres to the place from which it was detached. The pads must be renewed from time to time, as they lose their elasticity. Care must be taken in replacing them not to injure the vibrating plate, either by too strong a pressure or by grazing it with the instrument employed to fix the pad.

The first experiments should be with single words or very short sentences, which can be extended as the ear becomes accustomed to the instrument's peculiar tone.

The tone is varied by accelerating or slackening the rotatory movement of the cylinder. The cries of animals may be imitated. Instrumental music may be reproduced by placing a cardboard tube before the mouthpiece. The airs should be played in rapid time, since, when there is no system of clockwork, they will be more perfectly reproduced than those which are played slowly.

[21] We confess that we find it difficult to believe in this property of the phonograph, from which we have only heard the harsh and unpleasant voice of Punch.

[22] The action of this pedal is effected by two little rockers, so connected that the upper damper is lowered a little before the lower damper is raised--a condition necessary to produce the quivering motion of the plate which furnishes the rolling _r_.

[23] The arrangement of this part of the instrument is remarkable in this particular, that in the case of certain letters the air is ejected with more or less force through the pipe I, while in the case of other letters the air is drawn into the same tube. Since I was unable to see the internal arrangement of these cavities, I can only give an imperfect account of the mechanism at work.

Transcriber's Notes

Punctuation, hyphenation, and spelling were made consistent when a predominant preference was found in the original book; otherwise they were not changed.

Simple typographical errors were corrected; unbalanced quotation marks were remedied when the change was obvious, and otherwise left unbalanced.

Illustrations in this eBook have been positioned between paragraphs and outside quotations.

Footnotes, originally at the bottoms of the pages that referenced them, have been collected, sequentially renumbered, and placed near the end of the book.

The Table of Contents is not well-coordinated with the actual text. The Transcriber has not added missing entries, but has attempted to correct page number discrepancies.

Several diagrams use labels with prime marks, but the accompanying explanations do not always include the prime marks.

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The practice of osteopathy

Carl Philip McConnell

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Transcriber’s Note Italic text displayed as: _italic_ Bold text displayed as: =bold=

THE PRACTICE OF OSTEOPATHY

[Illustration]

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FOURTH EDITION

Rewritten in collaboration with osteopathic specialists of note with much new and original matter

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DEDICATED TO THE MEMORY OF ANDREW TAYLOR STILL

FIRST EDITION 1899 SECOND EDITION 1902 THIRD EDITION 1906 FOURTH EDITION 1920

PREFACE TO THE FOURTH EDITION

A science is said to be known by its literature and, if that be true, Osteopathy is backward for there are few available books on the subject for the student and investigator although there is a vast amount of unclassified journalistic matter. A pretentious start was made and, for a time, it appeared that we should have texts on all subjects for the teaching of Osteopathy but, for reasons not necessary to give here, these books did not live although their value and need was never questioned.

The third edition of the Practice of Osteopathy was exhausted very soon after publication and there have been insistent calls for a fourth which is now presented with the hope that it will find as friendly a reception as was accorded the previous editions. Close attention to current literature has been given and reports from experienced practitioners in the field has been sought and this material made use of wherever possible. Besides this, certain sections have been written by specialists in their several lines whose signed articles we confidently present. The subject of osteopathic practice has been handled to avoid undue optimism in the light of experience but, also, not to lose sight of the fact that osteopathy won its way by performing the so-called impossible in a multitude of cases. Therefore, it has been thought best not to draw a hard and fast line on our limitations.

The border line between osteopathy and surgery has been demonstrated as well as can be done on paper without the actual patient in hand. Medical literature has been called upon to give its store of knowledge wherever our needs have appeared and all osteopathic prints have, also, given from their accumulated wisdom and experience.

The authors acknowledge, with thanks, this information from the many writers for osteopathic journals who have created a great fund of knowledge on osteopathic subjects and particularly those who have contributed special sections.

CARL PHILIP MCCONNELL. CHARLES CLAYTON TEALL.

1920.

“Osteopathy is not so much a question of books as it is of intelligence. A successful osteopath is in all cases, or should be, a person of individuality with a mechanical eye behind all motions or efforts to readjust any part of the body to its original normality, because unguided force is dangerous, often doing harm and failing to give relief that should be the reward of well directed skill.”—A. T. STILL.

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PART FIRST

INTRODUCTION

What Hippocrates was to the Allopath, what Hahnemann was to the Homeopath, Andrew Taylor Still is to the Osteopath, and it is safe to say that when another century shall have rolled away, his fame will be equal to that of either. That he is a maker of history, even the most skeptical will admit. His teachings are revolutionary but are borne out in fact, and on that as a foundation, is built the superstructure of the young therapeutic giant—Osteopathy.

It would be of great interest to trace the history of the first inception of the thought that drugs were not only unnecessary but harmful, then view the struggle to grasp something tangible to take their place, then see the development of the idea that the human body has within it all that is needed for its upbuilding and repair until he came to this fundamental: "The power of the artery must be absolute, universal and unobstructed or disease will result. The moment of its disturbance means the period when disease begins to sow the seeds of destruction in the human body; and in no case can it be done without a broken or suspended current of arterial blood," capped by the epoch-making discovery of the cause for this interrupted flow of the blood stream—the theory of obstruction by anatomical displacement. It is the only theory of the etiology of disease that will stand the test of science and its acceptance and practice means a revolution in the field of therapeutics.

As it is, he sets the exact date, June 22, 1874, when the light dawned and he saw the outline of his great philosophy—Osteopathy. Then came the years of adversity and struggle. With the eye of a prophet he saw the future of that philosophy, and with the firmness of a Spartan has defended it since birth. It must be a separate, distinct system. Outside the fact that it was to heal the sick and was founded on a knowledge of anatomy and physiology it had nothing in common with existing schools, and if it were ever to grow it must be alone, for his brother practitioners would have none of it and if left to their tender mercies it would have "died a-borning." Even had it been taken up the result would have been the same for they would never have fully developed it. And so through the lean, terrible years he struggled, buoyed by the faith of a discoverer, urged on by love of this child of his brain, fanatical in his determination to win. And win he did for it was vouchsafed to him in his vigorous old age to sit on his hearthstone and see the results of his work, his struggle and his faith. It is something to know that his fame has circled the earth, to be honored and sung by millions; a boon not accorded many a sage or philosopher. Not only has the public accepted it but the medical profession is making tardy but forced recognition of certain cardinal principles of osteopathy by using them, but, of course, without credit.

Osteopathy has been defined as "that science or system of healing which emphasizes, (a) the diagnosis of disease by physical methods with the view of discovering, not the symptoms but the cause of disease in connection with misplacements of tissue, obstruction of the fluids and interference with the forces of the organism; (b) the treatment of disease by scientific manipulations in connection with which the operating physician mechanically uses and applies the inherent resources of the organism to overcome disease and establish health, either by removing or correcting mechanical disorders and thus permitting nature to recuperate the diseased parts, or by producing and establishing antitoxic and antiseptic conditions to counteract toxic and septic conditions of the organism or its parts; (c) the application of mechanical and operative surgery in setting fractures or dislocated bones, repairing lacerations and removing abnormal tissue growths or tissue elements when these become dangerous to organic life."[1] In a word, osteopathy is adjustment and the osteopath is an anatomical engineer who knows what is wrong and has the ability to correct it. Dr. Still changed diagnosis from guess work to fact and on it his fame may well stand, for when the cause of the disease was found, treatment was easy. He has ever emphasized the necessity of thorough examination and correct diagnosis. All treatment must be based on the definite, specific object to accomplish certain definite, specific things.

"Osteopathy would expound and apply the true philosophy of manipulation. While the hands are used, it is not this alone and chiefly that distinguishes its method of operation, but the idea and purpose that lie behind manipulation."[2]

All manipulators are not osteopaths any more than all butchers are surgeons. The need for deep study of the subject is apparent from this characteristic statement of Dr. Still's: "Osteopathy is a science; not what we know of it, but the subject we are working is deep as eternity. We know but little of it. I have worked and worried here in Kirksville for twenty-two long years, and I intend to study for twenty-three thousand years yet."[3] This brings us to the point of the relations of osteopathy with other manipulative forms of treatment. They are not many, for Gerdine,[4] in closing a long article on the "Physiological Effects of Mechanical Therapeutics"

says: “I have striven to show that in no way is Osteopathy similar to massage either in theory or practice if Osteopathy is conceived of, according to its founder, Dr. A. T. Still, as a system of healing in which a definite lesion in form of a bony displacement is the causative factor and a removal of the same, the curative factor in disease.”

The fact that use is made of the hands to the extent it is by both osteopaths and masseurs or Swedish movement operators gives rise to the mistaken idea of similarity in treatment.

“The essential distinction,” says G. D. Hulett, “between Osteopathy and all other systems of healing based on manipulation, clusters around the etiology of disease. While these other systems, as indicated at least by their practice, look at disease from a peripheral standpoint, osteopathy views it from a central standpoint.”[5]

Massage is a small branch of manipulative therapeutics, but conceding that it is perfect and scientific it can only resemble osteopathic treatment in one ramification of osteopathic practice, viz: relaxation of muscles.

The fact that massage is often employed by osteopaths in connection with their work shows the limitations of that form of treatment. Says McConnell[6]: “In the human body, as in any delicate, complicated mechanism, there is mechanism within mechanism; and, in order to obtain certain mechanical effects, many times there is required a series of complicated movements, all of which bear a ratio one to the other according to the energy utilized and the mechanical principle involved.” No other form of manual treatment takes this principle of mechanics into consideration. It is possible, as Gerdine points out, for an undeveloped osteopath to practice massage under another name. That the two should be confounded before the public is due to his ignorance and not from any fault of the system. Massage is a valuable aid in the treatment of disease but it is not Osteopathy.

“In the bright lexicon of osteopathy there is no such word as rub[7].”

Osteopathy in its relation with medicine has little in common. From the beginning, its founder realized their paths should run divergently, so the first step, its teaching, must be considered from a different viewpoint. To quote from an address by Teall[8]: “But to adequately teach osteopathy a vast amount of original work must be done. Anatomy is anatomy but there is a vast difference in its application. Physiology must be taught to mean something more than an interesting phenomenon. Pathology has an unfilled gap between cause and effect which must be bridged. The post-mortem has a great story to tell but an osteopath must tell it. A slide of degenerated tissue under the microscope is of interest, but why the degeneration? It is described at length by the authorities, but the reason for the causes and morbific changes are not carried out. Obstetrics along strictly natural and physiological lines insuring both mother and babe against injury; gynecology, minus the knife and plus common sense; all these, and more must be put into shape to teach the osteopathic student. The archives of osteopathy were empty ten years ago. There was no precedent to follow and the ideas in teaching which had prevailed for centuries dominated. All this is changed. The colleges teach the science along strictly osteopathic lines, making the application of the truths which have escaped the notice of centuries of investigation.”

All schools recognize the wonderful recuperative power of nature, as this from the introduction of a standard allopathic text book will show[9]: “There is no scientific dogma better established than this: that the living organism is in itself adequate to the cure of all its curable disorders. This natural law sustains the medical skeptic in his infidelity, enables the homeopath to report his sugar cures, and helps all physicians out of more close places than they are generally willing to acknowledge.” But at times, as all will agree, nature is not able to overcome its maladies and assistance is needed. Here, again, is a divergence as to the method and character of that assistance. There is no system so trivial or absurd which cannot point to its cures, but a school of medicine should have a settled system with established methods of procedure. This is not true of any school employing drugs as its principal therapy. In the President’s annual address at Cleveland he says[10]: “The observant reader of the progressive medical press is struck at once by the unsettled condition in the field of modern therapeutics. The trend is emphatically away from drugs. But, in the effort to get away from medicine, the medical investigator has wandered far afield, cutting loose from nature and resorting to the artificial.” It is the last paragraph of the extract quoted which particularly emphasizes the point of divergence, natural _versus_ unnatural methods. It must be understood at once that the osteopath admits the reality of drug action for “there is no doubt that the pharmacopeia records many drugs whose action is rapid and effective so far as securing activity or decrease of secretion is concerned, but the element of danger, i. e., their destructive power is great. Oftentimes their power does not stop at the point desired or limit its effect to the therapeutic action sought[11].” This point of unreliability of the drug is emphasized by the following from recognized medical authority[12]: “We give drugs for two purposes: (1) To restore health directly by removing the sum of the conditions which constitute disease. Here we act empirically with no definite knowledge—often indeed with little idea of the action of our drugs, but on the ground that in our hands or in the hands of others they have restored health in like cases. (2) To influence one or more of the

several tissues and organs which are in an abnormal state so as to restore them to or toward the normal; with the hope that if we succeed in our purpose recovery will take place. The purpose we effect by means of the influence which the chemical properties or drugs exert on the structure and function of the several tissues and organs. Minute information, therefore, of the nature of drugs and their action is essential for their proper employment." Osteopathy brings into action the latent or stagnant forces of nature by specific methods which are usually reliable. Naturally there being such a wide difference in theory of the cause of disease it would be also shown in diagnosis as well as treatment. The most striking points to the layman in medical procedure are: first, wide difference in the system of diagnosis and in its findings by physicians of the same school; second, the great variance in remedies employed by different physicians of the same school for the same disease.

Osteopathic diagnosis is so physical in its character, depending upon actual conditions found and not upon the subjective symptoms alone, that the same patient examined by a number of experienced osteopaths will be given the same diagnosis, and he will also be able to detect in each the same effort to correct in all their technique. All the methods of physical diagnosis are used plus the distinctive osteopathic procedure. Results wherever used bear out the effectiveness of the system.

The osteopath must and does consider the necessity of surgery, but his effort is always to prevent the operation if possible. There can be no doubt that surgery is carried to extremes and there is a strong sentiment growing that much of it is unnecessary. Says Homer Wakefield, M. D.[13]: "It is to the everlasting disgrace and mortification of the medical man that the wealthy classes who are continually under the observation and direction of eminent men, in dietary, and all life habits, in health as well as in sickness, are not only the very ones who develop appendicitis and most largely go to operation, but are almost exclusively those who attain to this distinction." The operations of today are wonderful and the surgeon shows great skill and genius in their performance, but great as he is in these matters how infinitely greater is the man who can prevent them. The need of the osteopath today is to be trained to recognize surgical conditions and neither allow surgery unnecessarily nor make the more terrible error of not acting soon enough. Where surgery is a necessity there is always an etiological factor to be considered. The cause of the manifestation not always being removed what is to prevent a recurrence or serious sequela in spite of the operation? "The specialist ... if he has wit enough to read the lesson presented to him, that it is not sufficient to remove an ovarian tumor, e. g., and that if nothing is said at the same time or subsequently as to the causes which induced it, a positive damage may be done to the woman, who may, therefore, while considering herself cured, proceed to manufacture one on the other side, or may find herself in a few years suffering from cancer in the stump of the previous one[14]." And so the combination of osteopathy with surgery may be necessary that the cause shall be removed. Osteopathic treatment before operations in reducing congestions and inflammations, also in toning the nervous system, is particularly efficacious while the after treatment gives gratifying results. In fact, the two go hand in hand when conservatism rules both.

That diet should receive particular attention from the osteopath is not strange, for his veneration of nature peculiarly fits him to realize the necessity of correct feeding. Probably no subject is more discussed or presents a wider range of opinion than diet. There is overfeeding and underfeeding; long intervals and short between feedings. There is the no breakfast and no supper plan, mixed diet and the vegetarian, uncooked foods, and one exclusively of milk, anything you want so long as you are hungry but chew it well, etc., ad. lib. All are represented by osteopaths in their following as they are from other professions, but probably this would more nearly represent the views of them as a school. In health, first, most people eat too much and do not thoroughly masticate and insalivate. This applies to all stations of society. Second, meat forms too large an item in the daily dietary. Third, there is not enough variety and the ration is not well balanced as to elements. Fourth, not enough care is used in preparation of foods. In illness, first, the stopping, complete or partial, of food until the system can take care of it; second, the giving of easily digested foods. The man who avoids violent extremes in diet as well as in other habits of life will usually last longest. It is to be hoped that some rational system can be evolved on which all factions may agree, for the present confusion of authorities is bewildering. The osteopath gives attention to hygiene, sanitation, exercise, environment, mental attitude, etc., as they may affect the welfare of his patient.

Osteopathy can cure all curable diseases, for the same forces which will overcome one malady will overcome another when set in motion. Forces that produce a diseased condition will it normalized restore the established type.

FOOTNOTES:

[1] Littlejohn, (J. M.)—Journal of the Science of Osteopathy.

[2] Encyclopedia Americana.

[3] Booth—History of Osteopathy.

[4] Journal of Osteopathy, May, 1905.

[5] Principles of Osteopathy, p. 190.

[6] Journal of the Science of Osteopathy, Dec. 15, 1900.

[7] Osteopathic Calendar, 1900.

[8] Reported, Portland, (Me.), Advertiser, Feb. 27, 1905.

[9] Potter's Materia Medica.

[10] Teall—Journal of the American Osteopathic Association, Aug., 1903.

[11] Tasker—Principles of Osteopathy, p. 110.

[12] Allbutt's System of Medicine.

[13] Cyclopædia of Practical Medicine, June, 1906.

[14] Rabagliati—Air, Food and Exercise, p. 129.

OSTEOPATHIC ETIOLOGY AND PATHOLOGY

Osteopathic Etiology

Osteopathic etiology and pathology constitutes the most interesting chapter of osteopathic science. The primal divergence of the osteopathic schools from previous systems is to be found in the osteopathic interpretation of disease causes and processes, and not in osteopathic therapy as some may think. Osteopathy makes claim to an independent school because it possesses a distinct etiology, pathology, diagnosis and treatment. Thus osteopathic practice is not a mere method, but instead a system, a school, a science.

At no period of medical history have physicians of the older schools felt more keenly the futility of medical methods and the lack of an all-embracing principle of medicine than at the present. A recent writer[15] who claims to have discovered a principle that encompasses the entire field of medicine, says: "We found, we may say, that the backbone of medicine was the absent factor, and that if the patient labors of so many great minds had not proven as useful in the development of practical medicine as they should, it was because they lacked such a fundamental framework to afford a fixed _nidus_ for each discovery, wherein its true relation to other discoveries would at once become evident."

Since the conception of osteopathy its fundamental framework has not changed one iota as to principle, although the application of the principle has been greatly elaborated. When Dr. Still proclaimed that "the rule of the artery is supreme" he gave utterance to a basic physiological truth. But when he demonstrated that osseous and other anatamo-mechanical lesions disturbed the artery and caused disease, and that readjustment of the anatomical cured the disorder, thus allowing the physiological to potentiate and revealing that the living body contains all the attributes of a vital and physical mechanism, did his teaching contain the germ of a comprehensive philosophy; this gave osteopathic science a "backbone" with a consequent fixed _nidus_ for all existing facts and future discoveries. And thus, it should always be emphasized that mechanical readjustment of the component parts of the vital body is the eternal keynote of the osteopathic school of healing.

=The Osteopathic Lesion.=—Broadly speaking a lesion is "any morbid alteration in a tissue whether attended by a recognizable structural change or not; but especially a change in which the continuity of some of the tissue elements is broken in upon.[16]" There are several kinds of lesions expressing the tissue involved, character of degeneration, locality of same, etc. But upon analyzing the medley of arbitrarily defined lesions the fact will be evident that much of medical etiology and pathology has not been logically and consistently sifted and arranged; and moreover, it will be found the =cause of causes= of many diseases is unknown.

Herein, arises the great significance of the osteopathic lesion, for the lesion alters the very governing and controlling tissues of the body, viz., the nervous tissue and the vascular channels. Hulett[17] defined the osteopathic lesion as "any structural perversion which by pressure produces or maintains functional disorder." The constant maintenance of the structural perversion will, also,

cause organic disease, although it is granted that functional disorder must necessarily result prior to any organic change.

The osteopathic conception of a lesion, functional and organic disorder caused by pressure from disturbed structures, does not bring us into an absolute new field. Medical literature of all ages contains references to diseases caused by pressure of tissues on nerves, blood vessels, or other channels. But the osteopathic idea is an absolutely new one in the application of this principle universally. It simplifies and makes uniform the arbitrariness of present semeiology.

Thus the osteopathic idea that many diseases originate, primarily, from anatomically malaligned, malpositioned, or malrelated tissues causing a blockage of vital processes, immediate or remote, is a theory inclusive of disturbances to all tissues. This principle is fundamental and is supported by the physiological truth that uninterrupted vital channels preserve health; moreover clinical and experimental data, as will be shown later, substantiate this fundamental. It at once places interpretation of a lesion in an entirely new light from preconceived concepts, and is analogous to and co-extensive with etiology and pathology.

=Etiological Factors.=—The osteopath believes in the potency of inherited and environmental influences. There can be no question that a few diseases and certain disease tendencies may be inherited, the principle feature, however, from the standpoint of heredity is, various organs and tissues have less vital resistance. These should not be confounded with congenital weaknesses and diathetic tendencies.

Environmental influences are very important factors. One's surroundings and daily habits in the home, shop, or office count for much in the aggregate. Food, drink, air, rest, sleep, clothing, exercise, mental attitude, etc., are all factors in the sum total of health, and consequently ill health may be traceable to their abuse. In fact, all hygienic and sanitary measures are duly considered by the osteopath. Various abuses, over use, and disuse of the functions will certainly be followed by physiological discord.

The germ theory contains much truth, but in the very large percentage of cases where the micro-organism is a factor its significance is only of secondary consideration. Immunity and resistance comprise an important part of the health problem, of which the intact anatomical is of first consideration. Usually the micro-organism plays the role of an exciting and determining factor; before it can multiply and grow there must be a field that is first nutritionally disturbed. Nutrition of the tissue is the one great point always to be considered. The constitution of an individual is the pivot about which predisposing, environmental, and exciting factors of disease center. Health represents the integrity of the artery as well as a maintenance of that master tissue, the nervous system, and anything that produces or influences, directly or indirectly, a disturbance of physiological functioning borders on the pathological.

Hence the osteopath recognizes many of the common medical causes of disease, but reserves the privilege of rearranging their relative positions, for the osteopathic cause of disease greatly modifies their value.

=Osteopathic Etiology= distinctively emphasizes structural derangements and perversions. Of =first= importance, owing to static requirements, is the =osseous lesion=. This lesion is represented by any abnormal change of position or relation of the many bony constituents of the body. The framework of the body is subject to not only any and every physical violence of any mechanism, but moreover being the corporeal foundation of a vital mechanism is subject to both direct and indirect biochemic changes and influences.

Thus the osseous lesion is caused (a) by traumatism, e. g., strains, falls, blows, etc.; (b) indirectly by atmospheric changes, over and violent exercise, the slumped posture, debilitating habits, etc., through the media of muscle changes and imbalance; (c) by nutritional effects disturbing the elements of bony tissue; (d) by ligamentous change such as thickening of a capsular ligament; (e) by infections; (f) compensatorily and reflexly through the media of body distortions and muscular irritability or debility, e. g., an innominate lesion may be compensatory to a lumbar curvature, dietetic errors may cause dorsal muscular irritation and contraction produce a constant osseous lesion which in turn may result in chronic indigestion.

The pathological changes in the osseous lesion are commonly one of structural derangement, deviation or complete displacement. The vertebral segments are of primary consideration owing to their important relations to the spinal nerves, spinal cord centers and sympathetics; the ribs owing to the close sympathetic and spinal nervous relations; and then other osseous tissues, as the innominata, clavicles, etc., depending upon their importance to contiguous vessels, nerves and organs. It should always be remembered and emphasized that mechanical changes of the anatomical structures is the primary essential in osteopathic etiology; this is the one great inception of pathological variations from the distinctively osteopathic conception, which the osseous lesion typifies. Consequently the osseous lesion factor is actually a luxation (complete, or partial, even to a very slight degree), or

malalignment of the bony constituents, which by virtue of their physical malposition impinge or irritate contiguous tissues. The essential test is the functional one, movement. The degree of involvement may be one of many gradations ranging from a slight malposition or impaction to a marked deviation or firm anchorage.

=Second= in importance from the static requirement of support is the =muscular lesion= though from the standpoints of movement and dynamics it is often of the first consideration etiologically. Many interosseous lesions are the result of spastic involvement of deep seated spinal muscles, of fibrotic changes and of tensions and weaknesses that either establish a rigidness of the segments, compromising nervous stimulus or vascular channel, or produce an imbalance of muscular tone and tension. In the latter instance some type of sidebending-rotation osseous lesion occurs, commonly anchored within the physiologic movements of the spine. The muscular lesion may be an actual dislocation of either muscle or tendon, but rarely. Commonly it is a contracted, or tensed, or contractured muscle. The muscle, also, may be diseased either from primary or secondary causes through nutritional and infectious sources and thus be an etiological feature.

The muscular lesion is caused, (a) by direct or indirect violence the same as the osseous lesion; (b) by atmospheric influences; (c) by slumped posture, debilitating habits and various errors of living; (d) infections; (e) by reflex irritations; (f) by compensatory changes; (g) by disease causing hypertrophy or atrophy; and, (h) secondary to osseous lesions, being the result of impingement to the muscles' nervous control. The tensed or stretched muscle may result from a separation of the points of origin and insertion.

Herein the fundamental osteopathic concept is the resulting affection due to the physical encroachment, directly or indirectly, of the muscle tissue upon vascular channel or nerve fibre, or the effect upon the movement or alignment of the osseous tissue.

Muscular contractions, displacements, and tensions play a most important part in acute disorders, although muscular lesions that are secondary to other lesions are usually taken into account when treatment is given. Muscular lesions affect, (a) blood and lymph vessels; (b) nerve fibres. Muscular contractions, especially, impede mechanically the return of the venous blood to the heart. The lesions to the nerves may be manifested in innumerable ways, depending upon the location of the muscle and the function and distribution of the nerve affected.

Then there is the relaxed, overstretched, and atonied muscle. This condition results as a secondary effect to mechanical strains, these being so severe and constant as to cause direct stretching and possibly tearing of the muscle fibres. This should be distinguished from the exhausted or debilitated muscle, e. g., as found in neurasthenia and anemia.

Diagnostically there are, (a) contractions of more or less area, due to atmospherical changes; (b) the deeply seated contractions involving a very small area, caused by vertebral and rib lesions; (c) contractions due to reflex disturbances; (d) contractions caused by postural effects and deformities; (e) contractions from spasms of the blood vessels as a result of nervous irritations; (f) contractions due to toxicity of the blood. All of these characteristic muscular lesions give a direct hint as to both etiology and prognosis.

=Third=, the =ligamentous lesion=, as a lesion _per se_, is usually of secondary importance to the osseous lesion. In chronic cases affections of the capsular ligament and muscular fibrosis commonly maintain malalignment or rigidness. There are two features that should be noted in particular when considering this lesion; first, thickenings and adhesions; and, second, relaxations.

The tone and integrity of the ligaments cannot but be of vital concern to the stability, suppleness, and adaptability of the bony framework in all physical movements. No matter how slight the osseous lesion may be the ligament must of necessity be involved. The osseous derangements are either a source of irritation to the ligamentous tissue, resulting in congestion and inflammation and hence thickening and adhesions, or else the ligaments are so strained and tensed that in time atony may occur. Probably, in a fair percentage of atonied cases the first disturbance to the ligament is one of irritation and congestion, and from long continued involvement irritation is supplanted by debility.

Consequently the primary consideration of the ligamentous lesion from the etiological standpoint is the character of the tissue (ligament) changes. This, also, gives us a direct hint that is of the utmost value in prognosis. The independent displacement of a ligament is rare, thus ligamentous lesions from the viewpoint of purely physical displacements are secondary to if not an actual part of the osseous lesion. Ligaments, when displaced or tensed, readily impinge or irritate contiguous tissues, but the original cause of the structural perversion is commonly either the osseous or muscular lesion. Hence, whatever factors enter into the production of these lesions will at least indirectly produce the ligamentous lesion.

=Fourth=, the =visceral lesion= is frequently overlooked as being of much moment as an osteopathic lesion. Visceral displacements acting as a source of functional and organic annoyance on the physical plane (structural perversion which produces and maintains pressure) alone are not in the least uncommon.

Any or all of the abdominal viscera, or even the organs of the thorax, may be displaced (physically) pathologically. Actual displacement of the viscus is a prolific source of distinct disorders and many obscure symptoms. True it is the organs are most frequently displaced from indirect causes, but nevertheless the actual physical malposition is in turn a primary cause of still another train of symptoms and diseases.

Visceral lesions are caused by, (a) vertebral lesions; (b) postural defects; (c) direct violence; (d) nutritional disorders; (e) childbirth; (f) unhygienic measures (tight lacing, heavy skirts, etc.); (g) congenital weakness.

From the displaced heart due to valvular and debilitating influences to the displaced liver, the stomach, the kidneys, the intestines, the ovaries, and the uterus, may arise a source of direct or indirect irritations, a train of apparent or masked symptoms, or a group of nutritional disturbances that include an extremely important chapter in etiology. Moreover not only may one organ alone be involved but several may be displaced or prolapsed as a whole as in splanchnoptosis; and even these in turn may be the direct cause of further organic displacements as the abdominal viscera prolapsing upon the pelvic organs. Here is a very fruitful field for the diagnostician, for to separate cause from effect requires keen perception, an acute sense of touch, and above all, most careful weighing of all the factors that enter into the maze.

=Fifth=, the =composite lesion= is not always recognized as an extremely important osteopathic factor. By composite lesion is meant a structural lesion that primarily includes the osseous, muscular, and ligamentous tissues as a whole. This may be termed a lesion _en bloc_ or _en masse_.

Composite lesions are of exceedingly frequent occurrence. Indeed, many composite lesions are overlooked and instead of treating the _en bloc_ disturbance as a consistent whole the component factors are treated separately with no concern or attention to the whole.

Postural defects are excellent types of the composite lesion. The various curvatures, the tilted pelvis, etc., are representative of the composite lesion. Etiologically, pathologically, diagnostically, and therapeutically the contour of the spine and ribs, the relation of the innominata to the sacrum and spine, and the symmetry of the body generally should be recognized and appreciated. The relation of the part to the whole and of the whole to the part are of vital etiological concern. An incipient curvature may be easily overlooked, a pendulous abdomen neglected, and a slipped innominatum passed unnoticed wherein as a result the entire vertebral column is malaligned in relation to the physiological curves or to the perpendicular line of gravity.

Frequently attempts are made to correct individual lesions when attention should be directed to the composite lesion and _vice versa_, e. g., a displaced rib is usually dependent upon a corresponding vertebral lesion, and thus the transverse plane or section of the body should be considered as a whole. A single lesion may be dependent upon a composite lesion or a composite lesion dependent upon one or more single lesions. A slipped innominatum or a disordered hip joint may bring about a strain to a greater or less section of the spinal column, or a twisted vertebra may cause a curvature, whereas on the other hand postural defects may cause a strain at its maximum focal point resulting in over-stretching and relaxing of ligaments so that an osseous lesion results, or a spinal curvature cause an innominatum displacement. Thus there is a constant establishing of equilibrium, physically and physiologically, through the medium of compensation, but at some phase of the change there are apt to be pathological phenomena resulting, and very frequently physiological harmony is not reestablished but instead irritation, debility and other disease symptoms are constant effects until relieved.

Consequently osteopathic etiology is many sided and complicated. To know whether an osseous, ligamentous, muscular, visceral, or composite lesion is primary or secondary, compensatory, reflex, predisposing, or exciting, requires a command of theoretical knowledge backed by much actual clinical experience.

In noting the above distinctive osteopathic etiologic features the student should not lose sight of the constitutional status of the patient which may be modified by inherited, congenital, diathetic, and environmental influences, all of which go to make up the predisposition of the individual and have an important relation to osteopathic factors. Then it should be recalled that disease processes may be of insidious progress, and the products and effects of pathologic changes accumulative.

Osteopathic Pathology

In the etiologic study the osteopathic characteristics have been designated structural maladjustment, although at the same time not losing sight of the angle that the body is not only a physical mechanism but also a vital organism. Structural perversions characterize the osteopathic distinction when dealing with the physical body, and remembering the vital or biochemic mechanism, mental attitude, diet, hygiene, etc., are not forgotten. To retain or attain health, thorough appreciation of both the physical and vital mechanisms should be kept in view, for there is both an independent and dependent interaction on the part of each. The living body being an entity premises a system of therapeutics both physical and vital, that acts in direct accord and harmony with physical laws and physiological functioning.

Osteopathic pathology deals with the distinctive osteopathic lesion as a factor in production and maintenance of disease. Then the province of pathology is, first, to determine whether the lesion is in reality an etiologic factor; second, the immediate character of the lesion disturbance; and, third, how organic life becomes involved.

Inspection, palpation, clinical results, dissection and laboratory experimentation include the methods employed to prove that the lesion is of practical consequence. That the lesion is an etiological factor can be known only through clinical and experimental proof; the immediate character of the lesion disturbance can be determined by dissection; and how organic life becomes involved requires the summation of histological, physiological and pathological data.

The following outline assumes that the reader is familiar with anatomy, physiology and pathology. Osteopathic pathology does not add to medical pathology an absolutely new pathology in all of the present known numerous details, but instead interprets much of clinical pathology anew, and furthermore it presents absolutely new data that is exclusive, but germane to the present general medical and surgical fields.

Nervous tissue and arterial blood are the master tissues, the controlling and governing factors in health, and disturbances of these tissues are necessarily the cause of ill health. The rule of the artery and the control of the nerve must continue uninterruptedly in order that physiological functioning remains intact. The body should be looked upon as a being complete, no more or less, each tissue and organ essential to the whole and the organism as a whole essential to every part. This is fundamental and germane to a living structure, and hence disturbance to the governing and controlling tissues, the nerves and vascular channels, must necessarily cause a break in the concatenation and disease must logically follow.

Thus in the osteopathic pathology we look to those influences that primarily disturb the nerve or artery, study the disease process or extension from inception to effect and from primary lesion to morbid results, and note action and interaction of tissue upon organ and organ upon organ.

That all parts of the body are in intimate and dependent relations each with the other through the media of the nervous and endocrine systems is a well known fact based upon histological and physiological grounds. The neurone being the physiological unit implies that any disturbance to the cell quickly disturbs any or all of its processes. It may be said that “nervous tissue is dependent for its integrity upon two things, blood supply and trophic influences. The nerve cell is solely dependent on a proper supply of blood, and dies when this is withdrawn. But the nerve fiber is more dependent on the trophic influence of the cell of which it is a prolongation. It dies when cut off from the cell but it can get along for a time with but little direct blood supply. On the other hand, if the nerve fiber is injured it reacts on the cell, leading to a partial but curable degeneration of the cell body.”[18] Here is the immediate pathologic key to many diseases. Whatever cuts off or obstructs the artery leading to the cell is a primary etiologic factor; this then leads to degeneration of protoplasmic processes and axone. It should be carefully noted that if the obstructed blood vessel is one to the nerve fiber only the resultant partial injury to the cell is curable.

“When an axone degenerates the retrogressive process involves not only the main axone, but also its terminals, together with the collaterals belonging to it with their terminals.”[19] This is an exceedingly important link in the explanation of osteopathic pathology, that distant organs may be affected by the osteopathic lesion. Moreover, “degenerations of a secondary character may occur in those systems of neurones which are more or less dependent upon the peripheral sensory neurone system for their impulses.”[20] This is equally true with the central motor neurone, or any neurone. It shows how far-reaching a degenerative process and its effects may be. It further makes clear that nerve intactness is directly and absolutely dependent upon a normal circulation, and that it is self-evident any blockage either to blood vessels or to neurones will vitally affect those tissues that govern and control the life processes of the body. The integrative action of the nervous system is one of the outstanding facts of physiology.

The above is presented so the student may see how osteopathic spinal lesions, if deeply seated and effective enough, can involve remote tissues and organs. No one will doubt that fractures and complete dislocations of the spinal column will seriously affect

visceral life, or a prolapsed kidney will be a cause of nutritive disturbance, or a displaced uterus the cause of ovarian congestion, or a dislocated hip the cause of atrophy of the leg muscles, but it has remained for the osteopath to offer proof that slight misplacements of the vertebræ or ribs, incipient curvatures, postural defects, slight deformities, and unsymmetrical bodies are of sufficient etiological importance on the physical plane to affect neurone integrity and obstruct artery courses, and thus organic life.

The question at once arises, what is the immediate or direct effect upon blood vessel or nerve of the osseous, ligamentous, muscular, visceral or composite lesion? The osseous lesion will be taken as a type. The direct effect is usually one of hyperemia or ischemia, generally the former, for as physiologists and clinicians observe irritation commonly precedes debility. In the vertebral and rib lesions there may be direct pressure upon the spinal nerve at its spinal foramen exit or on the sympathetic chain directly contiguous to the heads of the ribs. This causes congestion, inflammation, ecchymosis, and degeneration of the nerve fiber, followed by macroscopic and microscopic changes as connective tissue proliferations, arterial scleroses, etc. Or, as seems probable in experimental work, the inception of the pathology may be frequently the result of blockage to nervous stimuli, which when maintained affects the efferent vasomotor, secretory, trophic and other fibers so that circulation and nutrition are definitely involved.

Thus the cells so sensitive to altered vascular changes are directly and remotely affected, and disease characteristics dependent upon structure and function of tissue, and degree of irritant are evident. This can vary, in degree only, with the muscular lesion that involves collateral spinal cord circulation, the visceral lesion that irritates sympathetic life, or the composite lesion that deforms or perverts structure en masse.

But is the physical noxa as potent an etiologic factor as the chemical or bacteriologic? Adami[21] informs us whether an irritant is physical, bacterial or chemical, no satisfactory distinction can be founded on the duration of the irritation; that a local irritation of the nervous system may lead apart from “direct reflex action, to changes of nervous origin, in the region of the injury and in the reflexes affecting associated regions, the higher centers; and through them the system at large, may become affected by paths that it is not always easy to trace.” Again he says that “centrifugal impulses alone, apart from any local injury, may originate a succession of phenomena of inflammation in a part.” And “in all probability a nervous and central origin must be ascribed to some, at least, of the sympathetic inflammations seen to occur in areas supplied by the other branches of a nerve supplying a part primarily inflamed; and again in areas supplied from the same region of the brain or cord as the inflamed organ.” Other inflammatory changes, of course, may occur independently of centrifugal nervous influences, and the vessels react independently of central influences.

This, then, presents a situation postulated thus:

1. The body follows definite structural relations and is influenced by mechanical arrangements in its morphology.

2. The integrity of tissue depends upon structural freedom of nutritive courses.

3. The above predicates a structural etiology as exact and precise as structural relations are important to nutrition.

What proof, then, of the foregoing have we to offer?

First, the =clinical proof=. Clinical results have been obtained in tens of thousands of cases that include disease of various types and lesions, and of all sections and organs of the body. The art of osteopathy has been perfected in many of its details, based upon actual experience and splendid results. The cure of the patient is paramount to all other consideration, and whereas the osteopathic school has been shown a superior system it logically follows on _a priori_ grounds that relief and cure of suffering is of the first and final importance.[22]

Were it not for clinical results no new system of therapeutics could withstand criticism and calumny and finally triumph and be publicly, legislatively, and scientifically recognized.

Second, the =autopsy proof=. Many dissections have been made and autopsies held with the view of discovering the character and the potency of the osteopathic lesion. This very important work has borne out the osteopathic theory of disease. Vertebral and rib displacements have been noted, corresponding ligamentous tissues thickened, associated nerve tracts and vascular channels disturbed, and finally the related organ found diseased.[23]

Third, the =experimental proof=. Experimental proof appeals, logically, to the scientific mind. This proof[24] is being gradually developed.

Experimental investigation has been successfully carried out upon numerous animals. The experiments conclusively prove that not only spinal inhibitory and stimulatory manipulations (mechanical) are productive of immediate physiological changes in the viscera, but that the structural anatomical lesion or noxa is an important factor in the etiologic field. Pathological changes in several organs directly follow the artificially produced vertebral and rib lesions, showing beyond doubt the reality and effectiveness of the osteopathic lesion. This emphasizes the point that centrifugal impulses originate an inflammation in a previously healthy and uninjured tissue or viscus. And as “inflammatory phenomena may be sympathetically developed in regions innervated from the same area in the brain or spinal cord” it remains to prove the actuality of vertebral and rib lesions, i. e., structural perversions really affect contiguous nerve courses and vascular channels; and this has been demonstrated in laboratory experiments and at the autopsy. Consequently the vertebral, rib, or other lesion may be an important etiologic factor either to the nerve strand from cord or brain to viscus or from viscus to cord or brain.

Dr. Still says in his Autobiography that “all nerves depend wholly on the arterial system for their qualities, such as sensation, nutrition and motion, even though by the law of reciprocity they furnish force, nutrition and sensation to the artery itself.” It matters little in this outline whether obstruction to nervous integrity is by way of an impinged artery or by direct pressure, or both, or otherwise, for the primary consideration is the noting that the osteopathic lesion is a real and potent factor of disease. Sajous[25] informs us that “a neurone is directly connected with the circulation (via neuroglia-fibril) by one or more of its dendrites, which serve as channels for blood plasma,” that a neurone receives its nutrition directly from the general circulation, and that from the axone the blood passes into a lymph space connected with a vein. Thus in reality a part of the circulatory system is that of the entire cerebrospinal system.

The student is referred to the various publications of the Research Institute and Deason’s Physiology for experimental data confirming the validity of the osteopathic theory, although it should be emphasized that clinical evidence is quite conclusive. Malalignment injuries of the vertebral articulations, for example, ranging from imbalance of muscular tension to infections, is certain to result in some type of rotation and sidebending of the segments to an extent that apposition is compromised and abnormal anchorage supervenes. There are many factors of the pathology: muscular tension and fibrosis; damaged ligaments, particularly the capsular; interference of nervous stimuli, blockage of impulse directly and reflexly as shown by pathologic involvement in cord centers and sympathetic ganglia, and in certain cases direct obstruction of nerve fibers as revealed by Wallerian degeneration; involvement of circulation as shown by damage to blood-vessels, local edema and local acidosis, and effect upon local tissue respiration and drainage. Through a combination of these various factors circulation, nervous equilibrium and chemism of related parts are involved, both anatomical and physiologic balance is upset, and resistance of corresponding viscera affected. Reciprocal innervation and the axone reflex are also disturbed, all of which are important predisposing causes that disturb resistance of tissues and organs, upset their correlated mechanisms and render active various possible infections and toxins that otherwise a normal circulation, nervous and endocrine systems, and oxygen supply would rapidly and successfully combat and restore the organism to normal. Thus from the practitioner’s standpoint there are three points to always keep in mind: readjustment of the lesion; correction of the forces, habits, environment, etc. that produce the lesion; and hygienic attention of the body after lesion adjustment in order that normal condition may be maintained. A thorough study of the physiologic movements of the spine is a prerequisite to an understanding of the various possible abnormal appositions, though it should be appreciated that these movements are not consonant or applicable to many abnormal conditions. Pathology reveals many gradations and combinations not found in normal conditions. Frequently the key of a successful technique rests upon an understanding of the individual make up of the interosseous lesion.

It has not been the purpose of this section to go into details but rather to follow logically an outline of osteopathic etiology and pathology. The various details will be found in the osteopathic works on Principles as well as in the experimental articles referred to. It should be understood that the osteopath believes thoroughly in _vis medicatrix naturae_ whether the indications are for stimulation or inhibition or for the basic readjustment. Generally speaking, however, therapeutic philosophy resolves itself (ultimately) into the principle that a cure depends upon giving an impetus to impaired, habitual and latent forces, which in the osteopathic field implies fundamentally adjustive manipulation whereby the resultant impetus or physiological stimulus is initiated.

In a word, osteopathy premises that the body is a vital and physical mechanism subject to derangements, structural alterations, and functional changes, as results of violence on the mechanical plane, as well as disturbances on the psychic and biochemic planes. Hence, osteopathic philosophy is inclusive of preventive, palliative and curative measure.

FOOTNOTES:

[15] Sajous—The Internal Secretions and the Principles of Medicine.

[16] Foster—Medical Dictionary.

[17] Hulett—Principles of Osteopathy.

[18] Dana—Text Book of Nervous Diseases.

[19] Barker—Reference Hand Book of the Medical Sciences.

[20] Delafield & Prudden—Hand Book of Pathological Anatomy and Histology.

[21] Adami—Inflammation, Allbutt's System of Medicine.

[22] See Case Reports, American Osteopathic Association.

[23] Clark—Applied Anatomy.

[24] McConnell—Numerous articles Journal A. O. A. 1905-19, Bulletins Research Institute; Deason, Bulletins Research Institute, Deason's Physiology; Burns' Osteop. World, Aug. 1905; Basic Sciences, Bulletins Research Institute; Pearce, Osteopathic Physician, Nov. 1905.

[25] Sajous—Internal Secretions and the Principles of Medicine.

OSTEOPATHIC DIAGNOSIS AND PROGNOSIS

Osteopathic Diagnosis

In osteopathic diagnosis the spine is the first and greatest object of interest, for on the result of its examination will depend the treatment to be given which is in turn hoped to bring about recovery.

As it is the structure on which rests the weight of the body the practiced eye is able to detect at a glance, by the poise and gait of the patient, if there is an abnormal condition affecting any considerable area of the spinal column. It is well to observe these points, especially in the female, before having them prepare for examination, as it will often give a clue to sources of trouble through faulty carriage, improper dress, particularly corset and shoes. Slight changes of gait, unnoticed by the patient may be of great aid in determining the beginning of disease in the spinal cord.

No osteopath is justified in accepting a patient who will not permit every examination deemed necessary, as remote and obscure lesions are frequently the cause of disease, so preparation of the patient for the first scrutiny is of importance. This cannot be made with the patient fully clothed, as visual observation is second only to the touch in making one's deductions. Neither can palpation be made through more than one thickness of clothing with accuracy, and examination next to the skin is always preferable. This need in no way ever cause complaint, for with the use of a loose fitting short kimono, with all outer clothing removed except the knit undergarment, and with skirt bands loosed, a complete survey of the whole dorsum from occiput to coccyx can be had without the slightest unnecessary exposure. It is well to remember that the patient has come for help and the osteopath is not justified in sacrificing thoroughness for any exaggerated feelings of modesty. With tact and care in the use of the garments the most sensitive ones need feel no hesitation in coming for treatment.

A complete history of the case should be taken before the examination begins, former methods of treatment, symptoms, environment, etc., as it will aid in the final conclusions. It is well to have blanks for keeping records of all cases.

Probably the most comfortable manner to begin physical examination is to seat the patient on a table squarely with hands placed upon the knees, then raise the garment and expose the whole back. Begin by noting the texture of the skin, if it is clear, pigmented, blotched, or has eruptions. Try the capillary reflex by pinching or stroking quickly with the finger tips or the blunt end of a pencil. Find if it is moist or dry and also outline the areas of changed temperature, if any. Then observe the general contour of the spine with the patient sitting upright, to find how near it is to the normal body curve.

Occasionally having the patient alternately sit and stand will, by comparison, throw light upon the condition. With the patient bending forward place the hands on the crest of the ilia and see if they are of equal height.

Occupation may result in over development of one side or there may be congenital asymmetry[26]. Note position of the scapulæ and habit of posture in sitting and standing.

Before taking up the subject of a critical examination of each vertebra there are certain points it will be well to consider. It is easy to know instantly, without counting, the number of the vertebra causing the lesion if these landmarks are remembered: First, the spine of the third dorsal is on a level with the spine of the scapula. Second, the spine of the seventh dorsal is on a level with the inferior angle of the scapula. Third, the spine of the last dorsal is on a level with the head of the last rib. It will save much time for the busy osteopath to have these well in mind.

The =pathognomonic symptoms= of the osteopathic lesion are: (a) maladjustment; (b) contracted muscles; (c) tenderness; (d) limited movement. To these might be added changes in local temperature and disturbance of function, but the former is not constant and the latter may be remote. Here the primary lesion is considered, for an osteopathic lesion may be, also, secondary or compensatory. Forbes speaks of compensatory changes as being an important diagnostic sign.

Diagnosis of the position of a vertebra is sometimes difficult to the beginner from its having longer or shorter spines than normal. Horsley speaks of the occasional congenital absence of a spinous process. They may be bent laterally, upward or downward and thus have all the appearances of a marked displacement, while occasionally the body itself seems much at fault. These present what might be termed normal abnormalities and make it necessary for the osteopath to be very sure of his diagnosis before attempting to correct what is not abnormal, for disappointment, at least, and injury, perhaps, may follow.

To avoid mistake, carefully palpate the transverse processes and determine if they are at right angles with the adjoining normal spine. In the cervical and lumbar vertebræ it is possible to reach the tips of the transverse processes, and on moderate pressure, if a lesion exists, pain will be elicited. Further, where tenderness is associated with other diagnostic points it can be safely assumed that a lesion exists, and by outlining the suspected vertebra with the finger and localizing the sensitive spot one can be sure of the point of greatest irritation and the character of the displacement. Associated also with these signs will probably be evidence of congestion, such as thickened tissues, contracted muscles, etc.

After having examined the condition of the spinal column thoroughly by inspection, begin at the first dorsal and examine the spinal column down to the sacrum. Place the middle and ring fingers over the spinous processes and stand directly back of the patient and draw the flat surfaces of these two fingers over the spinous processes from the upper dorsal to the sacrum in such a manner that the spines of the vertebræ pass tightly between the two fingers, thus leaving a red streak where the cutaneous vessels press upon the spines of the vertebræ. In this manner slight deviations of the vertebræ laterally can be noted with the greatest accuracy by observing the red line. When a vertebra or a section of vertebræ are too posterior a heavy red streak is noticed and when a vertebra or vertebræ are anterior the streak is not so noticeable. Thus when suspicious points are noticed a special examination of the localized point can be given. This examination simply takes into consideration the contour and superficial condition of disordered portions of the spinal column. In a few cases such an examination will not be necessary, for the symptoms and signs of the disease will be so clearly manifested that one’s attention will be called directly to the cause. Still, great care should be taken in the majority of cases, as the osteopath finds causes of disease remote from the seat of complaint. We must always bear in mind the significance of reflex stimuli and sympathetic radiation.

In making a critical and exhaustive diagnosis of the spinal condition after the foregoing general examination has been made, it will be best to have the patient lie on the side upon the operating table. When the patient is in this position a more thorough examination can be made, as then the spinal muscles are not contracted unless abnormally so, for when a person is in the upright position muscles are continually contracting first on one side and then on the other, as one of their functions is to act as a support in keeping the spinal column erect. The patient lying on his side, the physician should then stand in front of him and reach over upon the back and make a thorough examination of the affected portions of the spinal column, chiefly through the dorsal and lumbar regions.

Consideration should be given the contraction of the muscles along the back, chiefly the deeper layers of muscles. It may even be necessary to relax some of the muscles before a thorough examination of the vertebræ can be made. From a pathological point of view too much stress should not be put upon the contracted state of the muscles; although in a number of instances the contracted muscles may be the primary cause of the patient’s trouble; especially so when the affection is due to atmospheric and other changes. Contraction of the muscles may be secondary to the lesions presented in the bony frame work. For instance, a dislocated vertebra may be the cause of an irritation to the innervation of certain muscles along the spinal column and thus cause them to

contract. Still, we must not lose sight of the importance of the contracted muscles from a diagnostic point of view. They are oftentimes prominent signs that a lesion exists in the immediate region and are thus faithful guides in locating the cause of diseases.

In closing the general consideration of the spinal column it is well to emphasize the importance of training the faculties to grasp at a glance the story told by the back as a region, instinctively placing the proper value on each physical sign and weaving them into a composite whole so that the patient's condition stands out a vivid picture on the osteopath's mind. When this is accomplished the more detailed observations are but incidental. Relative to the examination of the spinal column Clark[27] says: "To the osteopathic physician, the most important part of the human body is the spinal column. By its changes in contour and condition the various visceral diseases can be diagnosed, in most cases. I believe that every disease is characterized by extreme changes or signs, and I further believe that every chronic visceral disorder is manifest by changes in the spinal column that can be, by the practical eye and touch, readily interpreted. In short, there are various signs along the spinal column that point out the weakened or diseased parts of the body. This method of diagnosing disease, that is by noting these spinal changes, is distinctly osteopathic, and I believe the time will come when it will become such an exact science that the character of the spinal change or lesion is diagnostic not only of the viscus affected, but the way it is affected."

Regional examinations and diagnosis will now be taken up.

=Neck, Head and Face.=—To make a thorough diagnosis of the condition of the cervical vertebræ probably requires more skill and a more acute sense of touch than of any other region of the body. The irregularities and variations of the cervical vertebræ, the numerous muscles and the passage of many vessels through the neck are very liable to mislead one.

One may examine the cervical vertebræ by having the patient either lying down or in a sitting posture. The former position is preferable, as then the muscles of the neck are passive, and besides it is much easier to relax the muscles if such should be necessary. Also one has better control of the field of examination.

It is undoubtedly best for the student when learning to examine the cervical vertebræ to first examine along the base of the skull the condition of the occipital muscles (after the patient has assumed the dorsal position upon the treating table) for any contractions; for if disorder exists in the upper five cervical vertebræ the condition will be manifested by contraction of muscular fibres along the base of the occipital bone. The muscles of the occiput are supplied by fibres from the posterior branches of the upper five pairs of spinal nerves, and if lesions exist to these upper nerves a contracted state of more or less extent of the occipital muscles will occur, no matter how slight the lesion. Thus the examiner after locating contracted fibres under the occiput has a direct clue to lesions existing somewhere in the upper five cervical vertebræ. After locating these contracted fibres of the occipital region and then still keeping the finger upon the contracted muscular fibres and following them downward until the contractions are lost and seem to enter the spinal cord, one has then located the exact point of disorder that is causing the irritation to the muscular fibres involved, and most probably the cause of the affection from which the patient is suffering, i. e., provided one has reason to suspect the trouble is in the cervical vertebræ. Simply follow the contracted muscular fibre downward until it seems to enter the spinal cord and there one will find a lesion. After the osteopath has become expert in diagnosis this will not be necessary unless he has to make a very fine diagnosis or unless he is examining a stout neck where it is hard to examine through the heavy muscles. With this method one has a firm, flat, broad surface to work on (the occipital bone) making it very easy first to locate contracted muscles and second to trace the course of contracted muscles and thus find the disorder. Otherwise the beginner is apt to get confused by trying to examine the condition of the cervical vertebræ. Later, when a student becomes more expert such a procedure will rarely be necessary only in cases that require special work in the examination.

When the point of disorder has been located the diagnosis as to the exact character of the maladjustment has to be determined. The abnormal position of the vertebra, tenderness at the point involved, local contracted muscles, and limited motion are the four diagnostic points, although the temperature of the affected part as compared with the general cutaneous temperature and the state of the local vascular channels (blood and lymphatics) will occasionally be of aid.

Owing to the irregularity of the spinous processes of the cervical vertebræ in regard to their length, great care has to be taken in the examination. Probably there is no other region of the body that will tax the patience of the osteopathic student so much in his practical work as making a diagnosis of disorders in the cervical spine. It requires patient and persistent work to become a fair diagnostician of the cervical region, and it will take much experience to become expert in both the examination and treatment.

One can depend that lateral deviations of the spinous processes are abnormal in most instances. Placing the finger upon the spinous processes of two consecutive vertebras the student can readily tell whether or not there is any lateral displacement; but telling as to other features is impossible as the spinous processes vary greatly in length. When a vertebra is lateral, a slightly twisted condition will be felt by the finger when placed upon and between the two spinous processes.

To elicit the various degrees and combinations of rotation and sidebending one should depend upon the symmetry of the transverse processes. Reaching anterior to the sternocleidomastoid muscle, or better still, pushing the cleido muscles forward and reaching posterior to them upon the transverse processes, a very fair examination can then be given the vertebras. When the vertebras are deranged, especially anteriorly or posteriorly, that is the apposition of the articular facets, a slight elevation will be felt, possibly not any larger than a very small pea, either the anterior or posterior aspects of the transverse processes, depending upon which way the vertebræ are deranged. Remember that accompanying this slight elevation will be degrees of sensitiveness of the vertebra at the point deranged. In cases where the vertebra is lateral a slight eminence will be noted along the outside of the process. Commonly disordered vertebræ are not entirely deranged in one direction but are oftentimes slightly rotated, so we may find them dislocated antero-laterally or in various combinations of sidebending-rotation. Several consecutive vertebras may be deranged in like manner of direction; this condition is chiefly found in pathological curves of the spinal column. Probably the most common general lesion is a strained condition of several consecutive vertebræ, each one being nearly intact but all of them as a whole somewhat strained or twisted. Thus there are many pathological states to take into consideration, although it is not surprising to the osteopath when he realizes that many of our pains and aches are due to anatomical derangement. Frequently bending the head strongly forward and downward, or downward pressure with slight rotation will produce pain at the point of lesion.

Subdislocations of the =atlas= are probably among the most common lesions presented to the osteopath. Owing to the articulation of the atlas and occipital bone being an anatomically weak point and the neck muscles being exposed constantly to atmospheric changes, besides the articulation between the head and neck receiving the brunt of many jars, falls and strains, the atlas is especially susceptible to derangements. On account of the intimate relation of the atlas to the superior cervical ganglion of the sympathetic and to the vertebral blood vessels it is certainly very necessary that the atlas should be well taken care of. No other tissue maintains such a significant position in relation to the blood and nerve supply to and from the brain. To diagnose correctly the position of an atlas and to be able to correct it is undoubtedly one of the most essential achievements of the practitioner of osteopathy.

The most common disorders of the atlas are anterior and lateral displacements. Next in order come “rotary” lesions of the atlas, i. e., where the atlas has been deranged diagonally or simply twisted. It may also be luxated anteriorly and laterally, or posteriorly and laterally, etc. A posterior derangement of the atlas is comparatively a rare disorder, although owing to the many lesions that are found in atlases one has, during the course of a year’s practice, several to correct. The atlas may occasionally be slightly tipped laterally, anteriorly, or posteriorly, and in a few cases it may be somewhat impacted against the occipital bone. Many times when the atlas is displaced the axis is also deranged on account of the close relation between the atlas and axis by the odontoid process of the axis.

To examine the atlas the patient may be either in the sitting or dorsal posture; it matters but little which position is taken. Possibly the dorsal position is better, as then the neck muscles are more relaxed and if necessary an examination of the cervical spine, below the atlas, can easily be made.

By placing the middle finger of either hand on the transverse processes of the atlas when the patient is in the sitting posture, or the thumbs on the transverse processes when the patient is in the dorsal posture and comparing the two sides, undue prominence of one side or the other can easily be noted. Remember the transverse processes of the atlas are slightly above and posterior to the angle of the inferior maxilla. Always, in examining one side of the patient, compare it with the other; it may save considerable embarrassment. One side may seem abnormal when by comparing it with the other side, both sides may be found the same and still be normal. With the fingers still on the transverse processes note the distance between the process and angle of the jaw, besides take into consideration the tenderness of the locality, and, also, what is of essential importance in all interosseous lesions, its articular range of movements. There should be room enough (approximately) to just comfortably wedge the end of a medium sized middle finger between the transverse process of the atlas and the angle of the inferior maxilla when both are normal. Thus with the fingers on the transverse processes an expert will be able to readily determine whether or not an atlas is lateral or anterior. If an atlas is posterior the distance between the angles of the jaw and the transverse process will be increased, besides the atlas will be quite prominent posteriorly. In conjunction with the abnormality of the tissues (prominence or depression of the bone and state of the muscles) the sensitiveness of the locality is extremely significant.

Outside of displacements of the atlas, a lesion between the =axis= and =third cervical= is most common; following next in frequency are lesions of the =skull= and =atlas=. By that is meant where all the cervical vertebræ are intact as far as their individual relation is concerned, but the skull is forward, backward or lateral upon the spinal column. This condition occurs quite frequently. To determine its condition the same methods are employed as in diagnosing a deranged atlas; for if the dislocations exist between the atlas and skull the same diagnostic points are presented as far as the skull is concerned as when the atlas, or atlas and axis, are dislocated from the occipital bone or from the axis or third cervical. Following the preceding examinations, additional examination will have to be made to see whether or not the atlas is intact with the vertebræ below. If the atlas is found to be intact with the vertebræ below and lesions are presented between the atlas and the skull, then the disorder must be between the atlas and the skull and nowhere else. Occasionally there are cases where the skull is so far posterior upon the spinal column that the angles of the jaw strike against the transverse processes of the atlas when the jaw is opened widely.

Derangement of the =muscles= of the anterior and lateral regions of the =neck= are common. Especially are contractions of the muscles on either side of the larynx liable to occur. In examining the cervical region do not pay too much attention to the superficial muscles, but examine carefully the deeper muscles. It is from these that impingements of nerves and constrictions of vessels are likely to take place in the contracted fibres. Also, imbalance of muscular tension may be the source of the resulting malalignment. In examining for contracted muscles do not gouge into the muscle nor grasp the muscle roughly, but bear down lightly (inhibitory) upon the muscles and then gradually exert firmer pressure. By carefully and firmly exerting pressure over muscular areas the deep muscles can then be felt beneath the superficial ones. Otherwise when the muscles are manipulated severely the superficial ones will contract to such an extent that the deeper ones cannot be felt. The muscles contracting on either side of the larynx tend to draw the larynx downward and thus there may arise a source of irritation. The various muscles contracting in the antero-lateral region of the neck are very often the source of chronic irritations of the pharynx or throat. The omo-hyoid muscle may become contracted and cause slight traction on the hyoid bone and thus produce an irritating cough. To examine the muscles of the neck thoroughly it is best to have the patient flat upon the back, for then all the normal muscles are relaxed.

Lesions quite frequently occur in the =temporo-inferior maxillary= articulation. The lesion may be either unilateral or bilateral, more commonly the former. The disorder usually consists of a relaxation of the muscles and ligaments about the articulation which allows a slight but perceptible dropping of the inferior maxilla on the side involved. In other cases there may be presented a spasticity of tissue, while in still others some degree of joint infection may be found. Lesions of this articulation particularly impinge upon fibres of the fifth cranial nerve. The points of diagnosis are clicking and tenderness at the articulation. These two points are the symptoms of which the patient complains; those noticed by the osteopath are a slight deviation of the jaw to one side or the other when the jaw is opened and a flinching of the patient due to tenderness when pressure is exerted over the articulation of the jaw. When the physician places his fingers around the jaw, anterior to the angles, and the thumbs over the bridge of the nose, having patient open the mouth, at the same time exerting pressure with the fingers and thumb, a sharp click may be elicited by the return of the jaw into its articulation.

In disease of the =scalp= the condition of the muscles of the scalp should be taken into consideration. The muscles are usually found contracted. The contraction of the muscles is generally due, as well as the disease of the scalp, to derangement existing in the posterior branches of the upper five pairs of the cervical spinal nerves.

In the =neck=, anteriorly the =hyoid= is the only bone to consider. It is easily palpated by standing at the head of the table and with the second finger of each hand outline both ends to ascertain its relation with the thyroid cartilage. Note carefully any contracted tissue or glandular enlargements which might cause undue tension. The tilting of either end of the hyoid from these contractions is productive of much throat irritation. At the same time the =larynx= may be examined. It may be prolapsed, causing irritation of the laryngeal group of nerves. The =thyroid= and =cervical= glands should be palpated for enlargements, and all the muscles and ligaments for contractions. Externally the =tonsil= may be felt by deep pressure in front of the angle of the inferior maxilla.

=The Ribs.=—Under the osteopathic diagnosis of the ribs will be included the examination of the clavicle and sternum. To be able to diagnose intelligently, the position of the ribs in detail is very necessary to the osteopath. Many of the diseases of the heart and lungs, besides a large number of the diseases of the digestive tract, may be traced to a deranged rib; also, occasionally diseases of different regions of the head and neck may be due to dislocated ribs. In making a thorough examination of the ribs each rib should be carefully noted as to its position. The ribs may be examined when the patient is sitting up; but it is better to have the patient flat upon the back and especially so if the floating ribs are to be carefully examined, because the muscular tissues of the side if contracted will interfere with the diagnosis. In many instances the rib lesion is secondary to a vertebral subluxation.

An expert osteopathic diagnostician will be able to detect at once by a single passage of the hands down over the ribs if there are any disorders of them. In passing the flat of the hand, especially the flat part of the fingers over the ribs, carefully observe if the intercostal spaces are too narrow or too wide, and if any of the ribs are unduly prominent or depressed. If an intercostal space is too narrow it shows that the ribs on either side of the intercostal space are too close together. Then the question arises, which one of the ribs is crowding upon the intercostal space, or whether both of the ribs are crowded together. Usually when the sternal end of the rib is displaced upward, the involved rib is prominent and when displaced downward the rib is depressed. Thus it is commonly easy to diagnose which is the involved rib. Besides finding an abnormal position of the rib there will be more or less tenderness over the rib. Finding a rib prominent or depressed and tender is generally quite conclusive that the rib is displaced. Then the range of movement as expressed through the sense of resistance is a helpful guide in diagnosis.

If a =typical rib= is placed upon a flat surface and one end of it is depressed the other end will be elevated and _vice versa_. This peculiarity holds true as well when the ribs (typical) are dislocated in the living body. If the anterior end is elevated the posterior end is commonly depressed and _vice versa_. Care should be taken in examining the first rib and the false ribs, for in these ribs this peculiarity is not found.

As a whole a very complete diagnosis can be made of the condition of the ribs by examining the anterior part of the thorax, although it is always best to examine along the angles of the ribs if for nothing more than to confirm the diagnosis made at the sternal ends. Still it must be remembered that the preceding only holds good when the entire rib is dislocated. Many times simply one end of the rib is deranged and the other end is practically intact.

Besides careful examination of the sternal end of the rib, attention should be paid to the condition of the costal cartilages. The costal cartilages may become deranged at either the articulation with the rib or with the sternum. The same rule holds good when the costal cartilages are dislocated as when the ribs are dislocated, i. e., when the cartilages are prominent, they are usually displaced upward and when depressed the cartilage is displaced downward toward its neighbor.

One is apt to think that a rib is only dislocated at its vertebral end. Although lesions of the vertebral end are generally of greater significance as far as the etiological factors are concerned, still the sternal end of the rib must not be overlooked. In examining the vertebral end of a rib attention should be paid the angles of the ribs, for at the angles a better opportunity for examination is given on account of the prominence. It will be necessary in many cases to find out whether or not the vertebral end of the rib is lying between the transverse processes instead of in front of them. In many severe lesions of the ribs the vertebral end of the rib is dislocated upward or downward from the transverse process of the vertebra and lies between the transverse processes of the vertebræ above and below its attachment. This certainly requires considerable skill in the diagnosis, for oftentimes the point to be found is barely an eighth of an inch in diameter. It is usually best before making such a close examination to relax the tissues well over the field of examination.

The =ribs= as a whole may be too transverse or too oblique upon one side. This is chiefly found in pathological curves of the spine, but still such conditions may exist where there are severely contracted muscles, especially in some cases of paralysis. Thus the contour of the ribs must be taken into consideration by comparing one side with the other.

In examining the =first rib= an examination somewhat different from the other ribs should be given. It is best to have the patient assume a sitting posture; then place the middle fingers of each hand upon the first ribs near their centers and compare one with the other. Also note the difference of the spaces between the ribs and clavicles. Generally the first rib is dislocated upward, rarely downward. Besides finding an abnormal prominence or depression of the rib at its center considerable tenderness will be noticed. Examinations of this region are every day experiences with the osteopath.

When diagnosing the position of the =floating ribs= it is best to have the patient lie flat upon the back with the thighs flexed upon the abdomen, so that the tissues about the lower ribs may be entirely relaxed. Then by placing the flat of the fingers carefully over the ribs the outline and position of them can be easily discerned. The floating ribs are oftentimes found deranged and are the source of a great deal of suffering through the iliac regions. These ribs may become dislocated from the vertebral ends and drop down obliquely toward the iliac crest, or else the free end may become locked beneath the rib above. Occasionally both ends of the rib drop down quite perceptibly and consequently is the cause of considerable distress. In such instances the rib is depressed inward so that the normal contour of the lower thorax is lost.

An examination of the =clavicle= should be carefully made. Always compare the clavicle with its fellow and examine thoroughly its articulation with the sternum as well as at the acromial prominence. Often the sternal end of the clavicle is slightly dislocated

posteriorly to the sternum; although it may become completely luxated. The acromial end may be dislocated upward or downward.

In examining the =sternum= special attention should be given the articulation of the manubrium and gladiolus. This is due to the crowding anteriorly of the articulation of the sternal parts. Normally until well along in adult life there should be some movement here due to its membranous attachment. Occasionally the ensiform cartilage is turned inward, producing a tender point, but this rarely occurs. Also the articulation of the cartilages in the region of the eighth, ninth, and tenth ribs may be found considerably deranged, causing local tenderness and even stomach trouble.

=Dorsal= and =Lumbar Spinal Region=.—With the patient sitting on the table abnormal deviations can be readily noted. There may be lateral swerves, from muscular weakness, or unilateral tension, involving the whole spine or less, or a reversal of natural curves, i. e., the spine depressed anteriorly between the shoulders and posteriorly in the lumbar making the straight spine. There may be, also, an exaggerated normal curve in the dorsal region producing a kyphosis with a compensatory lordosis in the lumbar region sufficiently great to change its relations with the pelvis. By the method previously given, now outline the spinal column for lateral and bilateral scoliosis. These, frequently, are at their incipiency, and to the casual observer would pass unnoticed. It is well to make an outline of the spine before beginning treatment, and at times following, that progress may be observed. A simple method is lead tape which can be had from any plumber shop and can be molded to the deformity and traced on paper together with date of examination. H. F. Goetz has perfected an appliance for outlining and recording these deviations. Observe well the ligaments, as well as extent of joint movement, under deep palpation; from irritation they may become thickened and more or less fill the spaces about the spines and transverse processes, causing a rigid, smooth spine.

To make a detailed examination the patient should be stretched out on one side upon a treating table, although the general examination may be sufficient. Then, standing in front of the patient and reaching over him, a most careful diagnosis can be made. Do not stand back of the patient as the flat of the fingers can not be used to advantage in outlining the different vertebræ. The various contracted muscles that may be found along the spinal column will be of valuable aid in locating derangements of the vertebræ and vertebral ends of the ribs. By using contracted muscles along the spinal column as a guide for locating lesions, reference to the large superficial muscles is not made, but to the small areas of contracted fibres of the deep muscles. It is the deep muscles that become more or less contracted, and even fibrotic, when lesions of the vertebræ and ribs exist. The superficial muscles are generally contracted by atmospheric changes, slumped postures, wrong habits, etc., and are not generally the result of disorders in the osseous system. The preceding points in regard to contracted muscles cannot be too carefully observed for there is a tendency among many osteopaths to treat the contracted deep muscles as primary lesions in nearly every case. Remember that if they are not due to the motor nerve fibres of the muscles being irritated by the spinal lesion, or to a reflex stimulus, or to a compensatory change, that although the muscular tension may be the inception of the almost certain interosseous lesion, still the leverages secured through bony adjusting are very essential not only in correcting the osseous malposition but in loosening and releasing fibrous muscles and thickened ligaments.

=Thorax.=—Examination of the thorax as a region has been largely gone over in speaking of the ribs and their sternal attachment, cartilages, sternum and the clavicles, but its appearance as a whole should be carefully noted for it will be a valuable aid in diagnosis. Deviations from the normal, such as the emphysematous or barrel-shaped chest in asthmatic affections, or chronic cough, or accompanying kyphosis, the flat chest and its association with phthisis, the rachitic, etc., should be considered. Spinal deformities are reflected in the thorax by marked changes in contour, such as elevations and depressions corresponding to the spinal changes. These result in marked interference with the thoracic organs and in young subjects are of particular interest. Rib changes are frequently the result of vertebral deviations.

=Abdomen.=—The position for examination of the abdominal viscera is usually with the patient supine, head slightly elevated, knees drawn up partially and supported to relieve any muscular strain, and with the hands at the sides. In this position complete relaxation is obtained. Observe any enlargements from gas, fluid, or tumor, muscular changes, color, etc. The patient may, also, be placed upon the side, and in the knee-chest position for further verification of the diagnosis. Where the abdominal wall is much relaxed, or there is a pendulous abdomen with enteroptosis, there will be found a change of relations of the viscera by these different positions, allowing them to be palpated in another position. When there is marked tenderness it is often possible to go deeper with less discomfort with the patient in the knee-chest position. The Trendelenburg position may also be utilized. Where ascites is suspected palpation should be made with the patient in various positions in order to note changes of location of the fluid. Frequently much can be learned by inspection with the patient standing. Clues to visceral disturbance can often be had by tracing the nerve connection from the spinal lesions to the suspected part.

In examining the =liver= care must be taken that any gouging or severe bruising of the organ does not take place. The liver can be outlined by percussion and also by palpation of its lower and inner borders Congestions, atrophy, enlargement or hardening should be noted, also any change in position.

A rather complete examination can be given the =biliary tract= from the =gall-bladder= to the =duodenal orifice= of the =biliary duct=. By a careful inhibitory pressure over the duct the outline of the tract can be discerned providing the patient is not too stout. When the tract is swollen considerable tenderness will be present. The patient will complain of a stabbing or piercing pain upon pressure and manipulation if the duct is inflamed.

Usually the tenderness is greatest nearer the =duodenal orifice=. The duodenal orifice is about one and one-half inches diagonally downward to the right from the umbilicus. In cases of impacted =gall-stones= the osteopath as a rule has very little trouble in locating the stone.

The =spleen= may be percussed and when in a markedly enlarged condition its lower border can be palpated. Great care must be used in the latter condition as there is danger of rupture.

In examining the =stomach= the usual methods of inspection, palpation, percussion, analysis of the contents, etc., are employed.

Palpation and manipulation over the =intestines= are practiced a great deal by the osteopath in various intestinal diseases. By his educated sense of touch he is usually able to locate at once any =impactions= of =fecal matter=. Such impactions are generally found in the ilio-cecal and sigmoid regions. In the various acute =obstructions= from invagination, tumors, twists, adhesions, spasticity, knots, etc., many times one is able to readily locate the seat of the disturbance. There is one point to specially emphasize; that is, do not overlook prolapsed regions of the intestines; such occur frequently and are a source of considerable distress, especially constipation. Simple manipulation will never do much good, neither will spinal treatment or injections, as a rule. A specific treatment must be given and, that is, after locating the exact point of prolapse, to reach carefully beneath the fold and replace it.

In emaciated subjects the =kidneys= can be readily located, and in a few instances when they are diseased one can feel the contracted tissues about them. Be very careful not to injure the =capsule= about the kidney. Do not punch or gouge them in the least; but locate the kidneys by a careful inhibitory palpation.

=Lumbar and Pelvis.=—The intimate relation between the lumbar spine and pelvis make a consideration of them as a region necessary. Outside of ordinary curvatures involving both the dorsal and lumbar regions there are certain conditions which involve but one structure and require careful differential diagnosis to determine whether the lumbar or pelvis is at fault. In the former the fifth vertebra is a weak point and is most frequently at fault. The deviations are usually a sidebending and frequently accompanied with some rotation. Occasionally a malstructure of the lower lumbar or pathologically relaxed ligaments will approximate the spines and be misleading as to the real condition. A rotation or lateral tilting of the fifth lumbar may have the effect of elevating the crest of the ilium so that the innominatum would appear involved. There will be a difference in the length of the legs, angles of feet when patient is lying on the back, anterior spines out of line and tenderness of the muscles attached near them. However, other diagnostic points of innominate lesions, i. e., tenderness of symphysis and sacro-iliac articulation, and prominence of the posterior spine, will be lacking. Marked deviation of other lumbar vertebræ may produce practically the same effect, but the lesion will be so apparent that there will be no doubt as to the cause.

To be able to diagnose accurately and intelligently the pelvic region requires nearly as much skill as in examining the cervical region. The pelvic bones are liable to many subdislocations, especially in the female. However, it should be remembered that many apparent innominate lesions are secondary or compensatory changes due to lumbar lesions. The pelvis as a whole may be tipped anteriorly or posteriorly upon the spinal column. It also may be twisted or rotated laterally upon the spinal column. The most common lesions are subluxations of an innominatum forward, backward, upward, or downward, or various combinations of these displacements, such as a tipping forward and downward of an innominatum, or a tipping backward and upward, but these combinations do not always exist in the manner given. As a rule when the ilium is anterior, the ischium posterior, then the innominatum as a whole is downward; when the ilium is posterior, the ischium anterior, then the innominatum as a whole is upward. This is only a rule, there are exceptions to it; for in some few cases when the ilium is anterior, the ischium posterior, the innominatum may be higher, and when the ilium is posterior and the ischium anterior the innominatum may be lower.

To be able to diagnose such derangements will require skill and practice; still there are symptoms and signs that are characteristic of such disorders. In examining the pelvic bones have the patient flat upon the back at first. Be sure he is flat upon the back for a very slight variation may make considerable difference in the relation of the pelvic bones, one to the other, so far as the diagnostic points are concerned. Then go to the feet of the patient and grasp the ankles firmly, rotate laterally both legs, first to one side and then to the other, as well as pull and push both limbs slightly, and then bring the heels together directly in the median fine of the body and compare the length of the limbs at the heels. If there is any disorder whatever in one innominatum, and the thigh muscles have been relaxed thoroughly by the preceding movements and the heels are brought together in the median line of the body, a difference in the length of the limbs will readily be observed at the inner malleoli or the heels. For if the ilium is forward the ischium must be backward and as a rule the innominatum is thrown downward, thus causing an apparent lengthening of the limb which will be noticed by comparing the heels; if the ilium is backward the ischium must be forward and as a rule the innominatum is then upward, causing an apparent shortening of the limb on the affected side. A very slight variation in the pelvis will make considerable difference in an apparent lengthening or shortening of the limbs. Such conditions are generally met with several times a day by osteopaths. The object of the lateral rotary movement and the pushing and pulling of the limbs is to make sure that all the thigh muscles are thoroughly relaxed, for it is a very easy matter for contracted muscles in one thigh to produce an apparent shortening of the limb. Also be very careful in comparing the length of the two limbs at the heels where they come together that they are exactly in the median line of the body, for if they should be to one side or the other, however slightly, there would be an apparent lengthening of the outer limb as compared with the limb near the median line. While the patient remains flat upon the back it is a good plan to compare the anterior spines of the ilia. It may be readily noticed that one is higher or more depressed than the other, which will help to confirm the diagnosis. It is a good plan also to have the patient sit up squarely upon the table and compare the crests and posterior spines of the ilia; thus one may be seen to be higher than the other. Then, also, note the angles of the feet when patient is supine; an everted foot usually means that the limb is shorter due to the tilted pelvis; the opposite is commonly true when the foot is inverted. However, this is not an absolute rule. Care should be taken in differential diagnosis of possible old fracture of leg, of infantile paralysis, of asymmetry, etc.

There are =three diagnostic points= exclusive of all other signs that are quite conclusive when coupled with the preceding examination. If an innominatum is dislocated or subdislocated there will be tenderness over the symphysis pubis on the side affected, tenderness over the ilio-sacral articulation on the side affected, and tenderness along the crest of ilium where the abdominal muscles are attached. When tenderness is found at these three points it is quite conclusive that the innominatum is deranged, for at the symphysis pubis and ilio-sacral articulation tenderness must exist if the innominatum is disturbed, and by a change in the crest of the ilium the abdominal parietes will be affected, provided they are not too much debilitated. Marked tenderness of the external cutaneous nerve as it passes over the crest of the ilium below the anterior spine will be noticed on the unaffected side (Dr. Still). There will be, on rectal examination, marked tension of the tissues on the affected side. Possibly the patient may complain of pain exclusively in one side along the pelvis and limb which will be a leading symptom telling which side is affected.

=Additional diagnostic= signs will be rigidity of muscles along the ilio-sacral articulation and abnormal prominence or depression of the ilium at its articulation with the sacrum, depending upon which way the innominatum has slipped. Considerable deviation of the pubic bones may be noticed. The pubic bone on the side affected may be either thrown upward or downward.

Radiographs have repeatedly revealed subluxations of the innominate bones in many instances. This is certainly quite conclusive in confirmation of the osteopathic ideas in regard to the pelvic bones becoming dislocated.

=Sacrum.=—Examination of the sacrum is best made with the patient lying on the side, with the osteopath standing in front and with the hand palpate its posterior surface. In the sitting posture its relation with both innominates can be determined. It is displaced posteriorly but seldom, the most frequent being anterior, downward, and a combination of the two. In the anterior conditions tenderness at the sacro-iliac articulations is a good point, but it must not be confounded with an innominate lesion. The downward displacement is shown by comparison with the lower lumbar vertebræ. Observe the relation between the two, as a change in contour of the spine will also change the angle of the sacrum and _vice versa_.

=Coccyx.=—With the patient and operator in same position as for the sacral examination outline the coccyx, as to first, =contour=; second, =rigidity=; third, =sensitiveness=. If abnormalities are detected go to the other side of the table and with a well lubricated index finger palpate its anterior surface. Changed contour, displacements, and old fractures can be readily determined. The most common deviation is anterior at its union with the sacrum. The lateral form generally resulting from muscular contraction is next, with posterior but seldom. “If the lower part of the sacrum is rotated backward, the sacro-coccygeal articulation or angle is affected

or becomes more acute, since the tip of the coccyx is not displaced, but held in position by structures attached to it. If the sacrum is displaced downward the effect is about the same. Often this sort of sacral lesion is mistaken for an anterior luxation of the coccyx."[28] Remember that normally there should be some movement of the coccyx. It has a fibro-membranous articulation.

=Uterine=, =ovarian= and =rectal= examinations are largely of the same nature as those given by other practitioners, although osteopaths find that oftentimes other practitioners are mistaken in regard to the etiology of many diseases to which these organs are subject.

=Arms= and =Legs=.—There is comparatively little that is exclusively osteopathic in regard to the diagnosis of disorders of the arms and legs. One important feature that the osteopath finds in examining the arms and legs is that many of the disorders supposed to originate in the affected member are found to be caused from vertebral or rib dislocations. Innominate and lumbar lesions are particularly fruitful sources of trouble in the legs and feet. Always carefully examine the spine in the region of innervation to the arms and legs when they are affected. The shoulder and hip joints, as well as all joints, are subject to partial dislocations. Many times when pain or other symptoms are presented in the arms or legs the trouble is at the shoulder or hip joint or in the spinal column. There are two regions that are very apt to be overlooked in the examinations of the arms and legs and they are the elbow joint and the fibula. The small bones of the =ankle= and =wrist= as well as of the foot and hand are subject to many dislocations which are easily discerned upon examination and often overlooked. Special emphasis should be given in regard to many supposed diseases of the knee joints which are really caused by lesions in the spine or at the hip joint.

Osteopathic Prognosis

Everyone is of the opinion that to forecast the probable result of a disease is one of the most difficult problems the physician has to meet. To state the duration, course, and termination of an attack of disease as presented by its nature and symptoms implies an accurate knowledge of both disease processes and changes, and an insight into the individual's idiosyncrasies backed by ripe clinical experience. And after each of these factors has been carefully considered to balance one against the other, nothing short of superhuman knowledge may present a sufficient insight in order to render an accurate prognosis. A prognosis represents the culmination of one's learning, an understanding of disease characteristics, and an insight into temperament.

C. M. T. Hulett[29] says: "Only when we can know all the conditions, causative and sequential, with their possible complications and terminations, together with a full history of therapeutic results in a large number of similar cases, and carefully analyzing and weighing these various elements, are we prepared to really make a prognosis." Nettie H. Bolles[30] writes as follows: "The prognosis depends upon the cause of the disease, the possibility of removing the cause, or the likelihood of recurrence of causes, and the chances of avoiding such recurrence. The circumstances to modify the outlook are various and deserve careful consideration." It is not the purpose here to go into the many essential details, for that would mean an outline and forecast of all disease processes, and the effect of numerous extenuating circumstances. The medical profession have been gathering data for these three thousand years and prognosis with them is still inaccurate and incomplete. Osteopathic science will add just so much to the accuracy of prognosis as the sum total of the knowledge displayed in the fields of osteopathic etiology, diagnosis, pathology and therapeutics. Suffice it to give here a few salient practical hints as noted in the osteopathic treating room and at the bedside.

Osteopathically it may be said that prognosis depends, first, upon the true conception of osteopathy; second, upon the relative value of all factors pertaining to health and disease; and, third, upon the skill (technique and native ability) of the osteopath. The first and second being granted, the third includes a remarkably practical and pregnant field, for in no school does the physician get into as close touch and understanding of the actual condition of the patient's disorder as in the osteopathic. Although the fundamentals and principles of the osteopathic conception of diseases are really broad, liberal, and all-inclusive, still owing to the fact that each individual (and thus each disease) is more or less a law unto himself should there not be absolute tables and prescriptions to be governed by; remember, however, this does not imply our fundamentals are not basic or our principles are not truths, but rather the application and execution of the same are as varied as the individual's constitution, temperament, and disease. Herein rests the really difficult practical consideration of etiology, pathology, diagnosis, treatment, and prognosis. In other words, if the diagnosis and treatment are accurate the result rests entirely with the patient.

First, too much emphasis cannot be placed upon the fact that prognosis is dependent upon the osteopath—his education, training, ability, experience, and technique. One's fitness is most important. And fitness and personality complement each other. An osteopath may know theory and still not be practical; still one cannot be practical unless he knows theory.

Second, osteopathic treatment frequently changes the usual course of acute disease. It is well known that many diseases have a certain regular course in their history. Many times the osteopath will be able to abort, lessen the severity, or cut short the ailment, thus changing the recognized symptoms and termination.

Third, the knack of treatment, or knowing how to treat, not only one region of the body but all regions, not only one temperament but all temperaments.

Fourth, the preparatory treatment before correcting the lesion. Prevention, palliation, or cure, and thus prognosis, may be dependent upon a necessary preparatory treatment. Here is where a study of the patient's temperament is very essential.

Fifth, a prolonged treatment may defeat one's purpose. As a rule a comparatively short, thoroughly indicated, specific treatment is best.

Sixth, much, relative to prognosis, can be told by the tone of the vertebral ligaments. When a lesion corrects too easily or does not remain well in place it shows a lack of tonicity on the part of the ligaments and muscles. Improvement is in direct ration to the increase of tonicity.

Seventh, special care should be taken with the irritable spine. This spine commonly precedes the debilitated spine. Unless precaution is taken to apply inhibition before treating specifically a cure may be prevented or at least the disorder prolonged.

Eighth, relaxation of muscles is not always essential, although the lack of it may prevent the correction of primary lesions. The relaxation should be carried out with care in order that all shock and irritation may be kept at a minimum.

Ninth, needless stretching, traction, extending, rotation, and snapping of the neck is not only useless but may be positively dangerous. Rarely is it necessary to go through the above "movements" as many are accustomed to do.

Tenth, it may be necessary, but not always, to give as additional treatment, after the anatomical defect has been specifically treated, a certain amount of stretching and moulding of the parts.

Eleventh, owing to the close personal relations of physician and patient, personality has a powerful influence on prognosis.

Twelfth, too much emphasis cannot be placed upon the uselessness and injurious effects of over and misapplied treatment.

All of the above have a positive bearing on prognosis. The osteopath should study his technique well. He will find that it gradually changes and improves from year to year. In a word, as he gains in experience he will become more skillful by giving careful attention to the development of the sense of touch, by noting the resistance of the tissues, and a score of details that are very hard to describe but the sum total of which determines and indicates the successful osteopath.

Another practical point that bears upon prognosis as well as upon the health of the osteopath is the manner of giving treatment. First, the height of the treating table should correspond to the height of the practitioner. The table should be made for the practitioner and not the practitioner fitted and warped according to a certain table. Second, give part of the treatments on a treating stool. Here there is greater freedom of movement on the part of the patient, hence greater and more effective leverage can be obtained. Suit your treatment to the patient, not your patient to the treatment. Third, make your weight count for energy expended in the treatment. As soon as one set of muscles become tired substitute another set, e. g., the back muscles and the arms, the arms and the hands. Fourth, whenever possible substitute the weight of the patient for expended energy. Fifth, when lifting keep the spinal column straight; do the bending of the body at the knees. Hence a better treatment and a more favorable prognosis, and besides that new occupation neurosis, the "=osteopathic back=," will be materially lessened in both severity and frequency.

FOOTNOTES:

[26] See Tubby, Deformities.

[27] Clark's Applied Anatomy, p. 334.

[28] Clark's Applied Anatomy, p. 331.

[29] Prognosis—Journal of the American Osteopathic Association, Jan., 1906.

[30] Prognosis—Journal of the American Osteopathic Association, Nov., 1902.

OSTEOPATHIC TECHNIQUE

The technique of treatment is, in a sense, a personal factor, for it is a well known fact no two osteopaths treat just alike. Nevertheless, the principles of technique are constant and universally applicable, and he who applies them with specificity manifestly secures the best results, and exhibits a technique that is finished and characteristically osteopathic. General manipulations are not essentially osteopathic, although by employing them a few definite results may be obtained; still such technique should not be classed as distinctive osteopathic therapy. Every case is a law unto itself and must be studied individually in order to be able to understand it perfectly. So much depends upon the ability of the osteopath in the treating of a case, that in order to meet the indications intelligently he must have command of the various anatomical details of the body, not only in his mind but upon his finger tips.[31]

The =sense of touch= should be very acutely developed and this requires months of persistent, practical experience. A carefully educated sense of touch is the keynote to both osteopathic diagnosis and operative technique. From the very nature of the osteopathic conception—the physical body viewed as a mechanism whose disordered or diseased conditions demand anatomical readjustment—it is imperative that a delicate and educated sense of touch be acquired in order to logically and successfully apply its tenets. Proficiency means not only being able to note certain small physical irregularities, and various degrees and areas of muscular contractions, and variations in body temperature, but the extent and state of vital resistance, that is, tissue condition, and the feeling of organic resistance, e. g., the heart, lungs, liver. These are the special features wherein osteopathic fingers detect disease causes and traces. To know the difference between normal and abnormal structural deviations and distortions, as well as organic changes, requires an accurate, detailed knowledge of anatomy and pathology with a systematic daily education of the sense of touch; but to realize, appreciate and know by tissue resistance feeling that nutritional condition is improving requires much more practical experience.

Thus two very practical points should be taught to and thoroughly impressed upon every osteopathic student: First, =the sense of resistance of the tissues=. This gives us an absolute clue to the vitality of the patient. As has been stated, there is a vast difference between the feel, the sense of resistance, of normal and abnormal tissues; for instance, a normal muscle and a contractured muscle, a normal liver and a congested liver, a normal intestine and a prolapsed intestine and these differences comprise innumerable gradations.

Second, =the receptivity of the patient to treatment=. This is dependent upon the vitality of the tissues. The sense of resistance to touch gives us an important diagnostic clue; the receptivity of the patient to treatment tells us much as to prognosis. After a few treatments the receptiveness will be positive or negative; that is, the patient is, or is not, responding to treatment. Consequently the receptivity of the patient usually tells much as to the state of nutrition.

Definite principles should be followed when applying the technique, for the osteopathic lesion is a “structural perversion,” thus indicating mechanical readjustment for its correction. The time is coming when the technique will be taught graphically and mathematically. This would not be a difficult thing to do, and it could not but prove invaluable aid to the student. He can then the more readily and comprehensively grasp the principles involved. To resolve and illustrate manipulative readjustment to and by the principles of mechanics would add considerable to osteopathic development. For example, how nicely the correction of certain innominata maladjustments illustrates the principle of the wheel and axle. Vertebral and rib displacements when readjusted make application of the principles of the simple machines. We are gradually approaching a more comprehensive understanding of the physiologic movements of the spine and of the etiologic role of muscle tension. This is part of the foundation work. Great care must be exercised in correlating this data with the individual case, for in therapy we are dealing with abnormalities—not alone normal physiologic changes. If our distinctive dynamics and therapeutics were taught in this manner the average osteopath would be more specific and comprehensive in his work and as a consequence more scientific. And consequently the principles involved in each and every case would stand out clearly. Hence diagnosis would be more exact, routine pommeling discarded, and better all around technique executed.

Two general rules are applicable to all dislocations, whether partial or complete: 1. Exaggerate or increase the dislocation. This is to relax the tissues about the dislocated articulation and to disengage the articular points that have become locked. 2. Reduce the dislocation by retracing the path along which the parts were dislocated. Hence to =correct= a =lesion=, for example, a vertebral lesion: (1) Exaggerate the lesion. (2) Place the fingers of the hand that are not employed in exaggerating the lesion over the extended portion of the lesion. (3) Extend the region that is flexed when the lesion was exaggerated. (4) When the lesion is being extended produce traction and slight rotation of the region. (5) At the same time extension, traction and rotation is being produced

push in upon the extended portion of the lesion. To this might be added for sake of clearness and greater assurance of success: (a) Be positive the focal point absolutely corresponds to the lesion, or else most if not all of your effort will be useless. (b) Just before reaching the maximum of exaggeration have your fingers correctly placed for the readjustment, and at the very moment of maximum exaggeration or just a fraction of a second prior begin to correct or readjust, or else you will lose the vantage gained and the operation will probably be a failure. (c) The general traction and rotation are to aid in unlocking the lesion, not to readjust as some may think. Inhibiting and releasing the soft tissues, such as spasms, contractions and contractures of muscles, and stretching thickened and adherent ligaments is very important preliminary work. Then, next to securing exact leverages an essential point is to maintain the release or exaggeration until the readjusting step is incepted. In other words, coordination of all factors is the desideratum. The lack of this is the cause of many failures. Hot fomentations frequently assist in relaxing irritable and spastic soft tissues. This, however, is but a preliminary measure. All rough handling, needless snapping of parts, and excessive rotation and stretching are not only apt to tighten the lesion more, shock the system and irritate the parts, but it may be absolutely dangerous.

It should not be forgotten that the osteopath includes many measures in his treatment of various diseases, as nursing, dieting, hygiene, sanitation, hydrotherapy, antidotes, antiseptics, etc., and does not depend upon readjustive manipulation alone, although correcting disordered anatomical structures and perversions are paramount in the treatment.

=The General Treatment.=—A general treatment but accentuates the ignorance, in a majority of cases, of many so-termed osteopaths. It is a deplorable fact that there is a tendency among some osteopaths to give general treatments in every case presented. The only explanation of such a procedure that one can think of is a lack of conception as to what osteopathy really is. To give a general treatment in every case is not only actually detrimental to the patient but it is the height of folly on the osteopath's part, for it gets him into a slovenly habit of procedure from both scientific and curative points of view, besides giving the outside world an impression that osteopathy is but little different from massage and Swedish movements instead of skillful, mechanical engineering of the human body. But a "general treatment" is not to be confused with definite attention to be a series of more or less interrelated lesions. The essential point is to normalize the body when and where distinctly indicated and after a skillful manner.

A general treatment, broadly speaking, should be given only under three conditions: (1) Constitutional diseases that are to be treated symptomatically. (2) Certain anemic cases. (3) When one is ignorant of the real cause of the disease. Each of these conditions is self-evident why a general treatment should be given. A fourth might be added, for those individuals who think they are not getting value received unless they are treated from head to foot. Such patients are usually ignorant of the philosophy of osteopathy and it is the osteopath's duty to teach them differently.

The general treatment consists in stretching the spinal column from the atlas to the coccyx and relaxing all contracted muscles along both sides of the spinal column, besides giving special treatment to the cervical region, between the scapulæ, the splanchnics and internal and external rotation of the legs. It is no wonder that fake osteopaths do cure a case occasionally. They are quite certain to correct some disorder by pulling and hauling a patient around in such a manner. Still on the other hand they are very likely to do injury to the patient. Those who claim that no injury can come from osteopathic treatment are mistaken. One can injure a person by treatment if he is not careful. It does not stand to reason that the most delicately constructed mechanism should stand any amount of manipulation and misdirected force that may be given it.

=Positions of the Patient and Physician in Treating.=—The position of the patient when a treatment is given depends altogether upon the affection to be treated. Probably about one-half of the cases can be treated to advantage upon a table, the remainder sitting on a stool. Many osteopaths treat nearly all their patients upon a table. It is much better to change back and forth, because to correct a certain disorder may be hard upon the table, but will be comparatively easy when the patient is on a stool, and _vice versa_. Besides, constantly changing back and forth rests a physician greatly.

Learn to treat in various positions, because it will be impossible to have all cases assume a certain position when being treated; and especially in treating acute cases one is obliged to suit his treatment to the patient and not the patient to the treatment. There is also a tendency for one to get into slovenly habits of treating when patients are all placed practically in one position, and certainly one cannot treat all cases in one position to equal advantage. Also learn to treat as well with one hand as the other. Many times one will be in such positions that equal use of either hand will be required. Carefully educate the sense of touch in both hands.

Another point should receive consideration: learn to shift the strength exerted in treating from one set of muscles to others. For example, when one is standing for a long time he will continually shift his weight from one limb to the other. In the same manner in treating use the strength of the hands awhile, then the arms, then the muscles of the back, then the weight of the body, etc.; all in

such a manner that there is a constant change by utilizing certain groups of muscles for the same work, as well as utilizing the weight of the body of both physician and patient to advantage. It rests a physician greatly and thus allows him to perform a maximum amount of work with a minimum amount of strength and labor.

It is frequently an advantage to the physician to treat upon the nude skin, thus preventing the fingers from becoming tender. Gowns can be easily made that open down the back so that the patient does not have to disrobe.

=The Neck and Head.=—In the treatment of the neck the patient may assume the sitting posture or lie flat upon the back. The latter is preferable, as then one has complete control of the neck and head. Absolute control of a part is always necessary and when this is secured the dangers are reduced to a minimum, provided always that reasonable discretion as to the amount of strength, is used. Before correcting the various deviations of the cervical vertebræ it is usually best to thoroughly relax all the muscles, superficial and deep, about the field of operation. In relaxing muscles three methods may be employed. The muscle may be firmly grasped and manipulated until relaxed, or a firm pressure may be exerted upon the muscle and thus inhibit its nerve force until the muscle relaxes, or the muscle may be longitudinally stretched. The second method is comparatively slow and is usually given in acute cases where the patients are so weak and exhausted that they cannot stand any severe manipulation. This method, however, has certain advantages when employed as a preparatory step in interosseous adjustments, though steady traction accompanied with slight rotation, if precisely localized, has many advocates.

In relaxing muscles by manipulation, grasp firmly the belly of the muscle and draw outward on the muscle several times until it relaxes. If the patient is sitting, place one hand upon the head of the patient or about the chin in such a manner that complete control of the head is maintained throughout the procedure; then with the fingers of the other hand upon the contracted muscular fibres a manipulating or kneading of the muscle can be given. It is best to flex the neck and head to the side where the contracted muscles are, so that a better hold of the muscle may be maintained; then by a series of flexions and extensions with manipulation of the contracted muscles outward, results can be readily obtained. When the patient is lying on the back the physician may stand to one side of the patient's head and with one hand on the forehead of the patient and the other hand around the opposite side of the neck, a rotary motion of the head and neck, which is equal to flexion and extension in the sitting posture, may be given by the hand on the frontal region while the other hand relaxes the muscles; or the osteopath may stand at the head of the patient and with either hand on the side of the head and neck of the patient a series of rotary movements of the head and neck may be given with manipulation of first one side of the neck and then the other; the hands and fingers being placed in such a manner that when the fingers of one hand are relaxing the muscles on its side the other hand is executing the movements of the head and neck, each hand continually alternating in the work. This latter method requires some practice in order to do the work readily and successfully, for quite a variety of movements are required.

In the former method after one has worked on one side he is obliged to change to the other side and go through the same process. Movements may also be given to stretch the contracted muscles, thus overcoming the contraction and producing relaxation of the muscles.

After having relaxed the muscles over the field of operation, correcting the vertebræ will generally be easier to accomplish. In readjusting an atlas it matters but little whether the patient is sitting up or lying down. A firm hold of the atlas can be gotten in either instance. In correcting the middle and lower cervical vertebræ it is best to place the patient upon the back.

In correcting dislocations, as heretofore suggested, two general rules should be followed: (1) Exaggerate or increase the dislocation. This is to relax the tissues about the dislocated articulation and to disengage the articular points that have become locked. (2) Reduce the lesion by retracing the path along which the parts were dislocated. One can readily see that a dislocated ball and socket joint could be reduced only by the dislocated bone retracing the path by which it left its socket, for the capsular ligament would at once prevent its returning to the socket by any path other than that taken when dislocated. This applies to all dislocations to a greater or less extent.

After locating the exact position of the abnormal vertebra the first rule is applied, i. e., exaggerating the lesion by flexing the head in the opposite direction to which the vertebra is dislocated. Then with one or two fingers placed firmly upon the side of the vertebra in the direction dislocated, so that when the proper time comes the vertebra may be pushed or slightly rotated back into its normal position, with the other hand produce flexion of the neck, so that the angle of flexion is exactly over the involved vertebra; next produce slight traction, so as to be sure that the articular points will be disengaged; and then with rotation and extension of the head to a normal or upright posture, at the same time pushing in on the disordered vertebra, are the movements to be executed in

reducing a dislocated vertebra. It takes considerable practice to be able to correct a vertebra and to know when it is corrected. The amount of force applied varies greatly in different cases. Cases of recent subdislocation require but little force unless there is marked spasticity of tissue, while in long standing cases many times the amount of force required is about all that one wishes to exert. As a rule in many chronic cases it is better to give a series of preparatory treatments in order to reduce muscle fibrosis and thickening of capsular ligament. Remember that often it is a slight rotary movement or twist given that aids the most in executing rule second. No matter to what position a vertebra is rotated or side-bent the principles applied are the same in each case.

Be very careful when flexing, extending or rotating the neck that too much strain is not brought to bear upon the ligaments. Some osteopaths seem to take delight in rotating and flexing the neck to a great degree. It is a dangerous procedure and moreover does not accomplish anything in particular. It should be kept in mind that osteopathic treatment is scientific and not a number of general movements of various regions of the body. Locate the lesions exactly and then a specific treatment can be given in every instance. To illustrate the treatment according to the preceding rules we will assume that a certain cervical vertebra is anterior, say the fourth cervical. This means that there is an interosseous lesion between the fourth and fifth. The inferior articular processes and facets of the fourth have slipped upward and forward on the opposing facets of the fifth. First, hyperextend the head in such a manner that the fulcrum comes exactly over the displaced articulating planes, thus throwing the fourth vertebra still more anterior, or in other words, exaggerating the lesion or increasing the space anteriorly between the fourth and fifth cervicals, so that when the head is flexed forward and pressure is exerted upon the anterior part of the vertebra (body or transverse process) the vertebra will have room and release enough to occupy its normal position. Second, when the head is hyperextended place a finger anterior to the transverse process of the dislocated vertebra and with the other hand around the head, that is producing the hyperextension, throw the head forward with slight traction and rotation and at the same time push posteriorly quite strongly upon the dislocated vertebra. Follow out the same principles in all cases, no matter in which way the vertebræ are deranged.

There are several methods of applying the underlying principles of adjustment. Relaxation and leverages may be secured in various ways. Preciseness, expeditiousness and skillfulness can be attained only by considerable personal experience.

In cases where the lesion is between the skull and atlas have the patient sit on a stool with the back part of his head against your chest, and reach around the head with one hand under the chin; then with the other hand around the transverse processes of three or four upper cervical vertebræ pull the spinal column toward the median line, while at the same time lifting up on the skull with the other hand and throwing the skull toward the median line. The object of lifting up on the skull is to relax and disengage the articulations, by inhibition, traction and rotation, between the occipital bone and atlas. This is one method applicable to the various lesions of the occiput, which are of frequent occurrence.

In treating the =pharynx=, =tonsils= and =larynx=, outside of correcting spinal lesions, an anterior treatment to these organs is very effective. Examine the deep muscles beneath the angle of the jaw when the pharynx and tonsils are involved; and when the larynx is affected note the condition of the muscles on either side of the larynx. After locating deeply seated contracted muscles in the region of the angle of the inferior maxilla place the fingers over the contracted tissues, and then by a downward, inward sweeping motion toward the median line the muscles may be readily relaxed. When treating the larynx relax the tissues on both sides by an upward, inward movement. These treatments are very effectual when applied directly to the disordered tissues.

Attention should also be given to the lymphatics. In simple infections treat the glands very lightly but attempt to break down the surrounding edematous barrier. Release all the tissues down to and including clavicles, first ribs and pectoral and axillary regions.

To treat slight lesions of the =inferior maxillary= articulation, stand at the head of the patient when he is lying down and hook the fingers about the jaw just in front of the angles, and with the thumbs over the bridge of the nose have the patient open the mouth while considerable force is exerted against his effort. This reduces any slight dislocation of the inferior maxilla. When the jaw is completely dislocated place a piece of wood or hard substance between the molars and exert pressure upward and backward on the chin. If the dislocation is bilateral work on one side at a time.

The object of treatment to the =face= is to stimulate or inhibit points of the fifth nerve that come near the surface (see neuralgia of fifth nerve). While the patient is lying flat upon the back carefully stimulate these various points, especially the supraorbital and nasal, with a downward and outward movement, or inhibit as indicated.

In treating the =scalp= relax the muscles over the scalp thoroughly. This is secondary treatment to correcting the innervation to the scalp at the upper four or five cervical vertebræ.

In cases of pharyngitis, tonsillitis, croup, hay fever, etc., an effective local treatment may be given through the =mouth= upon the soft and hard palate. Introducing a finger into the mouth clear back upon the roof of the soft palate, and with a downward and backward sweeping movement from the median line on either side toward the tonsils, considerable relief can be given the patient. This treatment relaxes the tissues, relieves the congestion, and gives a stimulating treatment to the local nerves. A treatment of the same nature may be given over the hard palate to affect the palatine nerves, especially in hay fever, when the itching of the palate and sneezing are extreme. In cases of young children it is best to protect the finger by wrapping a piece of cloth around it.

An osteopath should never give a manipulation or movement unless he understands why. Just as soon as one gives general imitating movements, from that moment his work is not that of a scientific osteopath, but of a Swedish movement curist and masseur and a poor one at that. The osteopath's work is to locate the anatomical derangement and correct it, as a mechanic would adjust any disordered mechanism. General treatment amounts largely to naught, although in some few instances it is of benefit.

To give a detailed description of the treatment of all lesions that may be found in the cervical vertebræ would be impossible in this sketch; only a general survey of the work can be given. Each case calls for special treatment, but the same general principles are applicable in each case. If there is any one thing that should be eliminated from osteopathic treatment it is those mechanical routine movements of rotating, flexing, extending, and various Swedish-movement-massage-like manipulations that certain osteopaths give in each and every case. It shows that they are imitators and do not have a correct conception of osteopathic therapeutics. True it is, that routine movements will have stimulating and other effects upon the system. But does the body require such treatment? Is it lack of exercise on the part of the patient? If it is, then let the patient exercise himself. You do not want to lower yourself to be a mere "engine wiper," or an exerciser. If it is not the lack of exercise and the system is in need of certain treatment, then seek the cause and apply a specific treatment. Do not hide behind generalities.

=The Ribs.=—In correcting dislocated ribs many methods may be employed, but all are subject to the same principles as given under the treatment of the neck and head.

One of the best methods to correct typical ribs is to have the patient upon the side with the side of the affected ribs upward. Find out exactly the nature of the dislocation, i. e., what is the relation of the dislocated rib to the other tissues. Note whether the rib is upward, downward, inward or forward, locate exactly the dislocated rib. Then, while standing back of the patient, place your fingers upon both ends of the rib. Place your fingers in such a manner that when the proper time in the procedure arrives, all that will be necessary will be to push the ends of the rib into their articulations. For instance, if the rib is raised anteriorly and lowered posteriorly, you will place the fingers on the sternal end, above the affected rib and the fingers on the vertebral end, below the rib, so that when the rib has been released from its abnormal position it may be slipped into normal position. After having placed the fingers in the exact position necessary, have an assistant take the arm and draw it obliquely across the face, while at the same time the patient takes a forced inhalation. The object of drawing the arm across the face and the deep inhalation is to exaggerate the lesion—to draw the ribs out of their locked position—so that the fingers upon either end of the rib may push the rib into normal position. Drawing upon the arm raises all the upper ribs as well as the dislocated typical rib, principally by the use of the serratus magnus; also inhalation has an effect to throw the rib outward and upward and thus away from its articulation. Thus after the lesion has been increased sufficiently to loosen the rib from its abnormal position, the arm is relaxed, the patient exhales, and the fingers upon the ends of the rib correct the dislocation. This treatment is used to the greatest advantage when there is a dislocation of a typical rib; it can be given while the patient is lying down or sitting up, although the former position is preferable.

An excellent method, when the =sternal end= of the rib is dislocated is to have the patient sit upon a stool with his back toward the physician; then by placing the knee in the back (while standing up, or easier still for the physician to sit upon an operating table back of the patient) over the vertebral end of the rib so that the rib may be held rigid posteriorly, reach around with one hand over the dislocated end of the rib and place the fingers upon the rib in the direction dislocated; so that when the rib is sufficiently released from its abnormal position it can be readily pushed into place; then with the other hand under the axilla of the arm on the affected side, pull up and back on the shoulder, so that the rib may be pulled away from its sternal articulation; and at the same time have the patient take a deep inhalation so as to aid in throwing the rib outward, upward and away from its sternal attachment; then when the end of the rib has been released sufficiently, relax the hold underneath the axilla, have the patient exhale, and slip the rib into its normal position by the fingers over the end of the rib. This is an excellent method. It is easy to give and does the work admirably.

Practically the same procedure may be gone through when the =vertebral end= is dislocated, by changing your position to the front of the patient, but there is danger of the knee slipping off from the sternum during the operation and injuring the ribs. Several other

treatments may be given to correct dislocations of the vertebral ends of the ribs. For example, while the patient remains sitting the osteopath stands in front of the patient and reaches around both sides upon the angle of the ribs; then with an outward and upward movement of the fingers upon the angle of the ribs, they are pulled away from their locked position and allowed to slip into normal articulation. This treatment is applicable only when the ribs are dislocated downward, but it is one of the best treatments for such cases.

Another method oftentimes employed in correcting dislocations of the vertebral end of the ribs is to have the patient lie flat upon the side with the affected side upward; then by flexing the arm on the forearm and placing the elbow against the chest or abdomen reach over the patient upon the angle of the dislocated rib and pull it away from the vertebra; when it is pulled away from the spinal column sufficiently, push upward or downward on the angle of the ribs, as the case may demand. The elbow placed against you gives complete control of the patient and aids, by your weight, in throwing the rib upward or downward.

A treatment somewhat like the preceding one which is commonly employed, is to reach underneath the patient's upper arm, when he is lying upon his side, with the arm extended upward across the face; then by placing the fingers of the hand underneath the patient's arm over the angles of the affected rib or ribs and reinforcing the hand by the fingers of the other hand an upward, outward and rotary movement can be given the ribs, which pulls them out of their abnormal position and allows them to return to their normal articulations.

An effectual treatment to spread and raise the upper ribs is to have the patient flat upon the back, and with the fingers of one hand underneath the angles of the ribs and the other hand upon the elbow of the patient's arm of the same side throw the patient's arm across the chest transversely and bear down upon the elbow, at the same time spring upward and outward on the angles of the ribs with the other hand. By throwing the arm across the chest and bearing down upon the elbow a strong leverage can be obtained upon the upper ribs, especially those between the scapulæ. This treatment is very efficacious in certain lung and heart diseases.

Still another method of adjusting ribs is to have the patient flat on his face upon an operating table with the arms hanging down on both sides of the table and a small pillow or folded blanket beneath the upper part of the chest; then standing beside the table, or better still, with one foot upon a low stool and the knee of the other limb upon the table in such a manner that one is directly over the patient's dorsal region one is then in a position to have full control of the vertebral end of the ribs. If the ends of the ribs are displaced downward, placing the thumbs over the angles of the ribs and pushing upward and outward on the angles, the ribs can be very readily crowded into position. If the ribs, especially between the scapulæ, are dislocated in any direction, they may be quite readily corrected by placing the hand over the shoulder posteriorly and throwing it outward and upward and away from the spinal column in such a manner that the ribs are pulled away from the abnormal position; then upon relaxing the hold upon the shoulder with the one hand, the fingers of the unemployed hand may push upward or downward, as the occasion requires, on the angles of the affected side so that the ribs may be slipped into place.

Many times one is obliged to treat the ribs of one side as a whole. In such instances the ribs are almost invariably thrown downward except on one side of scoliosis of the dorsal region. Several methods may be employed to raise the ribs. Probably the best method is to have the patient upon the side and with one hand upon the angles of the ribs and the other hand holding the wrist of the upper arm of the patient, an upward lifting movement is given both upon the angles of the ribs and upon the arm of the patient while the patient inhales. The work upon the angles of the ribs is to raise the ribs directly; the work upon the arm is to raise the ribs indirectly, principally by the use of the serratus magnus. Another effective treatment is to have the patient upon the back and with one hand over the anterior ends of the ribs and the other hand over the angles of the ribs an upward movement is given them by springing the ends of the ribs toward each other and by strong inhalation on the part of the patient. This treatment is most effective where the false ribs are at fault and especially in case of hemiplegia. While the patient is upon the back an assistant may take hold of the arm and draw it upward over the head of the patient, producing considerable additional upward tendency of the ribs, and the physician giving the same treatment of the ends of the ribs as before; or the physician may take an arm in one hand and raise it above the head of the patient and with his other hand around the angles of the ribs, and the patient inhaling deeply, the ribs may be raised.

A treatment used a great deal in raising the ribs as a whole is to have the patient sit upon a stool, and reaching around the patient from the front, place the fingers upon the angles of the ribs and raise them upward on both sides at the same time. This treatment can also be given by standing behind the patient and reaching around upon the anterior ends of the ribs and lifting upward while the patient aids you by deep inhalation. Remember that many times the ribs are drawn downward by contraction of the muscles, due to atmospherical changes and slumped postures. One should begin at the upper ribs in all treatments where the ribs are to be raised, as a whole, and work downward.

To correct the =first= and the =floating ribs= a different treatment has to be given than the foregoing.

An =upward displacement= is the most common lesion of the =first rib=. To correct such a dislocation, have the patient sit upon a stool and with one hand pull the head to the opposite side in order that the lesion may be exaggerated by traction of the lateral muscles of the neck (principally the scaleni) upon the rib; this disengages the rib from its abnormal position; then with the fingers of the other hand upon a point midway of the ends of the rib, exert a downward pressure at the moment the extended head is relaxed describing a short arc. But don't relax head until readjusting pressure is exerted upon rib. If the patient is unable to sit up, and it is not best to give the foregoing treatment, have the patient flat upon the back, with one hand take hold of the arm on the affected side and pull down and out upon the shoulder so that the rib may be somewhat drawn away from its articulation and released from its position; then with the fingers of the other hand upon the center of the rib, or its highest point, press downward when the hold upon the arm is being relaxed. Correction of an upper displacement of the first rib is an every day occurrence. =Downward dislocation of the first rib=, is rare. To reduce this dislocation, place the thumb beneath the vertebral end of the rib, and with the other hand lift up strongly on the shoulder from beneath the axilla, at the same time exerting pressure upward with the thumb on the end of the rib.

The =floating ribs= may be dislocated obliquely downward, or the free end of the rib may be caught underneath the end of the rib above. In either case, in order to correct the displacement, place the patient upon the back with the thigh on the affected side flexed upon the abdomen so that the tissues about the field of operation are relaxed; then bear down carefully but firmly over the free end of the rib with the fingers until one finger can be hooked underneath the end of the rib; then with the other hand over the vertebral end of the rib, have the patient take a deep breath, at the same time springing the ends of the rib toward each other, thus relaxing the rib from its locked position; then have the patient exhale quickly and at the same time spring the rib into its normal position. It oftentimes requires repeated trials, especially in stout persons, and quite often the operation is painful to the patient. It is necessary that one should understand this operation thoroughly, as it is one of the most common treatments in osteopathic practice. The floating ribs are very liable to dislocations and may be the cause of many pains in the side, disturbances of the vessels as they pass through the diaphragm and inflammation in the iliac region. A palliative treatment may be given the floating ribs by having the patient lie flat either on the back or on the side; then place the hand near the vertebral end of the ribs and raise them upward while the patient takes a deep breath.

Treatment of lesions between the =manubrium= and =gladiolus= are best given by placing the patient with the face downward upon the operating table, and having the articulation of the manubrium and gladiolus just over the edge of the table. An assistant should hold the patient firmly upon the table while hyperextension or flexion, as the case may require, with traction, is exerted upon the head, neck and shoulders, and manipulation of the articular points is given to reduce the dislocation. The same principles are employed here as in correcting lesions elsewhere.

Correction of the =cartilages along the sternum= is very easily accomplished by having the patient sit upon a stool and the osteopath standing behind the patient places a knee in the back; then reaching around with one hand over the cartilages and the other hand underneath the axilla, execute the same movement as given in correcting dislocations of the sternal ends of the ribs.

A treatment sometimes used to release a depressed condition of the =cartilages= of the =false ribs= is to stand behind the patient while he sits upon a stool and reach around him with fingers underneath the cartilages and raise them upward as he inhales. By having the patient take a deep breath and then exhale quickly while the fingers are over the cartilages a much better grasp of them can be obtained. This treatment should be carefully given, as there is danger of tearing the cartilages loose from the ribs.

=The Dorsal and Lumbar Spinal Regions.=—Here, as in other regions of the body, before an attempt is made to correct the vertebræ the muscles should be thoroughly relaxed. One of the easiest methods to relax the muscles is to have the patient lie upon the side, and then by standing in front of the patient and reaching over him with the fingers upon the contracted muscles an upward and outward rotary manipulation is given; or the patient may sit upon a stool while the physician stands in front with the arms around the patient and the fingers over the contracted muscles manipulating them upward and outward. Another very easy method is to stand behind the patient while he sits upon a stool and place a thumb over the contracted fibres, with the other hand underneath the axilla lifting the shoulder upward and backward so as to favor a relaxation of the muscles, while the thumb manipulates them.

In relaxing the =muscles= of the =lumbar region= have the patient on the side upon the table; then flex the thighs upon the abdomen with your weight against the knees so as to control all movements of the patient; reach over the patient with the fingers upon the contracted tissues and manipulate them outward and upward on either side until they are relaxed. A method sometimes

employed to relax the muscles of the dorsal, lumbar and sacral regions is to place the patient flat on his face upon the table; then by pushing up on the muscles from above downward with the flat of the hand they are easily relaxed. This treatment should be especially given when the patient's muscles are contracted by atmospherical changes and from standing in one position for a long time. When the muscles of the back are contracting they draw downward and many times draw the ribs with them, as well as tensing the tissues over the sacral foramina and obstructing or irritating the sacral nerves. By using the modern table longitudinally relaxing, or stretching, the lumbar and dorsal musculature saves considerable strength and effort of the physician.

To correct =vertebral lesions= of the =dorsal region= the same rules should be followed as in treating lesions of the cervical vertebræ. Treatments may be given with almost equal ease whether the patient is lying on the side or sitting up.

To illustrate the treatment of the dorsal region when the patient is lying down, assume that there exists a lateral lesion, combined rotation and sidebending, between two vertebræ; if the lesion is below the seventh dorsal use the legs as a lever, and if the lesion is above the seventh dorsal use the head and neck as the lever. Have the patient lie upon the side toward which the lesion is pronounced, either reach under the neck or around the limbs with one hand, and with the other hand upon the lesion bend the head and neck or the thighs in such a manner that the angle of the flexion is directly over the break in the spinal column; this is to exaggerate the lesion; then by lightly lifting up on the neck or limbs and with a slight rotation of this lever the flexed parts should be extended, at the same time exerting pressure with the hand over the lesion in such a manner that the vertebra is pushed forward toward its normal position.

Practically, the same treatment is given when a patient is sitting up, with the exception, of course, that the limbs cannot be used as levers. Lesions of the dorsal region or even the lumbar region can be corrected while the patient is sitting up. By this method considerable lifting is done away with. In fact, the weight of the patient can be used to great advantage by substituting it for one's strength. No matter in what direction the lesion is, the physician reaches around the patient's shoulders so that he just holds the weight of the patient from falling to one side or the other; thus with one hand manipulating the lesion the other arm is around the patient guiding the weight of the body in flexion, rotation and extension. It is not always necessary to lift up on the patient but just let the weight of the patient act as strength applied to the power arm. Always make it a point when working upon dislocated vertebræ in any region that just as soon as one has obtained a slight movement in the lesion =do not attempt= to correct it any more for the time being. A slight movement toward the right direction may be all that is necessary to relieve the ill effects of the lesion. In fact it might be impossible to get the lesion anatomically correct as the shape of the vertebra may have conformed in a greater or less extent to its abnormal position.

An excellent method to correct the various combinations of rotation and sidebending of the third to ninth dorsals is to have the patient sit up with the physician either sitting or standing, depending upon height of seat, back of the patient. Have the patient lean back until head is supported upon shoulder of physician, and the anterior and posterior musculature of torso, abdomen and pelvis are thoroughly relaxed. Reach around the patient's chest with one arm, the hand of which is placed beneath the axilla. The thenar eminence of the other hand is placed upon the posteriorly prominent transverse process of the lesioned segment. Then with careful hyperextension, traction, and rotation and, sidebending of the torso, the anchorage is released, care being taken that localization is exact; this moment of coordination is accompanied with a thrust of the thenar eminence upon the transverse process. Relaxation, leverages and thrust must be precise and thoroughly coordinated.

To reduce vertebræ that are =deviated anteriorly= in the dorsal region, especially between the scapulæ, is often a hard matter. A satisfactory method is to stand behind the patient, while he is sitting upon a stool, and reach around both sides of him upon the sternal ends of the ribs corresponding to the anterior vertebræ; then have the patient relax with the head upon the chest, and at the same time take a full inhalation while pressure is exerted posteriorly upon the sternal ends of the ribs. The object of this method is to pull back the rigid ribs (the lungs being filled with air) which are attached to the anterior surfaces of the transverse processes of the vertebræ, and thus upon the anterior vertebræ pushing them posteriorly; all of the muscles of the body being quite passive and the head relaxed on the body, a separation of the vertebræ is accomplished, thus favoring a crowding posteriorly of the subdislocated vertebræ.

To correct =vertebræ= of the =lumbar region= is on the whole much easier than in the dorsal region. Here the legs can be used as levers to great advantage. By the same method of flexion, rotation, and extension, as employed in the dorsal region when the patient is lying on the side, the result can generally be obtained.

Sidebending is the most common single lesion of the lumbar vertebræ, though there may be some rotation at the lumbo-sacral juncture. Occasionally malformation is found at the fifth. To correct the lumbar lesions the following method is often used: place the patient upon the side of the rotation or sidebending with knees flexed, buttocks well back and entire spinal column straight. Next bring torso and head, with spine straight, well forward to edge of table. Then with hand upon ilium tilt it slightly forward, and with other hand upon shoulder rotate entire spine, including head, so that spine is locked and the point of localization exactly corresponds to the lesions. This brings the spine back to nearly a straight position. Next, after a moment or two of tension-relaxation, either thrust back upon the shoulder or forward upon the ilium. Again exactly coordinating localization, relaxation and leverages is the key of the method.

=The Abdomen.=—Direct treatment of the abdomen is given in many diseases of its organs. The patient should lie flat upon the back, the legs flexed upon the thighs and the thighs flexed upon the abdomen, so that the abdominal muscles will be thoroughly relaxed; and then the various organs of the abdomen can usually be manipulated with ease. Remember that in many diseases of the abdominal viscera the treatment of the splanchnics and vagi will be the primary treatment rather than direct abdominal treatments.

In treating the =liver= directly, the ribs over the liver should be raised and separated, and the lower border of the liver manipulated directly, as considerable therapeutic results can be obtained, particularly when the liver is congested and enlarged. Manipulation of the =bile ducts= is very essential in many liver diseases. The treatment relieves congestion of the ducts and removes any collections of mucus in the ducts due to the congestion, as well as freeing obstructed flow of bile. The manipulation should be a deep, downward one, directly over the path of the ducts (from about the cartilage of the ninth rib to the duodenal orifice of the biliary tract, the latter being about one and one-half inches diagonally downward and to the right of the umbilicus). Be very careful when first manipulating, and bear down lightly over the duct so that the structures superficial to it may be relaxed as the duct is deep below the surface of the abdomen. Usually the gall-gladder can be emptied by light pressure over the skin above the cartilages of the eighth, ninth and tenth ribs. The light manipulation acts, probably, by way of the spinal segment, as a stimulus to the dilators of the sphincters of the gall-bladder. Very likely through reciprocal innervation relaxing the sphincter of the bile duct will contract fibres of the gall bladder.

Manipulation of the =stomach= has considerable effect in strengthening its circular fibres and toning up the coats in general. In cases of gas formation, the gas in some instances may by manipulating over the stomach, be forced through the cardiac or pyloric orifices.

Direct treatment over the =spleen= by raising the eighth, ninth, tenth and eleventh ribs of the left side is effectual in congestion and enlargement of the organ.

In thin subjects the =kidneys= can be treated directly by pressing down carefully but deeply over the kidneys, and lightly crowding them upward and outward. This treatment also has some effect in relieving contracted tissues about the renal vessels and kidneys.

Treatment to the =intestines= through the abdomen is an effective treatment. In the various obstructions to the intestines, constipation, etc., the direct work is essential. Treatment of the intestines is to correct any abnormal position that they may have assumed, to relieve constrictions of the gut caused by contracted tissues, to relieve impactions and adhesions, to increase peristalsis and to tone up the intestinal coats in general. The treatment consists in a manipulation of the intestines, especially in the right and left iliac fossæ, and the pelvic colon, ascending colon and duodenum, as impactions and prolapses of the gut are more liable to occur at these points than in any other locality. In manipulating the intestines, work for a definite purpose and not give a general kneading treatment unless the walls of the abdomen and the coats of the intestines are weakened; in the latter case the spinal treatment is the primary one. In treating over the iliac region, draw upward and inward on the folds of the gut. It is claimed by some authorities that nerves pass from the cutaneous surface of the abdomen directly to the intestine by way of the peritoneum; if such is the case, manipulation of the abdominal walls would have direct effect upon these nerve fibres. The abdomen may be treated when the patient is sitting up, but the treatment is not satisfactory. (See Prolapsed Organs).

=The Pelvis.=—The treatment of the pelvis is easy, but the difficult work is in making a diagnosis of the position of the pelvic bones. The pelvis is especially apt to become deranged by jars and falls. Some of the most successful osteopathic results have been obtained in correcting the pelvic region.

To relax the muscles over the pelvis, the patient should be on the side or upon the face; then relax the muscles by manipulating them upward, chiefly those over the sacral foramina. It is a good rule to adjust the lumbar first owing to release secured to the

nerves supplying pelvic muscles and also to the fact that many pelvic distortions are secondary or compensatory to lumbar lesions. The easiest method to correct the innominata is to have the patient lie upon his side; then by standing in front of the patient slip one hand between the thighs and grasp around the tuberosity of the ischium, and with the other hand upon the crest of the ilium, the innominatum can be moved upward or downward and forward or backward (wheel and axle principle). Simply pulling or pushing upon these two points in whatever direction necessary is all that is required providing the soft tissues are thoroughly relaxed. By having the patient flat upon the back practically the same treatment can be given, but not to so great an advantage. In cases where the ilium is posterior and the ischium anterior, the physician may stand back of the patient, while he is lying upon his side, and place one knee against the sacrum and with one hand upon the ilium, with the other take hold of the ankle of the affected side (the involved side being uppermost in all cases where the patient is lying upon his side); pressure can be exerted upon the ilium and the limb pulled backward, thus correcting the derangement. This treatment should be avoided as much as possible, as there is considerable danger of pulling back too severely and injuring the patient; the lever is long and the amount of force exerted upon it cannot be judged precisely.

Another method is, with the patient on the back, flex and evert the knee to the side so the side of the foot lies flat on the table. Grasp the ankle with one hand and with the other on the crest of the ilium of the opposite side then, by pushing down firmly on the knee the articulation is gaped and at the same time the operator pushes with his body against the knee with a sharp thrust. This may have to be repeated a few times before the articulation is released and if one is keen he will easily detect the slight concussion carried down the femur as the adjustment takes place. This will correct a forward and downward innominate. For an upward and backward one, place the patient in exactly the same position and go through the same motions except that the knee is pulled toward the operator. If the desired “chug” is not felt and adjustment is not definite, the leg may be pulled down rather smartly by the ankle to a parallel with the other. This is a technique that is easy, both for the patient and operator, and will correct any but the most stubborn.

In the case of a greatly relaxed and atonic condition of the ligaments of the pelvis much trouble is experienced, often, in making the adjustment permanent. Many suggestions have been made and most of them useless but, probably the use of a belt of non-elastic webbing about two inches in width buckled tightly around the pelvis just below the anterior spines will do as much as anything and is a procedure well to follow in all such cases. Where there is a pendulous abdomen a support in the shape of a simple belt which should be so fitted as to act as a sling will transfer the weight of the abdominal viscera from the muscles, already stretched and atonic, to the belt and put the burden over the sacrum. This prevents the pulling of the innominatum in lesion again. Overcorrection is suggested as a means on the ground that it sets up irritation and induces fibrous ankylosis and for the same reason W. W. Howard places his patient prone and with thumb works the ligaments associated with the joint until they are thoroughly inflamed. The patient is then put in bed a few days and after the inflammation has cleared up the ligaments will be found to have shortened.

To correct a rotary lesion between the pelvis and fifth lumbar the patient should be placed upon the side, and with the body held firmly, the pelvis can be forced backward or forward as the occasion demands. (See Coccyx).

=The Legs.=—The origin of many symptoms manifested in the legs, as in the arms, are due to spinal lesions corresponding to the region of innervation to the affected tissues. The derangements of the pelvic bones are a frequent source of symptoms that are referred to the legs and feet. The osteopath finds that a slight dislocation of the hip may occur which is especially likely to affect the knee. This partial dislocation is apt to be an upward-posterior one; the head of the femur resting in the upper and posterior part of the acetabulum. Many diseases of the legs and feet are due to local displacement of the bones. The method of treatment is the same as given in surgical works. (See Sprains).

A general treatment of the legs and thighs is oftentimes necessary; it consists of flexing the thighs quite firmly upon the abdomen, and executing thorough external and internal rotary movements of the thighs and legs. In a few cases both limbs are flexed strongly at the same time upon the abdomen. After giving these movements manipulation over the saphenous opening and beneath the popliteal space is performed. This general treatment tends to increase the circulation of the entire limb and to relax thoroughly all contracted fibres.

=The Arms.=—In treating the arms, care has to be taken that the affection is not due to spinal derangements; otherwise the arms are manipulated according to the disorder. Complete dislocations of the shoulder comes under the province of surgery. Many times the osteopath locates slight or incomplete dislocations of the shoulder. Partial dislocations of the shoulder are generally anterior. (See Sprains).

In cases where pain exists in the shoulder or arm, outside of locating the cause in the shoulder joint, the affection may be due to fibres contracting over the coracoid process, or a dislocation of the second or third rib, and in some instances the clavicle is deranged. Special care should be given to a possible bursitis and tendo-synovitis. Occasionally muscular fibres may slip out of the bicipital groove. Dislocations of the bones of the arm are treated according to surgical methods. The pains and various troublesome symptoms that may be manifested in the fingers or the hands are oftentimes caused by slight dislocations of the elbow, shoulder, ribs, or vertebræ, as low as the sixth to eighth dorsals.

=The coccyx.=—The coccyx, owing to its exposed position and rather unstable attachment, is subject to many injuries; more indeed than come to notice. Its injury results in many local and general disturbances owing to its close relation to the sympathetics. Successful treatment of deviations often bring startling results. They may be divided into =fractures= and =displacements=.

In =complete= or =partial= fracture of the coccyx, as well as in dislocation, if the patient can be seen with reasonable promptness after the accident much can be done for relief of the pain and the prognosis is good for complete recovery.

Examination should be made externally and internally and after the condition is diagnosed about the same procedure is indicated for any of the conditions. With the patient on the left side introduce the right index finger, well lubricated, into the rectum and carefully relax all tissue within reach of the tip. If there are spasms of the coccygeal muscles, inhibition of the anterior nerves will quiet them. When this has been done place the left index finger externally along the body of the coccyx and holding it firmly both within and without release it longitudinally and then adjust. After this has been done it is well to hold it there until all danger of returning spasm, which might displace it again, is over, when the finger can be withdrawn.

The pain following will depend on the severity of the injury, but will keep up more or less constantly for several days. When severe, relief is often given by introducing the finger and relaxing contracted tissue which is pulling it from its position. Hot water bags placed next to the part will be of benefit. The bowels should be kept confined for forty-eight hours if possible in cases of fracture. Watch carefully the progress of union that the bones are _in situ_ so there will not be deformity.

In diagnosing the first injury be sure that there is no splitting of the first segment or splinters which may require surgical interference. In old cases of fracture where there is complete bony ankylosis it is not justifiable to attempt any change, but where there is motion and a fibrous union, after preparatory treatments about one week apart, it can usually be replaced. Look well to any muscular contractions which might interfere with it. Force must never be used nor any attempt to replace until it has been first released from its articular attachment. In the various forms of =displacement= the same technique applies as in fractures, or the finger and thumb of one hand may be used, the tip of the finger internally at the sacro-coccygeal articulation and the thumb externally at the same point. Complete control of the part is secured in this manner. Great care must always be used in treatment of any displacement of the coccyx. Contractions of its muscular attachments will often cause deviations in contour. Removal of the irritation and relaxation will allow it to assume its normal position.

=The sacrum.=—Adjustments of the sacrum as distinguished from the ilium in strictly innominate lesions are not many. When posterior with the patient on a stool the knee of the osteopath coveted by a pillow and placed against the sacrum and both hands grasping the anterior borders of the ilia, strong traction will move it into position. In a downward displacement with the aid of an assistant from behind holding the crests of the ilia firmly as the patient sits on the table, the osteopath in front clasping both arms about the patient and with a rocking motion from side disengages the sacrum and at the same time lifts it into position.

For anterior displacements use the technique described in replacing upward and backward innominate dislocation first right side and then left, which will result in correcting the lesion.

The preceding osteopathic technique includes a few of the treatments given by the osteopath. Although many osteopaths use methods not given here, those outlined are sufficient for illustrative purposes. A point which cannot be too thoroughly impressed upon the student is that osteopathic treatment is in reality =constructive= work, that is, readjustive, not only in detail, but in viewing the body structure as a whole. Detailed readjustment is an essential, still do not lose sight of the relation of the part to the whole. In our distinctive work anatomical construction is the basis of physiological function, although physiological stimulus is essential to anatomical development.

=How often to treat.=—How often to treat a case depends entirely upon the nature of the disease from which the patient is suffering. Just as in giving drugs the frequency of treatment is entirely dependent upon the seat of the disease and its severity. Acute cases require a thorough treatment at least once daily, and many times in severe cases the treatment has to be repeated

several times daily. In subacute and chronic cases, as a rule, treatment should not be given as often as in acute cases; possibly once a day, but usually alternate days is better. In office practice cases are commonly treated two or three times weekly. Still it is better not to treat some cases oftener than once a week.

There is more danger in treating too often and too long than in not treating often enough. The distinctive work of an osteopath is to correct disordered anatomical structures; and when a certain derangement has been corrected the tissues should have rest and plenty of time for repair. When treatments are given often, it simply keeps the tissues in an irritated state and nature does not have time to heal the diseased tissues. Always make it a point at each treatment to correct some definite lesion, and when the work is accomplished let the parts alone until the tissues have recovered as much as possible from the effects of the previous treatment before another treatment is attempted. The reason why some cases do not get cured under osteopathic treatment is simply because the osteopath keeps the diseased tissues in an aggravated state by the constant treatment so that they do not have the least chance to heal; the physician is thus adding irritation to the disease.

It is only by experience that one can tell how often to treat. Each case is a special study; what would be quite sufficient for a certain individual with a given disease would not be at all suitable for a second individual with the same disease. As in drugs what is suitable for one person would not be adapted to another, because the make up of each individual is entirely different; but here the parallelism diverges, for in drugs there is a foreign agent introduced into the system, while in osteopathic treatment the curative agent is entirely harmonious with the idiosyncrasies of the individual. It is for this reason that experience in practice is so essential.

Most cases should not be treated, as a rule, after a meal unless the patient is suffering from some digestive disturbance; for treating other regions of the body outside of the digestive tract causes more or less stimulation of the parts treated and thereby draws blood away from the organs of digestion. Cases of disordered brain circulation, where the patient is unable to rest or sleep at night, should be treated at about their retiring time so that the circulation of the body may be equalized, thus giving the patient undisturbed rest.

To show in a practical way the methods of experienced osteopaths in this matter G. J. Helmer[32] is quoted: “I submit the following table to illustrate the frequency of treatment in one hundred cases taken from my practice: one case three times per week, sixty-three cases two times per week, twenty-two cases one time per week, nine cases once every two weeks, five cases once every four weeks. Comparing the present with the past, I find I am lengthening the time between treatments with much better results.”

Another very practical side of the question and one which will be greatly appreciated by the patient, is the lessened cost for the same result in the less frequent treatments, as well as the saving in time. With the loss in going to the office, rest after treatment, not to mention possible wait while there, three times weekly represents more time than the average person can well spare and not infrequently will deter him from continuing. More especially is this true of those coming from a distance.

=Length of Treatment and Overtreatment.=—Naturally the length of treatment depends upon the case at issue and nothing more. There is no reason why any two cases should be treated for the same length of time unless they present identical lesions and then the personal equation of the two might present such a wide difference of aspect as to forbid such a proceeding.

The question of time has no place in the matter, save that it must not exceed physiological limits and be sufficient for the needs of the case. The patient should understand at once that it is to accomplish a specific purpose that the treatment is given, just as definite as a surgical or dental operation, and when the work is done it is time to stop. He would hardly be attracted to the dentist who guaranteed to use forty-five minutes in extracting a tooth. Good judgment is required in this as in all matters pertaining to osteopathy. There is a generally expressed opinion among the older osteopaths, based on experience, that: first, a short specific treatment is productive of best results and, second, treatments given under high tension when quick work is necessary are most satisfactory. Long treatments are debilitating and over stimulation amounts to inhibition. Further, in a long treatment it is necessary to go over the whole body, thus dispersing the vital forces (which have been stimulated for healing and upbuilding the pathological area) to parts not involved, thus defeating the very purposes intended. Dr. Still always advocated and gave the short, specific treatment.

The point always to be considered is the individual characteristics of the patient, and effects of the first treatment should be carefully observed. After a patient has been under treatment for any considerable time it is well to give him a vacation from treatment, and it is remarkable what improvement will be shown at times by such a measure and how seldom he will lose ground. Dr. Still presented this subject vividly as follows: “To treat the spine more than once or twice a week and thereby irritate the spinal

cord, will cause the vital assimilation to be perverted and become death producing by effecting an absorption of the living molecules of life before they are fully matured and while they are in the cellular system, lying immediately under the lymphatics. If you will allow yourself to think for a moment of the possible irritation of the spinal cord and what effect it will have on the uterus, for example, you will realize that I have told you a truth. Many of your patients are well six months before they are discharged. They continue treatment because they are weak, and they are weak because you keep them so by irritating the spinal cord." It is not a rare experience for a patient to leave apparently with little or no improvement only to report a complete recovery a little later.

=Misapplied Treatment.=—Probably in spinal treatment more risks are taken than in any other region of the body. To us as a school it is by far the most important and interesting area we have to treat, consequently it is not surprising that various general treatments and methods have been devised with the idea of getting quicker and easier results. Herein lies the danger outside of mistaken diagnosis, for short cut treatments can never take the place of time and skill. Technically speaking, if one thoroughly understands the philosophy of osteopathy and is conversant with the underlying principles of its therapeutics, there is absolutely no danger of even the slightest injury. It is the one who takes chances by not properly diagnosing and by not being cautious enough with delicate persons when applying his treatments that is apt to overstrain some tissue or organ and otherwise do bodily harm. Of the treatments considered dangerous not one of them is without merit if judiciously applied, but unfortunately in many cases they are in general and indiscriminate use. It is well to remember that we are moving structures which have never been moved before and that time enough has not elapsed to observe what the ultimate result may be. Again, in adjusting a subluxation of the spine do not forget that the force necessary for that adjustment, if misapplied, is sufficient to produce a lesion, and there is no doubt that this has happened. Your patient's interests are above everything and must never be sacrificed for any reason whatever, so if at any time there is uncertainty always give the patient the benefit of the doubt. On the other hand the osteopath must have the courage of his convictions and fortunately when these are coupled with good judgment the results are all that could be desired. The following should be used with great caution if used at all:

First, =Indiscriminate stretching= of the spinal column with the aid of an assistant. It is not good osteopathy although there are some cases where it may be beneficial. While not specially dangerous, generally, in delicate patients, elderly people, arteriosclerotic conditions, and in some stages of Pott's disease it is absolutely contraindicated. Moreover in most spinal cases except impacted vertebræ and symmetrical curvatures the stretching of the vertebral ligaments locks the lesion firmer.

Second, =Extreme rotating= of the cervical region. This cannot be considered good treatment in any case with the exception of the muscle stretching. On the contrary it is dangerous; first, it is not osteopathy for it is not specific; second, the nervous shock is severe, an important consideration in delicate people; third, the cervical ligaments become stretched and the vertebræ are easily displaced, while damage to a diseased vertebra, an aneurism or in arteriosclerosis would be irreparable. No other region of the body should have greater care in treatment than the neck.

Third, =Hyperextension= of the spine with the patient on his face. This treatment is rarely indicated. In fact, it is barbarous and a relic of an early day. Possibly more cases have been injured by this treatment than all others combined.

Fourth, =Rough separating= of the vertebræ and ribs while the patient is on his face. This is a most excellent treatment in many cases, but great judgment is necessary. Delicate patients, heart disease, and necrosed vertebræ and ribs should be carefully excluded.

Fifth, =Innominate adjustments= such as placing the patient on the side and putting the knee against the sacrum while grasping the leg at the knee. Or, the placing of the patient face down with one hand on the sacrum and the other holding the knee. In both these there is a tremendous leverage and in the latter the strain is at the lumbar rather than where needed. There are other unnecessarily risky methods for this operation, while it is easy to perform in most cases and without danger.

Sixth, =Abdominal treatment= gives wonderful results when intelligently applied, but it may be productive of great harm in conditions of tumors, malignancy, and pus formations.

=Misapplied treatment= is always dangerous, no matter to what part of the body given, and it is proof of wrong diagnosis when given. As a rule treatment is given without proper diagnosis in such cases, so a misapplied treatment has two interpretations—first, ignorance; second, laziness. In the former lies the greater danger for ignorance coupled with force and lack of skill is an appalling combination.

Cases are frequently reported where tumors have passed from the vagina, rectum, nose, etc., the osteopath thinking it was the result of good treatment, without considering that it was simply the breaking of a long pedicle with great danger from hemorrhage. The greatest care should be exercised in treating cases where aneurism, osteomalacia, and arteriosclerosis are present, also in the leg treatment of tabes dorsalis and in the weak, thin ribs of elderly people and those with a gouty or rheumatic diathesis. Imagine treating an abscess directly, yet it has been done, as have varicose veins with the terrible danger of rupture and embolism. Aneurisms have been ruptured in the same way.

One could go on indefinitely with this subject, but to sum up: if the osteopath is not familiar with the feel of the living anatomy in its giving and resisting under treatment both in health and disease and does not know his osteopathy, nothing can prevent him doing harm. A successful practitioner means an understanding of pathology, then experience plus common sense.

FOOTNOTES:

[31] See Ashmore's Osteopathic Mechanics.

[32] Journal of the American Osteopathic Association, Dec., 1903.

OSTEOPATHIC CENTERS

"Osteopathic spinal centers" was a term commonly used in the early period of osteopathic development. From the facts, first, that a few centers have been actually determined in the cord, viz., genito-urinary, vasomotor, etc.; second, that the innervation from the spinal segment to various thoracic, abdominal and pelvic viscera correspond with a considerable degree of accuracy to certain vertebral sections, and third, displacements of tissues of the spinal column affect viscus integrity, depending upon the locality of the structural perversion as to the organ involved and is a clinical observation of great import, arose the misnomer "osteopathic centers." For one to ask what "centers" should be "treated" in this or that disease shows a lack of the conception of osteopathy as if he asked what "movements" to give when "treating" a certain disorder. It is as unosteopathic, as it is unscientific, broadly speaking, to suppose osteopathic technique implies the application of movements to certain nerve centers.

Osteopathic Stimulation

"Osteopathic stimulation" is another term loosely used without extensive clinical experience to support it. Mechanical stimulation is frequently utilized in the physiological laboratory. But to employ it extensively and comprehensively in the treating room or at the bedside the therapeutic potency of it will be found wanting; that is, to employ it to the exclusion of that most important basic treatment, readjustment, is a great mistake.

Clinically, the pathologically slowed heart may be stimulated by a stimulus to the cervical sympathies, the gall-bladder emptied by a stimulus near the costal cartilages of the ninth and tenth ribs (this is probably via the spinal segments), etc. Normally, these organs and others may be temporarily stimulated. Experimentally, Burns[33] of Los Angeles and Pearce[34] of San Francisco have shown the potency of osteopathic mechanical stimulation. For example, stimulation (mechanical) in the middle and lower dorsal regions irritates and increases peristaltic action and vaso-constriction in the stomach and intestines.

Osteopathic Inhibition

Likewise the term "osteopathic inhibition" has not always been scientifically employed. Mechanical inhibition is probably used less frequently than stimulation but still it is of more importance. Probably the true interpretation of considerable of so-termed stimulatory and inhibitory efforts, is simply one of normalization of tissues, physiologic equilibrium resulting from such changes.

Clinically, to relax contracted muscles by inhibition, to relieve neuralgia by impinging nerve courses, to relax the cardiac orifice of the stomach by pressure at the ninth or tenth dorsal vertebra on the left side, etc., are excellent examples of the therapeutic value of inhibition. Experimentally Pearce and Burns produced the opposite results to that of stimulation. Inhibition in the middle and lower dorsal region caused relaxation of the muscles of both the stomach and intestines, decreased peristalsis, and caused dilatation of the blood vessels.

The employment of stimulation and inhibition rounds out to a certain extent our therapeutics, that is, makes it more practical and specific. We should not, however, over-rate the relative value of stimulatory and inhibitory treatment as compared with the readjustive treatment. Not but what the former is of considerable practical importance, but the point to be emphasized is that it

gives a scientific demonstration of how pathological effects result, if long continued, from the various osteopathic lesions. In a word, it shows the physiological process from cause to effect, or rather a step in the beginning pathological (perverted physiological) in many disturbances.

Therapeutically, all will agree with Cherry[35] that “stimulation and inhibition should be employed in all forms of acute disease as palliative measures until such time as the primary lesion may be removed.”

As a preparation for adjustment of any bony lesion there is no question but that simple inhibition for a brief time in the area will bring about relaxation of soft tissues in a much more satisfactory manner than the usual massage like method. McPherson, Montreal, has developed a technique of sacral pressure which he uses exclusively in his practice. Without going into the merits of his theory there is no doubt that inhibition at the second and third sacral will bring about relaxation of the muscles of the lower trunk in a most gratifying manner. Another thing, if there is difficulty in introducing the finger in making either a vaginal or rectal examination, a minute’s pressure at these points will, in most cases, cause the sphincter to relax so as to cause no discomfort to the patient. This pressure will, also, have a great effect on the hypogastric plexus and the pelvic organs.

Osteopathic Readjustment

Readjustment or adjustment is many times particularly emphasized in this work as the key to osteopathic therapeutics.

If the theory of readjustment can not stand the most searching tests of science osteopathy will have to be relegated to a most subservient place, on a par with massage, Swedish movements, and various medical gymnastics. Consequently the readjustment theory is again referred to, and especially so when the subjects of osteopathic centers, stimulation and inhibition are outlined.

No doubt many stimulatory (so-called) and general treatments exert their greatest influence by inadvertently readjusting tissues. Then how much more effective would the readjustment treatment be if applied intelligently. In certain acute disorders, e. g., “colds,” immediate relief is often obtained by relaxing muscles through either stimulation or inhibition; in reality the final result, as far as the muscle is concerned, is one of readjustment. Likewise in stretching and rotation of tissues and sections of the body the effect may either be stimulatory or inhibitory, and still it may be, also, readjustive.

After all has been said the ultimate physiological effect of any of these treatments, if of any therapeutic value, must be one of stimulation to a part or to the body generally. But there is a vast difference between physiological stimulation and the one method of obtaining the same termed mechanical stimulation. It is not the purpose here to enter into anything like an exhaustive survey of stimulation and inhibition but simply to outline a few practical hints on the relative values. Everyone is aware that overstimulation is equal to inhibition, and even applying it to very delicate subjects the therapeutic end we may wish to obtain may be lost and as a consequence the patient exhausted; whereas at the same time readjustment possibly could have been employed and real permanent effects secured.

So we should whenever possible utilize the basic principle of our therapeutics, readjustment, for this represents in the majority of cases, first, permanent results; second, a saving of much time, and third, less exhaustion on the part of both patient and physician.

McConnell[36] has shown in his series of laboratory experiments on animals the reality and potency of the readjustment fundamental. The effect of malaligned vertebræ and ribs upon contiguous vascular channels and nervous tissues, not only affects immediate skeletal muscles by simple contractions but even produces interstitial myositis. Through narrowing of the intervertebral foramina and tension upon the fibrous tissue anchoring the spinal nerve in its exit, and through pressure and strain on the sympathetics in contact with the heads of the ribs, which are secured there by the parietal layer of the pleura, organs in corresponding cavities become diseased. Some of the diseases produced in the series of experiments were catarrhal and parenchymatous changes in the stomach and intestines, congestion of the liver and spleen, acute nephritis, goitre, inflammation of the lymphatics, edema of the cornea, and degenerations of nervous tissues. Still too much emphasis should not be placed upon the narrowing of the foramen for certain pathologic changes are shown to be due to other conditions than Wallerian.

The osteopath, as stated, may inadvertently correct osteopathic lesions. _Vis medicatrix naturae_ undoubtedly corrects many osteopathic lesions; this is evident from the fact that many bodily strains, sprains, and injuries are overcome naturally or involuntarily, that is, without any voluntary assistance from an osteopath. On the other hand all osteopathic lesions are not due to outside influences or forces, e. g., in pneumonia the severely contracted dorsal muscles often partially dislocate the vertebral ends of the ribs and thus increase the seriousness of the disease; and this is true in many acute conditions wherein visceral changes will reflexly contract spinal muscles and also through these contractions produce osseous lesions. Here is where osteopathic treatment

in acute diseases will not only correct the primary lesion but also these secondary ones and thus abort, or shorten, or lessen severity, or prevent complications of the disease. But it should always be borne in mind that when certain disease processes occur it will take a definite time at best for curative changes to predominate. In other words pathological changes are just as real and potent as physiological facts or anatomical data and the character of the same should always be considered.

Consequently in readjustment work a distinctive etiology and pathology has to be taken into account. The color, contour (whether the lesion is simply a local one or there is a composite or group lesion), condition (irritation, debility, contractions, and tenderness), and movement of the several regions, and the spine as a whole should be noted. And the student should always keep in mind that the osseous vertebral lesion may be, (a) a twist between two vertebræ (this generally means a rotation of one section of the spine on another section), (b) malalignment of several vertebræ (the composite or group lesion), or (c) the impacted or strained lesion, (this is a lesion that Clark attaches considerable significance to, wherein there is injury to the articular surfaces and ligaments without osseous derangement, followed by exudation and other inflammatory products, limited motion, etc.).

VasoMotor Nerves

It is extremely important that the osteopath should be thoroughly conversant with the regions where he may affect the vasomotor nerves to various tissues and organs. Many anatomical derangements undoubtedly involve the vasomotor nerves, and it is therefore necessary to know where they may be affected. The following table is taken mostly from the physiology of Landois and Stirling, but many of the statements have been noted at various times; it is, therefore, impossible to give full credit.[37]

The vasomotor center is in the medulla, consequently the osteopath gives cervical treatment to influence this center. Treatment of the upper cervical region has undoubtedly a marked effect in tending to equalize the vascular system of the body, when it is disturbed.

=Head.=—The cervical sympathetic for the same side of the face, eye, ear, salivary glands, tongue, etc., and possibly the brain. Lesions are found in all the tissues about the cervical region, but usually in the vertebræ, which influence these nerves. Deep contracted muscles oftentimes involve them. The spinal vaso-constrictors for the vessels of the head are from the first five or six thoracics. Many lesions are located in the upper five or six dorsal vertebræ, or corresponding ribs, that have apparently a direct influence upon the vessels of the head. Not only congestive headache and congestion of the brain tissues are influenced by lesions in this region, but disease of the eye, ear and face occasionally arise from such derangements. It is always best when the head, neck or even the arms are involved, to examine carefully this region. Vaso-dilator fibres for the face and mouth are found from the second to the fifth dorsals; these fibres unite almost entirely with the trigeminus, and pass from the superior cervical ganglion of the sympathetic, to the ganglion of Gasser. This fact is of great importance to the osteopath, for oftentimes when inflammation of the face and mouth occurs, lesions may be located along the upper dorsal vertebræ or ribs, or in the deeply contracted muscles of this region. Observation revealed in several cases of erysipelas that the causative lesion was located in the upper dorsal region; and the cases were cured by correcting these lesions, thus showing that probably the vasomotor nerves were the seat of the trouble. Other dilator fibres arise apparently in the trigeminus, for stimulation of this nerve between the brain and Gasser's ganglion causes dilatation of the vessels of the face. The lingual and glosso-pharyngeal nerves are the dilators of the lingual vessels. The sympathetic and hypo glossal are the constrictors; these arise in the sympathetic and reach the nerves by way of the superior cervical ganglion. Stimulation of the cervical sympathetic causes constriction of the retinal vessels. This point is extremely interesting to the osteopath, because diseases of the retina and optic nerve are oftentimes due to subluxated cervical vertebræ, usually the atlas or third cervical. The retinal fibres leave the sympathetic at the superior cervical ganglion and pass along the communicating ramus to the ganglion of Gasser, from whence they reach the eye through the ophthalmic branch of the fifth nerve, the gray root of the ophthalmic, the ganglion and the ciliary nerves. Almost all the fibres to the anterior part of the eye are found in the fifth nerve; this, also, is another important point for the osteopath's consideration. Cases of conjunctivitis, keratitis, corneal astigmatism and diseases about the eyelids and tear ducts are usually caused by lesions to the fifth nerve, due to a deranged atlas or third cervical. The vaso-dilators for the anterior part of the eye, and also dilating fibres to the iris may be affected at the first and second dorsals. This point is also taken advantage of by the osteopath, for lesions of these fibres occur oftentimes at the upper dorsal. It is claimed that important fibres that aid in the control of the metabolism of the retina, may be affected at the fourth and fifth dorsals.

=Lungs.=—Reflex constriction by stimulation of the intercostals, central end of the sciatic, abdominal pneumogastric and abdominal sympathetic. There is not a rich vasomotor supply.[38] The essential feature to the osteopath is that the vaso-constrictors to the lungs and bronchial tubes are very likely to be interfered with by rib and vertebral dislocations, from the second to the seventh

dorsals, inclusive, but chiefly at the third, fourth and fifth. The heaviest innervation being from the third, fourth and fifth spaces, probably explains why asthma is often due to a dislocation of the third, fourth or fifth rib.

=Heart.=—First to fifth thoracic via ganglion stellatum and inferior cervical ganglion. Vasomotor fibres to the coronary arteries are found in the vagi.

=Intestines.=—Sympathetic, chiefly through the splanchnic nerves. Vaso-constrictors of the jejunum from the fifth dorsal down, for the ileum slightly lower and for the colon still lower. There are none below the second lumbar. Dilators are present in the same sheath, but more abundant in the last three dorsals and the upper two lumbars; all probably end in the solar and renal plexuses.

=Receptaculum Chyli.=—Stimulation of the splanclinics causes dilatation.

=Liver.=—The splanchnics chiefly on the right side. The vagus contains vaso-dilators. There are also fibres from the inferior cervical ganglia of the sympathetic.

=Kidneys.=—Vasomotor nerves from the sixth dorsal to the second lumbar, but principally from the ninth to twelfth dorsals, inclusive. In the large majority of kidney diseases, lesions are found from the tenth to the twelfth dorsals. Stimulation of the sciatic centers causes contraction. There are also fibres from the superior cervical ganglion.

=Spleen.=—Vasomotor fibres are in the splanchnics, third dorsal to third lumbar, principally, on the left side. There are some fibres direct from the brain. Stimulation of the vagi contracts the spleen.

=Portal System.=—Fifth to ninth dorsal.

=Generative Organs.=—For Fallopian tubes, uterus, vagina, vas deferens and seminal vesicles, vasomotor fibres are found in the lower dorsal, and the second, third, fourth and fifth lumbar nerves, principally.

=Coccyx and Immediate Region.=—Third lumbar down.

=Back Muscles.=—Dorsal Posterior branches of the lumbar nerves and intercostal nerves. These nerves arise from the gray ramus of the corresponding sympathetic ganglia.

=Arm.=—From the brachial plexus, the sympathetic, inferior cervical ganglion and first thoracic ganglion, and sometimes lower.

=Leg.=—Second dorsal down, the sciatic and crural nerves, and the abdominal sympathetics.

Sensory Nerves

Inhibition of various regions along the spinal column is frequently given by the osteopath to lessen pain. It is only a temporary or palliative treatment, but many times gives great relief. One should inhibit usually over tender points and contracted muscles. These (tender points and contracted muscles) are signs to the osteopath that disturbances exist at these points. The following table is taken from Quain, which is Head’s classification:

=Heart.=—First, second and third dorsals.

=Lungs.=—First, second, third, fourth and fifth dorsals.

=Stomach.=—Sixth, seventh, eighth and ninth dorsals. Cardiac end from sixth and seventh. Pyloric end from ninth.

=Intestines.=—(a) Down to upper part of rectum, ninth, tenth, eleventh and twelfth dorsals. (b) Rectum, second, third and fourth sacrals.

=Liver and Gall-bladder.=—Sixth, seventh, eighth, ninth and tenth dorsals.

=Kidney and Ureter.=—Tenth, eleventh and twelfth dorsals. Upper part of ureter, tenth dorsal. At lower end of ureter, first lumbar tends to appear.

=Bladder.=—(a) Mucous membrane and neck of bladder; (first) second, third and fourth sacrals; (b) over distension and ineffectual contraction, eleventh and twelfth dorsals, and first lumbar.

=Prostate.=—Tenth, eleventh (twelfth) dorsals. First, second and third sacrals, and fifth lumbar.

=Epididymis.=—Eleventh and twelfth dorsals and first lumbar.

=Testis.=—Tenth dorsal.

=Ovary.=—Tenth dorsal.

=Appendages, etc.=—Eleventh and twelfth dorsals, first lumbar.

=Uterus.=—(a) In contraction, tenth, eleventh and twelfth dorsals, and first lumbar. (b) Os uteri; (first) second, third and fourth sacrals (fifth lumbar very rarely).

Other points are used by the osteopath to relieve pain of certain regions, for such the reader is referred to the article on neuralgia; besides many tender points are found along the spine by the osteopath, where inhibition gives relief to the patient, provided such points have a connection with the case in question.

Hot fomentations if property applied, through reciprocal relationship of the nervous system, are of value in relieving pain, releasing spastic musculature and normalizing visceral function. Frequently, in both acute and chronic cases, this is an excellent preparatory measure, to be followed by careful adjustment. It will be recalled that the functional test, movement of a vertebral lesion is of primary consideration.[39]

FOOTNOTES:

[33] Burns—Partial Report of Experiments upon Visceral Reflexes. The Osteopathic World, Aug., 1905.

[34] Pearce—Some Laboratory Demonstrations of Osteopathic Principles. The Osteopathic Physician, Nov., 1905.

[35] Stimulation—Leslie E. Cherry, Journal of the American Osteopathic Association, Feb., 1905.

[36] McConnell—The Osteopathic Lesion,—Journal of the American Osteopathic Association.

[37] See also Gaskell, The Involuntary Nervous System; Pattenger, Symptoms of Visceral Disease; Mackenzie, Symptoms and Their Interpretation.

[38] MacLeod, Physiology and Biochemistry in Modern Medicine.

[39] See Luciani, Human Physiology, Vol. III; MacLeod, Physiology and Biochemistry in Modern Medicine.

PATHOLOGICAL SPINAL CURVATURES

SPINAL CURVATURES

Any deviation of two or more consecutive vertebræ from the normal curves of the spinal column is usually termed by the osteopath a pathological curvature. Of the common pathological curvatures of the spinal column there are found: (1) scoliosis or lateral curvature, (2) kyphosis, or excurvation, an antero-posterior curve with the convexity backward, and, (3) lordosis, or incurvation, an antero-posterior curve with the convexity forward.

=Osteopathic Etiology.=—Of primary importance in the causation of pathological curvatures of the spinal column, are injuries to the spine, such as strains, falls, blows, and various physical forces, acting directly or indirectly, as injuries to the chest, pelvis and limbs. The osteopath in his daily work finds more curvatures, as well as acute and chronic diseases, resulting from some simple injury to the spine, as a slip, strain or twist, than from any other cause. The dire effects of any violence to the spinal column cannot be overestimated.

Among =predisposing causes= may be mentioned, continued ill health, general weakness, rapid growth, rachitis, tuberculosis, etc. Any habitual one-sided position may result in a curvature. An injury to the chest, adhesions from pleuritis, chronic liver disease, obliquity of the pelvis producing unequal length of the legs, carrying heavy weights on one side, and various morbid growths of the chest and abdomen, may all produce curvatures. Many cases are found in school children who are growing rapidly, and whose muscular strength and development do not keep pace with their growth. Unilateral atrophy of the muscles, due to central changes or overuse, may be the cause of deviations of the spinal column. Sacro-iliac disease in some instances is a potent factor. Thus there may be a great variety of causes productive of the incipiency, and the spine being strained or irritated at a single point and in

a certain way gradually develops a curvature. Every spinal and innominate lesion should be considered as a potential cause for a curvature.

=Scoliosis.=—This is the most common spinal deformity and is characterized by lateral deviation from the median line. In most cases the curve is to the right in the upper dorsal region, with a compensatory curve in the opposite direction in the lumbar region. The curve being to the right in the majority of cases, is probably due to the fact that most people are right-handed.

=Morbid Anatomy.=—The vertebræ in the region involved are rotated so that their spinous processes point toward the concavity of the lateral curve. The bodies of the vertebræ on the side next to the concavity are thinner, due to absorption; the intervertebral discs are made thin on the same side by pressure and absorption. The ribs are considerably distorted, depressed on the concave side and prominent on the convex side. The ligaments on the concave side are contracted, and stretched on the convex side. The muscles on the concave side are more or less contracted, and on the convex side they are stretched, causing atrophy and fatty infiltration of their tissues.

=Kyphosis.=—This may be a slight posterior curve really amounting to nothing, or it may be a very grave pathological condition as in Pott's disease. Therefore it is very necessary that one should make a most careful diagnosis (see Pott's disease).

The most common =causes= of kyphosis are Pott's disease, rachitis, occupation, general weakness, rheumatism and old age.

In Pott's disease, the posterior curve is characterized by a sharp angle, and by the spine being very rigid. This, taken in conjunction with the history and other symptoms should be sufficient to enable one to make a diagnosis. Radiographic examination should be made.

The condition of round shoulders, which in time produces marked kyphosis, is rarely a habit as it is usually termed. In nearly every case it indicates either a weakness of the back muscles or, what is more apt to be the cause, a strained posterior condition of the dorsal vertebræ, commonly of the lower dorsal region.

=Morbid Anatomy.=—In mild cases there is simply a relaxation of the ligaments of the vertebræ and a separation of the laminæ and spinous processes. In severe forms there may be absorption of the anterior portion of the intervertebral discs and the bodies of the vertebræ (Pott's disease).

=Lordosis.=—This may be a congenital condition, especially when occurring in the lumbar region. Anterior curves of the spine are generally found in the lumbar or cervical regions, but occasionally occur in the dorsal region, causing the spinal column to be more or less straight, and thus weakening the individual. This curve is commonly compensatory to kyphosis, hip-joint disease and congenital dislocations of the hip.

=Treatment= of =Spinal Curvatures=.—The treatment of pathological curves of the spinal column, by osteopathic methods, has been highly satisfactory to both osteopath and patient. The success of the osteopath in these cases has been due to his comprehensive and exact knowledge of each vertebra, and of the spinal column in general. He recognizes curvatures that the ordinary practitioner, and it is safe to say the orthopaedic specialist, would not even notice or recognize. On account of the highly developed sense of touch of the osteopath, he is capable of detecting the slightest deviation of one vertebra from another, and of the spine in general from the normal. Thus by the uniqueness and peculiarity of his work he is capable, not only of discovering a curvature, but also of reducing a curve when found.

The work consists of, first, relaxing any muscles that may have become rigid over the seat of the curve. Then follows a treatment to each vertebra involved, by attempting to replace it, and treatment to the curve in general by springing it toward its normal position. At each treatment effort should be made to accomplish something toward correcting the spine; too many treatments are given in a "general" way, and being unspecialized amount to nothing. One must become familiar with the exact location of each vertebra involved, to attempt a correction of a curvature intelligently. Upon this one point it is impossible to speak too strongly, for a great many treatments have been wasted and improvement of cases retarded by not paying enough attention to the details of the diagnosis, either from pure slothfulness or from an imperfect conception of osteopathy. Corrective exercises are always of value in addition to treatment.

These remarks refer to incipient and certain moderate curvatures. In other cases radical measures (Abbott) should be employed if age and conditions permit. Remember, however, that the practitioner in his daily work of adjusting the many combinations of rotation and sidebending lesions corrects innumerable actual and impending curves.

=Lateral curvature= in the dorsal region is undoubtedly the hardest to correct on account of the ribs, which complicate the condition. A marked curve in the dorsal region is sure to be accompanied by a dislocation of the vertebral end of one or more ribs. Treat each distinct lesion separately, follow by general stretching, replacing and molding of the tissues. A good method to stretch tissues and adjust a moderate lateral curve is to utilize the swing, or in lieu of this have the patient stand just at arm's length from the wall with concave side toward the wall with straight arm at right angles and palm resting against the wall. Stand in front of patient whose feet are firmly on the floor and reach around with both hands upon the spine. As the patient sidebends toward the wall it tends to correct the deformity, so if the operator coordinates his adjustment with that lateral movement of the patient, precise fulcra can be obtained and a certain, definite correction secured. The significance rests with the stretching of tissues and the definite fulcra obtained, thereby securing a maximum sidebending and rotation toward correction.

The =dislocation= of an =innominate= sometimes complicates matters, but is a simple point to remedy, and should not be overlooked.

The correction of a curvature presents a special study to the osteopath, whether it be scoliosis, kyphosis or lordosis, and special rules cannot be laid down for treatment. Cases of rare occurrence are what might be termed "symmetrical" curves; i. e., no vertebra presents separately a marked lesion, the column on the whole being simply bowed. Such cases can be treated by springing back the spinal column, and by the use of methodical exercises. Unfortunately most curvatures are characterized by various lesions between the vertebræ, and thus each lesion requires special work.

In simple curves the use of braces, jackets, and the various mechanical appliances are of very little use to the osteopath, in fact, more harmful on the whole, than beneficial. Naturally they would apply to a "symmetrical" curve, or where the patient is too weak to sit or walk, but they can be of very little use to the average patient, in place of correct osteopathic treatment. Mechanical appliances confine the movements of the patient, interfere with the development of the muscles, and impinge to a greater or less extent the spinal nerves. Due attention to hygienic surroundings and diet are certainly of aid. Proper exercises and occupation for the sufferer should be advised. Special care should be taken in examining (radiographic) for infectious lesions (arthritis).

=Straight Spine= is a term used particularly by osteopaths for a condition seldom recognized by orthopedic surgeons. The following is from H. W. Forbes[40]: Straight spine is "a departure from the normal in the conformation of the chest; characterized anatomically by bilateral diminution in size, decrease in the antero-posterior diameter, relative increase in the transverse diameter and flattening of the anterior and posterior walls; characterized clinically by diminution of respiratory capacity, lowered lung and heart resistance, impaired general nutrition and predisposition to neurosis.

"Of the many possible manipulations that may be used to lift and overcome the morbid bend of the ribs I will attempt the description of but one.

"Relax the musculature of the back and chest. Rotate, flex and extend the dorsal spine. Examine all the ribs on each side and loosen any that do not move freely. Having done this, the patient is prepared for the specific treatment. Have the patient sit on a stool and lean forward on a table. Have him separate the elbows, flex the forearms, place one hand over the other and his forehead on the hands. Tell him to relax all the muscles of the shoulders and arms and to breathe deeply without using the muscles. After a few trials he is able to fully expand his chest without contracting the muscles connecting the upper extremity with the trunk. The physician then takes a position at side (either side) of the patient and places the weight of his trunk on the ribs of the side he is on, a little external to their angles. He passes his arms around the patient's body; the arms passing across the front of the chest are carried around far enough to allow the hand to be placed on the ribs just external to their angles. The other hand is placed on the top of this one. In this position the physician's body on one side, and his hands on the opposite, occupy similar positions. The patient is now told to inspire deeply and at the same time to relax the shoulder muscles, as before instructed. As the chest expands drop the weight of the trunk on one side and make pressure forward (forward meaning toward the anterior surface of patient's body) with the hands on the other side. This lifts the ribs to a greater extent than the patient unassisted could lift them. At the end of inspiration and during the first third of expiration the chest is compressed laterally. The compressing force, if applied correctly, will fix the ribs in a position of less obliquity and will also correct the increased lateral bending of them. The dorsal spine becomes more convex posteriorly at the moment of lateral compression of the thorax, if correctly made. Great force should not be used at the beginning. Repeat the manipulation five to twenty times each treatment. Give treatment three times a week. A similar movement may be given on the table.

“The greater number of flat chests in patients under thirty years of age may be corrected. If the patient is above thirty, although complete correction may not always be accomplished, the results are satisfactory. Two to six months treatment is required.”

=A “typhoid spine”= comes as a sequel to typhoid fever. There is constant pain, tenderness along the lumbar region and rise of temperature. The pain is generally increased when the spine is moved forward or sidewise. Such a condition is clearly understood by the osteopath. There are always found distinct vertebral lesions along the region that is tender on pressure. In fact these very lesions may have been the predisposing cause of the attack of typhoid fever. The treatment is rest and the indicated manipulation to correct the derangements. It is of great interest to note that where the typhoid patient is treated osteopathically the condition just described seldom results. Observations by C. M. T. Hulett confirm this statement.

The =Neurotic Spine= may be the result of injury but the subject is usually of a nervous, neurasthenic type. It occurs from the age of puberty to adult, much more often in females than males.

The patient has dull pain in the back of the neck or in the lumbar or sacral region, complains of a constant tired feeling and often of a sharp neuralgic pain in certain parts of the spine. Generally there is a drooping posture in the upper dorsal with shoulders thrown forward, which is a sign of weakness. There is extreme tenderness along the spine and usually the pain is confined to the sensitive places.

Treatment consists of a constitutional toning up, and increasing muscular strength through judicious exercise. The posterior curve may be pushed toward the median line by laying the patient on the face; also with the knee in the back and the flat of both hands on the sternal ends raise the ribs; or by the arms making use of the pectoral muscles accomplish the same result. Deep breathing is also effective. Relief can usually be given and a cure will depend upon the patient’s general condition.

The =Hysterical Spine= is usually considered the same as the neurotic spine, but there are many cases which have the sensitive spine without being hysterical. There is more deformity usually present, particularly in the lumbar region. Probably there will be a history of some injury.

The treatment is to correct the curvature and build up the general health. These conditions are stubborn and progress is slow. In both the neurotic and hysterical spines the ligaments of certain areas will be found atonied and relaxed. This is especially noticed upon attempting to spring a group of vertebræ when all of a sudden the section relaxes. In either of these spines the lesions will irritate or obstruct nervous courses, produce venous stagnation or arterial starvation, and disturb lymph channels. H. F. Goetz has observed that in functional nervous diseases the dorsal spine is flat, while in visceral displacement the dorso-lumbar spine is posterior.

The =Spine of the Aged= wherein is found stooped shoulders and a rigid spinal structure, can be distinctly improved by slow, cautious traction. This tones weakened muscles, releases contractures, separates the compressed intervertebral discs, and definitely tones the viscera. Careful work is imperative.

FOOTNOTES:

[40] Journal of the American Osteopathic Association.

POTT’S DISEASE

An article on Pott’s disease does not really come within the province of a practice of medicine. Still it will be acceptable to the practitioners and students of osteopathy, as one of the objects of osteopathic work is to improve, not only medical and obstetrical practice, but also surgical practice, and besides the osteopath will have many cases of spondylitis to treat. “Pott’s disease, or caries of vertebral bodies, was first described by Percival Pott in 1779. It consists of a destructive ostitis affecting the spongy tissue of one or more of the bodies of the vertebræ. The ostitis is tuberculous, and is similar in character to tubercular ostitis seen in the epiphysis of the long bones. Owing to the superincumbent weight of the head and shoulders pressing upon the carious vertebral bodies, the spine and trunk become peculiarly and characteristically distorted. The morbid process is limited, as a rule, to the bodies; the transverse, articular, and spinous processes are rarely primarily affected.” (Park).

The first consideration in the =treatment= of Pott’s disease is rest. If the disease is a progressive one, rest in bed in the recumbent position is necessary. Naturally, the object of the treatment is to secure resolution of the tubercular ostitis as soon as possible. To do this, careful manipulative treatment should be applied to the diseased vertebræ. The treatment must not be harsh, for there

would be danger of greater irritation to the parts, and possibly infected particles from the destroyed tissue might gain entrance to the vascular system. The osteopath must be extremely careful how he manipulates the spinal column in Pott's disease. The object of the manipulation is not primarily to overcome the deformity, as some may think such an act possible, but to separate the vertebræ enough to allow a freedom of the circulation, and to remove impingements of the nerve tissue. It is impossible to overcome the deformity to any extent when part of the body of the vertebra is destroyed; but if one could treat the case at the incipiency, most probably deformity would be prevented. There is another danger in treating cases too severely, and that is causing exhaustion of the patient. Treat the spinal column not only to separate each articulation slightly, but to carefully crowd the diseased vertebræ toward their normal position. When the disease is in the dorsal region, considerable attention has to be paid to the ribs, as they are invariably involved when the spinal curvature is great. Hence it is necessary to treat each rib separately, and try to correct them at least, and remove any obstruction to nerve fibres or vessels that may be found. One of the strongest arguments against the indiscriminate use of braces, jackets and various mechanical appliances in spinal deformities, is that they tend to straighten the spine, by simply crowding the vertebræ and ribs as a whole into place, besides interfering with the cutaneous circulation. The osteopath should realize that each vertebra and rib has to receive special treatment, in order to correct the spinal column, and that mechanically exerting pressure upon all the vertebræ at one time tends to lock the vertebræ and ribs all the more securely. It is like trying to correct a certain subdislocation of the cervical vertebræ by pulling and twisting the neck instead of applying specific treatment—the lesion is all the more firmly fastened. Young, in his Surgery, makes this observation: "Like chronic abscess or chronic bone disease, this affection has its origin in the fact that the tissues of the anterior parts of the bodies of the vertebræ have been partly deprived of their nutrition because of luxated ribs or subluxated or twisted vertebræ."

After the tissue destruction has been limited, and the deformity corrected as much as can be, an ankylosis should be secured if possible. Promotion of ankylosis depends altogether upon the preceding treatment—rest and an improved nutrition of the parts. A truss or brace, if correctly applied, is often beneficial in such cases. The treatment of spinal abscesses is entirely in accordance with surgical treatment.

In all cases the general health of the patient has to be well taken care of. The osteopath must not be over zealous for quick results. It takes many months to perform a cure; however, there is always a tendency toward a cure. Treatment of the spinal muscles and of the limbs, and pure air, sunlight, massage and good food are very necessary.

SPRAINS AND FRACTURES

SPRAINS

The osteopath is often called upon to treat sprains of various sections of the body as well as to relieve after effects of fractures and restore function to the part. The osteopathic treatment is very effectual; therefore, an outline of the purpose and method is given.

Sprain is defined by Dorland as "the wrenching of a joint with partial rupture or other injury of its attachments, and without luxation of bones." From an osteopathic viewpoint the above definition is not fully explanatory, for there is in most cases a partial luxation of the bones. The most common cause of a sprain becoming chronic is the presence of partial bony displacements. Rupture of tissues may be the cause of a chronic state but is not nearly so frequent as the bony dislocation. In most sprains, the wrenching causes a displacement of the bony tissues, which may or may not return to normal position and relation. The function of the muscles is not primarily to hold the bones in place; this is left to the ligaments, so when a wrench of a joint is so severe as to cause rupture of muscles or tearing of ligaments, partial luxation of the bones is almost certain to follow; and even where such damage does not occur a change in the relation of the bones is a frequent occurrence.

Unless a sprain can be seen very early it may be difficult to detect just what has happened; whether it rests with a rupture of the areolar and connective tissues, a displaced cartilage, tendon, or bone, a torn ligament, or ruptured muscle. Hemorrhage and swelling take place so rapidly that no time should be lost in critically examining the joint. When in doubt as to the structural disturbances, particularly in acute cases if there is a possibility of a fracture, and in chronic cases any supposition that tubercular involvement is present, have a radiographic examination.

There is comparatively little to be found in medical literature relative to the =pathology= of sprains. Probably Moullin in his excellent monograph on Sprains has given as good an outline as can be found[41]. He says that "generally speaking, the tissues on one side of a joint are overstretched and torn; those on the other compressed and crushed together; but there is always so much twisting, and such a difference in the strength and power of resistance of various structures, that unless the part is examined with the

greatest care it is almost impossible to say what actually has given way." Hemorrhage due to torn vessels is the cause of most of the swelling within the first few hours. Later on, there is considerable lymph mixed with the blood. There is not only extravasation of blood into the surrounding tissues but also into the synovial wall and cavity. This causes considerable irritation and pain owing to the roughening of the membrane, and the joint becomes inflexible. And if the joint or any strained tissue is kept too long at rest the mass becomes organized and is the cause of much discomfort and annoyance.

Similar changes may occur in the bursæ due to the extravasated blood. Strong ligaments may be torn across, but not frequently. The tear is usually a separation from the bone. Occasionally interosseous ligaments, as for instance in the knee, may be injured.

The muscles may be severely torn, but more often they are "hurt by their own sudden and spasmodic effort at recovery than by anything else." In a few cases the tendons and muscles will be found bruised, lacerated, and dislocated.

The veins occasionally rupture and thus results more or less effusion, so that rigidity and edema may persist for a long time. The bones are very frequently damaged. This may be a simple bruising of the tissue but more often, as osteopathic diagnosis shows, there is partial displacement of the bony structure.

A point of great importance that every experienced osteopath will agree to is the following from Moullin: "Diseases of the spine, hip, and other joints in children may be due, in great measure, to some constitutional taint, though it is open to question whether the influence of this is not overrated; but it is quite certain that the immediate starting point in nine cases out of ten is some chance sprain, often so slight as scarcely to have been noticed at the time."

Before treating a sprain there are one or two points the osteopath should carefully note: first, that there is no complicative fracture; second, in children that there is not an epiphysial separation; and, third, note peculiarities of a constitutional character that would complicate matters. Whatever is done, always give the patient the benefit of the doubt.

If the patient can be seen early, before swelling has reached the maximum, many times a very quick cure can be secured. Do not at once put the part at rest and apply cold, but examine the sprain most carefully and thoroughly and readjust first of all any bony defects; then replace the softer tissues if displaced, and next relax contractions; follow this by light massage and passive movements to reduce and combat hemorrhage and swelling. This treatment alone in a fair percentage of cases will be all that is necessary provided frequent subsequent treatments of massage and passive movements are continued to reduce and counteract inflammation and to prevent rigidity and stiffness of the softer tissues. Where the osteopathic treatment is distinctly indicated is in the readjustive manipulation. This is the reason why the treatment is so efficacious, and the patient is cured in a fraction of the usual time, and few sprains result in complications and become chronic. In sprains that have become chronic there will be found almost invariably some osseous tissue slightly displaced. After correcting this, apply careful and thorough manipulation and massage and movements to break up adhesions, to remove effusions and extravasations, to relax muscles, and to promote normal circulation. Care should be taken that there are no displaced cartilages, ligaments, tendons, or muscles.

It is well to keep in mind that the osteopathic readjustive manipulation is not an exercise or movement, but definite, specific correction of the tissues anatomically. Do not treat the displacement by any general "pommelling," but apply the mechanical principles indicated as in any dislocation. This will mean much to the patient in more ways than one, and especially so should the sprain be so severe and complicated as to demand anesthesia for correction.

There is no objection to the employment of cold and heat; in fact, both are beneficial. Cold to prevent extravasation and swelling, and heat to remove and relieve the same, is a sound and practical method. But do not apply a wet bandage. Pouring cold water over the sprain is the best method; even better than immersing the part. An ice bag is another good way to apply cold. When the skin begins to look blanched and dull the maximum amount of benefit has been secured. Heat at the very first may be employed instead of cold, for it has a tendency to prevent bleeding and inflammation, but the temperature of the application must be hot as can be borne or else the desired effect will not be obtained. Later on to relieve pain and rigidity, and to relax the muscles so that a better circulation will be secured, moderate heat will be beneficial. Then the application of heat and cold alternately will be of service, employed as a douche for a tonic effect, when the part is weak, inactive, and powerless after the elapse of several days. It should always be remembered that the employment of heat and cold is only of temporary benefit, so if used too long opposite effects to those desired will result.

Bandaging the sprain may be helpful, but not always. Great care should be taken as to how pressure is applied. Bandaging from periphery toward the trunk, seeing that the bandage is smooth, and padding all depressions so that the bandage does not touch

bony prominences only, are necessary. Unless the bandage is applied so that an even pressure is secured, the material used not too warm, and the bandage attended to each day, the effectiveness will amount to but little.

Next, do not make the mistake of resting the injured joint too much. The function of a joint is movement, and it has been observed that prolonged rest of a healthy joint may result in rigidity, stiffness, and distension of the soft part, and even serious organic changes in the ligaments, synovial membrane, and cartilages have occurred. Consequently continued passive movements should be kept up from the inception of the injury, although it must not be carried to extremes so that inflammation, hemorrhage, or laceration will be aggravated. Moullin says: “As a rule, passive movement may be commenced from the second day with the certainty of preventing adhesions, and without the least fear.” Osteopathically, with due attention to readjustive manipulation, and care as to correct position and rest, passive motion will be allowable usually from the first day.

There is much corroborative evidence in current medical literature that bears in a general way upon part of the foregoing. The International Text Book of Surgery says: “Massage should begin early, in order to avoid, as far as possible, weakness of the muscles, and to ensure security to the position of the joints by the retention of a proper tone in them;” besides, early movement tends to reduce the effusion into the tendon sheaths around the articulation, which in some cases, particularly the ankle and wrist, may be a very prominent feature. The Reference Hand Book of the Medical Sciences voices the same opinion; and Mumford is referred to as follows: “Immobilization for more than a few days, as under the older methods, is objectionable because adhesions are apt to form, thus causing impairment of function, and because when there is a =tubercular taint=, proper conditions for a localized tuberculosis are established.” Among other statements Holder Sneve in the Journal of the American Medical Association of June 1, 1901, says: “Immobilization of muscles is not rest. On the contrary, in all sprains the muscles should have passive exercise the first few hours and days, and active exercise after that. In the majority of cases active exercise should be instituted from the beginning. The plaster cast should not be used at all, even in cases where we have a fracture, unless it be impossible to maintain a proper position of the joint.”[42]

Again quotation is made from Moullin. These quotations are taken from the chapters on Manipulation and Massage. It will be observed he makes a distinction between the two methods. And the osteopath should carefully keep in mind not only the difference between the two, but beyond these the more fundamental treatment, readjustment. The characteristic feature of osteopathy is anatomical readjustment, and this in sprains should be supplemented by massage (superficial work), and also manipulation (deep and more or less forcible work) in order to remove stiffness, rigidity, and fibrous ankylosis.

The following is relative to forcible manipulation: “Manipulation is much more useful than division; it can be employed for such a variety of purposes. In the early stages it prevents the occurrence of stiffness or the formation of adhesions. Later, when the swelling and heat have disappeared, it is no less successful in restoring freedom and ease of movement, and afterward, when all mechanical obstructions have been cleared away by its use, it is one of the most effectual methods known for bringing back the circulation and nutrition of the part, and giving again to the muscles and nerves the energy which has so long been wanting....

“To carry this out effectively two things are needed beyond all others. The one is a sense of touch so delicate that it can appreciate the least resistance or irregularity of movement; the other an accurate knowledge, not merely of the ordinary anatomy of the part, but of the different degrees of tension that fall on the ligaments in every position of the limb.

“Each joint requires a different kind of manipulation according to its construction....

“There should be no jerking. The movements must be vigorous and forcible, but perfectly smooth; and they must be carried out thoroughly, the joint being moved to its full extent in all directions that are natural to it. Each kind of action should be combined successively with the rest, one by one, so that the tension may fall in turn upon all the different parts of the capsule.

“Movements which are especially restricted or painful, of course require most attention, but the others, though they may not be affected to the same extent, are not to be neglected. It sometimes happens if these are dealt with first, that a considerable proportion of the main obstruction is cleared away, as it were, by side attacks, so that when its turn comes it yields more readily than it otherwise would.

“Recent slight adhesions give away at once without a sound, though the sensation is generally conveyed to the hand. When they are older the noise may be as loud and clear as when a bone is broken....

“The after treatment of these cases (cases where there has been tearing and breaking of adhesions) should be in all respects the same as that of a recent sprain, only if passive motion at an early date is advisable to prevent the occurrence of stiffness in the one,

it is absolutely necessary in the other."

The following pertains to massage of sprains: "Massage, in the strict sense of the term, is a great deal more efficacious, especially with older sprains. Its action is not limited to the skin and superficial structures. These undergo immense changes, it is true; they become softer and finer while under manipulation; their strength and elasticity increase, the extreme tenderness diminishes, and the natural appearance and texture return. The surface loses its dry, harsh character and becomes warm and moist again; the livid bluish color gives away to a brighter hue, and the deeper layers of fibrous tissue yield and stretch, so that the hide-bound, shrunken condition that is often present after long disuse gradually passes off. But the good effect is not by any means limited to, or even most conspicuously shown by, this. When properly carried out, massage exerts a simultaneous influence on muscles, nerves, and vessels; in fact, on all the tissues within its reach.

"The circulation is the first thing to feel its power. It has already been explained how, after prolonged rest, the blood, as it were, lies almost stagnant in the tissues, slowly circulating through them, and neither giving them sufficient for their nutrition, nor removing from them the waste products of their action. This is changed at once. The life of the part is quickened. The veins and absorbents are emptied first, and the fluid they contain driven out into the heart, which fills more rapidly, and contracts more vigorously and firmly. Then the pressure falls in the smaller vessels, and the tiny irregular spaces, full of lymph, which extend in all directions through the tissues. These, in their turn, are compressed and mechanically emptied, their contents being driven on into the empty vessels, from which any backward flow is prevented by the valves. The circulation becomes more rapid; nutrition is carried on with greater energy, and the actual amount of the blood in the tissues at any one time so much increased that they become full and soft to the touch and regain the even and rounded contour of active health....

"It is most essential to commence as gradually and as gently as possible, working on the deeper tissues only after the more superficial ones have become thoroughly accustomed, and have been unloaded of their surplus fluid. The skin, the soft subcutaneous tissue, the muscles, and the deeper layers, must all be worked in turn. Nor should the manipulation be confined to the injured part. In a sprain of any standing, the whole of the limb is affected more or less. It is usually better to devote attention first to the parts nearer the trunk than to deal with those around the injured area, and only afterward, when the circulation is thoroughly reestablished, to manipulate the joint itself.

"The tendency is to make the sittings last too long. Deep manipulation itself rarely requires more than =five minutes=; but in dealing with a recent injury it may be advisable to spend a longer time than this over the friction and other preparatory measures, so that a quarter of an hour soon passes by. When the tenderness is very great, and the amount of swelling excessive, much longer than this may be necessary, but short, frequently repeated sittings are of greater benefit than one long one. A skillful operator, too, will often effect more in a few minutes than an ordinary rubber will in as many sittings."

A summary of the general treatments of sprains would be as follows:

1. Readjustment of parts and removal of obstructions. Osteopathy is especially adapted in these cases, for two of the primal therapeutic factors in all cases from an osteopathic viewpoint are to readjust the anatomical and to remove obstructions. One should constantly keep in mind, "a temporary displacement followed immediately by a return to place, constitutes a sprain." The osteopath often finds that a perfect returning does not take place, and even remote lesions may affect a joint.

2. Manipulation, and massage of soft tissues, to restore circulation and to prevent and remove debris from rupture of vessels and inflammatory products.

3. The employment of cold, heat and pressure, and a certain amount of rest.

4. Anatomical readjustment and manipulation in chronic cases to break up adhesions, remove exudates, overcome the organized products of inflammation, and cure synovitis.

5. Movements both passive and active to stimulate and exercise functions of the joint.

=The Spinal Column.=—The osteopath is especially cognizant of the fact that many sprains occur to the spinal column. These may affect a single joint, or more or less of a section may be involved. The bones, ligaments, tendons, muscles, or spinal cord may be found injured. Even distant organs, through involvement of the circulation to the cord, or through irritation or impingement of spinal nerves and sympathetics, are frequently disordered. It is not necessary to go into detailed description, for the points bearing upon this will be found under Osteopathic Diagnosis, Etiology, and Technique, and the general description will, also, apply.

Readjustment, strapping, heat, massage, manipulation, ironing, stretching of muscles, fomentation, etc., have their place. There is no doubt that sprains, strains, and blows to the spinal column are the cause of many spinal disorders and consequent visceral disturbances.

=The Ribs.=—Sprains of the vertebral ends frequently occur, resulting in a partial luxation, stretching of ligaments, contraction of muscles, and exudative formation in the joint structures, which often is the cause of irritation to the sympathetic nerves. The costal cartilages are frequently strained, and may so irritate the intercostal nerve as to cause considerable pain both locally and reflexly. The treatment is essentially one of replacement, and relaxation of the softer tissues. Adhesive strips to limit movement due to respiration may be helpful.

=The Innominata.=—Sprains of the innominata are also commonly met with. Besides being a source of discomfort to the patient they are an important cause of pelvic disorders and leg affections. Partial displacements are the rule, the correction of which gives quick relief. Where there is considerable spasm of muscles, examine carefully the lumbar alignment. In chronic cases fibrosis of muscles and adhesions may complicate matters.

=The Hip Joint.=—Sprains involving the hip joint may be readily corrected, and again may be the exciting cause of serious involvement. Previous tubercular disease can be aggravated in this manner, or syphilitic changes in the joint disturbed. Care should be taken that there are no complicating displacements of the innominata or irritations to the spinal nerves. Possibly the hip may be so strained as to cause a twist of the femur in the socket and thus simulate a partial dislocation; this, in fact, would probably be termed a partial dislocation. Strain of one set of muscles about the hip joint is somewhat rare, and spinal lesions may disturb the innervation to one set of muscles. In cases of =intracapsular fracture= considerable can be done by careful massage and manipulation after union has taken place, to secure greater freedom of movement and strength of the limb. Likewise in =hip-joint disease=, after the disease is healed, massage and manipulation will be very beneficial. Care must be taken if the treatment causes spasticity of the muscles; this shows the treatment is irritative and should be stopped until the spasticity has ceased. Where the limb is shortened from either hip-joint disease or intracapsular fracture apparent lengthening may be secured by careful abductive and hyperextensive stretching.

=The Knee.=—The knee is the most complicated joint, and sprains are apt to be very serious. The usual treatment for sprains is employed. Occasionally the semilunar cartilages are displaced and may be a source of difficulty in diagnosis; likewise injuries to the patellar tendon and lateral ligaments. Another joint frequently overlooked is the innominate. In a number of knee cases that terminate in chronic synovitis there will be found a displacement of the innominate that is preventing recovery. A villous synovitis may arise in strains from faulty posture, especially in the obese. Injury to the hip-joint, also, may cause strain or irritation at the knee. Occasionally tender points about the knee, especially at the inner side, are due to irritation at the hip, or possibly from the spine. Referred pain of the knee joint is of frequent occurrence.

=The Ankle and Foot.=—The ankle is often sprained. One should examine carefully for a possible fracture of the malleolus, and for fracture of the tibia. There may be a dislocation of the fibula, also a separating of the tibia and fibula at the ankle. The common bony displacement takes place between the astragalus and os calcis. Then the cuboid is frequently displaced, and occasionally the navicular. The treatment should first of all be directed to correction of the osseous lesions. The arch of the instep may be weakened from the ligamentous strain and be an immediate step in the production of =flat foot=. Teall is of the opinion that lumbar and innominate displacement are common predisposing causes. Faulty position of the foot in walking may be an underlying factor.

=Bunions= result from a malposition of the joint. =Morton’s disease= due to a pinching of the metatarsal nerve will often yield to osteopathic treatment alone. There is generally displacement of the metatarsal bone. A pad worn directly under the painful point will be of benefit. In many of the local neuralgias, some anatomical displacement will be found as the exciting cause. =Hammer-toe= if not complicated with gout, rheumatism, etc., will yield to treatment if kept at persistently, otherwise surgical interference will be necessary.

Likewise various deformities of the foot and resulting neuralgias may be traced to local sprains, ill-fitting shoes, or anatomical maladjustments higher up of such a character as to affect the pedal circulation.

Flat Foot

Flat foot or weak foot is one of the common disorders that the osteopath is constantly called upon to treat. In the first place the patient should be taught to walk correctly. The feet should be parallel in walking so that the weakened muscles may be developed

and strengthened. This will be difficult at first, but recovery depends upon this important point. In addition to this, special exercises, like turning the toes under and tip toe exercises, should be persisted in for a few minutes two or three times daily. Upon the other hand, do not overdo the exercises but always carry them to a point of fatigue. These two features, walking correctly and exercising, are essential complementary measures to the adjusting treatment. In conjunction with the above, the Scotch douche at the end of the day will prove of considerable benefit.

In the technique work, first make certain that there are no innominate or spinal lesions that bear upon the circulation and innervation of the feet. Then frequently faulty walking is due to these lesions.

In recent cases, simply remolding the arches of the foot will be all that is necessary, providing correct walking and foot exercising is maintained. But in the more chronic cases considerable adjusting and remolding of the tissues, bones, ligaments, muscles and fascia, are demanded. Perfect apposition between the astragalus and navicular bones, the highest point of the longitudinal arch, should be first secured. Attention should also be given the other articulating structures down to the metatarsal bones. This reestablishes the arch and overcomes the everted tendency. Considerable repeated force is often demanded to release the fibrotic tissues, but it is the important part of this technique.

With the patient on the table, supine, place your thumb firmly at the articulation of the navicular and astragalus. Then with the other hand around the metatarsals to be used as a lever in extending, rotating and inverting the foot with the fulcrum at the thumb of the first hand, spring, thrust and adjust the arch. This requires considerable strength and exactness of application. The tissues must give freely before the result can be secured. This is often painful to the patient but should be continued and repeated to the furthest point of motion until recovery is complete. Treat as often as the condition permits. Substituting the crotch of the thumb and forefinger or the knee for the thumb will give added advantage. Follow this with thorough springing of the plantar tissues by thumb and fingers.

If this is kept up with suitable exercises and correct walking, and proper shoes (Munson last), excellent results will be obtained in the great majority of cases. Same pair of shoes should not be worn two days in succession.

Many times the anterior arch is involved, jointly or separately. Persistent adjusting and remolding of the arch tissues will secure satisfactory results unless the bones are markedly deformed and the weight of the body is relatively too great. In this disorder, aside from paying special attention to the metatarsal articulations, the great toe requires a particular technique. For this grasp the toe firmly, exert traction until the tissue gives slightly and rotate it inward, toward the median line of the body, on its longitudinal axis. Have the patient frequently turn the toes under, or attempt to do it until the exercise can be easily accomplished.

Do not employ arch supporters except in hopeless cases. They simply splint the foot and thus further weaken the foot muscles. If the above methods are persistently followed to the point of actual adjustment, accompanied by releasing of fibrous tissue and actual strengthening of muscles through exercise, a very large percentage of cases will recover. In a few cases adhesive strips will be of benefit.

=The Shoulder.=—Exclusive of muscular and other strains there may be a partial dislocation. In these cases the acromial end of the clavicle is frequently dislocated, and owing to a general lack of muscular tone may be very hard to keep in place. The lower and inner part of the capsule is often affected, so that freedom of function is lacking and there is considerable pain. This is due to the thinness of the capsule and the large amount of soft tissue, so that when the arm hangs at the side the tissue is thrown into folds; and being very vascular is easily injured, so that the vascular lymph readily organizes and the part becomes stiff and unyielding. It requires patient, laborious treatment to break up and absorb this fibrous tissue. Then the long tendon of the biceps in some shoulder sprains is dislocated, but rarely. In shoulder injuries, examine also, the upper ribs.

=The Elbow.=—The elbow is another complicated joint. One should be careful that there is no fracture, and in children that there is not =epiphysial separation=. Extending, flexing, pronating and supinating the arm will aid much in the diagnosis. Examine well the rotation of the radius at the elbow joint, and be positive that the olecranon process drops normally into its fossa at the end of the humerus.

=The Wrist and Hand.=—The wrist is another joint commonly sprained. Here, also, care should be taken that a fracture does not exist. Colle’s fracture is frequent. The bursal and tendon sheaths are usually markedly involved. The scaphoid and semilunar are apt to be displaced; also, the os magnum and the unciform.

Sprains of the =fingers= are often met with. Outside of strains to the muscles, ligaments, and other tissues the joint is apt to be somewhat impacted. Traction will correct the latter. Care should be taken that a fracture is not present. =Dupuytren's contraction= occurs from sprains or injuries, as the result of contraction of the fascia. The ring and index fingers are members usually affected. In some cases the affection will be found in both hands (symmetrical), and a spinal lesion will be the predisposing factor. Treatment every day, by straightening the fingers and stretching the tissue will at least retard the deformity, but in a number of cases surgery will have to be resorted to.

A =ganglion= or "weeping sinew" is a swelling in connection with the tendon sheath. It presents a round, firm outline, usually upon the back of the wrist. There is generally found a displacement of one or more of the wrist bones. If treatment of the joint and tendon sheath does not remove the ganglion, surgery may be utilized. =Trigger-finger= is a rare disorder. There is usually a history of local strain, which probably resulted in some thickening of the tendon. Manipulation and passive motion if continued will generally give relief.

Fractures

Immobilization and rest have been the paramount points with most physicians in the treatment of fractures and sprains. They have claimed that a sprain should be manipulated but rarely, much less a fractured bone. Rest, quiet, and fixation of an injured joint or bone have been rules that should not be violated under any consideration. In cases of sprain the great cry has been to let the joint alone for fear of spreading a possible =tubercular infection=. It is well to recall Mumford's statement that if immobilization is too long continued, should there be a tubercular taint, proper conditions for a localized tuberculosis is established. And still a word of caution here, that an osteopath should not be over zealous and should carefully weigh all possible factors, both local and constitutional, may not be amiss. In previous tubercular, syphilitic, and other diseased states discretion should be employed.

Reducing rest and immobilization to a minimum means much to the patient, not only in the loss of valuable time but in annoying and serious after effects. Many cases of sprains and fractures come to the osteopath. In sprains that have become chronic through too much rest of the part and improper treatment, almost invariably there is found displacements of bone and adhesions that should never have existed; then has followed organized exudates and chronic synovitis. In fractures and even in complete dislocations the osteopath continually observes that too much rest has been given the part, resulting in unnecessary adhesions, contractions, atrophy of muscles, and impairment of function. Treatment almost always cures the condition, or at least materially relieves. How much better if the proper treatment had been first instituted and thus a large percentage of cases prevented from becoming chronic.

Of particular interest to the osteopath is the paper prepared by Eisendrath on "Early Massage and Movements in the Treatment of Fractures and Sprains," and the discussion that followed before the Chicago Medical Society. The Illinois Medical Journal, December, 1903, contains a report.

Eisendrath said in part: "The former routine of immobilizing all fractures and the adjacent joints for a period of four to six weeks must, I feel, be subject to slight modification in the light of recent experience, and it shall be the aim of this paper to show what these changes are. When we are called to a case of fracture, it should be one's first duty after its reduction to consider how can I best aid the patient in recovering the usefulness of his or her limbs? Can we shorten the long convalescence with its resultant loss of valuable time and earning capacity? How can we most rapidly restore to the limb its normal joint functions and prevent an atrophy of muscles and an ankylosis which will require many months to overcome?...

"The use of massage and of active and passive movements in the treatment of fractures and of severe sprains has been gradually gaining in the number of its advocates through the writings of Lucas-Championniere of Paris. We owe him a great debt for calling the attention of the profession to the employment of these methods in order to prevent atrophy and ankylosis as well as to promote healing....

"Before taking up my subject in detail permit me to recall a few salient points in the surgical pathology of fracture. Soon after the injury the blood clot around and between the ends of the fragments is absorbed and replaced by a jelly-like mass of young connective tissue cells called the callus. It corresponds to the solder which the plumber places over the ends of two pipes he desires to join. Bone begins to form at the periphery of the callus about the tenth day and advances toward the center rapidly, forming a ring of bone around the ends of the fragments so that by the end of the third week there is but slight abnormal motion at the point of fracture (exception to this is the femur). This entirely disappears by the end of the fourth week, especially in young people, and the union is firm. In the case of the femur it requires six or eight weeks. The greater the displacement of the ends of the fragment, the larger the callus and the slower the healing of the fracture.

“During these changes (callus formation) the muscles which supply the immobilized joints atrophy and the circulation in the skin and neighboring tissues is sluggish, resulting in swelling, etc., of the limb. The enforced rest causes more or less fluid to accumulate in the tendon sheaths and joints. This becomes organized and results in fibrous ankylosis of the joints and great impediment to the free action of the tendons within their sheaths. It is this atrophy, fibrous ankylosis and tenovaginitis which interfere with the restoration of the normal functions of the limb....

“Can we decrease the amount of wasting of muscles and control the stiffness of joints and tendons after fractures?

“It is the belief of the writer, based on a large experience, that the earlier use of massage, active and passive motions, will to a great extent eliminate the above conditions, which retard convalescence and in some cases cause permanent disability.

“Massage of an injured limb increases the amount of blood supplied to it, promotes the absorption of the swelling and prevents atrophy of muscles. In the case of a joint injury the exudate rapidly disappears and the articular surfaces can be again approximated so that movement is facilitated. By the cautious use of active and passive movements, either with or without the aid of apparatus, the normal functions of a joint can be rapidly restored....

“The active and passive movements of the limbs can be carried out immediately after the massage, but should only be permitted for a period of =five minutes= at first and the time then gradually increased. When a severe sprain, say the elbow or ankle, is first massaged, the pain seems to be almost unbearable, but this discomfort as well as the swelling rapidly disappears, and it is surprising to those who have never applied this treatment how quickly the normal function of the joint reappears. The same applies to the synovitis which accompanies fractures in close proximity or even into joints.”

The relief given these cases by massage, movements and manipulations by the osteopath is a daily experience, and results to him are not surprising. Then in addition to what the surgeon would do, the osteopath applies his principles of careful detail readjustment.

Eisendrath continues his paper by referring to the principal varieties of fractures and giving the treatment for each. He says that if correct treatment is carried out with proper massage and movements in fractures of one or both bones of the leg, the patient will be at work in six or seven weeks instead of three or four months, that in Colle’s fracture some surgeons do not employ a splint, and that in fractures of the olecranon, massage from the first week on is of the greatest use. This part is very interesting but space forbids giving it.

He then concludes his article with citation of several very interesting cases of fractures and severe sprains. These cases are exceptionally interesting to the osteopath, but still the same good treatment and results are duplicated every day in the osteopathic school.

The doctor’s contraindications to the use of early massage in fractures or sprains are the following:

“1. Tendency to displacement of fragments in oblique fractures. Under such conditions it is best not to begin either massage or movements until the union is firm (fourth to fifth week).

“2. In compound fractures until the wound is healed.

“3. Whenever the condition of the skin is such as to permit of infection; for example, the presence of blebs, or extensive abrasions.

“4. The presence of fragments which project but do not penetrate the skin.”

His conclusions are:

“1. Massage, active and passive motions prevent atrophy of muscles, tenovaginitis and ankylosis so frequently accompanying and following fractures, especially those close to the shoulder, elbow, wrist, knee and ankle joints.

“2. They give far better results than complete immobilization in the majority of fractures.”

In the discussion that followed Henrotin said that for some time, “I have never put a restraining apparatus of any kind, nor have I used any lotions on any sprain, no matter how severe....

“It has taken many years to bring this subject before the profession. It is a method that is absolutely effective as regards sprains and some forms of fractures. I have treated several hundred such cases with the greatest success.” He also said that, “In treating

an inflamed joint it is improper to use a restraining apparatus of any kind. I consider that the plaster cast is the bane of all inflamed joints unless there is a =specific form of infection=, a traumatic condition." Neither does he believe that an inflamed joint should be put at rest. He says the patient is a good judge as to the amount of quiet the joint needs. He has treated Colle's fractures and fractured clavicles without bandages or apparatus.

To sum up, the osteopathic procedure in the treatment of fractures would be as follows:

1. Immobilization in those cases especially demanding it, from the character of the fracture, until formation assures solid and firm union.

2. Manipulation and massage and movements of parts at an early period, compatible with the above, to render soft tissues pliable, to remove stiffness and adhesions, to restore a normal circulation, and to exercise and function the parts.

3. In cases of laceration of soft tissues, abrasions, etc., great care should be taken so as not to infect the parts.

4. Great care should be taken where fracture is compound, and where fragments exist.

5. In all cases, both acute and chronic, critically examine for slight anatomical deviations locally and remotely.

In dislocations the fundamentals of the above are applicable. Do not let chronic stiffness, or rigidity, adhesions, or synovitis supervene if possible to prevent.

An important consideration in all cases of sprains, fractures, and dislocations that become chronic is the probable effect upon dependent tissues by way of nerve impairment and vascular obstruction; for examples, the sprained back may readily impair organic life, the fractured elbow prevent use of the arm, the injured leg predispose to flat foot. (See J. B. Littlejohn—Osteopathic Surgery, including Treatment of Fractures, Journal of the American Osteopathic Association, Nov., 1905.)

FOOTNOTES:

[41] See also Jones' latest work, Injuries to Joints.

[42] See also Wharton Hood, Sprains and Fractures.

POSTURAL DEFECTS

A postural defect is any abnormal position, congenital or acquired, of the body, assumed in sitting, standing or walking. This leads to a symmetrical development, causes structural changes, and as a sequel, disturbance of function and organic life results.

Defects in posture are of very common occurrence. A perfect posture, in fact, is somewhat rare. Considerable is being accomplished, especially of late years, by the laity through various physical methods and exercises to correct the many defects of position in sitting, standing and walking. The originators of the many so-termed systems of exercises have gone so far as to even advertise to cure various diseases of the body as well as attempting to improve the normal tissues and structure.

Exercises, undoubtedly, have their place, particularly in the life of those of sedentary habits. Most of us do not exercise enough, neither do we as a rule get enough fresh air and pure water. But there are many defects of the anatomical that mere gymnastics can not adjust. And there are still other defects that gymnastics may decidedly aggravate. In these cases the mechanism of the body has become so deranged and disturbed that nothing short of actual readjustment can be effective.

In the consideration of postural defects there are a few points that should be particularly emphasized. First, these defects may not only be the result of laziness or carelessness, but of more frequent occurrence is some previous strain or injury to the spinal column or other parts of the body framework. Some defect of position or symmetry of the body may easily follow as a result. Here gymnastic work may reduce the defect to a minimum, but rarely can the compensatory forces of nature entirely obliterate the structural disorder, unless assisted by actual, specific readjustment. Second, in the examination and treatment of the patient due attention should be given the symmetry and figure of the body as a whole so that relation of the part to the whole and _vice versa_ may be rightly proportioned. Remember that the spinal column is only one part of the body outline, thus one should consider the transverse section of the body in relation to the spinal column and not the spinal column alone. In a word, correction of postural defects implies both structural rearrangement and molding of the contour. Do not make the mistake, for example, when correcting a deformity that involves the chest, of paying attention to the spine alone, but take into consideration the thorax as a whole of which

the spine is only a part.

Round Shoulders

=Round Shoulders= are a defective posture with which everyone is familiar. How many children have escaped the parents' criticism to sit, stand, and walk erect? And not a few of the afflicted have not succeeded after persistently doing their best.

Round shoulders or stoop shoulders are commonly attributed to indifference. Probably a few cases are due simply to laziness and indifference, and others may be carelessness, and usually when they arrive at an age where pride of their physical demeanor and powers enters as a life factor, the child soon overcomes the postural weakness. With still others the correct, persistent physical training, as exemplified in military schools, will readjust the defect. But there is a class, and by far the largest, where round shoulders are a very real and active weakness of the physical body. And the weakness is not primarily in the shoulders as nearly everyone thinks. The stoop is a result. The origin is in the lower dorsal spinal column. Here will be found a posterior curvature that involves nearly the entire dorsal and lumbar areas. This is the real, the original cause of the larger number of round shoulders.

This backward curve of the spinal column, instead of the forward curve as it should normally be at the waist, obliterates the brace or truss of the spinal column that is so essential in maintaining an erect posture of the shoulders. It allows the individual to "fall into his stomach," to drop the shoulders, and as a consequence the chest cavity is depressed. The spine is one continuous backward bow, and when he does try to sit straight, and it is always with a constant effort, the normal, the physiological curves of the spine are not apparent.

First, then, there is a spinal weakness in the region of the innervation to the digestive organs. Indigestion of various forms is a common accompaniment. Second, there is lessened lung and heart capacity. The ribs are depressed, interfering with perfect aeration and elimination on the part of the lungs and with normal activity and tone of the heart muscles. Phthisis is predisposed. Is it any wonder the child's blood is impoverished and anemia results from the insufficient aeration and poor digestion and assimilation? Costogenic anemia may also be a result. And, third, the shoulders are "round" from the spinal weakness and flattened chest, really an effect; but while the most noticeable, it is the least serious.

It is evident from careful observation and study of these cases that the treatment resolves itself into the treatment of a posterior spinal curvature. Shoulder braces, steel braces and jackets, and casts have very little place, if any, although there may be diseased bone of such character and severity that a cast will be necessary; this, however, would refer to treatment of Pott's disease and similar conditions.

Hence, the =treatment= is, first to replace and readjust the malaligned vertebræ. There must be an actual physical manipulation in order to correct the vertebræ at fault. This is the essential, and by far the primal, treatment for the key to the truss or brace that holds and retains the body in an erect position is then replaced.

Second, raising the depressed ribs. Remember the depressed ribs are dependent upon the spinal condition. The thorax should be treated as a comprehensive whole, not the spinal column alone.

Third, exercises are a valuable aid. The individual's part is as necessary, in a way, as the physician's, for in order to accomplish the maximum there should be consistent and appreciative work on the part of the patient. Holding the shoulders back, the head erect and the chin in, drawing the abdomen in and up, all with deep breathing by the use of the chest muscles, the patient will be able to retain the correction obtained during treatments. "Setting up" exercises are helpful. Developing the muscles of forced expiration is excellent. Thus the patient must be conscious of the work required of him and act in concert with the physician. Minute instruction on the requirements of each case is demanded.

Good food, pure water, and fresh air are necessary, particularly in the anemic. Right living and correct environment are always in order.

Painful Shoulders

Under this heading may come a variety of conditions affecting one or both shoulders causing much distress and, at times, total disability. The conditions may be the result of direct injury to the joint, systemic, or from spinal lesions. Anatomically the shoulder offers frequent opportunity to injury as it has the greatest range of motion of any joint, is least secure in its articulation, and is most vulnerable from location. Once the shoulder has been dislocated it is rarely back to normal functioning again as this injury tears the

capsular ligament and stretches the structures in relation. Many times there is only a =subluxation= in which the head of the humerus is driven upwards in the fossa, usually from a fall or blow on the point of the elbow. As a rule, after such an accident, the only thing done is to rest the joint and apply a liniment and, after a time, begin the use of the arm. It is, however, painful and to save himself, the patient each time restricts movement until he reaches a point where he is unable to dress without assistance. It is then found that normal motion is reduced fully one-half and even this will be accompanied by pain on movement and in bed. A radiograph will, usually, show the condition. Articular crepitus and fibrous adhesions are present while the adjoining structures have undergone changes so that a reduction is impossible without certain preparation. Very often a trivial cause will disable a joint; a sudden movement which finds the muscles about the shoulder unprepared and the resulting lesion is so slight as to, often, defy detection. At first there will be swelling and pain but, in time, it settles down to a limited motion with more or less distress.

=Bursitis.=—This is a condition in which the subdeltoid bursa is involved or where there have been a number of bursæ formed from overuse of the joint. One authority reports as many as twenty-five in a shoulder. There may be, also, tenosynovitis primarily or from extension. These conditions may not be easily diagnosed at first.

=Brachial neuritis= (chronic) beginning with or without an acute attack is usually from a cervical lesion involving the brachial plexus but most frequently it is the 5th and 6th cervicals at the origin of the circumflex nerve. From this the deltoid is particularly affected and its contraction leads to pressure on the nerve and subsequent partial or complete paralysis. Brachial neuritis is found in an increasing number of osteopathic practicians and is the result of overwork of the arms and to strain of the upper dorsals and lower cervicals. There are contractions of structures about the joint constantly limiting motion and pain when a strain is put on them.

Many methods for the treatment of the conditions described have been employed, all involving the same principle but none of them systematized. C. H. Spencer has worked out a technique which, while originally intended for bursitis, has been found well adapted to all conditions described. It gives a stretching of all structures and gradually breaks up adhesions, both in the joint and in the tendon sheaths, so there is no resulting irritation which could easily result if suddenly done. His technique is[43]:

“First: The patient on the side, the affected shoulder up; operator facing the patient, places one hand on the top of the shoulder, does nothing more than fixing it; with the hand grasping the forearm above the wrist, push the elbow backward, the arm parallel to and almost in contact with the body, then pull forward in the same plane. Second: Elevate the elbow with the hands of the operator in the same position as before, carry the elbow in as wide a circle as possible. Third: With the hands still in the same position, extend the forearm with traction; carry it as high in front of the patient as possible. The foregoing are designed to relieve the congestion about the shoulder, bring pressure to bear on the subdeltoid bursa and moderate traction on the supraspinatus, infraspinatus, subscapularis, teres minor and major, latissimus dorsi and the tendon of the biceps. These manipulations will be all that is possible in the more aggravated cases for some considerable period of time. As the tenderness subsides, the second group may be cautiously started, the hands in the same position as above noted, with the arm extended as nearly as possible at right angles with the body, carry the arm in as wide a circle as the pain will permit. Again, with the arm flexed at the elbow, one hand of the operator on the point of the shoulder and the forearm of the patient across the forearm of the operator, the other hand of the operator resting on the point of the patient’s elbow, push down toward the middle line of the body and carry the elbow toward the head. Then flex the arm and place the back of the hand behind the patient, flexing the shoulder in front with one hand grasping the point of the elbow and pull forward. This group of movements accomplishes with greater force the same ends obtained in the previous, and the first in this group is the most effective in overcoming swelling of the subdeltoid bursa. Direct manipulation of the muscle masses and this bursa is desirable from the first.” It will be noticed in all these movements that the joint is protected by one hand of the operator while the other is grasping the arm of the patient. This is desirable as it makes the technique absolutely safe. An additional treatment will be found very effective, especially where the deltoid is involved. With the patient on the well side, facing the operator, locate the quadrilateral space which is bounded by the subscapularis above, the teres minor below and the long head of the biceps medially and the surgical neck of the humerus externally, and the circumflex nerve can be easily palpated along with the artery. If these structures are stretched and the deltoid lifted from the shoulder it will be found to free the action of both nerve and artery, one supplying the joint with nutrition and the other innervating it.

Certain conditions for which these movements are contraindicated arise and the following differential points by H. Glasscock are well to remember[44]: =“Rheumatism=: Fever in the joint, with redness, swelling and other joints involved. =Tuberculosis=: Daily temperature and other tubercular foci. =Neuritis=: Pain in the neck and shoulder muscles, also near insertion of deltoid and in the forearm, particularly musculo spiral. Pain worse at night. No pain on movement. No swelling. =Bursitis=: No pain in neck. Pain in anterior and posterior part of joint and on motion. Pain near insertion of deltoid. Arm held close to the body, motionless. =Infection=: Chill, limited motion, severe pain with temperature. =Dislocation=: Deformity with preternatural mobility. =Dislocation= of

=acromio-clavicular= joint: Tenderness over articulation. Arm cannot be raised beyond right angle with the body, but elbow may be brought across the chest with external rotation of arm and raised perpendicular with the body without pain." The infected joint should never be manipulated and all conditions showing swelling, redness and pain on touch should be viewed with suspicion. Remember that all other conditions will almost invariably have vertebral lesions, primary or secondary and a permanent result will depend upon their correction.

The Prominent Hip

A hip that is prominent and larger than its fellow is of frequent occurrence. It may not be necessarily conducive to a defect in posture, but it often is. The female is more frequently afflicted with this anatomical irregularity than the male. In the first place, the female pelvis is not so stable and rugged as the male pelvis, i. e., a mechanical wrench or fall will more easily displace the relative position of the tissues in the female. Then, in the second place, the dress of the woman accentuates irregularities of the figure, so that possibly in some instances the defect, from a diseased or deformed point of view, is more apparent than real. But of still more importance is the fact that many cases of a prominent hip are due to a lateral curvature of the lumbar spinal column. Lumbar curvatures are of common occurrence in the woman; first, the spinal column is not so strong as in man, simply on account of the physique not being so robust; second, modern dress constricts the waist by the use of corsets and many waist bands, and the weight of heavy skirts upon the waist, hips and abdomen; and, third, severe strains from childbirth. Care should be taken that there is no congenital abnormalities of the lumbar spine, or that congenital asymmetry of one-half of body, or trunk or leg is not present.

Thus the principal =cause= of a prominent hip is the lateral lumbar curvature. This, through compensatory action, renders the hip on the concave side prominent and high, while the hip on the convex side is depressed and less pronounced in appearance. Dressmakers and tailors are all too familiar with this feature of the irregularly outlined figure, and, consequently, have to resort to "padding" to round out the symmetry of the body. The mere irregularity of the figure, unfortunately, is by far the less serious part of the defect. Many ailments and diseases can be readily and directly traced to this. Not that the prominent hip itself necessarily always plays a leading part, but rather the lumbar curvature is the cause of very much suffering and misery. To enumerate the many disorders that arise from malaligned lumbar vertebræ may be unnecessary but a few will be given. A point to be emphasized is that the prominent hip often plays the role of a sign or symptom, or an effect, that an ailment or disease may be elsewhere.

In the female one of the most common causes, if not the most common cause by far, of disorders of menstruation, whether painful, profuse, or irregular, is irritation or obstruction of the lumbar spinal nerves due to lumbar curvatures. It is well known the lumbar spinal nerves control, to a large extent, the pelvic organs; consequently the osteopath pays particular attention to this area. Then certain intestinal disorders, such as appendicitis, typhoid fever, dysentery, rectal diseases, owe their origin to predisposing lesions here; also, bladder ailments, and sexual diseases of men, and many affections of the legs, as sciatica, varicose veins, etc.

In a number of instances the prominent hip will be due to a displaced innominatum. Then a lumbar curvature will result as a compensatory condition. This reverses the compensatory act as heretofore referred to; the prominent hip, in this instance, is the cause and not the effect. To diagnose which is cause and which is effect will frequently require considerable technical knowledge and experience. The slipped innominatum then produces symptoms and disorders directly from its changed anatomical relations; the points of diagnosis are given in the chapter on Diagnosis. The prominent hip can easily be detected when the subject sits down upon an even, firm surface, or stands up, and the one side is compared with the other. In some cases where the prominent hip is due to a lumbar curvature, and the prominence is a secondary feature, the legs will be found uneven in length, but not always, for the lumbar curvature may straighten out when the patient lies flat upon the back. To diagnose the cause from effect and to differentiate the maze of signs and symptoms that may be present is not always easy even for the skilled practitioner.

The =correction= of a prominent hip is not ordinarily a difficult matter. In the cases where lumbar vertebræ are principally at fault, and these include the greater number, the problem is one of correcting the spinal curvature. Lumbar curvatures are the easiest of any of the curvatures to correct, for one is not hampered by the rib articulations, and the lumbar section presents an area where a leverage can readily be obtained. Where the innominatum is primarily at fault it is simply a matter of readjusting this, with probably some attention to the lumbar region. Care should be taken that the prominent hip is not caused by a tubercular sacro-iliac disease, by hip-joint disease, by a dislocated hip, or by an overlapping of thigh or leg bones from fracture.

Standing erect will, of course, be a valuable help, for standing with the weight on one foot will tend to make the hip on that side more prominent. But generally the reason why one favors a certain side is because the other side is weaker; a weak back, a slipped innominatum, or an injured leg are common causes. There are many cases where the skirts will have to be considerably altered

after the hips have been made symmetrical.

Pendulous Abdomen

The =pendulous abdomen= is another defect that is all too common. A great many people have prominent abdomens because they do not stand properly, but a pendulous or prominent abdomen is not necessarily synonymous with a stout abdomen. They attempt to stand erect by drawing the shoulders back and extending the abdomen. If they would hold the head erect and the chin in, with the shoulders back and the chest forward, and draw the abdomen inward and upward, their figures and physiques would undergo shortly a wonderful transformation. These directions also apply to pregnant women. Drawing the abdomen upward and inward will at first require considerable effort. It certainly will not be an involuntary act for the first few days.

The sagging of the abdomen not only causes an unsightly appearance but results in great relaxation of the abdominal muscles, interferes with digestive functions, displaces the pelvic organs, and weakens the action of the lungs and heart.

The laxity of the abdominal muscles allows the abdominal organs—the intestines, stomach, kidneys, etc.—to displace downward. This tends to indigestion, constipation, inactivity of the liver, etc., and causes a score of reflex symptoms. The organs become simply weakened from a lack of proper tone. This is a frequent cause of nervous prostration. Also it is one of the common causes of prolapsed and displaced pelvic organs, because the abdominal organs sag down upon them and the pelvic organs thus receive the brunt of the gravitative effect. Internal local treatment of the pelvic organs can only be a makeshift in these cases. The lungs and heart are weakened because the abdominal organs are dragging on the chest, the lungs can not aerate the blood freely owing to the abdominal weight and to the blood being obstructed in passing from the abdominal organs through the liver to the heart and lungs. The heart is handicapped in its work through lessened chest capacity and obstructed circulation. Just “suck” up the abdominal organs and see how much easier it is to expand the chest and to breathe.

There are other causes for a pendulous abdomen, such as a weakened spinal nerve supply to the abdominal muscles and organs. The weakened nerve supply may cause a loss of tone to the abdominal organs themselves, so that certain organs, as the stomach and intestines, become dilated and prolapsed; to the ligaments, and to the tissues and organs as a whole so that they become gravitated.

Through childbirth muscular fibres of the abdominal walls often rupture, leaving scars and a relaxed condition. Actual ruptures, hernia, of the abdominal muscles occur and cause a pendulous abdomen. Then there are cases of obesity where the pendulous abdomen is a symptom.

Much can be done with all of these conditions through osteopathic work; the patient must also help himself. The center of gravity of the body must be changed, and kept changed; correct posture and a constant effort will accomplish considerable. The “setting up” military exercises are excellent. Even in some cases of obesity the abdominal prominence can be markedly lessened by careful exercising and keeping the abdomen drawn in so that the abdominal muscles, the diaphragm, and the chest may be strengthened. For the relaxed, flabby abdomen, self manipulation of the weak muscles when lying on the back will materially aid.

Postural Curvatures of the Spinal Column

Undoubtedly, the great percentage of postural defects, or slumped states, are dependent, directly or indirectly, upon weaknesses in the spinal column. As was seen, round shoulders, the prominent hip, or the pendulous abdomen, are often initiated by spinal deviations and deformities, so naturally spinal column curvatures are a most fruitful source of direct defects of posture.

It is somewhat uncommon to find an anatomically true spinal column, although this does not preclude that one’s posture is defective, for often through pride and effort one may consciously overcome a defective posture.

It is the purpose here to offer a few suggestions relative to the development of a greater symmetry of the body. Nearly every one is more or less interested in physical exercises and development. And especially to those of sedentary habits do means and methods of exercise appeal. Curiously enough, in a way, nearly every layman looks upon defects in posture, symmetry and stature as an effect arising from lack of, or improper, exercise. He seems to be imbued with the idea that the body in most instances is practically permanent in construction and when irregularities in figure occur certain exercises will correct the defect. Thus have individuals been prone to look upon osteopathy as a method of passive exercises. Osteopaths should believe most thoroughly in exercising, personal hygiene, etc., but the idea of osteopathic manipulation is primarily one of anatomical reconstruction, and not muscular development alone. The work of the osteopath is to readjust or to re-mold the body framework and the many tissues that clothe it

so that normality of function may predominate. The manipulation is not routinism but mechanical rebuilding of the tissues so that perfect freedom of vital forces may be forthcoming.

The spinal column presents the most frequent as well as many extremely interesting phases for re-correcting work. The number of abnormalities as to contour to which it is subject are many and varied. Emphasis should be placed upon possible congenital abnormalities and developmental defects as sources of certain derangements. Any variation or combination of variations with the normal or physiological curves constitutes an abnormality or pathological curve. And as a consequence defective posture, unless thoroughly compensated, is readily initiated. Not only may the normal curves be exaggerated, lessened, eliminated or reversed, but lateral and rotary curvatures are of frequent occurrence.

Curvatures involving the cervical region to the extent of producing noticeable defects of posture are principally lateral deviations of several vertebræ. Wry-neck is probably the most noticeable disturbance. The head and neck being drawn and slightly twisted to one side is a defect that is both noticeable and painful. Another common source of postural affection is an exaggerated forward curving of the neck vertebræ. This produces a stooped appearance of the neck.

The dorsal vertebræ are often curved backward too far. This produces roundness with too decided a fullness of the upper back and shoulders. The chest may be somewhat flattened as a secondary effect but not necessarily so. Neither are the shoulders what may be termed “round shoulders,” still such a condition may occur, for “round shoulders” are more often caused by a backward swerve of the column at the waist line. There is often a shortening of the anterior structures which pull the point of the shoulders forward. Forcing them backward will aid in correcting the fault. The dorsal vertebræ may be forward from what is termed a “straight” spine; this results in an exaggerated “braced” back position. Then lateral curvatures of the dorsal spine are common, which in time may develop into a rotary curvature; that is, the vertebræ are actually rotated on their axes. Lateral curvatures of the dorsal spine are slow and difficult to correct, for the ribs complicate matters very materially. Then, also, the vertebræ are apt to be deformed.

Curvatures of the lumbar spine, whether posterior, lateral or anterior, are common. Both dorsal and lumbar curvatures, as any one can readily see, are extremely common sources of postural defects. Erect positions of the body are maintained through the support of the dorsal and lumbar vertebræ. Stooped shoulders, one shoulder lower than its fellow, sitting humped over, sitting on the sacrum instead of squarely on the buttocks, the prominent hip, standing first on one foot and then on the other in order to rest the back, and the many allied variations of incorrect postures are largely dependent on the condition of the lumbar and dorsal spines.

It is not to be supposed that the above defects are the only ailments and disturbances that spinal curvatures cause, for, indeed, the defective posture may be by far a minor consideration. Disorders of body functions and affection of organic life itself are very often traced to the malaligned vertebræ.

The =causes= of spinal curvatures are many, but without question one of the most common causes is mechanical wrenching or twisting of the column from falls, jars, etc. Often the strain or sprain of the sections are readjusted through the inherent powers of the body, but there is a point where _vis medicatrix naturae_ requires extraneous help to correct the perversion; and, naturally, such aid, by virtue of the cause of the disturbance, should be physical force mechanically applied. Other causes of spinal curvatures are contractions of muscles on one side of the column or paralysis of the muscles on one side; in either instance, muscular action is greater on one side than the other, which easily results in a curvature. This imbalance of muscular tension, whether due to the above or other sources such as overfatigue or various deleterious habits, is a prolific source of lesions. And among still other causes may be noted, bone diseases of the spinal column, compensatory deformities, and constitutional weakening and irritating diseases. Also, some occupations predispose to certain curvatures.

One can readily see that the =treatment= which is directed specifically to the cause of the vertebral deviation would be the most scientific. This is just what osteopathic work implies, direct readjustment of the sections at fault—not exercises, or routine stretching, or braces; although these latter methods may in some cases have their place as secondary aids. Of course exercises are usually physiological and may be employed, in many instances, as an auxiliary. Care should be taken to eradicate infectious foci when present.

Where curvatures are extreme, complicating and deforming the ribs, and absorbing the bodies of the vertebræ so they become wedge-shaped, and resulting from abscesses, no one can expect within reason to absolutely correct the posture. Some aggressive work can be accomplished, but a perfect symmetry will not be forthcoming. It may be well to emphasize again that where the ribs are involved the osteopath is not contending with the deformity of the spinal column alone, but in addition the entire transverse area of the body. (See also Spinal Curvatures).

=Conclusion.=—In concluding this rapid survey of a number of postural defects the principal lesson to be drawn is not one of developing the physique and thus perfecting a better posture, so much as curtailing and eliminating insidious beginnings of disease. These little ailments and deformities, of which postural defects may be the most noticeable, are so often the inception of more serious disorders. The anatomical structure being maladjusted, -aligned, or -positioned, easily and readily leads to consequences that require much time and patience to overcome.

Poise of body represents much to every one. Poise or correct posture coupled with careful and methodical exercise and correct breathing are material aids in constructive development, as well as in eliminating disease, for not alone may abdominal, pelvic and thoracic integrity be benefited, but the upper respiratory tract may be toned.

The most important goal that osteopathic science and art is striving for is that of a fully developed and rounded out prophylaxis or preventive treatment. When the public realizes that the proverbial ounce of prevention is an established medical reality then it can truly be said our science has reached its ultimate good. To those who are familiar with osteopathic theory, facts, and development, it is an open secret that this school holds the key to successful preventive treatment. The time is rapidly approaching when the actual lessening of diseases will be an established fact. Then will be the universal practice of the layman going periodically to his osteopath to see if there are any small or insidious beginnings of disorder or disease.

Not only must the many deleterious habits and errors of the daily regimen be corrected, but after environmental, physiological and structural adjustment, in so far as possible, has been attained, a daily regimen to maintain the normal should be instituted.

FOOTNOTES:

[43] Journal American Osteopathic Association, Jan. 1916.

[44] Osteopathic Physician, Nov. 1919.

PROLAPSED ORGANS

Prolapse of various organs or tissues are among the very common ailments that afflict all classes. Prolapse of the stomach, a kidney, the uterus, or the rectum is a familiar term to every one. But this condition may also rest with the intestines, the liver, an ovary, or even the heart.

Outside of injuries, congenital weaknesses, and so-termed surgical disorders, there are commonly two constant forces predisposing to prolapsed organs, viz: gravitation and weakened innervation; the one, of course, is a constant factor in either health or ill health, the other is dependent upon acquirement. Here the latter, or acquired nervous weakness, will especially demand our attention.

Where tissues are torn or lacerated, or congenital malformations are present, or tissues are weakened from ulceration and with a resultant scar tissue, or certain tumors are present, the disorder must be amenable largely to surgical measures if at all.

The perpendicular position of the body favors a decided gravitation of the abdominal and pelvic organs. This gravitative effect being a constant one, many methods, both surgical and mechanical, have been devised to hold in approximate and relative position certain organs and tissues that may be prolapsed. But it is well known that outside of a certain few instances where surgical measures are clearly indicated the prevalent use of braces, bandages, supports and the like are usually poor makeshifts.

The one great feature in these cases is that tonicity to organs and supporting muscles and tissues is more or less impaired. The tissue atony may vary from mere weakness to actual tearing and separating of the fibres. The indications in the cases about to be described are to stimulate a lowered nerve supply and to increase a lessened blood supply; if this can be accomplished, supporting muscles, ligaments and other tissues will be able to restore the prolapsed organs to normal positions, thus improving functions and eliminating disease symptoms.

In discussing the prolapse of the following organs, perhaps it should be noted here that all of the abdominal organs may be prolapsed as a whole. The intestines, stomach, liver, kidneys, etc., may actually prolapse together. This is more apt to occur in persons whose abdominal walls are thin and flabby. In women pregnancy is a common cause. When the abdominal organs have gravitated, the pelvic organs, also, are very likely to be disturbed and displaced; in fact, the pelvic organs are frequently disordered this way.

Prolapse and Dilatation of the Stomach

Dilatation of the stomach is a much more common and serious affection than prolapse of the stomach, although usually the two are associated. Prolapse, or ptosis, of the stomach means simply a downward displacement of the organ. This is apt to take place in those cases where all of the abdominal organs have gravitated. There is invariably some dilatation of the organ as well.

Weakness of the abdominal walls and of the supports of the stomach constitute the principal =causes= of the prolapse. Spinal deviations that impinge or obstruct the nerve strands (or obstruct the blood and lymph supply to these strands) to the supporting stomach tissues is the most frequent cause of the ailment. General debilitating diseases, as anemia, cancer, etc., are indirect causes of weakened organs with consequent displacements.

In dilatation of the stomach the condition may be either acute or chronic. The former is found where immense amounts of food or drink have been introduced.

One of the principal causes of chronic dilatation is some obstruction to the opening from the stomach into the intestine, so that the stomach contents do not pass readily into the bowel. This leads to chronic disturbances of the stomach walls, and the food remaining in the stomach somewhat indefinitely weights down and stretches the walls of the stomach. The obstruction may be a tumor, or some stricture or adhesion from scar tissue resulting from ulceration or inflammation. The treatment of these cases comes within the province of surgical interference rather than other methods.

The second important cause of chronic dilatation is muscular weakness of the walls from poor nerve supply. This is a common cause and osteopathy is very successful in curing these cases. The splanchnic nerves are below normal, usually from a slight lateral or posterior spinal curvature. The nerve force to the walls of the stomach not being normal causes atony of the muscles and dilatation results. This nervo-muscular atony, also, results from a chronic catarrh, or from a general nutritional disorder as tuberculosis or anemia. The treatment of the former would imply direct correction of nerve and blood supply with attention to diet; the latter can be cured only through relieving the nutritional disorder of which the stomach condition is a symptom.

Dilatation of the stomach is most common in people of middle age or older. The disease is usually easily diagnosed. The symptoms may not be indicative of the trouble beyond showing that the stomach is disturbed. Indigestion, uneasiness, and nausea are common. Vomiting of large quantities of material from the stomach is likely to occur. The patient is generally emaciated, the skin is dry, the bowels constipated, and the urine scanty.

The =diagnosis=, as a rule, is not hard to make. Through the media of inspection, palpation and percussion, the careful osteopath will have little trouble to determine the size of the stomach. Kemp's[45] distinction between gastroptosia and dilatation of the stomach is as follows: "In dilatation the lesser curvature retains its relation to the diaphragm. The distance between the lesser and the greater curvature is increased, but the lesser curvature still maintains its relation to the diaphragm, with the exception that the pyloric end may extend farther over and somewhat farther down." Another instructive point relative to diagnosis the above authors make is the importance of the splashing sound. Owing to the fact that the stomach in health closes concentrically about its contents and thus adapts itself to the volume of ingesta, no splashing sound can be elicited. Three different degrees of relaxation are diagnosticated as follows: "Splashing sound, which can be elicited only during the normal period of digestion, means simple atony; splashing sound produced after the legitimate time of digestion has expired means motor insufficiency; and splashing sound produced in the morning, after the night's fasting, before liquid or food has been introduced, may mean stagnation, dilatation of the stomach, as understood by most writers." (For a more complete outline see Dilatation of the Stomach. The object of this section is to present an outline of prolapsed organs as a whole, and to refer especially to the effectiveness of osteopathic treatment in this condition).

This is a disease where osteopathy has been particularly successful in not only relieving distressing symptoms, but in actually curing the disorder. This refers to the nervo-muscular atony type, for where there is obstruction due to stricture or tumor of the pylorus, resulting in stomach dilatation, the treatment, from the very nature of things, must be largely surgical. Stomachs that have been dilated and prolapsed several inches have been entirely restored to function and organic integrity. To =cure= these cases is a matter of stimulating nerve control and blood supply to the stomach tissues, and, often of greater importance, removing spinal impingements to the stomach nerve fibers, thus allowing nature to fully assert herself. In reality, outside of so-termed surgical cases and other cases where the stomach dilatation is merely a symptom of general nutritional disorder, the primary treatment, by far, is the spinal one. Treatment over the stomach is a decidedly beneficial treatment; it aids materially in toning both abdominal and stomach muscles; still this is mostly a secondary treatment.

Dieting is essential. Careful dieting lessens the tendency to catarrhal inflammation and reduces the work of the stomach to a minimum. Still, nourishing food is necessary and the dieting can easily be carried to an extreme. Liquids should not be taken freely. Fatty and starchy foods should be eliminated. Give the patient food at short intervals. Various nutritious meats are excellent.

In dilatation, and also general abdominal relaxation, daily abdominal treatments may be indicated. If the relaxation is pronounced, keeping the patient in bed with thorough spinal treatment two or three times a week, daily abdominal treatment, having the patient exercise abdominal parietes by drawing the walls in and up, upper thoracic breathing, and frequent feeding will accomplish comparatively quick results. The progress of each case depends very materially upon the general health, the physical status of other tissues, constitution, inheritance, environment, age, etc. Some cases will yield in two or three months, others will require two or three years in order to obtain the greatest possible benefit.

The Prolapsed Kidney

A =prolapsed kidney= is often termed a floating kidney, or movable kidney, or dislocated kidney. It is of common occurrence, especially in thin persons. Some authorities state that one woman out of every four has a floating kidney. It is more common in women than in men, and among the working class than other classes.

The condition is usually an acquired one, following severe strains from lifting, falls, injuries, etc. It is claimed by some that a floating kidney arises from congenitally weakened and relaxed tissues about the kidney, that is, the tissues that keep the kidney normally at anchorage. Thus a congenital looseness of the kidney would easily be a predisposing cause whence mechanical violence, repeated pregnancies, an enlarged liver, or tight lacing would act as an exciting cause. Undoubtedly in some instances there is a congenital predisposition, the peritoneal fold attaching the kidney to the spine being loose and the capsule of fat retaining the kidney being scanty, but osteopathic experience has amply demonstrated that the tissues anchoring the kidney may in many case become atonied and relaxed from lower dorsal spinal lesions. Rarely is a case presented to an osteopath that does not exhibit two apparently characteristic causative features, viz: spinal irregularity in the lower dorsal spine, and constriction of the zone about the waist, i. e., dropping and constricting of the floating ribs. Furthermore, correction of these lesions will almost invariably lessen the mobility of the palpable kidney.

The =symptoms= of a floating kidney are many and variable. The kidney may be slightly movable or it may be so loose that one can easily grasp it through the walls of the abdomen. Most of the symptoms are of a nervous reflex nature. Indigestion, which is likely to be very persistent, flatulency, heart palpitation, painful menstruation, irritable bladder, etc., are the most common symptoms. Still, blueness, depression and morbidness are frequently present. The most distressing direct disturbance is the feeling of weight in the abdomen, especially on standing, running or lifting. Sometimes the ureter becomes twisted and severe pain, colic and even collapse occurs. (Dietl’s crisis.)

The =diagnosis= of a dislocated kidney is not a particularly difficult matter. A little experience coupled with a delicate sense of touch will usually readily detect abnormal mobility of the kidney. A point to always remember is that the kidney normally descends about one-half an inch with each inspiration. Care should be taken not to mistake a floating kidney for a movable spleen, although this is not likely, as the shape of the spleen is different.

The =treatment= of a movable kidney under osteopathic measures is usually successful. In the first place a number of cases require but little attention, simply toning up the general health, and especially directing attention to the abdominal walls and organs. There are a number of cases where the kidney prolapse is incidental to general abdominal laxness and weakness. In more severe cases, treating the spine, raising the floating ribs, carefully manipulating over the abdomen, keeping the bowels open, and lessening liver congestion should it arise, will suffice; in fact, will remedy a good percentage of the cases. With others, a well fitting, medium width, elastic bandage with pad underneath will be beneficial. In these cases the patient should be taught how to treat the abdominal organs, to manipulate the abdominal walls, and to replace the prolapsed kidney; particularly after going to bed this can be done successfully by the patient and will prove a decided help in obstinate cases.

=Surgical measures= for fixing the kidney should seldom be resorted to. If the patient will live a careful life, avoid unduly straining himself, keep the bowels normal, and have the anatomical lesions corrected, he will come very near being entirely relieved, if not absolutely. Surgical measures are not always a success. Surgeons are not operating for this disorder so often as in past years. (See Movable Kidney—Diseases of the Kidney.)

Liver Prolapse

This is commonly termed a =floating liver=. There is prolapse of the organ as well as its being abnormally movable. It is not of frequent occurrence; women suffer from it much oftener than men.

Normally, the liver is partially held in place, in the concavity of the diaphragm, by a number of peritoneal folds. The attachment of these ligaments is to the spine and the diaphragm; their principal function is to prevent extended lateral movements. Of greater importance in supporting the liver in a normal position is the integrity of the abdominal walls, and the position of the stomach and intestines. If the abdominal walls are of normal tone the liver is very apt to be in correct position. And the rest of the abdominal organs, especially intestines and stomach, act as a cushion support. Often when the liver is displaced the remaining abdominal organs are, also, out of normal position and relation to each other; in fact, general prolapse of the abdominal viscera is a frequent cause of liver prolapse. An additional support of the liver is a certain cohesion of the liver and diaphragm, and the elastic traction of the lungs.

Foremost among the =causes= that predispose to inelastic and atonied abdominal walls are spinal irregularities, deviations, and curvatures, which impinge nerve force and obstruct blood supply. These same lesions weaken ligamentous supports of the liver and lessen tonicity of the other abdominal organs, so that local or general displacements are readily forthcoming. Strains, injuries, frequent pregnancies, etc., also act as causes that weaken the supports of abdominal tissues and organs. In a word it is very often the pendulous abdomen that is the immediate cause of a floating liver.

It is very rare to find the liver displaced to the lower region of the abdomen. The ptosis is usually somewhat slight. The organ generally rotates on descent, the right lobe being the lowest portion, owing to the attachment of a ligament, the ligamentum teres, to the umbilicus. Probably in some cases there is a congenital tendency to relaxation of the ligaments, and, thus violent exertions and atonic and flabby abdominal walls and diaphragm are secondary but important factors.

The principal =symptom= of a floating liver is a tumor in the right side, which may be low down. Palpation will usually determine this. Then the abdominal walls are flabby. Pain and bearing down of the right side are common. There is apt to be considerable indigestion. Various reflex symptoms are often present. The floating liver will seem larger than normal, as the liver is below the costal arch and much of it can be felt. Percussion will be of value in determining the extent of the disorder.

Much can be accomplished by =treatment=, especially where the displacement is of a lesser degree. Correcting the spinal lesions, toning up the abdominal walls and diaphragm, and replacing the displaced organs will be extremely effectual. The abdominal bandage may be of service. Certainly abdominal exercises will be beneficial.

A point to remember is, stimulation over the abdomen beneath the right costal arch will cause the liver to contract and retract. This is of considerable osteopathic note. The liver will often recede at least a half an inch. This is a liver reflex (Abrams).

Prolapsed Intestines

=Prolapse= of the =bowels=, as a whole, or, more frequent still, of a part, is undoubtedly the most common form of organ prolapse. The intestines are so situated that they readily feel the effect of gravitative influences, of atonic and anemic states, and of weaknesses and disorders of other abdominal organs.

Spinal irregularities come first as potent =causes= of bowel prolapse. The spinal nerves to the supports of the intestines, to the muscular coats of the intestines, and to the abdominal walls, are obstructed in their normal activity, and consequently those tissues to which these nerves are distributed are affected. Wasting diseases, as anemia, consumption, cancer and the like predispose to intestinal atony.

The severe mechanical wrenches, strains, frequent pregnancies, tight lacing, heavy skirts, large abdominal tumors, obesity, cause more or less general or local weakness.

The pendulous abdomen, from wrong or careless posture, and exclusive of other causes, is a common source of general bowel displacement. This form of disorder, besides being unsightly, favors abdominal stoutness. There are a number of instances where simply voluntarily holding or “sucking” the abdomen into place, until it becomes strong enough to support itself, has reduced one’s weight by five, ten or fifteen pounds. These were cases where most of the adipose tissue was about the abdomen. Thus exercising and toning the abdominal organs by keeping them in normal position rectified a dormant blood and lymph circulation, which was followed by absorption of the abdominal stoutness.

Congenital weaknesses are to be considered in many cases. The muscular ligaments may not be developed, the mesenteric attachments may be too long, and various other abnormalities may result from congenital disturbances.

Of particular local interest to the osteopath, outside of the bowels dislocating as a whole, are: first, the hepatic flexure; second, the ileo-cecal region; third, the sigmoid flexure; fourth, the rectum; and fifth, hernias. Each of these sections are of separate interest and will be considered presently.

The =symptoms= are extremely variable. Constipation, a feeling of discomfort in the bowels, nervousness, depression, lassitude and anemia are frequent. Colicky pains in the intestines, indigestion, hysteria at times, are also among the symptoms. In reality a great variety of symptoms may be present. The patient is likely to be emaciated. In some cases exhaustion is marked.

=Diagnosis=, as a rule, is not a difficult matter. The various neurasthenic symptoms in a lean patient with constipation, indigestion, and stomach and intestinal distress would lead one to suspect intestinal displacement. The outline or contour of the abdomen will often reveal the character of the trouble. The atonic, thin and relaxed walls of the abdomen may readily give view of the displaced organs. Then careful examination by palpation and percussion will help very materially in the diagnosis. Radiographic examination is a decidedly helpful diagnostic method.

The =hepatic flexure= is frequently prolapsed. The bowel (colon) ascends from below upward to beneath the costal arch and then angles sharply into the transverse colon, which extends directly across the abdomen to the left side. The ligaments that support this flexure are apt to become weakened or stretched and allow a descent of this section of the bowel, which is followed by constipation, indigestion, etc. The ligament especially involved is the colo-hepatic ligament. The =duodenum= may require attention. This can be raised by getting beneath it where the organ descends alongside of the ascending colon. The effect of treatment is to release tension of the duodeno-hepatic ligament which is closely associated with the portal vein, hepatic artery and bile-duct.

The =ileo-cecal region= is an area that readily becomes congested and catarrhally inflamed, especially from constipation or impaction at this point. The section often becomes atonic and prolapsed with resultant clogging of fecal matter. Owing to the close proximity of the vermiform appendix, appendicitis frequently results from the above condition. The osteopath can do much in these cases of appendicitis. Lesions are invariably found in the lumbar vertebræ or the floating ribs are depressed.

The =sigmoid flexure= is also frequently prolapsed. The fecal mass often becomes impacted here, owing to a settling or prolapse of this part. In some cases the prolapse is so marked that it extends to the rectum below and drags on the splenic flexure above.

Lumbar and innominate lesions are the usual causes, although, it seems in a number of instances, that relaxed walls of the abdomen cause a “contraction of the diaphragm resulting in kidney displacement and followed by intestinal prolapse.” The vertebral lesions, probably, first weaken the muscular coat of the bowel, then, second, the bowel supports (other than its own inherent tonicity) and the abdominal walls.

Prolapse of the =rectum= is of such separate importance that it will be but partly outlined here. As stated above, a source of rectal displacement arises from the section of the bowel above settling downward and ultimately causing invagination of one or more coats of the rectum. Dislocation of the coccyx is a potent cause of rectal disorders. Lumbar lesions, especially twists between the fourth and fifth, and fifth and sacrum are common causes of rectal weaknesses. Slips of the innominata are other causes of prolapse.

Osteopathy has had marked success in these cases. Cures may result from a single treatment to readjust the coccygeal displacement or temporarily relieve excessive physiological activity by dilating the rectal sphincter, or the treatment may demand a number of months’ work in correcting general abdominal prolapse. Raising the sigmoid is effectual.

A =hernia= is “the protrusion of a loop or knuckle of an organ or tissue through an abdominal opening.” Two of the common hernias of the intestines are inguinal and femoral. These conditions are most often acquired from severe straining, so that a loop of the bowel protrudes through a weakened and stretched area of the abdominal walls, though there is reason to suspect that congenital defects are often predisposing factors.

Mention of the hernia is here made because, in a way, it is a form of bowel prolapse; that is, a limited form, and osteopathy contains certain possibilities for a successful treatment. Hernia has always been looked upon as purely a surgical disorder; i. e., remediable by surgical measures only. Where a truss has failed to give relief surgery has been resorted to. This is true in most instances, but

where the hernia is in the incipiency careful abdominal exercises (this should be carried out with great care, for severe exercise may produce a hernia or increase one already existing), massage to the tissues about the hernia, attention to the bowels, and spinal stimulation corresponding to the weakened tissue, and avoidance of strains may strengthen the tissues materially about the hernia.

Occasionally a loop of the intestine will prolapse into the cul-de-sac back of the uterus. A heavy dragging pain low down in the center of the abdomen and constipation or complete obstruction are the pronounced symptoms. Careful lifting of the loop of bowel by pressure within the vagina and traction from above with a hand outside, with the patient, on her back, with buttocks elevated, gives speedy relief.

The =treatment= of the prolapsed bowels represents those measures that will replace and keep in position the displaced organs. Naturally, the spinal and abdominal treatment comes first; this strengthens intestinal ligaments, tones intestinal muscles, and contracts the abdominal parietes, and at the same time the bowels are regulated, digestion and nutrition improved, and the general health built up. In some cases abdominal supporters will be of value. In a number of instances attention to chest mobility and diaphragm tonicity will be of value. Right living, which is represented by proper diet, sufficient outdoor exercise and regular habits, is invaluable.

The really specific treatment is to correct spinal, rib and innominate deviations and abnormalities. But direct local work will be, in many instances, necessary. General abdominal manipulation is good, but this should be supplemented by careful local treatment. The hepatic flexure requires a direct stimulating and replacing treatment. The ileo-cecal section should be raised, stimulated and emptied of the fecal mass. Direct upward manipulation of the sigmoid flexure in the left iliac fossa and of the splenic flexure beneath the left costal arch is extremely efficacious. Care must be taken not to bruise the parts. Getting beneath the prolapsed area and gently and intelligently raising the bowel so that it is emptied, toned up, and vascular congestion relieved, are the indications. This requires careful work and the necessity of gentleness can not be emphasized too much. Still in all of this treatment we should never forget the absolutely essential spinal readjustment.

Rectal prolapse requires lacol internal treatment, external tissue correction, especially of the coccyx, an innominatum or the lumbar spine, and, of much importance, deep, careful and thorough work over the sigmoid section.

Cases of bowel prolapse are every day experiences with the osteopath. The osteopathic treatment is of great value in these and a successful issue is very often the result. Cases of pendulous abdomen, of obstinate constipation, of chronic indigestion, of many nutritional disorders, of feeling pain, weight or dragging, locally or generally, in the abdomen, are very apt to be in persons suffering from prolapsed intestines.

A number of cases of bowel prolapse are associated with general prolapse of abdominal organs; that is, displacement of the stomach, kidneys, liver, spleen, etc. This general condition is termed enteroptosis or Glenard’s disease. It usually requires several months to treat it successfully. These patients are neurasthenic, malnourished, and often hysteriacs. The symptoms from which they suffer are innumerable. Mechanical weaknesses, lowered vitality, poor innervation and blood supply, and auto-intoxication are causative factors.

The Prolapsed Uterus

=Prolapse= of the =uterus= is of common occurrence. The prolapse may be incomplete or complete; the latter when the organ is presented to the external world. Of special interest are those affections exclusive of surgical cases. Ptosis of the abdominal organs upon the pelvic organs is a common cause of uterine prolapse. The abdominal prolapse crowds uterine space, congests the uterus, weakens the ligaments, and drives the uterus downward as a wedge.

Lumbar spinal curvatures are frequent causes of prolapse, as well as other displacements of the uterus. In this region vasomotor nerves to the pelvic organs make their exit, and, consequently congestions, inflammations, and weaknesses of supports are results. Also, slips of the innominata disturb the pelvic circulatory balance. Weakness of the uterine support from below, the vaginal walls and perineum, most often arises from lacerations at childbirth. Still, the vaginal walls may become relaxed through other causes. Tumors and extreme congestions are causes of prolapse. Heavy lifting is quite a frequent source of uterine displacements. Osteopathy is very successful in uterine prolapses; that is, any displacement of the uterus not of a surgical character. Correction of the external causes comes first. Then local treatment to replace, tone, and relieve congestion, and break up adhesions is necessary. The external treatment is usually the primary treatment. Local work is not always necessary. Lacerations and other

surgical indications, of course, require surgery.

Ovarian Displacements

The ovaries may be prolapsed, the left much oftener than the right. When prolapsed, it drops backward, downward and inward.

Ovarian congestion, tumor, retroverted or retroflexed uterus, tubal disease, and pregnancy are among the principal causes. Back of these congestions, tumors and uterine displacements, are the osteopathic causes, particularly spinal and rib lesions from the ninth dorsal downward. Specific lesions at the ninth and tenth dorsals and corresponding ribs, affecting directly ovarian tissues, and lumbar and innominate lesions and abdominal prolapse disturbing uterine and tubal tissues, are the most frequent osteopathic causes. A retroverted or retroflexed uterus is often found. Uterine displacements bear down upon the ovary and cause its descent, and also disturb ovarian circulation.

As has been stated, the left ovary is more apt to be displaced than the right. This is owing to the absence of a valve in the ovarian vein on the left side, and also, this vein opens at a right angle into the renal vein; this anatomical feature easily leads to passive congestion of the ovary, and thus to diseases of the organ. Then the rectum is on the left side and large fecal masses are apt to crowd against the ovary, which tends to its displacement.

Thus it is readily seen that osteopathic treatment is very applicable to ovarian displacement unless the indications are surgical. A more or less constant burning or sharp pain in the ovarian region, with probably some feeling of weight, profuse and painful menstruation, depression, irritability, etc., are =diagnostic=. However, a local examination will reveal the status of the ovarian position and congestion.

The same =treatment= as in other organ prolapse is indicated: toning weakened tissues, relieving congestions, replacing organ, with careful attention to the bowels and the general health. There are no tissue disorders of any part of the body wherein osteopathy is more thoroughly indicated and the results more generally satisfactory than in prolapse. And especially should it be remembered that in prolapse of various organs many vague intestinal and pelvic disorders and even ureteral and bladder disturbances may be traced to bowel dislocations and excessive kidney mobility in which osteopathic measures are often successful.

=Conclusion.=—The purpose of this section on Prolapsed Organs has been to supplement the various articles on Dilatation of the Stomach, Movable Kidney, etc., with an outline that may include relaxation of a part or of the whole of the abdominal viscera. The physician is all too prone to simply note the most offending or conspicuously disturbed organ instead of carefully analyzing all the features, great and trivial, that may be either apparent or marked. A general relaxation of the abdominal and pelvic organs may be found, and a nearly complete restoration take place under treatment, but still a lacerated perineum may have to be repaired before a cure is completed. Or it may be in a general abdominal ptosis that a floating kidney will resist all measures for restoration, short of surgery, and before much improvement can be obtained the kidney will have to be stitched into place. An enlarged liver may crowd the kidney out of place or a transverse colon may prolapse and drag on contiguous tissues and still the annoying symptoms be referred elsewhere. Then the primal point of general relaxation may not be in one organ, but there may be a simultaneous displacement of several.

The thorax itself may be distorted from various diseases so that the chest is narrowed, the diaphragm displaced with consequent descension of the abdominal organs, and from the latter a displacement of the pelvic.

“Far down displacement, marked changes of form, and real disfigurements of the stomach are found in some cases of kyphosis and scolio-kyphosis.”[46] The osteopath will not only find this true in some cases, but in many cases, although he recognizes as causative factors injuries to the spine causing curvatures and postural defects as prolific sources of abdominal relaxation.

“Glenard’s whole theory of splanchnoptosia is based on the relaxation of the suspensory ligaments of the intestines, especially that of the transverse colon; and Stiller, the discoverer of the floating tenth rib, says that splanchnoptosia is a descent of the atonic stomach, of the colon (especially the transverse portion), of the kidney (the right or both kidneys), exceptionally of the liver or the spleen. A descent which has been developed mostly in tender age, in consequence of general relaxation, especially of the peritoneal suspensory ligaments in individuals with congenital general dyspeptic neurasthenia, tender muscles, lean habit, and slender bone structure, manifested in a higher degree by a floating tenth rib.” Stiller observed that when there is a floating tenth rib there is a displaced stomach and a floating kidney, although it is not found in every case, but never missing if the case is pronounced. The tenth ribs in these cases have only a ligamentous fastening and are as freely movable as the eleventh and

twelfth.

That abdominal relaxation plays a very important part in many diseases of the abdominal and pelvic organs, in cardiac and pulmonary affections, disturbs the circulation in the legs, and is the source of many reflex affections no one can gainsay. The osteopath should always pay particular attention to tonic condition of the abdominal viscera, for relaxation of the suspensory tissues and walls, and atony and sluggishness of the organs are frequently paramount etiological factors. And the osteopathic treatment is the remedy par excellence.

FOOTNOTES:

[45] Rose and Kemp—Atonia Gastricia.

[46] Rose and Kemp—Atonia Gastricia.

SKIN DISEASES

Various skin diseases have been treated osteopathically with varying success. So much depends upon the cause of the disturbance and its removal, in skin diseases, that the cure does not rest so much with the mere treatment, as with the necessary skill in locating the disturbing factor. One has to be continually on his guard to locate external irritations and disorders of the digestive and genito-urinary tracts. A great deal depends upon the avoidance of external influences; eating nutritious food and having an unobstructed circulation. The leading object of osteopathic treatment is to free the circulation and thus promote a healthy and unobstructed flow of blood; in no other class of diseases is this more essential than in skin diseases. After the removal of cutaneous irritations and the correction of internal disorders, the cure of the case depends upon the removal of constrictions to the cutaneous blood-vessels. The osteopath corrects the lesions found, relaxes the muscles thoroughly and stimulates the circulation to the parts involved, and promotes a healthy activity of all the excretory organs. When the upper part of the body is affected, lesions are generally found at the atlas and axis, and when the lower part of the body is affected, lesions at the fifth lumbar are of common occurrence, although lesions may be located at various points corresponding with the seat of disturbance. The constant use of hot baths will be found a helpful measure in many skin diseases. But use of soap must be considered as too much alkali will neutralize the oil of the skin and cause undue dryness, but bran may be substituted to advantage. Cleanliness is necessary but the result sought is, also, flushing the cutaneous vessels. There are many cases where a specific vertebral lesion will cause, through the peripheral nerves, a cutaneous irritation with intense itching and discomfort. This, in turn, produces an exudate with or without a crust and a condition results which is not amenable to any local or constitutional treatment but an adjustment of the lesion will in most cases bring immediate relief. Application of this principle will aid greatly in treatment of any skin disease. In no disturbance of health is it more necessary to find the cause than in skin disease and once found to apply specific treatment.

=Eczema= is frequently met in osteopathic practice. It is the most common form of skin disease, comprising nearly one-third of all these disorders. For a differential diagnosis of the several varieties the student is referred to special texts. It is well to remember that the same underlying causes may be basic to the various forms, for several varieties may occur at the same time or one variety pass into another, though commonly one form is more prevalent. The limbs, face and genitalia are the most common sites, though the eruption may occur on various parts of the body.

=Etiology= includes a number of factors, constitutional and local. Dietetic errors, indigestion and faulty elimination comprise the principal underlying causes, often manifested through absorption of toxins and leucomains. In fact any disorder of the abdominal viscera, organic or functional, may be a predisposing factor, likewise various disorders of the pelvis, tuberculosis, diabetes, anemia, etc. should be considered. So-called gouty and rheumatic tendencies may be the constitutional basis.

The many osteopathic lesions play a very important role in lowering not only systemic resistance but of local tissue as well. This feature can not be over-emphasized.

Then local irritants, mechanical, chemical and thermal, are not to be neglected. These are usually of secondary importance. Micro-organisms are probably a complicating factor after the lowered resistance has been established. Vasomotor neurosis, through constitutional defects, toxins and the very significant osteopathic lesion, is probably an essential part of the pathogenesis.

=Treatment= is usually successful if the various etiologic factors are eradicated. Early treatment is very important. If the disorder is of more than local significance change the entire daily regimen of the patient. Diet, outdoor exercise and sufficient sleep should be

definitely regulated. A certain amount of general treatment to improve digestion, assimilation and elimination is imperative. An unbalanced diet and over eating must be corrected. In certain moist types, eliminating fatty foods will be helpful, while in dry forms the starches and sugars should be reduced.

If there is an underlying disease this should be remedied if possible. Particular attention should be paid to constipation.

Common sense in diet, rest, change of environment and free elimination, coupled with due attention to the osteopathic lesions, will cure the vast majority of cases. The greatest difficulty arises where there is some underlying disease. The parts should be protected against irritation such as dirt, cold, soap, and too much water. Meddlesome local treatment is to be guarded against. A simple application is boric acid, rice-flour or cornstarch, or where there is much itching add carbolic acid to the saturated solution of boric acid. Substitute bran for soap for cleansing purposes.

=Herpes Simplex=, fever-blister, or “cold sore” comprise two principal varieties: =herpes facialis= and =herpes genitalis=. The first occurs upon or near the lips, face, neck or ears. When the herpes is on the tongue or the mucous membrane within the mouth it is commonly termed “canker sores.”

Herpes genitalis is located on the prepuce, glans penis or farther back upon the penis. In the female the labia majora and minora and vestibule are the usual locations. Lack of cleanliness, sexual excitement and adherent prepuce are causative factors, though predisposing factors such as faulty circulation and disturbed innervation are to be considered.

In “cold sores” there is often some gastro-intestinal disturbance, especially intestinal stasis, cold in the head and other infections that supply toxins which irritate the nerves. No doubt there are underlying osteopathic lesions that lower the local nerve resistance or block the impulses such as vertebral and inferior maxillary lesions. The predisposing disturbance is probably due to the Gasserian ganglion.

Cold winds and excessive exposure to the sun’s rays will effect the tissues over the mental and infraorbital foramina, tensing the muscles and irritating the nerves at these points. On palpation they will be found sensitive. Frequent rotary motion by tip of finger over foramina will open them and allow congestion to drain.

=Herpes Zoster=, or shingles, is an acute inflammatory disease characterized by groups of small vesicles, usually along the course of the intercostal nerves on one side of the body. Before the vesicles appear there is more or less severe neuralgia. The eruption is unilateral, very rarely bilateral. The nearby lymphatics are usually enlarged.

Though the intercostal nerves are the ones most frequently involved, still the lumbar, thigh, trifacial and other cutaneous nerves may be affected.

The most common lesion is an inflammation of the posterior spinal ganglion which usually involves the fibers of the entire nerve. Inflammation of the nerve outside of the ganglion will cause the disorder. Toxins from various infectious sources are often exciting causes. Vertebral and rib lesions are always found; and where the Gasserian ganglion is involved lesions of the inferior maxilla and upper cervical vertebræ are predisposing factors. Thus osteopathic lesions from traumatism, cold and wet, and imbalance of muscular tension are important. Exudates, tumors, pleuritic and pulmonary affections are to be considered as possible sources.

=Treatment.=—Adjust vertebral lesions and carefully raise and separate ribs if intercostals are affected. Look after vertebral origin of any other nerve or nerves if otherwise. Local application of talcum or starch or boric acid will generally be sufficient.

=Urticaria=, hives or nettle rash is a common affection often due to some derangement of the digestive tract. This may be a mechanical irritation or of a toxic nature. Every one is familiar with the various foods that are apt to cause the hives, shell fish, strawberries, cheese, pork, oatmeal, mushrooms, etc.

The irritation may be a reflex one from the visceral disturbance; also, there may be irritation of the pelvic organs that would give rise to the trouble. It is well known that certain drugs will produce urticarial eruptions. There are cases where the irritation is simply local due to the nettle, mosquito bites and wasp stings.

In chronic cases intestinal stasis, nervous exhaustion and nephritic diseases are important.

No doubt osteopathic lesions frequently determine the location of the wheals. These lesions affect the innervation and thus establish a basis for the reflex vasomotor effect. This is in the nature of spasm of the cutaneous vessels quickly followed by dilatation with exudation of serum. The irritant probably acts on the walls of the blood vessels.

=Treatment= consists of thoroughly emptying the bowels by warm water enema, correcting the diet, toning the viscera and adjusting the osteopathic lesions. Thorough attention to the patient's environment, daily habits and occupation are of value. Warm soda baths will relieve the itching.

=Acne= is a common skin disorder that is characterized by an inflammation of the sebaceous glands of the nature of papules, tubercles or pustules. The face, shoulders, chest and back are the regions usually involved. It generally, appears about puberty. Blackheads is the starting point; these are accompanied with greasy skin and dust, and influenced by micro-organisms and more or less intestinal disorder.

The general or systemic health no doubt affects the local disorder, as in many skin diseases; for various intestinal derangements as indigestion, constipation, etc.; pelvic and menstrual irregularities; general ill health; anemia, etc. affect circulatory, glandular and nervous integrity. Any disturbance of normal elimination is important.

The =treatment= consists of careful attention to the general health and to the local innervation of the face or region involved. Measures that tone the bodily organs such as outdoor life, regular habits, plenty of sleep and correct diet are important. In some cases the X-ray is of value.

ANIMAL PARASITES

Tape Worms

=Varieties.=—Taenia solium; taenia saginata; bothriocephalus latus.

The larvæ of tape-worms are introduced into the intestinal canal by food and drink. The parasite reaches adult growth in the intestines. The larval forms are then found again in the muscles and solid organs.

=Taenia Solium.=—This is derived from the hog, and is the most common form in this country. When mature it is from two to four yards in length. The head is small, about the size of a pin, and provided with four cup-like suckers surrounded by a double row of hooklets, hence it is called the armed tape-worm. The head is fastened to the body by a thread-like neck, and following the neck, the body occurs in segments. The sexual organs, both male and female, occur in the center of the broad surface of the segment. The segments are about one millimeter in length and seven or eight millimeters in breadth. There are thousands of ova in each mature segment. The worm attains its growth in about twelve to fifteen weeks, after which time the segments are shed and passed. For further development the ova must gain entrance to the stomach of a pig or of man, and passing from the stomach they may reach the muscles and organs and develop into larvæ or cysticerci.

=Taenia Saginata.=—This is derived from beef, and is much longer and larger than the taenia solium. It is from five to six yards in length; the head is over two millimeters in breadth, is square shaped, and has four large sucking discs, without hooklets; hence it is called the unarmed tape-worm, in contra-distinction to the hooked variety. The segments are thicker and the ova larger, and they are passed and ingested in the same manner as the taenia solium.

=Bothriocephalus Latus.=—This is found especially in Europe and is very long, measuring from eight to ten yards; it is derived from fish, is not provided with hooklets, but has two lateral grooves. The segments are short and wide, the sexual organs being on the narrow side of the segment.

=Etiology.=—Unhealthy condition of the stomach and intestines is the predisposing, and uncleanliness an important, factor in the occurrence of tape-worm. Those eating imperfectly cooked beef, pork, fish or other meats, and those handling fresh meats, are liable to be affected with tape-worm.

When the ovum is taken into the stomach the capsule is dissolved and the embryo passes into the small intestines, fastening itself into the mucous membrane, by its hooklets and suckers and grooves.

=Symptoms.=—Tape-worms occur in the human being at all ages. Oftentimes symptoms are absent, the expulsion of segments being noticed and thus the worms accidentally discovered. The tape-worm is seldom dangerous, but if a worm is known to exist it is always a source of considerable anxiety on the part of the patient. Severe anemia may result and be wrongly diagnosed.

There are dyspeptic symptoms, colicky pains, nausea and occasionally diarrhea. The appetite is variable, sometimes ravenous. This condition is followed by loss of flesh and various reflex phenomena, as vertigo, headache, convulsions, palpitation, choreic

movements, itching of the nose and anus, paralysis, and rarely, insanity. In addition to these symptoms there may be a wrinkled countenance, sensation of a cold stream winding itself toward the back immediately after a meal, pain in various parts of the body and ringing in the ears. The decisive diagnostic symptom is to find segments of the worm in the stools.

=Diagnosis.=—Discovery of the ova or segments in the passages of the bowels is the only proof of the presence of a tape-worm.

=Prognosis.=—Favorable in all cases.

=Treatment.=—Prophylactic treatment is necessary. Meats should be thoroughly cooked so that the larvæ will be destroyed; and all segments of tape-worms passed in the stools should be burned—by no means should they be thrown outside or in the water-closet.

The immediate expulsion of a tape-worm is not a necessity. First of all the mode of living, and then the general state of health should be corrected. Tape-worms invariably result from a general state of unhealthiness, and with improved health and corrected digestive processes the worms cannot exist, and in a short time will be expelled. Expulsion of the head is necessary before the case will be cured, for if the head is not expelled new segments will continue to grow.

Stimulating the liver to increase the amount of bile, and increasing the activity of the digestive glands of the stomach and intestines, by a thorough treatment of the splanchnic region and direct treatment over the abdomen, will usually be sufficient for the cure of intestinal parasites. The treatment will probably have to be repeated several times, in order that the intestines may regain a healthy tone, so that the parasite will not find favorable conditions for its existence within the intestines, and that the bile may be secreted in sufficient quantities to dislodge the worm.

Hahnemann claimed, “that during a period of comparative health tape-worms do not inhabit the intestines proper, but rather the remnants of food and fecal matter contained in the intestines, living quietly as in a world of their own without the least inconvenience to the patient and finding their sustenance in the contents of the bowels. During this state they do not come in contact with intestinal walls, and remain harmless. But when from any cause a person is attacked by an acute disease the contents of the bowels become offensive to the parasite, which in its writhing and distress touches and irritates the sensitive intestinal lining, thus increasing the complaints of the patient considerably by a peculiar kind of cramp-like colic. (In similar manner the human foetus in the womb becomes restless, twists its body and moves whenever the mother is sick, but floats quietly in the liquor amnii, without distressing her while she is well.)” This but harmonizes with the osteopathic theory and practice with regard to tape-worm, that there is an unhealthy condition of the intestines which predisposes to the affection, and consequently the cure must be a correction of such a disordered state.

During the treatment, if a light diet of milk and broths is given, it will favor an earlier removal of the parasite, by helping to remove the mucus in which the head is embedded. If this fails extract of male fern is suggested.

Ascaris Lumbricoides (Round Worm)

This is the most common parasite, and is found principally in children; it is also found in cattle and hogs. It is of a yellowish brown color and in form resembles earth worms. The worm is cylindrical, pointed at both ends; the female is from seven to twelve inches in length, and the male from four to eight inches. They are probably introduced into the stomach by food and drink. They occupy the upper part of the small intestine, and are usually one or two in number, though they may be numerous. Occasionally they migrate into the stomach and are ejected by vomiting, or into the trachea and produce suffocation, or into the larynx or Eustachian tube, or they may pass downward to the anus, or into the bile ducts.

=Symptoms.=—Oftentimes symptoms are absent. There may be dyspepsia, colicky pains, mucous stools, meteorism, vertigo, fretfulness, voracious appetite, anemia, sallow complexion, headache, chorea and convulsions. Other symptoms may be present, as grinding of the teeth and itching of the nose and anus. Obstruction of the bowels has occurred. If a worm enters the bile duct obstructive jaundice occurs. A decisive diagnosis can be given only when the worm is seen.

=Treatment.=—Particular attention should be paid the liver, for it is here that we must seek the natural remedy in the form of bile, in order to eject and cleanse the system from nematodes.

Modes of improper living should be corrected; cleanliness is essential, and there should be attention to the general health of the patient. Thorough correction of all defects of the spinal column in the region of the splanchnics, and careful direct treatment of the bowels is indicated. The child may be put to bed and fasted twenty-four hours, then the liver strongly stimulated to increase flow of

bile.

If the above treatment is not successful oil of wormwood may be employed.

Oxyuris Vermicularis

(Thread-worm; Pin-worm)

This small parasite, commonly seen in children, is from three to five millimeters long in the male and about twenty millimeters in the female, is blunt at one end and sharp at the other, and occupies the colon and rectum. They are probably introduced into the intestines in the ova, by uncooked fruits and vegetables, or by the dirty hands of mothers and nurses of the infants. They vary greatly in number; migrate to the rectum where they deposit their eggs, and are often discharged in the feces, where they appear like pieces of ordinary white thread.

=Symptoms.=—Loss of appetite, anemia, restlessness and irritability are marked. The itching becomes intolerable when the worms come down in the rectum to the anus and within the folds about the anal orifice. In the female the worms may wander into the vagina where they become particularly distressing, and thus may produce excessive sexual excitement and cause nymphomania and masturbation.

=Treatment.=—Cleanliness of the most scrupulous kind should be demanded in every instance. Injections of cold salt water (repeated for at least ten days) and other agents within the rectum will destroy the eggs as soon as they are deposited, besides relieving the terrible itching. In obstinate cases use quassia decoction.

Attention to the general health of the patient and great care of the intestines and other digestive organs are absolutely necessary. The spinal treatment to the intestines and other digestive organs, as well as thorough direct treatment over the abdomen, is indicated.

Uncinariasis

(European hook-worm disease; Miner's anemia; Ankylostomiasis; Hook-worm disease)

This disease results from infection by the hook-worm of any of the various types. In Europe it is found in Italy, Belgium, Germany, France and Switzerland. In America it seems to be of Africo-Asiatic origin but was first discovered in the Southern states and abounds chiefly in Texas, Florida, Georgia, North and South Carolina as well as in the West Indies. Infection comes from unprotected feces that are allowed to be spread where the feet or hands may come in contact as it is without doubt that the contagion occurs through the skin. One authority states that hook-worm is rarely found except in cases where ground itch has occurred within a period of eight years. Negroes harbor the parasite and transmit it but seem immune to its effects while the poorer whites are afflicted to a large degree. The worms are carried from some abrasion of the skin, by the blood to the heart and lungs, thence to the pharynx and swallowed, thence to the duodenum and jejunum where they attach themselves to the lining walls. Here they not only feed upon the blood but develop a toxin. The female worm is about twice the size of the male, 10 to 18 mm. as against 6 to 11 mm. and there is slight difference between the old and new world varieties. The head is provided with four hook shaped teeth which form the attachment to the intestine and it is very secure.

=Diagnosis.=—For years the languid, dull, expressionless, lack-luster of eye and general unambitious characteristics of the inhabitants of the great sand belt of the United States attracted attention and was attributed to laziness but the discovery of the hook-worm explained the cause. Children are stunted in mind and body and have a muddy, dirty white complexion.

At the beginning there must be a very considerable colony of the parasites to cause symptoms but as the disease advances there is a distention of the abdomen from enlargement of the spleen and liver and from flatulency. There is palpitation, shortness of breath, cardiac bruits from the severe anemia while edema of the feet and legs is rather common. The blood shows a severe secondary anemia with its coagulation time much increased. Leucocytosis is not common; hemoglobin is from one-tenth to one-half normal with erythrocytes about half normal.

=Treatment.=—The removal of the worms with the least possible harm to the body is indicated. Thymol is a poison which is not absorbed by the body, when carefully given, and which is very toxic to the parasite. The dose varies from eight grains for a child under five years of age, to forty-five for an adult. Thymol is soluble in fats and in alcohol, so that for a day or so before the thymol is given, and from one to four days after, no fats or alcohol should be taken. The best way to avoid poisoning by thymol is to give the

patient charcoal, then no fats or alcohol is permitted until the treatment is completed. When the stools become black, the thymol is given on an empty stomach. A purgative is given a few hours later. Enemas should be used very freely in order to facilitate the removal of the injured or poisoned worms. Another dose of charcoal is given, and when the stools are black again, the patient may return to his ordinary diet. The denial of fats to the person so thoroughly accustomed to bacon three times a day is a factor met with difficulty in dealing with patients of the ordinary class with the disease. (Clinical Osteopathy.)

=Prophylaxis.=—After treatment it is imperative to prevent reinfection and to do that the most rigorous sanitary measures must be instituted. All feces must be disposed of and habits of cleanliness in defecation insisted upon while negroes, who harbor the worm without showing symptoms, must be looked after as well as the actual victims. Care of the feet is important and shoes should be worn in infected regions and all abrasions of the skin protected. Drinking water must be uncontaminated which presents a problem as wells and springs are usually unprotected. Absolute and persistent cleanliness is the answer to the question of prevention.

Trichiniasis

Trichiniasis is a name given to a disease produced by the embryos of the trichina spiralis. In the adult condition the trichina spiralis lives in the small intestines. The embryos migrate into the muscles where they finally become encapsulated. Man is infected by eating insufficiently cooked pork containing the encapsulated worm, which is set free during the digestive process. About the third day they attain their full growth and become sexually mature. Each one discharges large numbers of embryos. As soon as born the young brood is carried away from the bowel and invade the muscles through various channels—principally by means of the blood stream and along the connective tissue routes. The female trichina may bring forth several broods of embryos in succession. In nine or ten days after infection the first brood reaches its destination. They attain to maturity in about two weeks after entering the muscular tissue. In this process an interstitial myositis is excited and a fibrous capsule is formed in four to six weeks. The capsule gradually becomes thicker and finally calcareous infiltration may take place.

Thorough cooking destroys the parasite. The disease is most frequent among the Germans who eat raw ham and sausages.

=Symptoms.=—These are sometimes absent, especially when only a few are eaten. If large numbers have been ingested, gastro-intestinal symptoms develop in the course of a few days. Vomiting, diarrhea, and pain in the abdomen may be present.

In from one to two weeks muscular symptoms develop. There is fever, muscular pain, especially during motion, and the muscles are stiff, tense and sometimes swollen. When the respiratory muscles are involved dyspnea is produced, which may prove fatal. Eosinophilia is a helpful diagnostic point. Edema, especially of the face, is an important symptom. Profuse sweats, itching and tingling of the skin have been observed.

=Diagnosis.=—Epidemics of this disease are more easily diagnosed than an isolated case. Among the Germans, if cases of apparent typhoid fever occur after a picnic or other feasting occasion, where raw ham or sausages have been indulged in, this disease should be suspected. Examination of the stools and of the muscles will be of aid. The worms may be discovered in the pork, a portion of which has been eaten by the patient.

=Prognosis.=—This depends upon the number of worms ingested. The prognosis should always be guarded. Early, marked diarrhea is favorable.

=Treatment.=—Prophylactic treatment is of great importance in trichiniasis. Inspection of the meat supply, is doing much to prevent trichiniasis; although the most practical way to prevent the disease is to thoroughly cook all pork and sausages. The central portions of the meat should be well cooked.

In the feeding of hogs care should be taken that they do not receive any offal, but only milk, grain, vegetables, etc.

When a person is infected with trichiniasis, thorough and prompt evacuation of the bowels should be performed at once, so that the embryos will not have time to pass into the muscles, but will be ejected from the body. This should be followed by a thorough and persistent treatment for several days of the liver and intestines; treat both the liver and intestines directly and through the spine. The object of this treatment is to render all the digestive juices active, so that they may dislodge the animal parasite, and to prevent their passing into the muscles. Also keep the bowels active for several days.

When the larval parasites have entered the muscles, a treatment cannot be applied to affect them directly, but the health of the body should be maintained if possible, and the severer symptoms, as the muscular pains, weakness and insomnia combated. Thorough manipulation, massage and hot baths will be of special aid in relieving the stiffness and weakness of the muscles.

Filaria

(Filaria Sanguinis-Hominis)

There are two varieties. One is a thread-like worm with tapering, blunt ends, appearing in the blood at night, hence called =nocturna=, while the other is of slightly different form, appearing in the blood only by day and is called =diurna=.

The mosquito is the communicating host of the parasite. During the night, or should the patient sleep during the day, the =nocturna= appears in the peripheral circulation, while during the other interval they are probably in the other vessels, particularly the lungs.

After the mosquito has taken blood from an affected patient it requires from six to seven days for the metamorphosis of the minute filaria which are then lodged in the probosis of the mosquito and introduced into the blood of the next victim. The adult parasite is from three to four inches long and the thickness of a coarse hair, with clear sexual distinction.

=Pathologically= there are no distinct lesions, as the parent worm must establish one. Lymphatic engorgement may result from plugging of the thoracic duct or of a large lymphatic with consequent engorgement which may develop symptoms in the inguinal glands, pelvic and lumbar lymphatic trunks. As these varicosities develop rupture may occur; if into the genito-urinary tract chyluria or chylocele may result, or if in the abdominal cavity chylous ascites.

Lymphangitis follows a lymph stasis, which later results in =elephantiasis=. (Barbadoes leg.)

=Symptoms.=—Elephantiasis affects the legs, but the arms rarely; the labia of the female and scrotum of the male; occasionally the breasts and other parts of the body. Fever is present on account of the lymphangitis, accompanied by rigors and delirium and there is marked local inflammation. The attack terminates in a pronounced sweat. In deeper parts there is deep seated pain and signs of sepsis, while abscesses may develop over the inflamed area.

The varicose inguinal glands are doughy, soft and painless, with both sides affected alike. The scrotum is affected by the extension, and at times the testes.

=Treatment= is surgical, as the tumors must be removed. Unless the female worm is also removed this is, however, only palliative.

Methylene blue is said to be destructive to the filaria and it is practically harmless to the human body. The only treatment is one that will aid in building up the general health.

HEMORRHAGES

Nasal Hemorrhage

(Nose bleed; Epistaxis)

=Osteopathic Etiology= and =Pathology=.—Traumatism, such as picking the nose, blows, and surgical operations; straining when coughing; nasal tumors and ulcerations; lesions of the atlas, or any lesion of the upper cervical vertebræ, that would interfere with the vasomotor distribution to the nose and cause local congestion or weakness of the blood vessels; obstructions to the general circulation; irregularities or suppression of the menstrual flow may result in nose bleed, as a vicarious menstruation; suppression of a habitual hemorrhoidal discharge.

=Pathologically= the great frequency of nasal hemorrhage is due to the great vascularity of the nasal mucous membrane. Usually in cases of spontaneous origin, bleeding is from the region of the septal artery. Spontaneous bleeding may also occur from posterior hypertrophies or adenoid vegetations. The blood flowing downward into the fauces, is expectorated in such cases, and may be mistaken for a hemorrhage from the lungs.

=Treatment.=—The position of the individual is important. He should assume a sitting posture, or as nearly so as possible. Holding the nostrils tightly, or plugging them with a piece of cotton, will favor the formation and retention of a clot, so that the hemorrhage may be controlled. Pressure upon the carotid artery, or upon the facial artery at the angle of the inferior maxilla, will slow the blood current and favor the formation of a clot, also pressure on the sides of the bridge of the nose may influence it. Correcting any lesions that may exist in the superior cervical region, as derangement of the vertebræ or contracted muscles, will remove

obstructions or irritations to the vasomotor system of the affected region, and thus equalize the vascular system. Holding the arms above the head, and the application of ice to the nose are of aid in some cases. Also, injection of cold or hot water into the nostrils. In serious and obstinate cases, where other methods fail, a plugging of the anterior and posterior nares should be resorted to, using absorbent cotton or gauze.

Broncho-pulmonary Hemorrhage

(Hemoptysis)

=Osteopathic Etiology= and =Pathology=.—Pulmonary congestion; croupous pneumonia; tuberculosis; hemorrhagic infarction; ulcers of the larynx, trachea or bronchi; gangrene of the lung; fibrinous bronchitis, carcinoma of the lung; lesions of the ribs or vertebræ from the second to the seventh dorsal inclusive, may cause diseases of the bronchial tubes or lungs, that result in hemoptysis, or the hemorrhage may be caused directly by extreme congestion resulting from the disordered vasomotor nerves; diseases of the heart, such as mitral disease, causing pulmonary congestion; aneurism of the branches of the pulmonary artery; vicarious menstruation from deranged menstrual functions; diseases of the vessel walls, or blood, as scurvy, anemia, hemophilia, etc.

=Pathologically= in many cases, the lesions are microscopic, consisting of ruptured capillaries. In other cases larger vessels may be ruptured, or are the seat of erosion. Many other lesions may be observed. After death the bronchial mucosa is occasionally found inflamed and the lung tissues paler than normal.

=Diagnosis.=—A differential diagnosis must be made between epistaxis, hemoptysis and hematemesis.

In =epistaxis= the blood may flow from the posterior nares into the pharynx; it causes coughing and a discharge of the blood may occur the same as in hemoptysis. A careful examination of the nasal region alone can determine the source of the bleeding.

In =hemoptysis= the history of the case as to pulmonary or cardiac diseases is to be considered. There is a feeling of weight and of uneasiness in the chest. A salty taste and a tickling of the throat precedes the bleeding. The blood is ejected by coughing and is bright red, frothy, very little coagula, and is alkaline in reaction.

In =hematemesis= the history would indicate disease of the stomach, spleen, liver or heart. Uneasiness, and occasionally nausea and faintness, precedes the bleeding. The blood is ejected by vomiting, and is dark, clotted or fluid, mixed with food, and is of acid reaction. In a few instances the blood due to hemoptysis may be swallowed, and vomited.

=Treatment.=—In all these cases of hemoptysis the patient should be placed in bed and absolute rest demanded. An attempt should at once be made to correct any lesion that may be found influencing the cause of the bleeding. Correcting lesions to the vasomotor nerves of the lungs and bronchial tubes, and equalizing the disturbed vascular area, may be sufficient in a number of cases. These lesions will be found principally in the upper dorsal region. In some cases, perhaps, there is an impairment of the trophic nerves by the same lesions, thus interfering with the tone of the vessel walls and pulmonary tissues. The diet should be light, nutritious and non-stimulating. The use of hot drinks is to be avoided. The rapidity of the heart's action should be reduced. This is best performed by thorough treatment of the dorsal spinal nerves of the left side over the heart, and by inhibition in the suboccipital region. The ice-bag to the precordia is also helpful. Iced drinks and the eating of ice is of aid. Stimulation of the systemic circulation will be of value in helping to relieve the pulmonary congestion, although the two systems are somewhat independent of each other. Also, hot foot baths and the evacuation of the bowels may be of additional value. In cases due to organic disease of the heart, the mind and body should receive absolute rest, so that the diseased areas may be strengthened as much as possible; besides a tonic treatment for the heart's action is necessary.

After the hemorrhage has subsided care should be taken that bleeding does not occur again. All irritations of the respiratory tract should be avoided. A stimulating diet, tobacco and alcohol should be avoided. Nutritious food and a moderate amount of exercise is indicated.

Hemorrhage of the Stomach

(Hematemesis)

=Osteopathic Etiology.=—Injuries to the stomach; local diseases, as congestion, ulcers and cancer; vicarious menstruation; a mechanical obstruction to the portal circulation; spinal lesions to the vasomotor nerves of the stomach; alterations in the blood;

perforation of the stomach walls, involving a blood vessel; disease of some neighboring organ.

=Diagnosis.=—A careful examination of the case and of the blood ejected will be necessary to determine the nature of the cause. The differential diagnosis as to the source of the blood, whether from the stomach or lungs, was given under hemoptysis.

=Treatment.=—Correction of any lesions that may influence the blood pressure in the region of the stomach, is the first requisite. Treatment of the splanchnics has the greatest influence upon the vasomotor nerves to the stomach. Treatment of the vagi nerves and of the fourth and fifth dorsals, will quiet the violent movements of the stomach, and thus aid in controlling the hemorrhage. Stimulation of the cervical sympathetics and heat applied to the feet will tend to equalize the vascular system, and thus lessen the gastric congestion. The application of a broad flat ice-bag over the stomach will be of great value. Keep the patient quiet in bed. Surgical interference may be necessary.

Intestinal Hemorrhage

=Osteopathic Etiology.=—An obstructed circulation of the blood through the venaporta, as in diseases of the heart, lungs and liver; lesions of the vertebræ deranging spinal nerves to the intestinal blood supply; injuries caused by corroding or cutting substances; mechanical injuries to the intestines; degeneration or erosions of the blood-vessels from ulcers of the intestines, as from typhoid fever, typhus, dysentery, etc.; disordered menstrual or hemorrhoidal discharges.

=Diagnosis.=—The locality of the intestines affected can be approximately determined by an examination of the discharged blood. When the blood comes from the upper part of the intestines, it is generally dark and mixed with the intestinal contents, which gives it a tarry appearance. It is generally red and fluid when it comes from the lower portion of the bowels. If from the stomach, the blood is thoroughly mixed with fecal matter. Throwing the passage into water, the water is colored red when it contains blood, and if the contents contain bile the water is colored green or yellow. Also, noting the areas of contracted muscles, as in intestinal colic, will aid in the regional diagnosis.

=Treatment.=—Absolute rest in all cases is necessary, the patient remaining as quiet as possible. Food, in severe cases, should not be given for ten or twelve hours. The bed-pan should be used in caring for the evacuations. Correction of the lesions along the spinal region, chiefly of the lower dorsal and lumbar regions, that are impeding the innervation to the intestines, should be attended to at once. This treatment tends to relieve any hyperemic condition of the intestinal mucosa and influences the whole vasomotor area of the mesentery. Direct treatment of the abdomen in a few cases is of great value to relieve obstructed and contracted vessels in the mesentery, but in certain pathological conditions, e. g., typhoid fever, leave the abdomen alone. Treatment (inhibition) along the spinal column from the sixth dorsal to the coccyx is helpful in all cases to quiet the peristalsis of the intestines. In severe cases cold drinks, eating of ice and an ice pack to the abdomen are of aid. In a few instances surgical measures will be necessary.

Hematuria

=Osteopathic Etiology.=—Congestion and acute inflammation of the kidneys, exacerbations of pyelitis, renal calculi, chronic nephritis, traumatism, tuberculosis, etc.; affections of the urinary tract, as calculi or lacerations of the ureter; calculi, cystitis, ulcerations, etc., of the bladder; calculi, gonorrhoea, parasites, etc., of the urethra; general diseases, chiefly the acute specific fevers and blood diseases; blows, wounds and traumatic influences, external to the kidneys; lesions of the renal splanchnics.

=Diagnosis= of the locality of the hemorrhage in the urinary tract: In hemorrhage from the =kidney= the blood is thoroughly mixed with the urine, giving a uniform color. Blood casts and leucocytes are present. In hemorrhage from the =ureters= the blood is usually molded in clots which conform to the shape of the ureter. The clots appear like small dark worms. In hemorrhage from the =bladder= the blood is not thoroughly mixed with the urine and large clots form upon standing. In hemorrhage from the =urethra= the blood often discharges without micturition. When urine is passed the blood precedes the passage of urine.

=Treatment.=—Rest is essential. A correction of the lesions to the renal splanchnics is necessary to control the congestion and inflammation of the kidneys. When the ureters, bladder or urethra is involved, attention must be given to the condition of the spinal column below the renal splanchnics. In all cases the inhibitory treatment to the lower spinal column and ice to the loins are of value. If surgery is indicated, do not delay operation.

Uterine Hemorrhage

Most of the causes of uterine hemorrhage come under the subject of obstetrics; others under menorrhagia and metrorrhagia. Such will be found in obstetrical and gynecological works.

=Treatment.=—The patient should assume the dorsal position with the buttocks raised. If any displacement of the uterus is present or if there is any foreign material in the uterus, usually such should be corrected or removed at once. Stimulation of the clitoris is a most effectual means to control uterine hemorrhage; it contracts the circular fibres of the uterus. Stimulation of the uterus directly through the vagina, and over the abdomen, and stimulation of the upper wall of the vagina, will aid in contracting the uterus. A quick, unexpected pull of the hair on the mons veneris will have the effect of closing the capillaries by shock to the nervous control (Dr. Still). Before closing the os, however, it is well to know that there is no irritating foreign material within the body of the uterus. Correction of obstructions of the vasomotor nerves of the uterus through the splanchnic and lumbar region is important. Compression of the abdominal aorta, and vaginal injections of hot water may be of aid, as will also a hot water bag at the lumbar region and ice water bag over symphysis. In severe cases inversion of the body, if it can be done with safety, may be performed. Packing the vagina is a method resorted to occasionally in severe cases.

Hiccoughs

Occasionally there is a case of hiccoughs that has been continuous for hours or even days and that all efforts have failed to stop. They are caused by an irritation to the peripheral distribution of the phrenic nerve from some gastric disturbance or a local irritant acting upon the center in the medulla. It may follow fright or great emotion and be associated in persistent form in rheumatism, typhoid fever and other febrile diseases. It follows abdominal operations at times and is very distressing. When occurring in elderly people with pneumonia and in peritonitis with distention it usually marks the end. The same may be said in case of carcinoma of the stomach and bowels.

=Treatment.=—Go first to the origin of the phrenic nerve at the third, fourth and fifth cervical and, if there is a lesion as there will probably be, adjust it and note results. This will be sufficient in many cases. Failing, bring direct pressure on the nerve just above the clavicle and anterior to the sternomastoid muscle and release the scaleni muscles. After this examine and treat at the fifth and twelfth dorsals. Correct any lesions but best results will be had from inhibition at these points. Another method is to stand beside the patient and insert the fingers of both hands under the costal end of the ribs and lightly pull. Firm pressure over the solar plexus with flat of the hand is sometimes beneficial. In hysterical cases, drawing out the tongue will often be effective and it has been suggested that standing the patient on the head will stop them in short order. Tickling the nose to produce violent sneezing is an ancient remedy. Some one of these will cure the case, as osteopathy has never failed so far as recorded.

The stomach should be emptied of all irritating matter to prevent recurrence.

VARICOSE VEINS

In varicose veins there is a dilatation of the calibre of the veins and their valves are insufficient. The walls are irregularly thinned, lengthened and tortuous.

=Osteopathic Etiology= and =Pathology=.—The =internal saphenous= is the vein most frequently affected, although any vein throughout the body may become varicose. Commonly, varicose veins occur in the lower extremities and occasionally in the arms.

The =valvular insufficiency= is caused by stretching of the wall of the vein, thus separating the thin, free edges and leaving an interspace that allows regurgitation of the blood. The valves becoming insufficient, the column of blood in the veins has no support against gravity, and being interrupted in its course does not flow normally into collateral channels. The walls of the veins become thin, as does also the adjacent skin, thus increasing the danger of a rupture, either external or subcutaneous.

Varicose veins are most frequently found in females, following uterine enlargements. The condition may be due to any obstruction or constriction that prevents the free return of blood from the veins, such as dislocations of the hip, either slight or complete, dislocations of innominata, contractions of adductor magnus muscle affecting femoral vein, prolapse of diaphragm obstructing vena cava, tissue constrictions about the saphenous opening, garters, and, in fact, anything that might impede the free venous flow. The tendency to varicose veins increases as age advances, and many cases are found among people of middle life who have been accustomed to standing a great deal. Injuries to the pelvis, thigh or leg, lessening the nutrition to the leg, or injuries to the nerves, as vertebral dislocations in the lower dorsal or lumbar regions (the fourth lumbar especially) may be causes of varicose veins. Pregnancy or tumors in the abdomen or pelvis, causing pressure upon the iliac veins, are occasionally causes. Distention of the

sigmoid flexure, causing pressure upon the left iliac vein, or distention of the cecum; pressing upon the right iliac vein, are fruitful sources, as are also diseases of the heart and lungs. Varicose veins of the upper extremities are due to occupations requiring overuse of the arms.

=Complications.=—Varicocele, hemorrhoids, labial varix in the female, varix over pubes, ulceration and eczema due to disturbances of nutrition, edema and thrombus.

=Symptoms.=—=Lower Extremities.=—Cramping pains in the limbs upon rising. Fullness and heaviness of the limbs. Inspection may reveal superficial varicose veins near the saphenous opening, upon the external thigh, in the popliteal space, upon the external leg or behind the ankles. Edema and congestion of the foot and ankles occur in a few cases. Pain is quite a prominent symptom, due to pressure upon the nerve fibres. Eczema and itching are due to disturbed innervation and blood supply to the skin. Ulceration may occur, due to the bursting of a vein.

=Upper Extremities.=—Before the varicosity appears there is usually pain or a feeling as of a sprain in the involved region of the arm. The pain is usually confined to a muscle or group of muscles.

=Treatment.=—The majority of cases are due to disorders about the pelvis, hip or thigh, and the treatment resolves itself into the removal of these obstructions or constrictions. Occasionally cases are caused by partial dislocations of the hip joint, which can be easily overlooked during a hurried examination. The slipping of an innominatum is an important factor. Rest in a recumbent position, attention to the general health, and especial attention to the bowels and liver, are essential in acute attacks. Occasionally the heart and lungs are at fault. Treatment twice per week should consist of removing any of the numerous causes of the condition, and spinal treatment as well; then the leg should receive special attention. Remember, thrombi may form and the vein must, under no circumstances, be touched in the treatment. Begin by carefully rotating the leg to stretch contracted tissue about the saphenous opening, then separate the tendons of the popliteal space and follow the course of the vein to the abdomen and relax tissue about it. Keep patient off the feet as much as possible and elevate the leg when sitting.

In rupture of varicose veins the hemorrhage can be arrested by elevating the limb and applying pressure with the fingers, above and below the wound, until a compress and bandage can be applied. The support of the varicose veins by elastic stockings will ease the pain and prevent edema in many cases, but, as a rule, it is a direct hindrance to the circulation on account of the necessity of having the stocking fit closely. Surgical operations are rarely indicated.

Phlebitis

(Phlegmasia alba dolens; milk leg)

An inflammation of a vein. In the condition described here it is a puerperal septic inflammation of the femoral vein. About the third week after confinement there is a swelling of the leg with or without redness. Great pain accompanies the condition and the temperature gradually rises to 102°-3°. As understood by osteopaths, this is the result of a partial closing of the saphenous opening during parturition so that the venous flow is partly stopped.

=Treatment= consists in carefully rotating the leg at the hip so that the fascia lata is spread, opening the lumen of the vein so the congestion will drain out. There will, also, probably be found innominate or lumbar lesions which must be adjusted with the result that almost immediate relief is given as a rule.

Chronic Phlebitis

The chronic form shows considerable inflammation along the line of the vein marked by tenderness, edema and thickening of tissue. The entire leg may be more or less involved through circulatory injury. In these cases will be found definite innominate lesions of a primary type or the distortion is superinduced by lumbar lesions. A few cases are quickly cleared up through adjustment that is readily secured. However, in others, there being considerable thickening of the sacro-iliac articulating tissues, some time may be required to get complete adjustment and consequent restoration of femoral circulation. In addition to this, careful abduction, flexion, hyperextension and circumduction is indicated. This last technique should be executed with great care and with due regard to pathology. If Dr. Still’s emphatic command were followed, that all maternity patients should have both legs rotated and innominates inspected, there would be no phlebitis cases, acute or chronic.

THE RECTUM

To treat the rectum intelligently and thoroughly, requires special knowledge on the part of the osteopath. A speculum should be used in many cases when making an examination, and all abnormal conditions carefully inspected with the eye; although much can usually be noted by the examination with the finger alone. The best position in which to give an examination and treatment is to have the patient on the side, with thighs flexed upon the abdomen. In a few cases the patient may lean over an operating table.

The =objects= of =rectal treatment= are many—to relieve hemorrhoids, etc., of the mucous membrane; to correct a dislocated coccyx; to treat an enlarged prostate gland; to replace a prolapsed rectum; to tone the lower bowel in cases of constipation; to give reflex stimuli to the heart and lungs, in cases of fainting, paroxysms, etc.; to relieve severe pains in the rectum at the time of the menstrual period, and to relieve congestion, inflammation, contracted tissues, etc., of local sources; to relax spasms in croup, and to remove tension to the nervous system in some forms of insomnia. In fact, so many diseases are affected by reflex irritations from the rectum that its examination is a necessity in many cases. The phrase “when in doubt treat the rectum” was coined by a progressive student and there is an element of truth in it. Surgical assistance to treatment will be considered under hemorrhoids.

The principal need of osteopathic internal rectal treatment, is: (1) To relax all contracted and constricted fibres about the walls of the rectum and between the sacrum and coccyx. (2) To correct a dislocated coccyx. (3) To dilate the sphincters thoroughly, in order to relieve irritations about the sphincters, and to stimulate the sympathetic nerves.

Work through the rectum to treat an enlarged prostate gland, to correct a displaced uterus, and to make a more thorough examination of the uterine tissues, the Fallopian tubes and the ovaries, is a frequent occurrence.

In giving =local treatment=, cleanse the fingers and oil the index finger; then, after introducing it into the rectum relax the contracted tissues by an upward sweeping motion on all sides. This treatment relieves all obstructions to vessels and nerves caused by contracted fibres, and tones the rectal walls. In prolapsed sigmoid, causing obstructive constipation, the finger can be used to separate the folds of mucous membrane and open the lumen of the bowel. Frequently there will be enough tone to the muscular coat so that the irritation will set up slight peristalsis and cause the bowel to draw up to a considerable degree. In children where there is much straining at the stool, the sigmoid will often be found down and by using the little finger the same results can be accomplished and much relief given.

To =dilate= and =stretch= the sphincters thoroughly a speculum or dilator should be used under anesthesia; still, considerable can be done by one or two fingers. The sphincter should be thoroughly stretched in all directions, care being taken when an instrument is used that too much force is not applied. Secure as much voluntary relaxation of the sphincter as possible. Inhibition at 2d and 3d sacral will aid. This treatment is of aid in cases of hemorrhoids and prolapse of the rectum, in constipation due to the loss of tonicity of the lower bowels, in tightness of the sphincters, in pain of the rectum, and in stimulating the heart and lungs. In cases of a prolapsed rectum, due to irritation about the sphincters, causing tenesmus, this treatment is of special value, as it gives the sphincter a physiological rest. Frequency of treatment per rectum must depend entirely on the patient and disease. It can be given daily in many cases and is frequently so indicated in acute hemorrhoids, prostatic troubles, etc.

According to Quain, the sensory nerves to the rectum are from the second, third and fourth sacrals. Some of the motor fibres of the circular muscles of the rectum are from the lower dorsal and upper two lumbar nerves; these pass by the aortic plexus to the inferior mesenteric ganglion. Associated with these fibres, are the inhibitory fibres of the longitudinal muscles of the rectum. The sacral nerves contain motor fibres to the longitudinal muscles, and inhibitory fibres to the circular muscles of the rectum. In all cases of rectal trouble, the lower dorsal and upper lumbar vertebræ may be found deranged, and thus interfere with the rectal nerves. Relaxation of the sacral muscles over the sacral foramina has a marked effect in relieving =tenesmus=. In dysentery, where there is a constant desire to defecate, a thorough upward relaxation of the sacral muscles will give great relief.

=Proctitis= or inflammation of the rectum is not an uncommon disorder. The disease has been divided into acute, chronic, gonorrheal, dysenteric, and diphtheritic. Foreign bodies, impacted feces, cold, purgatives, prolapse of the sigmoid, and lumbar, coccygeal and innominate lesions are the most important causative factors. The =acute= form is more frequently found in older people. The =symptoms= are tenesmus, frequent evacuations of blood and mucus (possibly pus), prolapse of the mucous membrane, feeling of fullness, and radiating pains. The gonorrheal, diphtheritic and dysenteric forms are of rare occurrence, with the exception that the dysenteric may be somewhat frequent. The =treatment= is to remove all local irritations, cleanse the bowels, and put the patient in bed. All irritating foods are to be prohibited. Use milk, soups, beef juice, soft boiled eggs and similar foods. Correct all osteopathic lesions; especially will inhibition over the sacral foramina relieve the tenesmus. Cold water in the rectum and applied to the anus will be beneficial. If abscesses occur, employ surgical measures.

=Prolapse= of the =rectum= is another common rectal disorder. Acute cases are especially found in children, due to straining at stool. The sacrum is more straight, and thus violent straining, coughing, etc., the more readily produces prolapse. Prolapse of the mucous membrane is the most common, although all of the rectal coats may be involved. Prolapse of the upper part of the rectum into the lower or invagination is frequently met with by osteopaths. The sigmoid may prolapse and also affect the rectum. The =treatment= is to return the mass, using an anesthetic if necessary. If it is not retained, place straps across the buttocks. Then with attention to lesions that may be disturbing and weakening the rectal walls, and thorough local toning treatment, the prognosis should be favorable. In high rectal prolapse local attention is necessary as well as deep treatment through the abdominal walls to the sigmoid and upper rectum. The use of Cole's irrigator for high enema will replace and elevate both the upper rectum and sigmoid and greatly aid in a cure. Regularity of habits and proper food are essentials.

Hemorrhoids

=Definition.=—A dilated or varicose condition of the plexus of veins lying in the submucous tissue of the lower part of the rectum. The dilatation of these hemorrhoidal veins may extend into the adjoining subcutaneous tissues and mucous membrane, and the perirectal plexus and adjoining venous plexuses of the bladder, uterus, vagina and sacral canal may become involved.

=Osteopathic Etiology= and =Pathology=.—The chief predisposing cause of piles is man's erect position and the absence of valves in the hemorrhoidal veins. Thus a retardation or stagnation of the portal vein would cause a backward movement of the entire column. It is evident that such a downward pressure of the blood in the portal system would dilate and extend the blood vessels, to the very capillaries in the rectal region.

This retardation may arise from several causes: obstruction of the portal vein, from diseases of the liver; diseases of the heart; obstruction or destruction of the capillaries of the lungs; pressure from a gravid uterus, tumor, etc.; a general loss of tonicity of the abdominal walls, as in persons who take but little exercise; the excessive use of wine, tea and coffee; injuries to the spinal column, especially in the lumbar, sacral and coccygeal regions; a dislocation of an innominate bone; lifting; constipation; straining at stool; carelessness of the calls of nature, etc. Catarrh of the bowels may cause a congestion of the mucous membrane and consequently piles. Hereditary influence may be a factor in a few cases.

Hemorrhoids are divided into two classes, =external= and =internal=. An =external pile= is one that arises from the margin of the anus outside of the external sphincter muscle. It differs from the internal pile from the fact that it is always composed either of skin or hypertrophied connective tissue, forming a mere cutaneous tag, or else it is composed of a small cutaneous vein enlarged by a clot of blood. The =internal hemorrhoids= are composed mostly of enlarged veins and are connected by hypertrophied connective tissue. They have a free arterial supply and are covered by the mucous membrane of the rectum. They are due, usually, to an affection of the middle hemorrhoidal blood supply, thereby being a part of the visceral vascular system. Internal hemorrhoids, when protruding, can be returned within the rectum, while the external ones cannot. The venous turgescence varies in size from a pea to a walnut. They may be single or may surround the entire anal opening like a bunch of grapes.

Repeated attacks of engorgement of the veins involved, will in time change the mucous membrane or the submucous tissue, and cause catarrhal swelling of the mucous membrane, or hyperplasia of the connective tissue. At first the hemorrhoid is usually a blood tumor, but in chronic cases it is oftentimes made up largely of connective tissue. Owing to pressure of the varicose veins, atrophy of the mucous and submucous tissue may occur. The white or slimy hemorrhoids occur when these roughened parts of the mucous membrane become inflamed and thickened, resulting in suppuration.

=Symptoms.=—The symptoms are quite diagnostic and need not be mistaken. Besides the appearance of tumors, there may be constipation, pain during stools, indigestion, headache and pain in the back. Hemorrhages frequently occur, and if suddenly checked, as by cold, other disturbances may occur, as congestion of the head, lungs, stomach, liver, kidneys, etc., which may result in hemorrhages from these organs. Fissures of the anus, contraction of the rectal sphincters and prolapse of the rectum may occur. Occasionally in old people there is a varicose state of the veins of the neck of the bladder, and in females, of the uterus and vagina, which causes hemorrhages of these organs. The communicating plexus of the spinal canal may be affected, causing weight, numbness and pain, so as to simulate a lesion of the cord. The patient may have a hypochondriacal disposition and be disinclined to work, especially at mental labor.

=Prognosis.=—Depends upon the predisposing and immediate causes, but a large majority of cases can be cured.

=Treatment.=—A thorough examination of the patient should be made, not only to ascertain the extent of the local trouble, but to understand thoroughly the general health of the sufferer, especially the state of the heart, lungs and liver.

Many cases of hemorrhoids are caused by lesions in the lumbar and sacral regions, and especially dislocations of the coccyx (usually anterior) and the innominata. Correcting these lesions will oftentimes cure the hemorrhoidal disorder. Simple dilatation of the rectum once a week, in addition to other treatment, is of great aid in curing hemorrhoids, not a few of the cases being cured by dilatation alone. It relaxes the tissues about the tumefied vessels. Treatment is rarely necessary above the second lumbar, (unless there is more or less of a constitutional disorder) as the superior hemorrhoidal blood vessel of the inferior mesenteric is given off about opposite the second lumbar.

In cases where the abdominal walls have become relaxed, a treatment should be given to strengthen the abdominal muscles and viscera. Particular attention should be given the liver. Treatment should be given over the abdominal muscles directly, and also to the spinal nerves of the same region. The diet should be strictly regulated and the bowels kept loose, and stimulants, indigestible food, full meals and too much meat should be avoided. Injection of cold water before stools is a good prophylactic, and applications of cold water to the protruding pile will be of some help in relieving the congestion. A squatting position during defecation will relieve considerable strain.

=Hemorrhoids= in the =acute state=, within twelve or twenty-four hours from the engorgement, yield quickly to treatment. The local technique is to relax the tissues about the tumor, especially above and along the line of the vein, then with pressure at its base carefully force out the engorged blood. Follow this up by another treatment the next day and continue until normal. The vein wall, not being permanently stretched, will contract and if the irritating cause is found, there is little danger of return. Remember, in a case like this, the danger of embolism and be sure a clot has not formed. Cases of hemorrhage at stool, during or immediately following evacuation, when not from a bleeding pile, may be of considerable quantity and the source difficult to locate. It may be due to ulcerations or easily ruptured capillaries of the mucosa, but the cause will in many cases be found in the innominata and a reduction of the lesion give relief.

=Rectal conditions=, associated with piles, and =requiring surgery= after treatment has failed, are: =hemorrhoids=, which are of such long standing as to become organized tissue, (these will keep up continual irritation and cannot be absorbed); =saccules= or pocket, formed by folds of mucous membrane catching and holding particles of feces, gradually enlarging and ending with considerable reflex symptoms; =fistulae=, complete or incomplete, may frequently be healed by adjusting coccygeal or innominate lesions, but are apt to recur from the tract not being clean in the center or bottom; =abscesses= in or about the anus or rectum are usually traced to coccygeal, innominate, or local interference to circulation; =fissure=, complete dilatation under anesthesia to insure physiological rest of parts, is probably the best treatment. It is suggested that a fissure may be healed by making surgically clean, touching with iodine and coating with collodium. =Papillae= are small, hard black-capped papules in the lower rectum, each one involving a nerve terminal and causing much distress. All these conditions give rise to much discomfort and with surgical assistance can be cured without much trouble. It is not necessary to make them a major operation and do uncalled-for things. The less surgery about the rectal sphincter the better.

=Care= of the =anus= and =rectum= after operation or successful treatment is a factor in preventing return. First, there should be soluble, non-irritating stools, which do not tend to bring about prolapse from straining. Diet and regularity contribute to this. Second, absolute cleanliness. This can only be obtained by following the stool with an enema of four or five ounces of cool water and immediately passing it. It will bring forth a considerable quantity of feces which would otherwise have been retained for another twenty-four hours. This procedure following, as it does, the stool does not in any way interfere with the normal function or create a habit. The anus should then be thoroughly washed in cool water and as thoroughly dried. Dusting with borated talcum powder, starch, etc., will prevent chafing.

GENITO-URINARY

THE PROSTATE GLAND

This gland is subject to several painful and annoying diseases, controlling, as it does, the flow of urine and exerting such a profound influence over the sexual functions. The nerves to the prostate pass between the gland and the levator ani muscle, and the secretory branches are from the sacral nerves, while Quain gives the sensory as from the tenth, eleventh (twelfth) dorsal, first, second and third sacral and fifth lumbar. Lesions affecting the prostate are occasionally found at the tenth and eleventh dorsal and

fifth lumbar, while the innominate lesions are common causes of trouble. These should be corrected, if present, and local treatment given to the gland. “Massage of the prostate,” says Lydston,[47] “properly performed, is one of the most valuable advances in genito-urinary therapeutics that has been developed in many years.” Osteopathic technique is to place the patient on the side, knees flexed, and standing in front insert the index finger. Care must be used not to bruise the gland and it must be touched lightly when sensitive. Relax tissue about the gland, and, then, from the median line with an outward movement, massage the surface of each lobe. This influences the blood and nerve supply, while the pressure will tend to relieve congestion. Length of treatment, as well as frequency, depends entirely upon conditions. Do not make the mistake of treating the perineum instead of the gland and do not gouge it with the finger. Remember it is sensitive tissue.

=Hypertrophy= is most commonly met with in practice, as twenty per cent of men past middle life are said to be afflicted. It is probably not a sequence of old age, but due to chronic, congestive and inflammatory conditions. Anything which would produce these conditions—spinal lesions, excessive venery, masturbation, or other more innocent causes—would in time bring about enlargement. As the length of catheter life is estimated at six years it is of great importance that the condition be early recognized, for in advanced stages surgery is the last resort. In early stages the prognosis is good, either for a cure or to stop further enlargement, while many enlarged ones at the catheter stage have been greatly benefited or cured. Treatment of the gland once per week is usually enough, but in older cases can be given semi-weekly. Look well to nerve and blood supply.

=Acute Prostatitis= is a serious and painful inflammation, causing urinary retention usually. It results from trauma, horseback riding, over exertion, gonorrhea and its maltreatment, etc. Lower dorsal and lumbar lesions are frequent. This condition must be closely watched. Inhibition of the sacral nerves will help control pain and stop any spasm of the sphincter. Cold applications to the gland externally at the perineum will aid in reducing inflammation. Local treatment should at first be given to the adjacent tissues as the gland will be very sensitive. Later direct massage will be of great benefit.

=Chronic Prostatitis= may follow an acute attack or it may originate as a chronic or subacute affection. Frequent micturition and dull pain, referred to the perineum and rectum, with the local examination, make diagnosis sure. The spinal lesions should be corrected and the gland massaged. This will induce absorption, by squeezing out the inflammatory products and do much toward preventing future hypertrophy. “Massage is done by the finger. The patient is placed in the knee-elbow position and massage employed for four minutes daily. The value of massage in chronic prostatitis is very great, but should be employed with much caution and never in cases of suppuration.”[48]

=Prostatorrhea= is often taken for spermatorrhea and any irritation of anterior sacral nerves would cause undue activity to the secretory nerves to the gland. This is easily determined.

=The Seminal Vesicles= can be reached just above the prostate, and if inflamed and tender or if engorged by inspissated seminal fluid, local treatment will be of benefit. Frequent massage, daily in some cases, to the gland and treatment to the sympathetic nerves above the trigone of the bladder, to the nerve fibres passing along the spermatic cord, and to the arteries directly, will be of the greatest aid in impotency.

In =Chronic Gonorrhea=, where the gonococcus has found lodgement in and about the gland, it can be more readily dislodged by massage than by any other form of treatment.

=Retention of urine= from nervous excitement or other minor causes, can often be overcome by local massage of the prostate.

=Spastic stricture= can usually be cured by work about the prostate and its innervation.

Varicocele

A varicose enlargement of the veins of the spermatic cord, epididymis and testicle. In varicocele the pampiniform plexus is usually enlarged, but all the veins of the cord may be involved. The swelling gets smaller under compression or in a horizontal position and enlarges again on standing erect. It is almost invariably found on the left side, and the testicle on the affected side is generally smaller and softer than its fellow.

The predisposing =causes= are a longer and tortuous spermatic vein on the left side; the absence of support of the veins from surrounding muscles; the imperfect valves; the entry of the left spermatic vein into the renal vein at a right angle, instead of at an acute angle like the right vein; the more liability of compression of the left spermatic vein by accumulation of feces in the sigmoid flexure; the lack of normal exercise of the sexual functions in young, unmarried adults. Lesions in lower dorsal and upper lumbar

affect the condition; the eleventh dorsal particularly. A lesion at the second lumbar may cause neuralgia of the testicle with engorgement of the vein.

The exciting causes are straining during stool, heavy lifting, excessive sexual indulgence or anything that would determine more blood to the testicles. Varicocele is similar to the varicose state of the hemorrhoidal veins and may have like causes.

The =diagnosis= is easily made. The feeling of the veins between the fingers like a convolution of earth worms; dull, aching, dragging sensation, and possibly prostration, weakness and dejectedness of spirits, are characteristic symptoms. “The condition is devoid of danger, except that it often begets morbid fears on the part of the patient, usually the result of suggestion.”[49]

The =treatment= consists of regulation of the bowels, removal of such predisposing and exciting causes as may be found, treatment of the vessels along the spermatic cord, and treatment to the lower dorsal and lumbar regions. In severe cases a suspensory bandage will give temporary relief. Surgical interference may be necessary in some cases in order to effect a cure.

Impotency

Results from treatment in these conditions are particularly gratifying and offer a great field of activity in this day of sensational medical advertising. This condition can well be classed under four heads, Exhaustive, Traumatic, Psychic and Organic.

=Exhaustive Impotency= is the result of functional abuse, masturbation in early life, excessive venery, coupled with intemperate use of alcohol and improper diet without sufficient sleep. It can be symptomatic in neurasthenia. There is at first irritation of the spinal centers, which causes exaggerated sexual activity, and later this is followed by complete or partial loss of function. The first step is for a radical reform in habits; regulation of the bowels, as they will likely be constipated; direction of the mind into wholesome channels, and then skillfully directed spinal treatment. Where there has been masturbation, look well for sources of irritation to the parts; a long foreskin or adherent prepuce indicates surgical aid, or there may be a lesion at the sacrals involving the nervi erigentes or, of greater importance, the pudic nerve. The innominatum can be at fault in this. The lower dorsal, ribs and upper lumbar are of importance. Kraft-Ebing says: “Conditions of absolute impotency are, however, rare, and are caused =only= by severe vertebral and nervous diseases.” Nerve irritation undoubtedly is the cause of sexual perversion (outside of heredity and malformation) so their relief is as necessary to bring about reform of habits as to effect a cure. Where the general health is affected constitutional treatment should follow. Motschutkovsky uses suspension in treating these cases with good results. The effect is to separate the vertebræ, freeing spinal nerve and blood channels. The prostate will probably be found in an irritated, sensitive condition, as well as the seminal vesicles. Treat as outlined under the prostate gland. Ligation of the dorsal vein of the penis is recommended by some authorities as tending to aid turgescence of the organ. Prognosis is so dependent on how well the patient follows directions, age, environment and general condition that it is hard to give, but as a rule is rather favorable.

=Traumatic Impotency= is a strictly osteopathic classification, for the reason that sexual weakness is often traced to lesions resulting from remote injuries. These injuries may be to the spine, ribs or sacrum. The lower spine may be impacted from a fall or the result of long continued riding on rough streets or the railway. This inhibits the nerve supply to the extent of often seriously impairing the sexual functions. If the cord is injured to any extent the results are more serious. Treatment in these cases has given uniformly good results. It will always be due to a specific lesion, so the examination must be thorough.

=Psychic Impotency= is the form most frequently met with and generally the most difficult to cure, yet it should not be if the patient’s confidence can be secured, for in many cases sexual power is but slightly impaired, but owing to the suggestions given by the medical advertisers the victim diagnoses his own case as hopeless. “It is not uncommon that virility returns with the peace of mind.”[50] Observe all the procedure given and then inspire hope where it can be honestly given, and if the patient is progressing favorably, other things being equal, advise early marriage under strict rules of conduct. If already married, conjugal relations should be most carefully investigated and the wife taken into your confidence. Her cooperation in correcting very possible errors in sexual matters, as well as sympathetic aid in easing the patient’s anxiety and chagrin, will be invaluable. Nothing but the frankest understanding between all parties is permissible and the osteopath must be in absolute control.

=Organic Impotency= is the result of a cortical injury or disease. The latter is the most common, as it follows tabes dorsalis, paralysis affecting the lumbar cord, some cases of diabetes, etc. Also, any congenital malformations or absence of all or part of the organs. Prognosis in these cases is bad, as cure is seldom possible.

In no other class of cases will honesty, tact and good judgment count for so much or the rewards be greater.

FOOTNOTES:

[47] Twentieth Century Practice of Medicine, Vol. XXI.

[48] C. Kruger, Munch Med. Woch.

[49] Deaver's Surgical Anatomy, Vol. II, p. 652.

[50] Vecki, Sexual Impotence.

HEAT STROKE

(Heat Exhaustion: Sunstroke)

An affection produced by exposure to excessive heat. Two varieties are recognized; heat exhaustion and thermic fever.

=Heat Exhaustion.=—This is caused by prolonged exposure to high temperatures, combined with physical exertion. Fatigue, overeating, alcoholic drinking, and poor sanitation predispose. This may occur without exposure to the direct rays of the sun, the heat being artificial, or in mid-summer, in close, confined rooms the same result will be produced. There is vasomotor paralysis, the surface of the body is usually cool, the temperature may be as low as 95 degrees F., while the pulse is small and rapid.

=Sunstroke= or =Thermic Fever=.—This is usually caused by prolonged work under the direct rays of the sun in a humid, very hot and sultry atmosphere. This is caused by the action of the heat upon the heart centers producing a paralysis of those centers.

=Pathologically=, rigor mortis develops early and is marked. Putrefactive changes appear early, owing to the high temperature of the cadaver. The various organs are deeply congested, the venous engorgement is extreme in the cerebrum. There is rigid contraction of the left ventricle; while the right is dilated and filled with blood. The blood is fluid and dark. Parenchymatous changes take place in the liver and kidneys.

In heat exhaustion with lowered temperature there is a paralysis of the vasomotor center in the medulla, and the heat is dissipated more rapidly than it is produced. In thermic fever the heat regulating centers become paralyzed by the action of the excessive temperature and more heat is produced, and less dissipated than normal.

=Symptoms.=—=Heat Exhaustion.=—This may occur gradually or suddenly with a severe attack of faintness, pallor, dizziness, headache, cold perspiration and sometimes blindness as the first symptoms. Consciousness is rarely entirely lost. In severe cases there is more permanent collapse. The pulse is rapid and feeble and there is great restlessness and delirium. Under prompt treatment mild cases may recover in a few hours, while in extreme cases death may occur almost at once from heart failure.

=Thermic Fever.=—In some cases the patient is struck down, becomes quickly unconscious, and may die within an hour, or death may be almost instantaneous. In other cases there is pain in the head, oppression, dizziness, nausea, vomiting and sometimes diarrhea or frequent micturition. Soon unconsciousness sets in, the face is flushed, the eyes injected, the breathing labored and there is a temperature of from 105° to 110° F. The pulse is full and rapid, the skin hot and dry and the pupils are contracted. There is usually complete relaxation of the muscles, and in some cases there is twitching and jactitation. Epileptiform convulsions are rare. In fatal cases the coma deepens, the pulse becomes feeble, rapid and irregular, the breathing hurried and shallow and death occurs in a few hours. Favorable cases are indicated by a fall in the temperature and by the return of consciousness. In these cases recovery may be complete. In some cases the patient may never be able to stand even moderate degrees of temperature, which often produce excitement, headache and pain in the cervical region. Failure of the memory, and the loss of power to concentrate the mind are sometimes sequelæ. Meningitis, epilepsy and insanity are also sequelæ.

=Diagnosis.=—This presents little difficulty. The history and circumstances preceding the attack are very important in making the diagnosis. The diagnosis between heat exhaustion and sunstroke fever is readily made. In heat exhaustion the temperature is =lowered=, the pulse is feeble, consciousness is rarely completely lost; in sunstroke fever the temperature is extremely =high=, there is usually complete unconsciousness, and the pulse is full and rapid.

=Prognosis.=—This should be guarded, depending upon the severity of the case.

=Treatment.=—In cases of =heat exhaustion= remove the patient to a shady place and apply water to the face, chest and spine. Thoroughly treat the upper cervical region, in order to control the impaired vasomotor centers and nerves. If the temperature is

below normal a hot bath should be given. Keep the heart and lungs stimulated.

In =sunstroke=, place the patient in a recumbent position and loosen all constricted clothing, and stimulate the heart's action. The high fever is to be met promptly. Place the patient in a bath of water, to which add ice freely. The patient may also be rubbed with ice, and ice water enemata may be employed. The muscles of the neck will be found contracted, probably due to cerebral hyperemia. A thorough relaxation of these muscles will be of great aid in equalizing the vascular system. It is a good plan to thoroughly relax all the muscles along the spinal column for the same purpose. When the temperature nears normal the baths should be stopped. After the temperature has been reduced place the patient upon a cot with ice to the head. The cervical treatment should be repeated as often as necessary. The diet of the patient should be liquid for a few days. Plenty of water and stimulation of the kidneys and bowels will be found beneficial. The sequelæ are to be treated according to the condition. Much can be done for the sequelæ of heat exhaustion and sunstroke. Lesions will be found corresponding to the regions involved. Deep contracted muscles are common.

DEPARTMENT OF OPHTHALMOLOGY

By C. C. REID

It is the desire to make this discussion on the eye the most useful possible to the whole profession. Let it be plainly understood that there is no effort to cover every phase of eye pathology but to elaborate eye diseases and therapeutics strictly from the standpoint of osteopathy. There are many very elaborate and extensive text books and even encyclopediæ written on the eye by the medical profession. The world of ophthalmic literature is extensive and profound. Just so are the elaborations on the general field of medicine. Such things as hereditary influences, congenital deformities, amblyopias, albinism, coloboma and the field of ophthalmic surgery does not concern us at the present time in an osteopathic text book. This department is dedicated to a scientific development of ophthalmic therapeutics along osteopathic lines of thought. Some things in the therapeutics of the eye concern all schools alike. For instance, proper cleanliness and antiseptic precautions in regard to the eye, dietetics, hygiene and the care of the general health. The same anatomy and many of the same methods of examination and diagnosis obtain in all schools. It is the intention to go into the opthhalmic therapeutic field in these discussions where osteopathy has a different outlook with a definite distinct reform to offer in the viewpoint of the anatomy, methods of diagnosis and the system of treatment.

How to Examine an Eye

It has been said that one should be a good general man in order to be a competent specialist. This is especially true in regard to ophthalmic therapeutics. Many systemic diseases have eye symptoms and pathology. The same blood and lymph that nourishes and bathes different parts of the body, also circulates in the structures of the eye. In the examination of the eye, heredity, occupation and environment are to be taken into consideration. Osteopathic lesions may exist from falls, strains, twists, blows, colds and exposure and impair the integrity of the metabolic processes of the eye through the nerve connections and blood supply and lay the foundation for a great variety of eye diseases. With these lesions existing about the neck and upper dorsal, it is only required to have some insignificant local irritant to start symptoms and cause pathology apparently out of all proportion to the etiology. It is important then that one understand the nerve centers and reflexes and the osteopathic logic underlying these conditions or else he must frequently work without a satisfactory explanation of the etiology and consequently be more or less unscientific in his treatment.

The eye examination should consist of the case history, the family history, inspection, osteopathic examination, especially from the fourth dorsal vertebra to the occiput and especial examination of the eye by inspection and other methods.

=1. The Case History.=—Thoroughness of the doctor, or the lack of it, will be readily displayed at this point. Every little thing, as far as possible, that has a bearing on the case should be observed and uncovered in the case history. The physician should want to know every fact that helps him to better understand his case. Patience in hearing the history will often be of great assistance. It gives light on the physical and mental condition of the patient. Much can be gained by being careful and attentive. Notice carefully what he emphasizes and what he thinks is the most important. Inquire in regard to headaches, nervous symptoms, previous eye trouble and past illnesses. Get a venereal history if present, as many eye diseases are complicated or caused by syphilis or gonorrhea.

=2. The Family History.=—Inquire as to blindness in the family and about the age it occurred, if any. Get a venereal history if possible.

=3. Inspection.=—Much inspection can go on while the history is being taken. Observe the countenance, whether there is strabismus or frowning due to eye strain, photophobia as suggested by the effort to avoid the light; note symmetry. Look closely at the lashes, lids, conjunctiva, cornea and iris. Note any scales or crusts on the lids at the root of the lashes. Turn the lids for further inspection. Note the size and relation of the eyes. Exophthalmos may be due to an enlarged globe in high myopia, to Graves' disease, orbital tumor and paralysis of the extrinsic muscles, or staphyloma. In blepharospasm there may be a corneal ulcer or a rupture of the eyeball. An exact examination must be made at the first visit in order for a diagnosis to institute the best treatment possible. Study the conjunctival sac for congestions, hypertrophy, swelling, tumors, foreign bodies, trachoma bodies and secretions. In all forms of conjunctivitis the congestion is most marked in the fornix and decreases toward the sclerocorneal junction. In iritis and cyclitis there is a circumcorneal injection, a pink or red color radiating from the cornea. Note any corneal pathology in the way of ulcers or abrasions and foreign bodies. Compare the tension of the eyes.

=4. The Osteopathic Examination of the Eye.=—This heading is put here in order to show what osteopathy has to offer that is distinct as belonging to our system and not practiced by any other school. Osteopathic research so far has shown that osteopathic science has much to offer on etiology and diagnosis and treatment in eye diseases. The case history, family history and inspection should require but a few minutes but they are essential to a proper examination and may aid us in what to expect osteopathically. Weak nerves will cause asthenopia. A broken arch, an innominate lesion or a slipped axis may cause weak nerves. The osteopathic eye examination then should consider the whole mechanism of the body. In case glasses are being worn for asthenopia they may readily be made unnecessary by osteopathic treatment in the correction of the lesions and building up the system. Some time ago some parents sent their daughter to me to have her eyes fitted for glasses. They stated that she had been to different doctors and opticians and no one had ever given satisfaction. They said she was all right every other way if her eyes were properly fitted with glasses. They did not want her examined or treated otherwise because she would be well every other way with correct glasses. Her vision was right eye 5-20, left eye 5-15 or about one fourth vision in each eye. A plus .87 diopter sphere combined with a plus 3 diopter cylinder in axis 90 gave her perfectly normal 5-5 vision in each eye. This gave her perfect satisfaction until she started to school in September, a couple of months later. Before the end of the first month she was having trouble with her eyes and was again sent to me by her parents. Her vision was reduced to 6-15 in each eye with her glasses on. She wondered and no doubt the parents did, if it was not another case of a misfit in glasses similar to all her previous experiences. This time I insisted upon a thorough physical examination against all protest. The following lesions were discovered: the left innominate was up and back or tilted posteriorly, first lumbar anterior and to the right, sixth and first dorsals to the right. The case was not refracted again. I took particular care the first time and I was quite sure the refractive error was corrected. It was all explained to the parents and regular osteopathic treatment was begun. In less than a month practically every lesion was corrected, her vision returned to normal and she also was cured of an annoying backache with which she had been bothered for years. Her nerves were depleted a great deal. She got benefit in ways that she had not dreamed of. This approach to the eye is not considered by physicians in general, even the oculists. I have had about ten special courses in medical colleges and hospitals on the eye, ear, nose and throat, and I have never heard anything mentioned that would indicate any ideas of the logic involved in this case. Surely osteopathy has much to offer in eye troubles that is new and unique. The osteopathic examination of the eye then should begin with the feet, going then to the innominates, lumbar, dorsal, ribs and cervical regions. Oculists are too prone to rely upon crutches (glasses) in the treatment of asthenopia.

It is easy for the osteopath to conceive how lesions of the upper dorsal and cervical regions may occur and disturb the nerve and blood supply to the eye. This is why asthenopia appears so frequently with ordinary use of the eyes, even without abuse or refractive errors.

The Lumbar Region

The lumbar region should be carefully examined, especially for any curvature which might cause a disturbance of the equilibrium above. Compensatory curves or individual lesions would be the result with a consequent interference with the integrity of the nervous reflexes to the eye.

The Dorsal Region

The same may be said of the dorsal region as of the lumbar in regard to curvatures. There is one individual lesion in this region that very frequently exists with eye troubles, i. e., the 2nd dorsal vertebra lateral. Any of the upper four dorsals in lesion may be a causative factor in predisposing to disease of the eye but it has been my observation that the 2nd is involved most often. In severe headaches due to eye strain from refractive error, a good diagnostic symptom is tenderness and contraction at the 2nd dorsal even when there is no subluxation.

The Cervical Region

This region should have particular care in search for individual lesions. It is quite easy to pass over some small cervical lesion that may be causing serious disturbance, especially if the neck happens to be fleshy. I have corrected cervical lesions and stopped twitching of the eyelids (orbicularis palpebrarum) and other muscles about the face.

The first case I ever saw was twenty-two years ago when I was a junior at Kirksville. Dr. F. P. Millard, now of Toronto, was a room mate of mine. He was constantly annoyed by a twitching of an eyelid. I did not find any lesion for it. We went one day to see Dr. Still at his home and told him of our difficulty. He said without examination that the 3rd cervical was in lesion. There was a senior student present whom the “Old Doctor” directed how to use the proper technique. There was a sharp pop, the vertebra evidently went into right relation, the twitching stopped. I understand the patient has had very little trouble since.

Injuries, exposure and strains to the spine may have antedated an innominate lesion and caused weak joints, muscular and ligamentous tension, local inflammations and partial immobilization of joints. All this would have its modifying effects upon the manifestation of secondary lesions from the innominate abnormality. This makes the study of the bony relations very complex and the effect upon the numerous blood vessels, nerves and other soft tissues still more complicated.

The Ciliospinal Center

Following osteopathic examination and giving proper importance to lesions below the fourth dorsal vertebra, we must remember a special significance to be attached to lesions of the =upper dorsal= in relation to the eye.

Almost any author on nervous diseases or diagnosis will discuss this center. Many of us have it not sufficiently impressed, hence I repeat some known relations. The =ciliospinal= center consists of a nuclear group of cells in the lateral horn of the last cervical and two upper dorsal segments of the spinal cord. From this nucleus fibers pass to the anterior division of the eighth cervical and first and second dorsal nerves and become the white rami communicantes which are efferent in their function. These fibers pass to the =inferior cervical sympathetic ganglion=, thence upward with the sympathetic trunk through the =middle= and =superior cervical sympathetic ganglia=, along the carotid plexus to the vessels of the face and eye, to the glands of that region, to the unstriped muscular fibers of the levator palpebræ superioris and to the =dilator pupillae muscle=.

Any strong feeling or emotion (which of course is perceived and interpreted by the brain cortex) will cause a dilatation of the pupil of the eye. The cervical sympathetic being cut, dilatation does not take place. The rami of the cervical, first and second dorsal cut, the phenomenon stops. It is evident the ciliospinal center is under the influence of a center or centers in the brain. Bing says “There is even an idiomotor mydriasis, which may be brought about by a very vivid mental conception of darkness.”

It has been noted that paralyzing lesions of the cervical sympathetic, of the last cervical and two upper dorsal segments of the cord, and of the anterior roots and rami communicantes of the same, will result in myosis.

The efferent rami are also vasomotor, secretory and trophic. It must necessarily follow that congestive and inflammatory conditions, secretory perversion of the lachrymal, Meibomian, Zeissian and perspiratory glands, and disturbance of the normal nutrition of any of the orbital tissues may result from lesions of the lower cervical and upper dorsal vertebræ.

Osteopathically we know that such a lesion may not be sufficient to be paralytic in its effect, but stimulatory. In this case we may note a pupil habitually too wide and more or less photophobia from a superabundance of light. The unstriped muscle fibers in the levator palpebræ superioris may be unduly contracted making an appearance of a slightly bulging eyeball when it is only a wide open eye.

One who has eye strain from a refractive error, overuse of the eyes, or unbalanced muscles will as a rule have tenderness at some spot in the region of the =ciliospinal= center. A mechanical lesion at that part of the spine may or may not exist in such conditions, but I believe the soreness is there every time. This is one of the diagnostic points in differentiating =headache= of eye strain from

other conditions.

White rami are only in the dorsal region and to the second lumbar and from the second, third and fourth sacral. It has been noted that lesions of the cervical vertebræ do not have as profound an effect upon the eyes as do lesions of the first three dorsal vertebræ. The plausible explanation of that is that the cervical vertebræ have no white rami from their corresponding nerves in the bulbo-spino-sympathetic-ciliary arc as have the upper dorsal.

From all the foregoing statements one can readily contemplate the intricate complexity of our osteopathic problems in relation to the eye. Combine this logic of the lesions outlined and the ramifications of the structures with their normal and perverted functions and combine it with contributing causes, such as infection, exposure, irritants, etc., and amidst the great diversity we reduce much miscellaneous, unclassified material to a degree of simplicity. Many otherwise unexplainable conditions become reasonably clear.

Dr. Louisa Burns under “The Experimental Demonstration of Osteopathic Centers” has this to say:

“Somatic Reflexes”

“In the first series of experiments, the electrodes were placed upon the nasal mucous membrane of animals under anesthesia. The muscles near the third thoracic vertebra were at once strongly contracted....

“The electrodes were then placed upon the conjunctivæ. The muscles near the second vertebra were then contracted. There were also slight and inconstant contractions of the cervical muscles....

“The electrodes were placed upon the eye ball. The muscular contractions were sometimes noted near the second thoracic vertebra, but the reaction was not constant. The cervical muscles were scarcely contracted at all.

“The electrodes were placed upon the outer surface of the eye lids. The facial muscles were contracted very quickly and forcibly, but no contraction of the muscles of the upper dorsal region were noted....

“The =superior cervical ganglion= was exposed to view, and the electrodes placed upon it. The pupils became greatly dilated, the conjunctivæ became lighter in color, and the mucous membranes of the nose and throat were also lightened....

“The =Gasserian ganglion= was exposed to view. The ganglion was stimulated directly. The upper thoracic muscles were very strongly contracted, and the blood vessels in the area of the distribution of the fifth nerve were immediately and strongly contracted. Some of the sympathetic fibers are carried by way of the fifth nerve. In order to exclude the effect of the direct stimulation of these fibers, the fifth nerve was cut, and the central end was stimulated by the electrodes. The muscles of the upper thoracic region were contracted, as before. The vessels in the area of distribution of the fifth nerve were contracted after latent period of a minute or so....

“The stimulation of the central end of the cut fifth nerve caused strong muscular contractions in the upper thoracic region, and also constriction of the vessels in the area of distribution of the fifth. Direct stimulation of the superior cervical ganglion produced effects identical with those produced before the mutilation.

“The spinal cord was cut above and below the superior cervical ganglion. This cut was made from behind, and the sympathetic chain was uninjured. The effects noted after both operations were the same, and can be described as one.

“The stimulation of any cranial structure failed to cause reflex contraction of the muscles in the upper dorsal or the cervical region.

“Stimulation of the cranial structures did not produce any vascular changes except those which might be referred to the direct effects of the electricity upon the vessel walls.

“Direct stimulation of the =superior cervical ganglion= produced the effects noted before mutilation.

“Therefore the cervical portion of the spinal cord is an essential element of the reflex arc by way of which sensory impulses from the cranial structures are able to affect the condition of the upper dorsal muscles, and also in the path by which these impulses are able to affect the size of the blood vessels of the cranial structures themselves....

“Mechanical stimulation of the tissues near the second thoracic spine was followed by a contraction of the blood vessels of the cranial mucous membranes and the conjunctivæ, by a dilatation of the pupils, and an increased secretion of saliva. These effects were practically invariable....

“The superior cervical ganglion was subjected to mechanical stimulation by the manipulation of the tissues over it. In animals, this maneuver was followed by dilatation of the pupils and by a contraction of the cranial vessels, which was soon followed, if the stimulation continued, by a dilatation which was rather persistent.

“After the =extirpation= of the =Gasserian ganglion= without the injury of the sympathetic nerves, the mechanical stimulation of the tissues near the second and third thoracic vertebræ caused the same vaso-constriction and =pupilo-dilation= as was observed in the animal before mutilation.

“After the destruction of the cervical portion of the sympathetic chain, and after the extirpation of the Gasserian ganglion in most animals, the mechanical stimulation of the tissues in the upper dorsal region did not produce any perceptible effects....

“Mechanical stimulation of the tissues near the second and third thoracic spines caused dilatation of the pupils and contraction of the vessels of the cranial mucous membranes.

“Inhibition, or the maintenance of an artificial lesion, caused dilatation of the vessels of the nasal mucous membranes and of the conjunctivæ. The eye ball was also somewhat congested. The pupils were dilated in this case also.”

The Nose and Throat in Eye Trouble

An examination of the eye would not be complete without a careful inspection of the =nose and throat=. The same nerve and blood supply that go to the eye is tied up so definitely with the nose and throat that when there are lesions of the nose and throat the eye is often affected secondarily. Just recently a case of =dacryocystitis= came into my office. After I had carefully examined her eye, spine, nose and throat, she informed me that she had been to three eye specialists before and not one of them had ever looked at her nose and throat, not to mention the spine. She had cervical and dorsal lesions, and =diseased tonsils=. The =inferior turbinate= on the side of the dacryocystitis was curled out so that it lay against the external wall of the nose almost if not altogether blocking the entrance of the =lacrymal duct= to the inferior meatus. This was evidently the predisposing cause of her dacryocystitis.

In =neuralgia= of the eye, =blepharitis=, =obscure pain=, =conjunctivitis= and often deeper troubles you will find a bad condition of the =nasopharynx=, such as adenoids, vegetations, pus pockets, adhesions in the fossa of Rosenmuller, contraction of the soft palate, disturbed relations of the septum and turbinates, sinus trouble, poor drainage, exostoses and polyps. In eye disease all these things should be discovered if they are present, in order to get best results and in order to make a careful diagnosis.

Examination of the Eye by Special Methods

The first thing after the family history, personal history, inspection of the eye and the osteopathic examination, is to find out how well the patient can see. To test the acuteness of vision certain test letters are used. Snellen’s Test Letters are good. The normal eye can read 3-8 inch letters at twenty feet. The test letters on the cards usually range in size to be read at 10, 15, 20, 30, 40, 50, 70, 100 and 200 feet. The most desirable distance is 20 feet. If at the distance of twenty feet he reads the 3-8 inch letters his acuteness of vision would be marked 20-20 or normal. Always use the distance between patient and chart as the numerator of the fraction and the number above the letters which he reads as the denominator. If he is twenty feet away, the numerator remains twenty and the denominator changes according to the line of letters seen on the test cards thus: 20-15, 20-30, 20-70, or 20-200 may express the vision. If the patient could not see the 200 feet letters at 20 feet he must be brought nearer, say 10 feet, for him to see the large letters; his vision would be 10-200. These fractions representing the acuteness of vision may be expressed in meters. Some charts have letters numbered that way.

If the vision is good enough for small objects to be clear, the near point should be taken. This would show the amount of accommodation of the eye. This is expressed in diopters.

A =diopter= is the unit of measurement of the =refractive= power of lenses. =Lenses= are numbered by their refractive power in diopters. A lens that has a curvature that will refract parallel rays of light and bring them to a focus at one meter distance is said to be a one diopter lens. This unit of measurement for the refractive power of lenses was proposed by Nagel in 1866. It soon became quite generally used.

The focal distance of a lens decreases as the strength of a lens increases. One diopter lens (written 1 D) has a focus of one meter (1 M) or 100 cm distance. A 2 D lens has a focal distance of ½ M or 50 cm. A 4 D lens has 25 cm focal distance and a ½ D lens has 100 cm ÷ ½ = 200 cm distance or 2 M. Trial cases have in them lenses varying in strength from .12 D or .25 D to 20 D of the

spheric form. We will not discuss the trial case here.

Accommodation in the Eye

=Accommodation= in the eye is the ability of the eye to vary its focal point. When the normal eye (emmetropic) is at rest its focal point is at infinity so far as parallel rays are concerned. This is called the far-point or the “=punctum remotum=” (P. R.).

When the eye looks at letters twenty feet away it scarcely accommodates at all to get a focus, or so little that it may be disregarded in ordinary practice. Now if one brings fine print close to the eye he will find a point so close that it becomes indistinct. This point is the near-point of focus or the =“punctum proximum”= (P. P.). The range of accommodation is the difference between the refractive power of the eye when it is at rest and when the accommodation is exerted to the utmost, the difference between the P. R. and the P. P.

If one must accommodate one diopter to get a focus at one meter or forty inches distance, at thirteen inches or reading distance one must accommodate at least 3 D in order to see the letters clearly. If 3 D were the total of his accommodation he could not read at that distance but a few minutes; because the accommodation could not be held at its maximum for long at a time. Eye strain with its train of symptoms would result. Hence it is quite important to find the near-point or punctum proximum in order to judge in regard to eye strain in an emmetropic eye. If there is a refractive error, allowance for it must be made accordingly.

As a person gets older the accommodation in the eye becomes less and less until at 45 years of age he can only use 4 to 5 D of accommodation. This is so close to the amount required for reading that he has some eye strain. He begins to hold his paper farther away from him so he requires less accommodation. This condition we call “old sight” or =presbyopia.= An emmetropic eye at forty-five to fifty years of age requires a plus glass to make up for some accommodation in reading.

Frequently there are latent disturbances of equilibrium of the extrinsic muscles of the eye. This is =heterophoria.= If it is a latent convergence it is =esophoria=; if a latent divergence it is =exophoria=. The latter is more frequent. Hyper- and hypophoria are used for upward or downward tendencies. Normal muscular balance is =orthophoria=.

Cause the patient to fix on an object about thirteen inches away with both eyes; push a sheet of paper in front of one eye and watch behind the paper, the eye thus covered. If heterophoria exists the eye will move slightly from its point of fixation since it no longer sees the object. In orthophoria it will remain fixed as long as the other eye sees the object; the innervation to the different muscles is properly distributed.

A Maddox rod found in any complete trial case may be placed before one eye. Have the patient fix on a candle flame, say twenty feet away. The flame appears drawn out into a luminous line. This line can not be fused with the candle flame as the other eye sees it if there is heterophoria. The amount and kind of disturbance is somewhat indicated by the distance and direction of the luminous line and the flame. The exact amount can be measured by the use of a prism that will cause them to fuse.

Next the patient should be taken to the dark room and a careful inspection of the anterior segment of the eye should be made with oblique illumination. First use the unaided eye, then use a lens that magnifies. The 20 D plus lens from your trial case will suffice for the magnification. Note the transparency or lack of it in the cornea and crystalline lens; the depth of the anterior chamber and the appearance of the pupil and iris. Now we are ready for the ophthalmoscopic examination.

=The Ophthalmoscope.=—This is an instrument that commands great respect. Any one who is interested in eye troubles must have and use the ophthalmoscope if he expects to be efficient in diagnosis, upon which, of course, intelligent treatment must forever depend. One must try and try again in order to become proficient in the use of the ophthalmoscope.

A Schematic Eye is of great assistance to a beginner who does not have clinics or patients on whom to practice. Such an eye with full directions can be obtained at almost any optical goods store. It will make the study of ophthalmoscopy easy and interesting. The pupil can be regulated to any size and the eye can be made short (hyperopic), long (myopic) or normal (emmetropic) for study.

The efficient use of the ophthalmoscope makes the diagnosis of internal diseases of the eye as easy as the diagnosis of external diseases of the eye. Only some rare conditions will puzzle, and that is true of any part of the anatomy.

The ophthalmoscope is a simple instrument; its chief function is to illuminate the interior of the eye. The value of ophthalmoscopic findings depends on their correct interpretation by the examiner.

The ophthalmoscope has a mirror to reflect the light into the eye. It has two discs on which are mounted convex (plus) and concave (minus) lenses. The larger disc has seven plus and eight minus lenses. To these may be added the lenses in the smaller disc making many combinations.

A drop of a 2% solution of cocaine or homatropine may be used as a mydriatic where one can not otherwise see clearly the fundus. If no mydriatic is used a somewhat weak illumination should be employed in order not to arouse the accommodation to much activity and make the pupil small. If there is any opacity in the media a strong illumination should be used. The room should be dark; the darker the better.

There are two methods of using the ophthalmoscope. The =indirect= and the =direct= methods. One is more useful at one time and the other at another time. By the indirect method we view the whole field of the fundus more readily but less in detail. With the ophthalmoscope before his eye the examiner's face is twelve to fifteen inches from that of the patient. When the "=red reflex=" of the eye is seen a plus 13 or 16 D lens is interposed near the patient's eye. This magnifies the field. The image is inverted. As a rule it is best seen with a +4 D lens in the aperture of the ophthalmoscope.

This method is especially more satisfactory in high degrees of myopia and astigmatism. The =optic disc= is the objective point. One may see a retinal vessel first; this should be followed to its emergence from the disc. From this point view all parts of the fundus by having the patient look in different directions. This is better by the indirect method than for the examiner to vary his position.

The direct method of ophthalmoscopy is better for detail work and in all cases except high degrees of myopia and astigmatism. It is also better in determining errors of refraction. The patient looks straight across the room. For a beginner it may be essential to dilate the pupil, hence the schematic eye as suggested.

If the examiner has a refractive error, he should wear his own glasses or correct by throwing in front of his eye proper lenses in the ophthalmoscope. Face the patient and sit on the side of the eye to be examined. Use left eye to examine the patient's left eye and right eye for the patient's right. Examiner and patient keep both eyes open. The examiner may not be able to suppress the image of his other eye and may have to close it part of the time. Catch the "red reflex" some 15 to 18 inches away and move close to the patient's eye. The "red reflex" color varies with the error of refraction, the transparency of the media, the degree of pigmentation and the size of the pupil. A blood clot will make it redder, some exudates will make it gray or yellow.

The examiner may approach as close as half an inch from the eye to be examined. Find the optic disc and examine all points of the fundus from it. Rotate in glasses to correct the patient's refractive error if he has any. The strongest plus glass with which the fine retinal vessels can be clearly seen will represent the =hyperopia= of the eye. This is true only if the examiner's accommodation is at rest. The weakest minus glass with which the fine retinal vessels can be clearly seen represents the =myopia=.

=A Normal Fundus.=—The color of the fundus is due to the blood vessels of the retina and choroid and the connective tissue of the choroid and sclera. Variation is due to the pigment. In the albino it is light pink. In the negro it is dark reddish. There are all gradations between the two.

The =optic disc= is the end of the optic nerve as it comes into the eye; it is circular in shape, pink in color, and sharply defined. It is about 1-16th of an inch in diameter; about 15° to the nasal side of the pole of the eye and slightly above the horizontal. There may be a dark =choroidal ring= around the disc or part way around. There may also be a white ring caused by the sclera. As a rule there is a depression in the center of the disc out of which the retinal vessels emerge and spread out over the fundus.

The =fovea centralis= or point of clearest vision is located two and a half disc diameters to the temporal side of the disc. Around this is a circular area of light yellow, the =macula lutea=.

The subject of ophthalmoscopy has been touched upon somewhat in detail because of its great importance to the general practitioner. Every osteopathic physician should know the ophthalmoscope well enough to recognize the ordinary lesions inside the eye. When we take up pathological conditions of the eye we will have occasion frequently to refer to the ophthalmoscopic appearance. Without the use of this instrument all of our clinical field research on internal diseases of the eye is valueless. Many have told me they have cured cataract with osteopathic treatment, some say they have cured specific neuroretinitis with no sequelæ, others testify to opacities and blindness from various causes. Invariably we ask if they used the ophthalmoscope in their diagnosis and with it watched the progress of the case. Almost invariably the answer is "no, it looked like it," "the symptoms indicated it," or "Dr. so and so, an oculist diagnosed it as such." Fellow Osteopaths! we can not base our claims on this kind of data. With a little study and practice the ophthalmoscope can be mastered. Not till then can we get reliable statistics on internal diseases

of the eye in our case reports. Osteopathy has much to reveal to us in this field and for the sake of the science and our patients we appeal to every one to do the work here set forth.

Diseases of the Eye

OSTEOPATHIC MANIPULATION FOR EYE DISEASES

A general correction of lesions should be made in order to give perfect alignment and equilibrium. Lesions that affect the nerve and blood supply will be found from the fourth thoracic to the occiput; more often at the occiput, atlas and axis in the cervical region and the second and third thoracic in the dorsal region including the ribs.

Correction of these lesions must have specific attention in every case of eye disease that shows any tendency to chronicity or in repeated eye disease and exacerbations.

A thorough upper spinal treatment to insure good mobility of all joints and establish freedom of fluids and forces is recommended.

The =nose=, _throat_ and =sinuses= should be examined for pathology. If the tonsils and pharynx are not normal the cotted index finger should be introduced into the mouth until the anterior pillar of the fauces is reached. A mouth gag may or may not be used. Massage the tonsil through the anterior pillar then move to the top and press down on the tonsil with a pumping motion. Repeat this from below the tonsil and posteriorly. Slip the finger under the soft palate and stretch it thoroughly. Clean out any adhesions and vegetations in the vault of the nasopharynx and fossa of Rosenmuller. Stretch the pillars of the fauces by pressing down on each side at the root of the tongue.

If the sinuses are diseased they should be drained. If the nose is diseased and has abundance of secretion, first use irrigation for cleanliness.

Manipulation in the nose will be of great benefit in some eye diseases as pathology there frequently has an important bearing on diseases of the eye. The nose is often too narrow and contracted. The first inch of the nose is muscular and cartilaginous; it is of even more importance to dilate the nose in contractured conditions than it is the sphincters at the lower end of the rectum. The great benefit derived from rectal dilatation has been recognized for years.

In dilating the contracted nose a wide blade nasal speculum may be used. The cotted and oiled little finger may be used where it is properly adapted in size. The dilating can be done with practically no pain and no damage to membranes or other tissues. It should not be extended beyond the cartilaginous and muscular part. Manipulation of the turbinates and tissue further back may be done if needed, by the use of instruments. The Edwards turbinate adjuster instrument (Aloe Co., St. Louis) or the Ruddy Nasal Third Finger (Sharp and Smith, Chicago) are the best instruments so far devised for this operation.

A thorough stretching of the =eyelids=, manipulation of the =eye ball= and the points of the fifth nerve are indicated in many diseases.

The lids may be stretched by pulling them from side to side. The cotted forefinger well oiled (sterile vaseline) may be slipped into the conjunctival sac back of either lid and with the thumb on the outside the lid may be massaged or stretched in any direction. The points of the fifth nerve may readily be influenced at their respective exits about the orbit. The eye ball and deeper contents of the orbit can be profoundly treated by pressing the finger into the orbit above, below and at the sides of the bulb and pushing it in all directions as far as possible. The Ruddy eye finger instrument was devised for this deep manipulation of the orbital and bulbar structures. It is of high value. One finger may be laid on the closed eye and with a tapping motion with the other hand a vibration or oscillation of the orbital structures may be had. This is a useful treatment.

The wise selection and skillful use of these various methods of treatment for the eye will solve most of our difficulties.

This short survey of osteopathic methods will aid us in the more specific discussions to follow.

Neuralgia

A considerable number of people seem to be subject to attacks of pain in one or both eyes. These attacks of pain come at varying intervals; in some cases several times a day, in others as far apart as one or two weeks. The pain will suddenly start almost without warning and with very little provocation, and last from one to twenty-four hours. It is very severe and the patient frequently thinks

something terrible is wrong. Something terrible is wrong so far as his comfort is concerned. But in these cases to which I am referring there is no organic trouble with the eye. The patient does not need glasses. There is no sign of inflammation. Vision is not disturbed. Local examination of the eye with the ophthalmoscope reveals that the fundus of the eye is normal. There is no symptom connected with the eye except pain, occasionally accompanied by a slight redness. I have had several cases in my own practice and my attention has been directed to cases of other physicians.

These cases differ from _tic douloureux_ in that there is no muscular spasm. In fact, motor nerves do not seem to be involved. The involvement seems to be largely in the =fifth cranial nerve=, usually the supraorbital, or other smaller branches of the ophthalmic division of the fifth cranial. Sometimes we note slight dilatation of the pupil with more or less congestion. This would indicate an involvement of the sympathetic branch to the eye.

The lesions discovered in these cases have been a subluxation of the occiput upon the atlas or an upper cervical lesion and frequently some involvement at the second dorsal. There has been noted also trouble in the nasopharynx such as contractures of the muscles of the soft palate and adhesions in the fossa of Rosenmuller.

Misplacements of the uterus have also been found in some cases.

Treatment

Nearly all these cases are curable with from one week to six weeks treatment. Of course the treatment must be intelligently directed after a correct diagnosis as to the cause. The cause can usually be removed. One case to which my attention has been directed was that of a woman about forty years of age who had very severe pains. With all the local treatment of the eye and otherwise she got practically no results until she had replacement of the uterus, which brought immediate relief. Other cases have no trouble on that kind but have lesions of the cervical region and on correction of these lesions the neuralgia disappears. Other cases have had the nasopharynx cleaned out by the finger operation and the stretching of the soft palate which relieved the neuralgia immediately or in a few days. Numbers of cases have been to medical physicians and had various eye remedies administered locally with no permanent benefit. Of course the treatment was administered at the wrong place.

The ramifications of the sympathetic and fifth cranial nerves are so complex and far-reaching that we must keep in mind that one or more of many causes for the trouble may exist and be quite remote from the seat of the pain.

Diseases of the Eyelids

Occasional factors are bee stings or insect bites, which completely occlude the palpebral fissure. We may have some palpebral edema from lid abscesses, chalazion, hordeolum, dacryocystitis, panophthalmia and so forth. In =hemorrhagia subdermalis= there is so much spongy tissue beneath the skin about the eye that the blood extends easily and far. The red tint will soon change to a reddish blue and then become dark, what is known as a black eye (ecchymosis). This frequently results from a blow. The skin is sharply attached around the orbital margin by tense connective tissue so the area of the hemorrhage is limited to the region of the orbit. There may be spontaneous rupture of some of the vessels by hard sneezing or coughing, especially in young children. In older people it may indicate a fragile condition of the vessels, arteriosclerosis or some trouble with the kidneys. The diagnosis of the eye condition is not difficult but the cause of the hemorrhage in that region might be investigated further. Local treatment is of some value in these conditions. They may be soothed by cold compresses. In bee stings and insect bites use an alkaline compress. Manipulation about the eye and osteopathic treatment of the neck with a view to directing a better circulation to that region will aid much.

Herpes Zoster Ophthalmia

This affection of the supraorbital branch of the fifth cranial nerve may extend to the eyelids. It may not go beyond the stage of blistering and redness with some edema. However, it is possible for it to become gangrenous and even extend to the conjunctiva and cornea. I had one case of herpes zoster gangrenosa of this region. There were several gangrenous spots as large as a dime on the forehead and extending down in the region of the eyelid. The process extended to some extent on the cornea and in healing left a condition of irregular astigmatism.

=Treatment.=—The prognosis in herpes zoster is always favorable under osteopathic treatment. Lesions of the cervical region will almost invariably be found interfering with the sympathetic connections of the fifth cranial nerve causing the trophic disturbance to the region. Osteopathic treatment applied to these conditions will always hasten normalization. The affected part might be kept

covered with some soothing lotion to keep the skin soft.

Hordeolum

This is commonly known as a =sty=. It is due to suppuration of the =glands of Zeiss=. It is a harmless affection but causes pain and inconvenience.

=Diagnosis.=—Swelling and pain with a small inflammed nodule in the palpebral margin is quite diagnostic.

=Treatment.=—The circulation is obstructed in this region. The effort should be made to open the circulation before pus has formed. This can frequently be done and the hordeolum aborted by carefully picking up the eyelid and rolling the nodule between the fingers. This will cause some pain but if it is kept up for a moment or two about every hour through the day with an occasional thorough treatment of the neck the sty will usually be aborted. If pus forms it should be opened as soon as it points and then the squeezing and rolling process may be employed again, which will aid rapidly in the freeing of the circulation.

Chalazion

This is a =Meibomian cyst= in the eyelid. It shows as a circumscribed swelling on the inner side of the lid. It frequently becomes large enough to produce some deformity of the lid. A chalazion is movable on the tarsal cartilage. It is a chronic condition and the cyst may become as large as a bean. There may be more than one in the same lid.

=Treatment.=—When a chalazion is small and not of long standing it can frequently be cured by osteopathic treatment. Introduce the finger into the conjunctival sac under the lid, and with the thumb externally, grasp the chalazion between the finger and thumb; roll it thoroughly. Squeeze and massage it two or three times a week for awhile. This, combined with a thorough treatment of the neck, will result in a cure. If at the end of six weeks the condition has not disappeared surgery should be resorted to.

Blepharitis

This is an inflammation of the eyelid. It is either =acute= or =chronic= according to the cause. Acute blepharitis may be due to heat or injury. Chronic blepharitis affects the glands of the lid causing a perversion of the secretions. There is usually the formation of crusts and scales. This condition is known as =blepharitis sicca=. In some cases infection will form little pustules at the roots of the cilia. There is soreness and aching. There may be photophobia. The nasal region may be involved. Osseous lesions of the cervical region are usually present. Refractive errors frequently exist in these cases. Occupation or environment may expose to dust or wind sufficient to keep up the irritation.

=Treatment.=—Change environment. See that there is thorough cleanliness of the lid. Rub or pick away all scales. Use a bland ointment. Correct any cervical or upper dorsal lesions.

Ptosis

This is =congenital= or =acquired=. In congenital ptosis operation seems to be the only treatment. Acquired ptosis is amenable to treatment frequently. The cause is some lesion interfering with the passage of proper nerve force to the levator muscle of the lid. The lesion may be at the origin of the third nerve, at the cortical nucleus in the sigmoid gyrus or in the trunk of the third nerve, or a lesion of the muscle itself. Tumor, trauma, syphilis, sclerosis, hemorrhage, gout or rheumatism, or anything that will produce a peripheral neuritis are causative factors. Lesions of the cervical and upper dorsal by reflecting back upon the nerve centers may produce a ptosis.

=Treatment.=—Remedial measures according to indications. Cases due to osteopathic lesions as indicated will usually yield readily to treatment. Where there are other factors treatment must be varied accordingly.

Trichiasis

This is a condition in which part or all of the eye lashes turn inward and touch the eye ball, due to cicatricial contractions in the conjunctiva and tarsus. Many of the cilia are so small in these conditions that it is very difficult to see them. A loupe or a magnifying glass must be used in order to discover them.

=Dystrichiasis= is a condition where the cilia come in irregularly growing in all directions, some of them turning in toward the eye ball and causing irritation.

=Treatment.=—An epilatory should be used to extract all of the wild hairs. Care should be taken to get out the finest ones as they will frequently cause irritation if not removed.

Entropion and Ectropion

=Entropion= is a turning in of the eyelid and =ectropion= is a turning out. These conditions may be spasmodic and temporary. Entropion is more often due to cicatricial contraction in old blepharitis or trachoma conditions. In some cases the condition may be corrected by the use of strips of adhesive plaster. In cicatricial conditions operation is the rule. Spasmodic ectropion may be corrected sometimes by curing the conjunctivitis. Bandaging may be resorted to. In paralytic ectropion osteopathic treatment may serve to produce a complete cure. Operative procedure should be a last resort.

Diseases of the Lachrymal Apparatus Dacryocystitis

=Dacryocystitis= is an inflammation of the lacrymal sac. It is due to some lesion in the nose, malposition of the inferior turbinate or a poor blood and nerve supply to the lacrymal region as determined by cervical lesions. The sac becomes infected and we have a =dacryocystoblennorrhea.= Pus and tears are regurgitated into the eye through the puncta. There is irritation and the conjunctiva may become infected at any time, also the cornea. It is a dangerous and annoying affection.

=Treatment.=—Osteopathic measures have something to offer along this line. The medical idea seems to be completely surgical in recent years. The first and only thing to be done surgically is to obliterate the sac or dissect it out and curette the nasal duct, completely destroying the apparatus. Lancing does not affect a cure. By treating for a good nerve and blood supply to that region, the irrigation of the nose and a thorough squeezing of the sac each time with a view to forcing the solution in the sac down through the nasal duct into the nose, a cure may be effected in many cases. If these cases can be gotten before infection has taken place, in the state of epiphora or the backing up of the tears into the eye, thorough treatment along the lines just indicated will in nearly all cases result in a cure.

Boric acid solution should be used to wash out the sac when pus is present. The attempt should be made to force it into the nose. Probing properly done is of value in many cases. These cases should be followed up with great care.

Treat the neck thoroughly and spring the inferior maxilla.

Diseases of the Conjunctiva Conjunctivitis

The conjunctiva is a mucous membrane that coats the posterior surface of the eyelids and the anterior surface of the eyeball. It forms a sac, which is slit open in front in the line of the palpebral fissure.

The conjunctiva consists of three parts (1) the conjunctiva tarsi, the part on the lids; (2) the conjunctiva bulbi, the part on the eyeball, and (3) the conjunctiva fornicis, the part connecting the first and second; it is the retrotarsal fold or the region of transition, often called the fornix. The first part can be seen by everting the lids. It is adherent to the tarsus. It is covered with a laminated cylindrical epithelium. The membrane contains an abundance of lymphocytes similar to adenoid tissue. This increases with every inflammation of the conjunctiva. This is why =chronic conjunctivitis= often results in thickened lids.

The =blood supply= of the conjunctiva of the lids is from the muscular branches of the ophthalmic artery. The =nerve supply= is from the ophthalmic division of the 5th cranial and the sympathetic.

The bulbar conjunctiva continues over the cornea. It is covered with layers of pavement epithelium. Its blood supply comes from the posterior conjunctival vessels about the retrotarsal fold, and the anterior ciliary arteries which accompany the tendons of recti muscles; these two systems anastomose in the conjunctiva. Conjunctival injection or congestion shows a superficial net work of larger or smaller vessels that move with the conjunctiva. The color is scarlet or brick red. Ciliary injection occurs as a rose-red or pale violet zone around the cornea, spoken of as peri-or circumcorneal injection. It does not move with the conjunctiva and occurs more with diseases of the cornea, iris and ciliary body.

In the =etiology of conjunctivitis= a great variety of germs are considered by different writers. Collins and Mayo give a report of “germs found in normal conjunctiva.”

Bacillus Xerosis in 94% of normal conjunctivæ; Staphylococcus Albus in 79%; Pneumococcus in 9%; Diplobacillus in 6%; Staphylococcus Aureus in 6%; Streptococcus in 5%.

If this be true, and I do not doubt their statement, we are practically compelled to say that these germs at least are only secondary in the etiology of conjunctivitis. Just at this point osteopathy comes with its flood of light and makes it easily explainable why some conjunctivæ become inflamed while others do not, when all have germs present. The lesion disturbing the integrity of blood supply and nerve force to the eye is the primary cause while the presence of germs may be the aggravating cause. The lesion prepares the soil in which the germs thrive sufficiently to become an irritant. There are all gradations of this soil preparation. The more fertile the field (i. e. the more profound the effect of the lesion) the more virulent germ life may become; the resistance is proportionately less.

=Conjunctivitis= is =classified= for convenience in study, diagnosis and treatment as follows:

(1) Catarrhal, (a) acute, (b) chronic, (c) follicular; (2) gonorrhoeal; (3) ophthalmia neonatorum; (4) trachoma; (5) diphtheritic; (6) eczematosa (phlyctenulosa); (7) vernalis; (8) tubercular; (9) traumatic. This is the clinical classification after Fuch.

Treatment of Conjunctivitis

In order to give the best care in these cases it is quite essential that both the primary and secondary causes be given attention. Some good =germicide= or =antiseptic= is to be used with intelligence. This is in harmony with the great principles of antisepsis and cleanliness taught by osteopathy from its inception. The use of the microscope in the =bacteriology= of conjunctivitis aids in more definite diagnosis and the selection of a proper germicide. For the Koch-Weeks bacillus, the pneumococcus and the influenza bacillus silver nitrate 1% or a 25% solution of argyrol is used; for the diplo bacillus (Morax-Axenfeld) zinc sulphate 1 gr. to the ounce is almost a specific.

A good way to prepare the zinc prescription would be:

Boracic acid and water oz. 1.

Zinc sulphate gr. 1.

The boric acid and water of course being a saturated solution. Apply one drop to each eye about four times a day. If one can not have the use of the microscope to make specific the diagnosis, the zinc solution may be alternated with the argyrol as the germicide. Ice cold applications are good in many of these cases.

Catarrhal Conjunctivitis

=Acute=.—mostly affects the conjunctiva of the lids in the light form. If severe it invades the bulbar conjunctiva. There is redness and swelling and increased secretion which dries at night upon the edges of the lids and glues them together. The eyes are better in the morning and worse toward evening. =Corneal ulcers= and =iritis= may arise as complications. Chronic inflammation may result.

=Etiology.=—Textbooks on the eye give =bacteria= as the chief cause; some scarcely mention anything else. After discussing how the bacteria get there and multiply, they usually bring in some statement to indicate that in many cases no bacteria can be found in the secretions from the conjunctiva. These latter are unaccounted for in the etiology.

=Catarrhal conjunctivitis= is non-specific in its origin.

The great science of osteopathy will fill in the missing links to works otherwise very exhaustive on the eye.

If the cause is due only to a passing irritant as dust, smoke, pollen or wind the disturbance may vary from hyperemia only, to a severe attack of conjunctivitis. Fuch says the majority of cases are produced by bacteria, but THAT IN NOT A FEW CASES OF CONJUNCTIVAL CATARRH THE EXAMINATION OF THE SECRETIONS FOR BACTERIA PROVES NEGATIVE. He also says that the usual course of the disease is from eight to fourteen days, but NOT INFREQUENTLY THERE REMAINS A CONDITION OF CHRONIC CATARRH PROTRACTED OVER A LONG TIME; THAT NOT INFREQUENTLY THE NORMAL CONJUNCTIVAL SAC CONTAINS PATHOGENIC GERMS.

Some authors divide the =etiology= into (1) specific, (2) non-specific. The first they account for by irritants due to dust, heat, smoke, metal, pollen, cold, wind, glare of light, eye strain from overwork of the eyes, ametropia and chronic alcoholism. The second they account for by germ life, most often the Morax-Axenfeld diplobacillus or the Koch-Weeks bacillus, the latter germ being found in the so-called “pink-eye.” It is contagious. This is one condition for which the zinc sulphate (½% to 2% solution) is almost a specific.

No doubt the irritants and the bacteria mentioned, with others, do cause much of our catarrhal conjunctivitis and that one who fails to consider properly the local conditions in practice will be sadly lacking in best results.

On the other hand many cases, treated for local conditions only by very competent men who used the best antiseptics and germicides, have very indifferent results. The acute condition would continue and gradually become chronic. From observation, study and experience there are causes aside from local irritants, ametropia, bacteria, syphilis, rheumatism or measles. There is some disturbance to the integrity of the =spinociliary sympathetic arc=. In many cases of eye disease note lesion and tenderness at the upper dorsal, the removal of which will cause improvement of the eyes. Many cases of eye strain can be relieved by correction of the first, second or third dorsal, and the use of glasses made unnecessary.

Irritation of the eye will cause more or less tension of the muscles at the second and third dorsal, and stimulation of the tissues near the second and third dorsal spines will cause dilatation of the pupils and contraction of vessels of the cranial mucous membranes; which means vasomotor, secretory and trophic disturbances.

It follows then that an =osteopathic lesion= at the second or third dorsal will cause or tend to cause disease of the eye. There may be all gradations in the effect produced, the lighter being mere tendency, while again it may be enough to set up profound vasomotor, secretory and trophic changes in and about the eye. The first effect of the lesion may be stimulatory, and later, inhibitory. The normal resistance of the eye would be lowered and naturally, local irritants, bacteria and ametropia would have a more profound effect. This will explain how one can develop conjunctivitis in the absence of a local irritant with no bacteria present, and no eye strain.

All of these causes, or any number of them, may be acting together, and each more virulent because of the influence of the other.

=Lesions= of the =occipito-atlantal= joint or any of the cervical articulations may cause eye disturbance. There are no efferent ramicommunicantes in that region and the course of the physical disturbance must be greater in proportion to the eye trouble produced, than at the upper dorsal. It is important however to make a close examination of the entire cervical region in eye trouble.

What has been said on the osteopathic causes of acute catarrhal conjunctivitis applies with equal force to chronic and =follicular concatarrhal conjunctivitis.=

What has been said on the osteopathic causes of =acute= catarrhal conjunctivitis applies with even greater force to the =chronic= form. The great variety of local irritants may account for acute conjunctivitis, and does in most instances; but in chronic conjunctivitis local irritants are more often secondary or incidental while the osteopathic lesion with its effect upon the =bulbo-spino-sympathetic= ciliary arc is the =fundamental= cause. Of course some continuous local irritant, e. g., an uncorrected refractive error, excessive light, heat, dust or germ life in the environment may cause a chronic conjunctivitis. Other causes may be retracted lids (lagophthalmus) leaving the eyeballs too prominently exposed; turning in of the cilia (entropion, trichiasis or dystrichiasis) which impinge upon and irritate the bulbar conjunctiva. =Chronic blepharitis= may spread to the palpebral conjunctiva and then the bulbar. Foreign bodies in the eye, or infarction of Meibomian glands may be causes. The diplobacillus (Morax-Axenfeld) is the most common germ in chronic catarrhal conjunctivitis.

=Symptoms and Course.=—In mild cases the redness is only moderate. The conjunctiva is smooth and not swollen. Old cases have hypertrophy with thickening. There was a small girl who came into the office recently who had the conjunctiva of the lids decidedly swollen with some hypertrophy. Her eyes were glued shut with pus every morning. Pus pockets were forming along the follicles of the cilia and on the direct edge of the lid. Her troubles started a year ago and got gradually worse. A few osteopathic treatments were given during three months (she was irregular in coming) and argyrol, 20%, used locally. All pus and debris were cleared off the lids and conjunctiva each time. The swelling all left and the thickening became inconsiderable; the eyes looked almost clear. On pressure there was tenderness at the right side of the second dorsal. No mechanical lesion was apparent there but in treatment that region was thoroughly loosened.

The subjective symptoms are usually worse at night; pain, heaviness of the lids; feeling of a foreign body in the eye; burning; itching and dryness in many cases.

This condition is one of the most frequent of eye diseases in adults; may be senile catarrh in advanced age. It is frequently complicated with blepharitis, ectropion, epiphora and ulcerations of the cornea.

=Treatment.=—The osteopathic treatment depends on the findings in the osteopathic examination. No case of chronic catarrhal conjunctivitis should be treated without a thorough examination of the whole spinal, rib and innominate mechanism. Careful and detailed adjustment should be made of any lesions that might disturb the ciliary arc, the other nerve connections, the blood supply or the body equilibrium.

This does not mean that local treatment of the eye should be neglected in any way. Any measure that will aid in getting rid of local pathology as quickly as possible should be ours. Where there is abundant secretion, silver nitrate 1% to 2% solution put on the conjunctiva with a brush when the lids are turned, or argyrol 20% to 25% dropped into the eye are among the best antiseptics for local use. If the diplobacillus is present zinc sulphate ½% solution is indicated.

The nose, nasopharynx and pharynx should never be overlooked in this disease.

Follicular Conjunctivitis

=Follicular conjunctivitis= is of catarrhal origin. It is characterized by the presence of follicles. There may be only a few or a great many. If numerous they are often in rows on the palpebral conjunctiva. Microscopically they show as circumscribed masses of adenoid tissue. In this they resemble the granules of =trachoma=. Sometimes cases persist for years with little or no inflammatory symptoms. On account of the follicles this disease is frequently confused with trachoma.

We have heard numbers of well meaning conscientious osteopathic physicians testify to curing cases of trachoma with a short course of osteopathic treatment with no pathology remaining. We are absolute believers in the effectiveness of osteopathic treatment and want to give it full credit for doing all it will; but here we want to enter a plea to the profession that we need more discrimination and definiteness in our diagnosis. Technique is being emphasized and we say Amen! It is proper for us to be thoroughly competent in technique but diagnosis should be made just as emphatic because scientific technique depends upon diagnosis for each individual case.

=Differentiation= of follicular conjunctivitis from trachoma.

=Follicular conjunctivitis= occurs (1) chiefly in the young; (2) the follicles are smaller, more sharply limited, project more above the conjunctiva, are often in rows, and oval in shape; (3) the disease clears up with no bad after effects often without any treatment and the tendency is to ultimately get well; (4) it never leads to shrinking of the conjunctiva, to pannus or other destructive sequelæ; (5) it can arise without contagion and is not considered contagious although, like trachoma, it does attack large numbers of people who are confined in a small place.

=Trachoma.=—(1) It seldom occurs in children; (2) the follicles are larger, do not have sharp outlines, are less prominent under the conjunctiva, are round in shape and never in rows; (3) tends to lead to more or less pathology and seldom recovers spontaneously; (4) scar tissue becomes a product of the inflammation in the conjunctiva and leads to shrinking of the conjunctiva, causing in turn entropion and trichiasis. Pannus is the sure result of unarrested cases as there is a tendency to infection of the cornea from the infected conjunctiva moving over it and remaining in contact; (5) trachoma has been proved to be contagious. Trachoma bodies which are considered the infective agent have been isolated.

The use of atropine in some instances will cause a follicular catarrh which clears up on stopping the use of the poison.

Parinauds “Infectious conjunctivitis” has granulations but almost always occurs in only one eye and is accompanied with constitutional symptoms.

=Treatment of Follicular Conjunctivitis.=—The treatment should be directed against the inflammation. The trophicity of the nerve terminals to the conjunctiva may be altered by osteopathic lesions.

Suggestions under chronic catarrhal conjunctivitis apply here. If there is no inflammation the follicles tend to disappear, leaving no trace of pathology, hence a few osteopathic treatments of the lids and the cervical region will hasten normalization.

Gonorrheal Conjunctivitis

This disease is sometimes called =purulent ophthalmia= or =acute blennorrhea=, It is caused from an infection of the conjunctival sac with the gonococcus of Neisser. Contact with soiled fingers or linen may transfer the germ.

=Symptoms.=—Within 12-48 hours after inoculation the first symptoms of redness and irritation occur. This is soon followed by much swelling and tension of the lids and chemosis of the conjunctiva. There is much pain and a copious discharge of pus coming from beneath the lids. At first the pus is yellow or yellowish green.

Later the symptoms begin to subside; there is less tenseness and heat; the lids can be more readily everted and the discharge ceases after 6 or 8 weeks. The puckered conjunctiva becomes rough and granular.

In these cases the =prognosis= is always grave; more so than in ophthalmia neonatorum. The eye is almost always marred in some way. One of the great dangers is involvement and destruction of the cornea. If the cornea becomes hazy soon after symptoms begin it is not a good omen. =Ulcers= will likely form and then there is a tendency to puncture the cornea. In mild cases the cornea may escape without injury. In severe cases it is likely to ulcerate. If it perforates, the anterior chamber is emptied and the iris prolapses into the perforation; adhesions take place and there is healing with reformation partially of the anterior chamber. An adherent leucoma is the result with practical loss of vision. There may be a bulging of the cornea known as anterior staphyloma. The iris and ciliary body may become involved, causing iritis and cyclitis, or the whole inner structures may be affected making a =panophthalmitis= with =atrophy= of the eyeball.

The cornea is affected by the infective material direct or the nutrient vessels to the cornea at the limbus may be obstructed by the extreme swelling and pressure.

=Complications= of arthritis, rhinitis, septicemia and endocarditis may arise. If there is none of these, at least there is a general debilitated condition which needs attention.

=Treatment.=—The treatment should be =local= and =constitutional=, The diagnosis should be made quickly from the history, symptoms microscopically, and local cleansing begun at once and followed diligently. Excessive discharge should be wiped away with cotton. The conjunctival sac should be thoroughly irrigated every hour or oftener if necessary to keep it clean. This is to be done day and night. A saturated solution of boric acid may be used, or corrosive sublimate one grain to the pint, or permanganate of potassium solution 1-5000. The irrigation should be followed by the free use of argyrol 25%. This procedure will keep the eye clean and be the means often of saving the cornea from destruction and the eye from blindness.

If there should be ulceration of the cornea a drop of atropine ½% should be used in the eye often enough to keep the pupil dilated and the ciliary body at rest.

Osteopathic physicians no less than other physicians should not neglect this local, careful, persistent, antiseptic cleansing of the eye in such cases. The osteopathist can do more. He is not limited to antisepsis even in this kind of work, however important it might be. The unaffected eye should be carefully protected. Buller’s shield should be used.

The osteopath should give thorough treatments to the neck and the fifth nerve.

Supporting treatment to the system according to indications should be given e. g., bowels, kidneys, nerves, muscles, joints as in constipation, nephritis, neurosis, rheumatism, arthritis, endocarditis, septicemia, rhinitis etc.

Ophthalmia Neonatorum

This is an =acute purulent conjunctivitis= in the new-born. Neonatorum comes from a junction of the Greek word Neos—new, to the Latin word natus—born; new-born. This disease is the bugbear to the obstetrician. He must always be on the lookout for it and act promptly in order to save sight. Every general practician should make a careful study of this disease if he expects to treat children.

Sixty to seventy percent of conjunctivitis neonatorum is due to the infection with the gonococcus of Neisser. It usually comes from a gonorrheal discharge from the genitals of the mother. The nurse or anyone who handles the baby might be the agent in the transmission of the infection.

The disease is not always of gonorrheal origin. Some cases are due to the pneumococcus, streptococcus, diplobacillus or one variety of staphylococci.

Thus there are two varieties or types of ophthalmia neonatorum; a severe type which is =gonorrheal= or specific and a mild type which is non-specific.

In some states there is a law which requires the use of silver nitrate in the eyes of all babies at birth. Every baby's eyes should be thoroughly washed at birth, with boric acid and where there is the least suspicion of gonorrhea silver nitrate 1% or argyrol 25% should be used. A routine use of one of the silver salts would be good practice.

=Symptoms.=—Gonorrheal cases begin usually the third day after birth, non-gonorrheal, on the fifth or sixth day. Both eyes are usually involved, one worse than the other. The lids swell much. There is chemosis of the conjunctiva which may put the cornea in a pit. The discharge is abundant. It is yellow or greenish yellow.

The disease gradually declines and the discharge ceases in six to eight weeks. The conjunctiva is thickened and looks granular. May be some cicatricial changes.

The chief danger is to the cornea, more so if it becomes hazy the first two days. Corneal lesions seldom occur in non-specific forms.

If the cornea is involved perforation is likely, with a general inflammation of the eyeball (panophthalmitis) followed by atrophy (phthisis bulbi).

Complications such as rhinitis, meningitis, endocarditis and general septicemia may occur.

=Diagnosis= is made from the onset, character, symptoms and course with the use of the microscope.

=Prognosis.=—Delayed or improper treatment in these cases will likely be fatal to sight as sloughing of the cornea will occur. With prompt and proper care the prognosis is favorable.

=Treatment.=—Mild cases (non-specific) are treated in the same manner as simple conjunctivitis. In severe cases (specific) clean the eye carefully and apply cold compresses of gauze 15 to 20 minutes at a time every hour or two. Keep the gauze on a block of ice and change every few minutes. If the cornea is involved heat may prove more satisfactory. There must be constant removal of the discharge. Wipe away the excess and irrigate freely with boric acid at least every hour day and night and more often if necessary. After each washing use a solution of argyrol 25%. Once a day silver nitrate 1% solution may be used and washed out with a salt solution.

If the cornea should ulcerate the treatment need not be altered.

The attendants should be carefully instructed as to the importance of the care and the contagious nature of the pus.

Antisepsis and cleanliness here is more essential, effective and exclusive than in any other disease of the eye. Wisdom in the use of antiseptics is a strong point in the armamentarium of every progressive osteopath.

Trachoma

This disease is known as =granular lids= or =granular conjunctivitis=. Although the germ has not been discovered, we know this is an infectious disease. A roughness and hypertrophy of the conjunctiva develops. There is development of follicles or granulations. Later these products are absorbed and cicatrization of the tissues follows.

=Cause.=—Trachoma is found most common in Egypt and Arabia. It spreads easily in crowded institutions. It is in many instances a mixed infection with the Morax-Axenfeld bacillus, Koch-Weeks bacillus and the gonococcus.

="Trachoma bodies"= have been discovered which are claimed by some to be a causative factor in the disease. These small bodies are not found in all cases however.

Spinal lesions of the cervical and upper four thoracic vertebræ will disturb the blood and nerve supply to the eye which will predispose to the disease should some of the virus or germs of trachoma be present. In practically all these cases there is tenderness if not an actual twist at the second and third thoracic.

=Symptoms.=—A small boy came to our clinics complaining that his left eye was smaller than the right. No inflammation or swelling was prominent. The eye looked normal except slightly smaller than the right. On turning the lid granules in the fornix of that eye

were readily noticed. Trachoma had a good start. The tissues were so hypertrophied in that region that the eye could not be opened quite as wide as the other one, hence the impression that that eyeball was smaller. The granulation often develops so insidiously that the victim may have the disease for months before he realizes he has a bad eye. When symptoms appear there may be photophobia, lachrymation, gluing of the lids from a scanty secretion, pain, and blurring of vision. The granules are gray, translucent and roundish under the conjunctiva.

Hypertrophy increases to a certain height when cicatrization and contraction begin. The duration may be years. The more the hypertrophy the longer the duration and the greater the contraction. (Note here that treatment should be directed toward combatting the hypertrophy by establishing circulation).

=Sequelæ.= I merely mention the sequelæ here: pannus, ulceration of the cornea, trichiasis, dystrichiasis, entropion, ectropion, symblepharon, xerosis, corneal opacities. For the explanation, pathology and treatment of these sequelæ not covered in this treatise, see any good works on diseases of the eye as Weeks, Fuchs or De Schweinitz.

=Treatment of Trachoma.=—In reporting cases of trachoma treated and cured by osteopathy we should be sure of our diagnosis.

The treatment is antiseptic, hydrotherapeutical, osteopathic and operative. A saturated solution of boric acid should be used. Argyrol 20% is good if there is much secretion. Nitrate of silver 2% and copper sulphate are still used in some cases to advantage as claimed by some physicians. The osteopath should count on careful cleanliness.

Hot compresses over the eyes are often very agreeable.

Operations are often performed for trachoma. The granules are rolled out with Knapp's roller forceps, and other methods.

=Grattage= is practiced with some wonderful results. It is done as follows: Get some fine sand paper and cut it in strips about one-half inch wide by three or four inches long. Put it in alcohol in a vessel for ten to fifteen minutes. Pour off all the alcohol except a few drops that will cling to the vessel by capillary attraction. Touch a match to the residue. This will burn just enough to make the sand paper absolutely sterile without burning the latter. Put the patient under somnoform. Use a small artery forceps to grasp the edge of the eyelid, roll the lid back over the artery forceps to expose all granulations clear to the fornix. Use a protector to the eyeball. Now with the sandpaper quickly scrape or curette away all of the trachoma bodies and granulations. Repeat the process on the other eye if it is involved. Wash out well with a saturated solution of boric acid and bandage the eyes for a few hours. This will cause considerable swelling and inflammation. Use cold applications and keep the eyes disinfected. I have seen some very good results from this method.

=Osteopathic.=—Following the sand paper operation a thorough treatment of the cervical and upper dorsal region would add considerably to the rapidity of the patient's recovery and sense of well being. General tonic treatment is of special benefit in nearly all trachoma cases as they are subnormal in their general health.

One form of technique which has been used by myself and others to advantage in these cases is as follows: Sterilize the fingers carefully, lubricate with vaseline or K. Y. the forefinger of the right hand. With the left hand raise the upper lid and introduce the forefinger of the right hand with the thumb above. Catching the lid between the thumb and finger squeeze and massage the whole structure clear to the fornix as thoroughly as possible. Repeat the process on the other eye.

A technique used by Dr. Edwards of St. Louis is as follows: After sterilizing and lubricating the forefinger lift the lid and introduce the finger as far as possible into the orbit pushing the fornix back into the orbit. This stretches all the tissues around the fornix, opening up a better conjunctival and palpebral circulation. The ciliary vessels and nerves are stretched and stimulated. It is rather surprising to one who has not tried it, how far the finger can be introduced into the orbit.

One set of nerves that should be especially studied and considered in trachomatous conditions is the cere-brobulbo-spino-sympathetic-ciliary arc. This has already been elaborated. All spinal lesions should be carefully diagnosed and corrected.

Dr. T. J. Ruddy's third finger eye instrument is very useful in these conditions in restoring normal circulation about the orbit.

See that the nose and throat are normal.

Phlyctenular Conjunctivitis

By some this disease is considered an =eczema= of the conjunctiva. This will at least enable us to get an idea of the conjunctival pathology. What is said of phlyctenular conjunctivitis applies largely to its corresponding disease of the =cornea-phlyctenular keratitis=. Scrofulous ophthalmia is applied by some because so many of these phlyctenular patients have =scrofula=. Herpes conjunctivæ is used as a name because of the small blisters or blebs that form in the beginning stage. Little red eminences develop near the limbus (sclerocorneal junction). They are cone shaped, slightly elevated about the surrounding tissue. There may be one or several, usually not more than one or two. After a few days the cone breaks and on top appears a small gray ulcer. There is further breaking down and the cone disappears leaving an ulcer on level with the conjunctiva. Vessels are congested about it. There may often be noted an area of small vessels, fan like in shape, running from the outer region of the conjunctiva to the ulcer or phlyctenule.

=Etiology.=—This is a disease of frequent occurrence in children, mostly among the poor classes. Such things as eczema, dirt, adenoids, scrofula, rhinitis, malnutrition, abuse of tea and coffee and exanthematous disease are mentioned by oculists as causes. I have no doubt any or all these conditions predispose to phlyctenular conjunctivitis.

De Schweinitz in “Diseases of the Eye,” 1916 edition, p. 242, says: “The exact cause of ocular lesions, or phlyctenular eruption, has not been determined.”

I have met Dr. De Schweinitz and heard him lecture on the eye. I consider him one of the best eye specialists in the country. His experience and study with the eye dates over many years and his book has gone through eight editions. He is professor of ophthalmology in the University of Pennsylvania; Ophthalmic Surgeon to the Philadelphia Polyclinic Hospital, the Philadelphia General Hospital etc., etc.

His opinion represents the summary of the investigation of the ophthalmic profession the world over and through all the past down to the present time. “The cause of phlyctenular conjunctivitis is not known.”

=Bacteriology.=—At times in the ulcers have been found the staphylococcus pyogenes aureus and albus. They are also found in a normal conjunctival sac. They could not with logic be taken as a causative factor; at least they would be only secondary.

If oculists and other students of the eye all had a good deep osteopathic vision to throw light upon these problems many causative factors would take on a new meaning. Such supposed causes as have been mentioned, e. g. eczema, adenoids, rhinitis and malnutrition may easily be secondary to the osteopathic lesions. Micro-organisms may be enabled to act because of trophic and circulatory disturbances to the conjunctiva through disturbed nerve connections from lesions in the cervical and upper dorsal regions. Herpes zoster is purely a trophic nerve disturbance manifestation on the skin as blebs or blisters with more or less neuritis. Any lesion that would affect the integrity of the function of the fifth cranial nerve might easily manifest itself as herpes of the conjunctiva.

We believe the osteopathic lesion is primary and fundamental in the causation of most of our phlyctenular conjunctivitis. Of course insanitation, scrofulous diathesis and the exanthemata play their role. A good diagnostician should figure out the relative importance. The history, onset and examination will usually eliminate these conditions.

=Symptoms.=—Lachrymation, photophobia, blepharospasm and injected vessels are the chief symptoms. There is pain as well as fear of light. The child fights examination.

The attack subsides in ten to fourteen days unless there is multiplicity of blebs. Some patients have repeated attacks for months or years. Many of these cases in medical clinics keep coming for months with repeated attacks. Never leave out careful osteopathic treatment.

=Prognosis.=—This is favorable for a final cure. If there should be multiple blebs and frequent recurrence and the cornea is invaded, the prognosis is not good for perfect sight. The pathology goes deep enough to affect Bowman’s membrane of the cornea disturbing the substantia propria. This causes a macular condition of the cornea which impairs sight.

=Therapy.=—Diet should be bland; the eyes should be protected from irritants; yellow oxide ointment should be used in the eye once a day or 10% argyrol. The ointment is preferred. Moist warm compresses on the eye are comforting. A boric acid wash in almost all conjunctival trouble is good. If there is much irritation giving a suspicion of iris involvement a drop of atropine ½% should be used. The general regimes of living should be regulated.

Osteopathic treatment should be directed toward building up the general health and correcting all lesions, especially that may have a specific bearing on the eye trouble. Such lesions will be found more often at the first, second and third thoracic, but may be anywhere from there to the occiput.

Vernal Conjunctivitis

This disease is known by many as =vernal catarrh= or =spring catarrh= of the conjunctiva. It is a chronic inflammation which sets up changes in the conjunctiva and tarsus. This disease may be confused with trachoma unless one observes closely. There are broad flat papillæ on the conjunctiva. These papillæ may readily be taken for granulations. They are larger than the granules in trachoma. They somewhat resemble the arrangement of cobble stones. The conjunctiva has a bluish-white filmy appearance called by some, milky shimmer.

The disease was thought at first to appear only in the spring, hence the name vernal. Many cases continue through the year with exacerbations in the spring. It occurs more often in boys. Both eyes are attacked. It may heal and leave no trace. It may last from four to twenty years.

=Causes.=—Almost all works on the eye say the cause is not known. De Schweinitz says, “Definite information in regard to the cause of this disease is lacking.” There may be a micro-organism which has not been discovered.

I wish to call the attention of the osteopathic profession to the great fact that there are numbers of diseases of the eye as well as of other parts of the body about which the medical profession are entirely “at sea.” This gives valuable ground for scientific research by our profession.

My experience with this disease is not sufficient for me to speak with any positiveness or finality as to its cause. The altered trophic parts and the very chronic condition existing leads me to the firm belief that we will ultimately find the cause as a mechanical lesion affecting the trigeminal or sympathetic (or both) nerve connections. Glare of light and local irritants act only as secondary causes. Nasal disease may be associated and act as a cause.

=Symptoms.=—There is photophobia, some mucus, slight pericorneal injection, redness of the conjunctiva of both the bulb and lids; that of the lids is thickened and of dull pale color due to sub-epithelial hyaline thickening. The fact that there is no pannus, and flat granulations and recurrence with spring, marks it from trachoma.

=Prognosis.=—Under medical treatment it is unfavorable; may last twenty years. Slight opacity of the cornea may develop.

=Treatment.=—The eyes should be protected with dark glasses. Cold compresses give some relief. Boric acid is good as a wash. Yellow oxide of mercury ointment may be of service as an antiseptic and alternative. If nasal disease exists, it, of course, should be treated according to indications. Fundamentally the lesions in the spine in the cervical and upper dorsal regions should be specifically corrected. When enough cases of vernal catarrh have been observed and treated osteopathically much light and benefit will be brought to bear upon this obscure and intractable disease of the conjunctiva.

Diseases of the Cornea

Anatomy

The cornea with the sclera forms the outer coat or tunic of the eye ball. The cornea is in front and forms one-sixth of the envelope. It is a segment of a smaller globe than that of the sclera. It is about 12 mm. horizontally and 11 mm. in the vertical diameter. Its thickest part is at its junction with the sclera where it is about 1 mm. This junction is called the limbus. The cornea is inserted into and rests on the sclera like a watch crystal. The fibers of the cornea pass continuously into the sclera, however. The normal cornea is transparent. Most morbid changes of the cornea cause a diminution in this transparency. In old age a narrow gray line near the corneal margin makes its appearance. This is known as the =arcus senilis=. There is a little strip of perfectly clear cornea between the arcus senilis and the limbus.

The cornea has five layers. These layers should be noted with care, as in wounds of the eye, foreign bodies in the cornea and ulcerations, the results depend much upon which layers are affected.

1. The =anterior epithelium= consists of pavement cells of several layers. This layer of the cornea may be damaged or scratched off in large patches and still it will heal readily leaving no trace of the injury.

2. The =anterior elastic lamina= or =Bowman's membrane= is very thin and homogeneous; it is just beneath the epithelial layer and forms a resisting sheath to prevent damage to the next layer.

3. The =stroma= or =substantia propria=. This layer composes about nine-tenths of the cornea. It is composed of minute connective tissue fibers between which lie some stroma cells or corneal corpuscles. Some of these cells are fixed while others are motile. The motile ones are the white blood-corpuscles which move about in the lymph passages of the stroma. They increase in any irritation of the cornea.

4. =Descemet's membrane.= This is a tough homogeneous hyaloid membrane back of the stroma. When the stroma is diseased and breaks down Descemet's membrane may be sufficient to prevent a puncture of the cornea.

5. The =Endothelial layer= is a single layer of flattened cells which coat the posterior surface of Descemet's membrane.

The margin of the cornea is in relation with three membranes, the conjunctiva, the sclera and the uvea (iris and ciliary body). In a disease of the cornea, a conjunctivitis, an iritis or a cyclitis is easily started.

The cornea contains no vessels. It is nourished by imbibition. At the limbus there is a rich network of marginal loops supplied by the anterior ciliary vessels. From these loops the blood plasma passes into the stroma of the cornea.

The nerves of the cornea come from the ciliary nerves and the nerves of the bulbar conjunctiva. These are from the trigeminus and the sympathetic. The nerves extend numerously in the stroma passing forward through Bowman's membrane into the epithelial layer. This makes the cornea very sensitive to the touch.

Examination of the Cornea

Note the size and form. Both may be modified by morbid processes. Note the surface with regard to curvature, evenness and smoothness. In =keratoconus= the curvature is greatly increased. Noting the reflex images in the cornea and comparing these with those of a normal cornea will show any variation in curvature. Also any =unevenness of the surface= may be noted by the irregularity or distortion of the images. Uneven spots on the cornea may be =depressions or elevations= from loss of substance; =wrinkles or collapse= from lowered tension.

If the smoothness or polish of the cornea is lost it looks like glass that has been breathed upon or greased. It is lusterless and dull.

Note also the transparency of the cornea and determine the form, extent and density of the opacity; whether it is diffuse or in spots; in the deep or superficial layers. A magnifying glass should be used in the study of opacities. According to the density of the opacity of the cornea it is known as a =nebula= or a =nebulous opacity=, a =macula= or a =leucoma.= The nebula is the least noticeable and the leucoma is the densest opacity. A leucoma is a condition of complete opacity. The cornea looks white.

Defects in the corneal epithelium may be made to show clearly by the use of a 2% solution of fluorescein which stains them green.

Note the sensitiveness of the cornea by touching it with the end of a thread, a little cotton or a shred of paper. The sensitiveness is diminished or lost in glaucoma and some other diseases.

Diseases of the Cornea

Almost all diseases of the cornea have some form or degree of inflammation. =Keratitis= is the word generally used for inflammation of the cornea. In order to aid clearness in discussion there are various subdivisions of keratitis made by different writers. Suppurative and non-suppurative are the principal types. In =suppurative keratitis= there is always some destruction of corneal tissue which on healing leaves an opacity with partial loss of vision. Germs gain entrance into the tissues usually from the exterior and some form of ulceration results.

The following classification is taken from Fuchs:

=Suppurative Keratitis.=—(1) Ulcer of the cornea; (2) Serpiginous ulcer; (3) Keratomalacia or Xerosis; (4) Keratitis neuroparalytica.

=Non-suppurative Keratitis.=—(A) SUPERFICIAL: (1) Pannus, or keratitis with blood vessels; (2) Phlyctenular, or keratitis with vesicles. (B) DEEP: (1) Parenchymatous or interstitial.

In keratitis there is first an infiltration or the increase of cells in the substantia propria or the parenchyma of the cornea. This is the exudate of the inflammation. It causes the cornea to look more or less dull or cloudy. The disease may clear up at this point or go on to suppuration. If it clears up it is known as =resorption=. If the lamellæ of the substantia propria are not destroyed by the process, resorption takes place with no loss of substance. The exudate disappears and there is perfect transparency of the cornea again. There may be slight damage of the stroma preventing perfect transparency. Resorption of the exudate may not be quite complete which may become partly organized and left permanently fixed in the cornea. Cases resorbing without destruction of the stroma are forms of the non-suppurative keratitis group.

If the stroma breaks, suppuration occurs. This is the second stage and is associated with a localized destruction of the cornea. These cases are known as =suppurative keratitis= or =ulceration of the cornea=. The disintegration begins in the most anterior layers of the cornea. A slight depression in the cornea can be noticed. The infiltration is all about the ulcer, getting less as it is more remote from it. If the floor and walls of the ulcer are foul with the infiltrate it is known as a =progressive= ulcer. =Sloughing= may continue to spread the ulcer.

If the cloudiness around it disappears and the ulcer acquires a smooth transparent base and edges it is known as a =retrogressive= or clean ulcer.

The disintegrated areas of the cornea may be replaced by newly formed tissue. This is the third stage or that of =cicatrization=. This new tissue is connective tissue. It is opaque, leaving a permanent opacity.

=Stages of keratitis=:

=Suppurative.=—(1) Infiltration; (2) Suppuration and (3) Cicatrization or Reparation. The suppuration is progressive or retrogressive.

=Non-suppurative.=—(1) Infiltration; (2) Resorption.

In the diagnosis of a keratitis one should look at it very carefully. A loupe which has thick plus sphere lenses will magnify the field and may be of great assistance in observing closely the condition.

If the cornea is clouded and dull the trouble is recent and if there is no loss of substance it is an infiltrate (first stage). If there is loss of substance it is a progressive ulcer (second stage.)

If the surface is lustrous but cloudy the trouble is an old one and if there is loss of substance it is a retrogressive ulcer; if no loss of substance it is a cicatrix.

Frequently blood vessels grow in from the margin in ulcerations of the cornea. This is usually a process of healing of the corneal ulcer. The advent of the blood vessels is favorable. After healing the blood vessels gradually disappear. They never entirely disappear from large cicatrices.

In some cases new vessels accompany the inflammatory process and like the exudate are a part of the clinical picture of the disease as in parenchymatous or interstitial keratitis. Pannus also has vessels. They are not in the cornea but are in new tissue deposited upon it.

=Symptoms appearing in keratitis=:

1. =Ciliary injection= or a red area encircling the cornea. If the keratitis is severe there will be considerable inflammation of the conjunctiva which may hide to some extent the ciliary injection.

2. =Iritis or iridocyclitis= may set in. The iris and ciliary body are in such intimate relation with the cornea that these structures are very subject to involvement in any severe keratitis. With iritis would come danger of =synechiae= or adherence of the iris to the anterior surface of the lens.

3. =Hypopyon.=—In suppurative keratitis there is some exudate into the anterior chamber of the eye. This exudate drops to the bottom of the chamber and looks like pus had gathered in the bottom of the aqueous. This condition is called hypopyon.

4. Other symptoms which are frequently prominent are =diminished vision=, =pain=, =photophobia=, excessive =lachrymation= and =blepharospasm=. Edema of the lids and conjunctiva may occur.

Intelligent treatment of keratitis of course is based upon the exact conditions present. Great care in diagnosis and treatment should be exercised.

Ulcer of the Cornea

Inflammation of the cornea sets in from some cause. There is an infiltrate into the substantia propria. A spot becomes cloudy and the surface over it becomes dull; at this point the epithelium breaks down or exfoliates and the loss of substance in the parenchyma is the beginning of an ulcer.

=Cause.=—The cause may be constitutional or local. The causes usually thought of from the medical standpoint may be noted in such books as “Diseases of the Eye” by De Schweinitz or Weeks. I wish especially to call attention to the fact that there is frequently a primary and underlying cause of corneal ulcers not mentioned in any medical texts, i. e. the osteopathic lesion. By this I mean more than the spinal lesion although the subluxation lesions that result from the occiput to the fourth dorsal are of most importance. Any tension or change of tissue in the cervical region that may interfere with perfect freedom of circulation of blood to the tracts and centers in the cord, is to be considered. The osteopath of course should take into consideration all causes primary and secondary and govern himself accordingly.

=Symptoms and Course.=—There is a gray area surrounding the ulcer at first, also the floor is grayish in color. In this condition it is known as a =progressive= ulcer or a =foul= or =unclean= ulcer. This cloudiness or gray area may increase in size and the ulcer keep spreading, or it may go deeper even to perforation of the cornea.

Some ulcers advance or spread on one side and heal on the opposite side so that they creep along on the cornea—these are the so-called =serpiginous ulcers=.

With corneal ulcers there is irritation, pain, photophobia and increased lachrymation. There is usually some ciliary injection which is an indication of involvement of the iris and ciliary body. If iritis occurs there is contraction of the pupil with slow reaction. =Hypopyon= may develop. With iritis and the exudate there is likely to be adhesions between the iris and the lens known as posterior synechia.

A few corneal ulcers are asthenic and do not have irritative symptoms and yet are dangerous.

When the ulcer begins to heal it is called =retrogressive=. Dead tissue is cast off; other tissue becomes transparent from resorption. We have a =clean= ulcer. Symptoms disappear and cicatrization begins. Vessels extend to the ulcers and soon it is leveled up with the corneal surface. Cicatrization may leave it slightly below the corneal level or above it.

If there should be perforation of the cornea from the ulcer there may be =complications=, e. g. keratocele, loss of aqueous, dislocation and expulsion of the lens, intra-ocular hemorrhage, flattening of the cornea, fistula of the cornea, glaucoma, intra-ocular suppuration, prolapse of the iris into the opening, etc. These complications and sequelæ that occur occasionally will not be considered here.

After healing is complete by cicatrization there is opacity of the cornea in proportion to the depth and size of the ulcer. In months and years of time there is some clearing of the opacity so that small superficial opacities may become invisible.

=Treatment of Corneal Ulcers.=—Most ulcers of the cornea are quite amenable to proper treatment and the prognosis is favorable. Neglect or wrong treatment is very dangerous. The treatment is local and constitutional. Often the ulcer is kept going by unwholesome constitutional conditions.

=Local Treatment.=—This varies according to the stage of the ulcer, whether progressive or retrogressive. In a progressive or foul ulcer if due to trauma any foreign bodies should be removed. If the ulcer is a result of pathology of the conjunctiva it is of primary importance to treat the conjunctival condition.

In mild cases of ulcer a dressing over the eye with atropine ½% to keep the pupil dilated is sufficient local treatment. The bandage protects the eye from bright light and other environment and the atropine puts the iris and ciliary body at rest preventing complications and giving nature her best chance to work.

If the ulcer is rapidly progressive, warm compresses an hour or two a day are good; iodoform sprinkled on the ulcer or actual cautery may be used. In the retrogressive stage (clean ulcer) healing has begun and we desire to get as near as possible a

resistant transparent cicatrix. Yellow oxide ointment is useful at this stage.

=Osteopathic.=—The local measures just mentioned are not incompatible with osteopathic theory or practice. They are merely adjunctive in getting nature's reaction toward normalization, as also are hot and cold applications. Osteopathy comes in now in a most important and fundamental way with the constitutional and specific lesion treatment. The =bulbo-spino-sympathetic-ciliary arc= has been mentioned and explained. Through this important nerve connection with the eye, profound and wholesome effects on the eye may be gotten by osteopathic treatment. Frequently lesions of the occiput, cervicals and upper dorsals will affect the integrity of the ocular structures through disturbances of nerve and blood supply.

The stomach, bowels, liver and kidneys should be carefully noted in corneal ulcers. Poor circulation, indigestion, constipation and auto-intoxication may have an important bearing on the recovery of the ulcer.

Xerosis or Keratomalacia

This is a disease of the eye in children due to insufficient nutrition of the cornea. Hereditary influences, depleting diseases and lesions affecting the trophic nerves to the eye are causes.

=Treatment= consists of building up the nourishment of the child, correction of lesions and careful dieting. Hot applications to the palpebral region helps to bring the blood supply to the eye for local effects.

Keratitis Neuroparalytica

This disease is due to a paralysis of the 5th cranial nerve. The cornea becomes slightly cloudy. The epithelium gradually sloughs away. An ulcer may or may not form. Pain and lachrymation are absent because of paralysis of the trigeminus. There is usually ciliary injection.

=Treatment.=—The most important treatment for this unfortunate condition is manipulation to restore the integrity of the 5th cranial nerve and the blood supply to the eye. Cervical, spinal, nasal, nasopharynx treatment should be given. Spring the inferior maxilla.

A drop of atropine (1%) should be used locally because of the ciliary injection. Warm compresses used locally will help. The healing usually leaves some opacity of the cornea. Keep the eye bandaged to protect the cornea.

Pannus

This form of keratitis is superficial and is characterized by the formation of blood vessels in the cornea. It is caused by some irritative influence. Most often it is a complication of trachoma.

If the irritation can be removed the vascularity gradually recedes, leaving a clear cornea unless the deeper structures of the cornea have been involved.

Phlyctenular Keratitis

This disease is an involvement of the cornea with an eczematous process similar to phlyctenular conjunctivitis. There is more likely to be ciliary injection and iritis, in which case atropine should be used. The treatment is the same otherwise as for phlyctenular conjunctivitis.

Parenchymatous or Interstitial Keratitis

This is shown by a diffuse inflammatory infiltration of the substantia propria of the cornea. Part or whole of the cornea of one or both eyes may be involved. Very fine blood vessels may invade the deep structures of the cornea.

=Cause.=—Syphilis, tuberculosis, rheumatism, diabetes and rachitis are systemic diseases found back of this trouble.

=Symptoms.=—Irritation, lachrymation, photophobia with ciliary injection are the chief symptoms.

=Treatment= must be local and constitutional.

Locally atropine should be used. Dark glasses should be worn or the patient must be kept in a dark room. Treatment to the trigeminal nerve and tissues of the orbit should be given.

Constitutional treatment should be spinal with the idea of arousing all the forces of the body to greater activity. Careful dieting should be followed according to indications.

The infiltration and blood vessels will ultimately disappear. Sometimes enough may remain to cloud the vision.

Diseases of the Iris and Ciliary Body

The iris and ciliary body have the same blood and nerve supply. That is, they are supplied by the same set of vessels and nerves. For this reason it is practically impossible to have an iritis absolutely independent of a cyclitis or some inflammation of the ciliary body. If the iris is the primary seat of the trouble there are certain symptoms that may indicate such a state. However, when we are treating the iris or diagnosing conditions of the iris we must remember that the ciliary body is very likely more or less involved and may be the primary seat of the trouble.

In =iritis= there are some symptoms which are caused from the hyperemic condition of the eye, such as a slight change in color. The pupil becomes rather inactive, there is some ciliary injection with photophobia, lacrymation and pain. In case of an exudate in the iris there may be thickening, and the exudate in the anterior chamber of the eye will form a =hypopyon=. Sometimes the small vessels will break and there will be a little bleeding which will be mixed with the debris in the bottom of the anterior chamber. This is known as hyphemia. There are likely to be adhesions between the iris and the anterior capsule of the lens known as posterior =synechia=. The pupil is more or less irregular. If atropine is dropped into the eye to dilate the pupil, parts of the edge of the pupil will be adhered while the other parts dilate making it very irregular.

In case of cyclitis there is an exudate from the ciliary body into the posterior chamber. This may cause a total adherence of the iris to the crystalline lens. With the ophthalmoscope, opacities in the vitreous may be noticed. These are exudates. The tension of the eye is liable to increase a little at first but as the exudates absorb there is more or less softening. Vision is low. Also in cyclitis there is ciliary injection, photophobia, lacrymation and pain, similar to that of iritis. Pressure on the eye ball will reveal a very tender condition around the sclerocorneal junction or over the area of ciliary injection.

The causes of iritis, cyclitis or iridocyclitis frequently are systemic conditions and infection such as syphilis, rheumatism, gonorrhea, tuberculosis, infectious diseases and metabolic changes, it may be of traumatic origin or sympathetic. Fuchs says “There are many cases of iritis for which no cause can be discovered and therefore which cannot be placed under these causes.” We agree with him and advance the theory of cervical and upper dorsal lesions or trouble in the sinuses, nose, nasopharynx or throat. No doubt osteopathy can throw some important light on the causes of diseases of the iris and ciliary body. The nose and throat should be examined in all these cases.

=Treatment.=—Atropine must be used in the sore eye to put the iris and ciliary body at rest and dilate the pupil to draw it back from the lens so that adhesions may not form. Warm compresses will give much comfort. Sweating should be brought about. All fluid should be reduced to a minimum. Diet should be very moderate and the bowels kept unusually free. The eye should be protected by dark goggles. Thorough treatment of the neck and upper dorsal region with attention to the nose and throat should be given. Constitutional treatment should be given according to the indications mentioned under causes. If annular synechia or total posterior synechia form or there is atrophy of the eyeball operative work may be needed. Also for injuries, tumors, anomalies and so forth of the iris see the latest medical works on this subject.

Diseases of the Choroid

The =choroid= is the vascular tunic of the eye. With the iris and ciliary body it forms the =uvea=. The iris and ciliary body are rich in nerve terminals and when inflamed; pain is a prominent symptom. The choroid has no sensory nerve terminals. When it is involved alone; pain is not present however severe the pathology. Embryologically Descemet’s membrane is a part of the uvea. When the uveal tract is diseased we frequently note symptoms of a descemetitis as a turbidity of the anterior chamber and spots on Descemet’s membrane. When one part of the uvea is inflamed the tendency is to pass to the other parts because of the intimate blood supply.

Choroiditis

There are many forms of choroiditis given by writers according to the clinical picture and the pathology.

=Symptoms.=—No pain is experienced unless there are complications. Vision is altered in some degree. The use of the ophthalmoscope may reveal opacities in the vitreous. Pigmentation spots and exudation may be noted in the fundus. In disseminated choroiditis spots of exudate appear in the fundus which go on to atrophy, leaving irregular circular light patches.

=Treatment.=—In all forms of choroiditis careful diagnosis of constitutional conditions should be made and treatment given according to indications.

Nasopharynx and orbital treatment as outlined under manipulation for diseases of the eye should be given.

Rest and protect the eyes. Secure free elimination.

Panophthalmitis

By injury or otherwise pathogenic germs are introduced into the eye. The trouble begins as a =suppurative choroiditis= and rapidly spreads to all the eye structures. The vitreous chamber becomes filled with pus.

=Symptoms.=—Pain is severe and sight is lost early. The conjunctiva and lids are much swollen. There is a mucopurulent discharge. The cornea becomes gray and may slough. In about two weeks the inflammation subsides and the globe passes into atrophy.

=Treatment.=—Elimination must be thorough. Spinal treatment for keeping up strength. Cervical, upper dorsal and nasopharynx treatment for the eye. Moist hot compresses to the eye. Operation, incision for drainage, or evisceration may have to be performed.

Sympathetic Ophthalmia

The other eye may become inflamed by the process from the panophthalmitis passing around through the circulation or the continuous structures. All symptoms of a general inflammation appear and vision gradually diminishes.

=Treatment.=—In panophthalmitis of one eye always watch the other eye closely. If it becomes irritable or shows any signs of being affected the diseased eye should be promptly removed, especially if vision is lost in that eye. If no irritation occurs, continued conservative treatment of the panophthalmitis may result in a subsidence of the disease without the well eye becoming affected.

Sympathetic inflammation rarely develops earlier than a month after injury to the exciting eye. Sooner than that or even a few minutes after injury there may be some signs of sympathetic irritation and the symptoms continue with no evidence except a slight circumcorneal injection. It should be treated like iritis. A thorough toning of the system by spinal treatment should be given. Order a limited diet. Secure free elimination.

Glaucoma

Glaucoma is essentially an increase in the intra-ocular pressure. All other symptoms of the trouble may be traced to this condition.

In =Primary Glaucoma= the increase in pressure sets in without any discoverable antecedent disease of the eye.

In =Secondary Glaucoma= the increase in pressure is due to some other disease of the eye. It is a symptom, a complication or accessory and is confined to the eye diseased.

Primary glaucoma affects both eyes, but not always at the same time. Fuchs says primary glaucoma constitutes about 1% of all eye diseases. It is often mistaken for iritis or iridocyclitis and treated with atropine which is contraindicated. It may be regarded as beginning cataract and time lost in expecting it to become ripe. These delays and wrong treatment have caused much blindness.

Palpation with the finger or the use of the tonometer may readily detect any increase in tension. A correct diagnosis must be made early and proper treatment instituted if vision is to be saved.

=Primary glaucoma= may or may not have signs of inflammation. If the tension rises suddenly inflammatory symptoms develop (acute) while if the increase in tension develops gradually these symptoms are lacking (simple).

=Acute primary glaucoma—Symptoms.=—First stage, rise in tension, vision obscured, sees a colored ring around lights, cornea dull, pupil dilated and sluggish, some ciliary injection. The attack may clear up for a day or for weeks. Gradually the symptoms become permanent after repeated attacks. Second stage, when the attack comes there is much pain, visual power fails rapidly,

may be edema of the lids and chemosis of the conjunctiva, all symptoms become much exaggerated, the cornea becomes cloudy. After a violent attack the vision is more or less permanently damaged. Third stage, after many attacks the optic nerve becomes excavated and atrophy takes place.

Simple Primary Glaucoma

=Symptoms.=—Tension comes gradually; no inflammatory signs; pupil somewhat dilated and sluggish, the cornea may look slightly smoky. With the ophthalmoscope a cupped disc may be noted. There is gradual diminution of sight, which begins by contraction of the field.

There are many theories advanced as to the cause of intra-ocular tension in glaucoma. (Fuchs, Weeks, De Schweinitz).

=Treatment.=—Eserine is used instead of atropine. The object is to contract the pupil and draw it away from the side wall of the eye ball so the sinus (Schlemm's canal) and the pectinate ligament (the filtering angle) may become free. The good effect of this is more marked in inflammatory glaucoma. In simple primary glaucoma miotics do little good.

Reports from osteopathic treatment of this condition have been favorable in a number of cases. Careful manipulation of the structures of the orbit with the finger or with Dr. Ruddy's third finger eye instrument is good in restoring better circulation of the lymph and blood. Special attention to the venous drainage should be given. Treat the points of the fifth nerve, the nasopharynx and cervical region, spring the jaw. Treat second dorsal.

Have the patient avoid strong emotions or excitement. Keep the bowels free and use only a very bland diet.

Iridectomy is considered the best operation in glaucoma.

In the treatment of secondary glaucoma the other diseases or complications must be considered in conjunction with the foregoing treatment.

Diseases of the Lens

Opacities or Cataract

=Symptoms.=—Beginning opacities can best be recognized with the ophthalmoscope. Advance opacities can be seen at a glance with the naked eye.

Vision is disturbed according to degree and location of the opacity. If the opacity is in the center of the lens and the periphery is transparent they see better when the pupil is dilated. When the opacities are in the periphery of the lens they see better by day. Muscæ volitantes and polyopia are present until increasing opacity closes up all clear areas shutting out these visual perversions.

There are many clinical varieties of cataracts which may be studied in works on ophthalmology.

=Causes.=—Some interference with the nutrition of the lens accounts for the condition. Heredity is supposed to play a part in some cataracts. Rickets, convulsions, traumatism, old age, some drugs (ergot), inflammation of iris, ciliary body and choroid are given as causes. Cervical and upper dorsal lesions and disease of the throat, nasopharynx and nose will interfere with perfect circulation and drainage of the orbit, and may well have much to do with many idiopathic cataracts.

=Treatment.=—Many cases have been reported cured by osteopathic measures. Correct lesions and treat to establish free nerve force and circulation of blood and lymph to the orbit. Manipulation of the orbital tissues and mild vibration of the bulb are measures of value. More hope may be held in symptomatic, toxic, secondary and progressive cataracts. The process may be stopped and in many cases there is hope of a clearing.

Diseases of the Retina

The retina lines the back part of the eye ball. It comes forward to the ora serrata. It consists of ten layers which have been demonstrated microscopically. One layer of it passes over the ciliary body and back part of the iris to the pupil. The fibers of the optic nerve spread out over the retina. The point of entrance of the optic nerve is the papilla. It is to the inner side of the posterior pole of the eye. The retinal vessels emanate there. The macula lutea is the yellow sensitive spot at the posterior pole of the eye. The fovea is the center of the macula. The rods and cones constitute the external layer of the retina. This layer is the light

perceiving stratum. For vision to be perfect all the other layers must be perfectly transparent. The visual purple is a chemical substance in the rods that gives the retina a purplish-red color. The light shining into the eye forms images which are converted into nervous stimuli by chemical action of the visual purple and by physical changes and fibrillations in the rods and cones.

Retinitis

=Symptoms.=—The ophthalmoscope must be used in diagnosis. There is at first cloudiness of the retina; the outlines of the papilla become indistinct. We may note light patches of exudates. The vessels are more tortuous and often there are hemorrhagic spots. Opacities in the vitreous due to the exudate may be seen. Vision is disturbed in proportion to the inflammation. Weeks or months are required for recovery. Atrophy may set in and cause blindness.

=Cause.=—Many general diseases are found back of this trouble, e. g. albuminuria, diabetes, leukemia, syphilis, gout and arteriosclerosis. Idiopathic cases occur with none of these diseases present, which gives a field for osteopathic research.

=Treatment= should be directed against the general disease when present. For local effects treatment should be given to all the centers and localities that affect the trophism, nerve supply and circulation to the eye. Protect the eye by dark glass or confinement to a dark room and complete rest. Keep the bowels free and produce diaphoresis.

Optic Neuritis

This disease when manifest in the eye ball is called papillitis. If back of the bulb it is =retrobulbar neuritis=.

=Symptoms of papillitis.=—Pupils are dilated and sight diminishes. The color of the papilla is altered to a white, reddish or gray and may show extravasation of blood. The papilla is swollen (choked disc), the arteries are thin and the veins are engorged. It takes months for the inflammation to clear. Atrophy is likely to occur.

=Causes.=—Brain diseases are the most frequent cause, e. g. tumors. Syphilis, febrile diseases, nutritive disturbances, lead poisoning, heredity and growths in the orbit are cited as causes.

=Symptoms of Retrobulbar Neuritis.=—There is little or no change in the papilla. The diagnosis must be made mostly from the way the vision is affected. The rule is a central scotoma in the field of vision. The first colors to disappear are red and green. In the acute form there is quick disturbance of vision. The eye looks normal outside and shows practically no change inside.

=Cause.=—Toxemia, cold, influenza; nasal, nasopharyngeal and sinus disease (ethmoids), and infectious diseases are causes. Idiopathic inflammation of the optic nerve is noted by most oculists. Here the profound effects of spinal lesions upon the eye adds some important light.

=Treatment of Papillitis and Retrobulbar Neuritis.=—In each individual case the treatment requires consideration of the causal factor. There may be required constitutional treatment in many cases. In others the cause may be found in the nose, nasopharynx, or spine. Effort should be made to remove the lesion in each case. Diaphoresis will aid in acute stages.

Atrophy of the Optic Nerve

There are many causes for this condition such as optic neuritis, meningitis, acute infectious diseases, locomotor ataxia, arteriosclerosis, nasal disease, syphilis, traumatism, alcoholism, exposure, embolism of the central retinal artery, diabetes and poisoning. Diagnosis must determine the original cause.

=Treatment.=—I have mentioned conditions in the nose as frequently accounting for various eye troubles. If these atrophies of the optic nerve can be gotten early, many of them will be influenced very favorably by osteopathic treatment. Spinal treatment to direct the circulation to the area of the orbit at the base of the brain is beneficial. Regulation of the patient’s diet, habits, methods of living and so forth is important. Excessive mental strain, excessive sexual intercourse and stresses of every kind should be prohibited. Special treatment should then be given according to the causal factors entering into the case.

Eye Strain and Its Reflexes

For the subject of refraction and refractive errors such as the different forms of hypermetropia, myopia and astigmatism the reader is referred to the many excellent works on ophthalmology which cover these subjects quite thoroughly. They are only used here in the relation to eye strain and its reflexes. The osteopathic logic here given should be combined with a reading of the refractive

errors in such works as Fuchs, Weeks, De Schweinitz and others.

Asthenopia

=Eye strain, weak sight or asthenopia= embraces the group of symptoms dependent upon fatigue of the ciliary muscles or of the extraocular muscles.

There are three varieties of asthenopia. (1) Retinal or nervous, (2) muscular and (3) accommodative.

The symptoms are headache—frontal, fronto-temporal or fronto-occipital. It may extend into the neck between the shoulders. Eye balls may be tender, diplopia at times, may be photophobia, lachrymation, congestion of the eye, itching and burning of the lids.

=Accommodative Asthenopia.=—In this form the ciliary muscle is fatigued. The cause is usually overuse of the eye when hyperopia and astigmatism exist; sometimes in myopia or presbyopia.

=Treatment.=—In this form the treatment is the proper fitting of glasses and improvement of the general health.

=Muscular Asthenopia= is due to tiring of the extraocular muscles, usually the internal rectus. This may result in a phoria or a non-paralytic squint.

Ametropia may exist but asthenopia may come even in emmetropia due to overuse of the eye.

=Treatment.=—Correct ametropia if present, with glasses. Exercise the weakened muscle. Correct the nerve supply to the weak muscle. Treat cervical and upper dorsal. Manipulate tissues of the orbit. Spring the jaw. Correct any nose and throat pathology.

=Nervous, Neurasthenic or Reflex Asthenopia.=—The cause is supposed to be some functional disorder, more often found in females. May be due to too dim or too bright light, overuse of the eyes. Hysteria may follow ametropia.

=Treatment.=—Often the treatment is troublesome and the case is very obstinate according to old school methods. Rest, hygiene, general health and habits are looked after. The cause must be found or the treatment cannot be specific.

These are the different forms of eye strain as ordinarily classified. Now as we study the reflex symptoms from these and attempt to trace out the reflexes from an osteopathic point of view, we may find some more definite causes of these conditions and consequently some methods of treatment not found in standard text books might naturally suggest themselves.

Reflex symptoms that have been traced to eye strain by ophthalmologists are as follows:

Constipation, indigestion, heartburn, nausea, vomiting, nervous attacks, fear of impending calamity, irritability, despondency, insomnia, restless sleep, epilepsy, nervous twitchings and enuresis. All these symptoms have been seen to disappear after eye strain was corrected. There is no absolute way of proving that all these symptoms have existed because of eye strain. The existence and disappearance of some of them at the time of treatment for eye strain may be a coincidence. It is evident that eye strain in varying degrees may produce a train of symptoms similar to many above mentioned.

A patient, nervous, anxious, uneasy, and despondent, constipated, and having some indigestion, showed on examination contractures and tenderness at the third dorsal. It was found he was suffering from eye strain from overuse of glasses that were too strong for him. The eyes were refitted. He was wearing a

(R)+4.50 D. S. = +.50 cyl. Ax. 180. (L)+4.50 D. S. = +.50 cyl. Ax. 90 for close work and a (R)+2.00 D. S. = +.50 cyl. Ax. 180 (L)+2.50 D. S. = +.25 cyl. Ax. 90 for distance. The new glasses were—Reading— (R)+3.00 D. S. = +.25 cyl. Ax. 180 (L)+3.00 D. S. = +.25 cyl. Ax. 180 Distance: (R) + 1.50 D. S. = +.25 cyl. Ax. 180 (L) + 1.50 D. S. = +.25 cyl. Ax. 180

He was fitted two years previously. At that time the stronger glasses were correct. Eyes change more or less constantly, especially between the ages thirty-five to fifty-five years. When glasses are fitted, a weak ciliary muscle after a rest may become stronger and allow weaker glasses to be worn.

If a young person is fitted for myopia, in a few years he may discard his glasses as presbyopia develops. A person fitted correctly, who has a strong ciliary muscle may not be able for awhile to see as well with the glasses as without them. After they are worn awhile the ciliary muscle will cease its efforts to accommodate so much and the glasses give the desired effect. In some cases the doctor’s reputation to fit glasses properly may suffer at the hands of such people who sometimes refuse to take glasses, or after

getting them refuse to wear them.

In the case of the man just mentioned a refitting quieted the nervous symptoms—he became more cheerful and ceased to worry. Indigestion and constipation improved. The soreness and contractures were overcome in a few treatments.

Now let us ask the question, why is it that eye strain will cause nausea and vomiting? Also why will indigestion affect the eyes by causing “spools” in the vision?

A little osteopathic logic, based as it always is or should be, upon anatomy and physiology, may throw some light on this subject. No doubt every one of us has demonstrated many times clinically that indigestion from overeating will cause soreness and contractures at the third and fourth dorsal, the nerve center in the spine for the stomach.

The reflexes between the viscera and the eye are complex and difficult to follow. In giving the probable course of the nerve reflexes from the optic nerve to the third nerve Dr. Louisa Burns suggests the following: “The nerve elements of the retina start the impulse; it passes over that portion of the optic nerves which enter the anterior quadrigeminates, the cells of the quadrigeminates where the impulses are coordinated, then by axons of these cells to the lateral or viscero-motor nucleus of the third nerve, thence to the cells of the ciliary ganglion, and by the non-medulated (sympathetic) fibers of these, the short ciliary nerves to the non-striated muscles concerned, viz: the ciliary muscle, some fibers of the levator palpebral and the sphincter of the iris.”

The third nerve arises in the floor of the aqueduct of Sylvius from two nuclei; a lateral nucleus which is a viscero-motor group of nerve cells, and a central nucleus or a somato-motor group of cells. The somato-motor nucleus supplies all the extrinsic muscles of the eye except the external rectus and superior oblique which are supplied by the sixth and fourth respectively. The nasal branch of the ophthalmic division of the 5th sends fibers to the ciliary muscle. Association fibers connect the nuclei of the 3rd, 4th, 6th and 7th. The evidence is in favor of the 10th or pneumogastric having such association fibers.

We noted four places in the brain to which the optic tracts go before the radiations reached the center of sight in the occipital lobe. If we cannot follow all the reflexes through the brain and cord at least with the facts we have it is not difficult to imagine abnormal impulses coming over the third nerve from a straining of the ciliary nucleus, thence over viscero-motor fibers in the lateral horn of the cord, over the white ramicommunicantes, through the sympathetic ganglia, over the splanchnics to the stomach, producing abnormal peristalsis, nausea and vomiting. In turn we would have the somato-motor nerves to the muscles affected as before described, contraction and congestion of muscles of the spine.

When we have patients consult us and describe a train of symptoms like nausea, vomiting, nervousness, frontal and occipital headache, we should have eye strain in mind and inquire for lachrymation, photophobia, itching and burning lids and congestion of the eye. Any of these things should make us think of testing for ametropia in its various refractive errors, as well as a careful spinal and a nose and throat examination. General physical and laboratory diagnosis should not be neglected.

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DISEASES OF THE EAR, NOSE AND THROAT

By J. DEASON

Diseases of the Ear

=Methods and Technic of Examination.=—The external ear may be examined by direct inspection with or without the aid of artificial light. The external auditory meatus may be examined by means of a simple conical ear speculum and reflected light from a head mirror. This method requires considerable practice but efficiency can and should be attained because it can be used under all conditions and therefore is a reliable method.

The Holmes electric auroscope which we use and recommend for examining the meatus and ear drum, is very efficient but like other electrical equipment is not always dependable. There are many electrical equipments for examining the ear, but so far I have found none other than the one above mentioned that is worth space in an instrument cabinet.

To examine the meatus, grasp the pinna and draw it firmly upward and backward. This tends to straighten the canal so that the aural speculum may be inserted well into the external canal. It must be remembered that the auditory canal is always sensitive and while there is really little danger of doing any harm by exercising ordinary care, the patient is always afraid of being hurt and one can accomplish better results by practicing careful technic.

If the electric auroscope is used, the eye should be placed very close to the lens and every part of the canal, walls and drum membrane carefully examined. The Holmes auroscope has a small tube and bulb, pressure upon which will vary the air pressure in the meatus and cause the drum to move. This must be done very carefully because in very thin, atrophic membranes there is some danger of rupturing the drum.

Diseases of the Auditory Meatus

=Inspissated Cerumen=, or hardened ear wax is one of the most common affections of the meatus. The cause in some cases can be traced to lesions of the mandible, but in many cases the cause is unknown.

=Treatment.=—Protect the clothing by means of a towel or rubber neck piece. By means of a soft rubber ear syringe, wash the canal thoroughly by forcing warm soap solution into it. I prefer concentrated liquid castile soap (any good soap will do) diluted about one to four in water as warm as the patient can bear it. The soap solution is contained in a pus bowl held tightly against the neck under the ear. There is little danger of using too much force with the soft rubber syringe.

In most cases the hardened cerumen will be dislodged by the syringing only. If this cannot be done, it may be well to discontinue the treatment until the following day. The solvent action of the soap solution will further reduce the hardened mass and it usually can be removed by syringing the following day. This method is preferable in many cases because patients dislike the pain which usually accompanies the use of a curet.

The dull loop curet is the most efficient and safest instrument for removing hardened cerumen that the syringe may fail to dislodge. This instrument must be used with great care because the membranes, long protected by the covering of cerumen are hypersensitive and bleed easily.

After removing the cerumen, the canal should be thoroughly dried and lubricated with some non-irritating lubricant. It is also well to place a small pledget of absorbent cotton into the external opening to protect the sensitive membranes from the cold, air and dust.

In drying the canal I prefer to use a small aluminum applicator, twisting a small piece of absorbent cotton on the end in such a way as to cover the tip well, thus making any injury from its use impossible.

Atrophic Meatus

Sensitive or itching ears as the patient commonly describes it, is a very common disease caused by any atrophic condition of the membranes of the auditory meati and frequently found in common with auditory or other cranial nerve deficiency or degeneration. The direct cause of the irritation is the collection of particles of dry cerumen.

=Treatment.=—The local treatment consists of syringing with warm (118° to 120°F) soap solution until all of the scaly cerumen has been removed. The canal is then dried and lubricated as described above. Several such treatments may be required after which I prefer the use of the continuous irrigating ear cup, using salt mixture instead of the soap. The same salt mixture as is recommended for nose and throat irrigation is satisfactory. After such irrigations the application of phenol-glycerine (10% phenol in glycerine) seems to be an efficient treatment.

The local treatment must, of course, be accompanied by corrective treatment to the mandible and upper cervicals.

Furunculosis

There are three acute affections of the ear which may usually be diagnosed from their points of tenderness or pain. Pain upon moving the lobe or pinna indicates furunculosis. Pain on pressure posterior to the angle of the jaw or externally in front of the ear indicates middle ear infection and pain on pressure over the mastoid region suggests mastoiditis.

Probably the most common of the painful diseases of the external meatus is furunculosis, which is a subcutaneous infection of the lining membrane of the meatus. The point of swelling may usually be seen but in some cases the entire canal is closed.

=Treatment.=—In all cases of occluded pus, drainage must be obtained, but in the early stages of furunculosis, it is not always possible to determine the place of “pointing” or the most desirable point to lance. As soon as the place of “pointing” can be located it is advisable to lance deeply by means of a curved paracentesis knife. The parts are thoroughly cleansed and anesthetized by applying phenol and neutralizing with alcohol. The external parts are first painted with alcohol to prevent “burning” from any phenol which may be dropped upon them. A small cotton applicator is used, applying the concentrated solution of phenol or the crystals (using only a small amount of phenol) to the affected parts and immediately neutralizing with alcohol. Care must be observed not to apply any phenol to the drum membrane and the operator must be sure that the action of the carbolic acid is completely neutralized by a liberal application of alcohol.

The knife blade is placed beyond the furuncle, its curved point turned outward and quickly drawn forward through the furuncle, cutting deeply. The canal is then packed with a pledget of cotton dipped into phenol-glycerine.

If the place of pointing cannot be seen, palliative treatment may be applied by thoroughly cleaning the meatus, drying and applying a phenol-glycerine pack. Heat may be applied by means of a therapeutic lamp. Any electric light bulb or the dry electric pack will do. The external parts are well lubricated with paraffin oil and the heat applied continuously or intermittently until the pain is relieved.

Infection of the Meatus

Infections of the meatus are frequently secondary to, or accompanied by furunculosis. The treatment, therefore, is similar to that of furunculosis.

Always try to locate the point of infection, lance or curet, apply phenol or other chemical germicide, neutralize, dry and pack with phenol-glycerine. After the point of infection has been thoroughly drained, cleanliness and protection from dust or further infection is all that is necessary.

In all cases of infection of the external meatus, suspect middle ear abscess as a cause. There may be a pin-point opening through the drum, from which the infection has originated and is being maintained.

=Otomycosis= or fungus infection of the auditory meatus is rare. It usually resembles other infections symptomatically, but often without pus. A microscopic examination will serve to diagnose the condition.

The treatment consists of thorough cleansing, drying and the free application of alcohol. Alcohol is dropped into the ear until the canal is full and a pledget of cotton applied to retain it. Usually two or three applications are sufficient to effect a cure.

=Eczema= of the auricle and meatus is of two types, the squamous or scaly form and the sclerotic form. Both forms are chronic and may be readily diagnosed by the appearance.

=Treatment.=—Some cases are very difficult to cure but we have had excellent results with the following treatment: Careful adjustment of cervical and mandibular lesions; thorough treatment of any local infections of head or neck; direct application of phenol-glycerine, local cleanliness and protection from irritation.

Diseases of the Middle Ear

Clinically the middle ear consists of the tympanic cavity and its contents, the Eustachian tube and the mastoid cells.

Acute Suppurative Otitis Media

Acute infections of the middle ear result from acute nasopharyngeal affections such as colds, influenza, measles, mumps, whooping cough, etc. Bathing in contaminated water often results in infection to the middle ear through the Eustachian tube.

=Diagnosis.=—Earache, pain on pressure under the angle of the jaw and sudden deafness are the symptoms. (There are also the common febrile symptoms.) The chief physical signs are: redness and bulging of drum membrane, and contraction and tenderness of upper cervical muscles.

=Treatment.=—If the patient is seen before the drum has ruptured it is seldom necessary to lance the drum if the proper treatment is given promptly.

Drainage must be obtained and maintained by catheter aspiration through the tube irrigation of the nasopharyngeal cavity, irrigation of the meatus by means of the continuous ear irrigator and application of dry heat over the affected part. Heat is best applied by means of a therapeutic lamp. (Any lamp with reflector that will furnish proper heat is efficient as there is no virtue in colored light.) The skin surface over the ear, side of face and mastoid region is first well lubricated with some mineral oil to prevent blistering and the heat is applied either constantly or intermittently. A pledget of absorbent cotton dipped into phenol-glycerine is placed in the meatus and forced loosely against the drum. This should be removed every few hours and a fresh pledget put in.

The neck and upper dorsal muscles should be kept relaxed and adjustive treatment given frequently.

Under this treatment the pain should be relieved and the bulging of the drum should disappear in from two to twelve hours. If this is not accomplished or if the condition grows worse, the drum should be lanced. See some text on otology for technique. In my experience, very few cases have required paracentesis.

It must be remembered that treatment should be continued regularly and for some time after the pain and other symptoms have been relieved or a recurrence is probable. Patients should have daily treatment until the physician is sure that no complication or recurrence is likely to result.

If the patient is not seen until after the drum has ruptured, the same treatment may be applied except the irrigation or syringing of the meatus. This, in case of ruptured drum, may force pus into the mastoid cells resulting in mastoiditis. Instead of syringing, the auditory meatus is cleaned by means of a cotton applicator or by aspirating with a catheter. At all times drainage through the meatus must be maintained until the drum begins to heal.

Acute Mastoiditis

Acute mastoiditis results from acute or chronic otitis media. In some cases the otitis media may have been only a mild attack.

=Diagnosis.=—There is no one symptom that is positively diagnostic but a number of signs and symptoms must be considered as follows:

1. Always suspect mastoid complications in acute otitis media and watch for this complication daily. Most cases have some mastoid inflammation.

2. Pain or swelling over mastoid. Pain may not be present, but usually is, sometimes radiating over temples and eye on affected side.

3. Tenderness on pressure not always present. May be very marked. Tenderness extending to tip or above ear means extension of infection. If persistent tenderness over tips with marked swelling and discoloration—operation is indicated.

4. Swelling, not always present, but sometimes very marked. If extreme swelling and bluish discoloration—usually means operation.

5. Temperature varies from normal to 104° or 105° F. Temperature of more than one or two degrees means systemic absorption and suggests surgical drainage. Streptococcus or staphylococcus infections cause higher temperatures and require drainage

earlier than other infections.

6. Transillumination not positive, but of some value. Like X-ray, usually shows dark, because of inflammation, but must rely upon symptoms, as above.

7. =Microscopic.=—Stain for pus, bacteria and bone debris. Hematoxylin stain shows dark bone particles if there is bone disintegration.

8. =Blood Count.=—If absorption, there will be some variation in proportions of leucocytes. Any high leucocytosis shows systemic absorption and the natural attempt to overcome the infection.

=Non-Surgical Treatment.=—1. Drainage must be maintained from middle ear through tube or drum or both. Catheter aspiration through tube. Sometimes gentle inflation to clear the tube, followed by aspiration is effective.

2. If drum is ruptured, aspirate middle ear by catheter or by Moore's method or both. =This is very important.= If no aspirating machine, use syringe and pump meatus and tube persistently. Dry meatus and keep well open.

3. Patient should be kept in bed if symptoms are marked, with light diet and bowels well open.

4. =Heat.=—Apply oil or other lubricant over whole side of face and head and apply heat by means of "therapeutic" lamp intermittently. Thirty minutes light on and fifteen minutes light off. The light-heat (any electric lamp with reflecting shade will do) is much better than hot water bottle or electric pad or sand bag. The heat must be kept going day and night if symptoms are marked until the pain has entirely subsided. Heat is most efficient in the early stages. After symptoms are well marked, the ice pack is more desirable.

5. If drum is not ruptured, heat may be applied by means of Deason's continuous irrigating cup. Start at 116° F. and gradually increase to 123° F. if patient can bear it.

=Surgical.=—If drum has not ruptured and symptoms continue, it is best to make free incision of drum,—keep open and apply (2) above.

=Indications for Mastoid Operation.=—There are no definite signs, symptoms or tests that will determine positively when operation should be done. If the above non-surgical methods are practiced, few cases will require operation, but many will develop into chronic mastoiditis and so it is very difficult to decide whether a mastoid operation should or should not be done. It is best to explain thoroughly the possible complications to the patient and relatives and request them to assume responsibility. Mastoid operations are attended by very little danger when properly done.

=Signs and Symptoms Suggesting Operation.=—Acute otitis media with mastoiditis.

(1) Persistent pain and swelling not relieved by non-surgical treatment.

(2) Marked protruding of posterior wall or meatus.

(3) Marked tenderness, swelling and discoloration above ear or over tip of mastoid.

These with temperature of more than 102° usually are enough to demand immediate drainage.

(4) Any evidence of extension of pus under skin of neck below tip. A positive indication for drainage.

(5) Any indications of brain or meningeal involvement such as very marked and persistent headache, partial or total loss of consciousness, etc.

(6) Indications of labyrinthine involvement such as marked vertigo, etc.

(7) Sudden cessation of discharge means obstructed drainage from middle ear or from mastoid into middle ear and if drainage cannot be restored by aspiration, this means operation.

(8) The whole clinical picture must be carefully considered at all times. Take no chances. Advise operation before someone else finds it too late.

Chronic Mastoiditis

=Cause.=—Always from unsuccessfully treated acute form or from chronic suppurative otitis media.

=Non-surgical treatment.=—See chronic suppurative otitis media. We have had a few cases that were seemingly permanently cured by non-surgical treatment, but believe they are rare.

=Indications for Operation.=—1. Recurrent exacerbation of acute or chronic otitis media.

2. Constant discharge which resists treatment for chronic suppurative otitis media.

3. Continued pain or recurrent pain and swelling following acute otitis media.

4. Open sinus into mastoid either external or through meatus.

5. Cholesteatoma.

6. Symptoms of labyrinthine or brain involvement following acute otitis media.

7. Definite evidence of bone disintegration in mastoid.

As stated above, none of these are definite indications. The whole group of signs and symptoms are to be considered.

Chronic Suppurative Otitis Media

=Etiology.=—Chronic suppurative otitis media usually results from an unsuccessfully treated acute otitis media. If in acute otitis media there has been bone erosion or extensive destruction of the mucous membrane by a virulent infection, chronic suppuration is likely to result. A persistent mastoid infection following otitis media is likely to result in chronic otitis media and this is strong argument for early mastoid operation.

1. Otitis media resulting from some virulent infection such as the recent influenza pandemic or scarlet fever is always more likely to result in mastoiditis and chronic suppuration of the middle ear.

2. Such infectious agents as streptococcus, staphylococcus, long-chain pneumococcus or bacillus influenzæ are likely to result in chronic suppurations.

3. Lowered vitality from any cause.

4. Inefficient drainage from failure to aspirate the Eustachian tube, delayed perforation or failure to lance drum sufficiently early.

5. Mastoid necrosis, which maintains drainage into the tympanic cavity.

6. Abnormal granulations, polypi, etc. in tympanic cavity.

7. Chronic inflammation with suppuration of the epipharynx or Eustachian tubes.

8. Cholesteatoma resulting from perforated drum and growths of epithelium extending into the middle ear cavity.

=Diagnosis.=—The diagnosis is easy because nearly every case of discharging ear without pain is chronic suppurative otitis media. The determination of the exact nature of the condition present is not only very important but very difficult.

Differential diagnosis consists in determining the nature of the infecting organism and the nature and extent of the pathology.

1. Direct examination of the external meatus after drying with cotton applicator usually determines the location and extent of perforation of the drum and the general nature of the discharge, whether purulent or mucopurulent. Very rarely one finds a serious discharge which means a very slight infection or discharge from non-infective inflammation. The presence of whitish or greyish pus, mucoid and stringy, usually means pneumococcus infection. Greyish, purulent non-mucoid discharge usually indicates streptococcus or bacillus influenzæ infection. Yellow, purulent discharge suggests staphylococcus infection. The general appearance of the discharge, however, cannot be considered of important diagnostic value because most chronic suppurations are mixed infections, because of long exposure to external contamination.

2. After cleaning the meatus, several smears should be made directly from the opening in the drum. By staining with methylin blue or gentian violet, the nature of the bacterial infection can be determined and this is very important.

By staining another smear with hematoxylin and washing in water, any dark irregular particles, bone debris, may be found, which means bone disintegration. This too, is very important.

3. Transillumination is sometimes of value. The mastoid may be transilluminated by placing a good rubber covered transilluminating lamp over the mastoid and observing the external meatus through an aural speculum. If the mastoid is free from infection the light will pass through and illuminate the meatus.

4. The X-ray plate is, of course, the best means of determining the nature and extent of mastoid involvement.

=Treatment.=—This is certainly one of the most difficult diseases of the ear that one is ever called upon to treat and the physician should be cautioned against offering a favorable prognosis. Perhaps the most difficult thing about its treatment that the doctor has to learn is that practically none of the so-called antiseptic washes do any good, but on the other hand they often do harm. Certain general principles are important and the treatment must depend upon the nature and extent of the infection and pathology present in each case.

The constitutional treatment consists of everything that will increase the patient's general resistance and certainly all lesions of the cervical, upper dorsal and mandibles must be properly adjusted, but this is not enough. All spinal lesions that may exert an influence on metabolism and elimination are of important consideration. The diet, habits and environment of the patient must be considered.

A careful examination of the nasopharyngeal tract may reveal some other focal infection, such as chronic tonsillitis, pharyngitis or sinuitis, which is maintaining the infection through the Eustachian tube. There may be a focal or general infection of some other part of the body, which is reducing resistance or causing a hematogenous infection of the tympanic cavity or mastoid cells.

Drainage must be maintained in all cases, both through the Eustachian tube by catheter aspiration and through the drum by aspirating and drying. If the perforation in the drum is small or in the middle or upper part, it should be opened down to the floor so that the contents may be more easily removed and better drainage established. It is well first to thoroughly cleanse the meatus and tympanic cavity by syringing with salt mixture (salt 3 parts, borax 2 parts and soda 1 part, a teaspoonful to a half pus bowl of water) at from 116° to 118° F. After syringing, the meatus is carefully dried, and the middle ear cavity aspirated through the tube and drum opening. The advantage of this simple treatment is thorough cleanliness and drainage with the minimum of irritation. This treatment given daily or thrice weekly will often cure the case.

Staphylococcus and streptococcus infections usually respond to the following treatment: After thoroughly cleansing as above, the meatus and tympanic cavity is syringed with a one to four or one to five dilution of Dakin-Carrel solution (Hyclorite may be used instead) followed by aspiration, the fluid being drawn through the tube, thus preventing reinfection from that source.

Pneumococcus infections do not respond to either of these methods of treatment. The pneumococcus, because of its capsule, is not affected by antiseptics, but on the other hand the irritation of the tissues caused by their use, only gives the infective agent a better opportunity for growth.

In pneumococcus infections we have found the following method efficient: Thoroughly cleanse the meatus and middle ear cavity by salt mixture syringing, aspiration and drying. The meatus and tympanic cavity is then filled with a neutral mineral oil. The oil is also pumped through the Eustachian tube. It is the purpose to fill the entire cavity and its openings so thoroughly that no air can enter. In some cases we have used bismuth paste after the oiling with excellent results. The pneumococcus is aerobic and if all air can be kept away for a considerable time, it furnishes an unfavorable culture environment with little irritation to the membranes.

=Surgical treatment.=—The presence of bone debris indicates bone disintegration in the tympanic cavity or mastoid cells. If the mastoid cells are thus involved there is little chance for direct treatment. If such cases do not respond in a short time to any of the above methods of local treatment, ossiculectomy or mastoid operation may be necessary. Some specialist surgeons claim from 80% to 90% favorable results from mastoid operation in such cases.

Non-Suppurative Otitis Media—Catarrhal Deafness

Deafness is any impairment of normal hearing and is that symptom next to pain and chronic discharge that causes the patient to visit the doctor. If acute diseases of the ear, nose and throat could always be successfully treated, there would be little trouble from the symptoms of chronic pathology. It must be understood that catarrhal deafness is a symptom of chronic otitis media and is, therefore, seldom of recent origin.

=Etiology.=—Chronic otitis media is nearly always the result of the extension of infection through the Eustachian tube and has come from some acute or chronic nasopharyngeal infection. Chronic colds, pharyngitis, tonsillitis, sinuitis, etc., resulting in acute or chronic otitis media either with or without suppuration, constitutes the beginning of catarrhal deafness.

=Symptoms.=—There is seldom any pain with this disease. Some cases have an occasional acute attack with pain and other symptoms of acute otitis media.

Deafness, varying with the progress of the pathologic changes, is always present. The patient in the early stages will seldom admit that he suffers from deafness and often he is honest because he may not realize that he cannot hear normally until his otitis media has progressed to the second or third stage. Most patients, in fact, do not become alarmed about their hearing until it is too late to restore normal hearing. For this reason, physicians should be on the lookout for such conditions and should advise special treatment early.

The human species in its present environment, depends much less upon the organs of special sensation than do the animals of the wild, and they may therefore be very deficient in sight, hearing, smell, etc. without actually realizing this loss.

In addition to deafness there are other symptoms such as occasional or constant fullness or feeling of “stuffiness” as the patients express it, due to partial or complete occlusion of the Eustachian tubes. Tinnitus aurium or head noises is very common and often the most annoying symptom. Autophony, or the loud sound of the patient’s voice to himself, which often causes him to speak low and indistinctly, occurs in the later stages. Presbyacusia, or the inability to adjust the hearing apparatus to variations in pitch, commonly occurs in the second stage and is evidenced by the fact that the patient does not hear when more than one person is talking. Paracousis or perverted phenomena of hearing, such as the better hearing of some persons in a noisy environment, is a symptom of the third stage of otitis media and often means an unfavorable prognosis, so far as marked improvement in hearing is concerned.

=Pathologic Stages.=—For convenience of discussion we may consider chronic otitis media in three stages.

=The First Stage.=—The active pathology is limited to the pharyngeal portion of the Eustachian tube with some inflammation of the membranes of the tympanic cavity. Closure of the tube followed by absorption of the oxygen causes a decreased pressure in the tympanic cavity and thus a retraction of the drum, decreased movement of the ossicles and a general decrease in function of all tympanic structures. Deafness in this stage may be very marked, especially if the Eustachian occlusion has occurred from some nasopharyngeal acute inflammation. There may be pain but there is always a characteristic “fullness” and sometimes dizziness. Deafness in these cases varies with weather changes. If proper treatment is had in time, the progress of the pathology can be stopped and every case can be restored to normal hearing.

=The Second Stage.=—The active pathology has extended throughout the Eustachian tube causing marked occlusion and some stenosis. There is further inflammation of the tympanic structures with an increase in the symptoms of the first stage. The drum membrane is less movable but there is no fixation of the ossicles. Pressure upon the bulb of the auroscope causes movement of that part of the drum to which the malleus is attached. The drum is thicker, more retracted, and less movable than in the first stage. Presbyacusia is common and often marked, but there is no paracousis. More than 90% of these cases can be materially improved and many can be made to hear normally if proper treatment is given in due time.

=The Third Stage.=—The active pathology in the third stage consists of an involvement of the entire mucous membrane lining the Eustachian tube and tympanic cavity. These membranes are all chronically hypertrophied. The Eustachian tube, however, is sometimes fairly well open, but the ossicular attachments are more or less fixed by hypertrophied tissue and adhesions and the drum is markedly retracted, thickened and usually very immovable. The deafness is usually quite marked, head noises are commonly present and often very annoying. Patients usually do not notice a variation in their hearing from weather changes. Presbyacusia is present in 80% of cases and their hearing for low tones is much reduced.

Unless there is a complicating nerve affection these cases hear well by telephone, which means that they can also use an electric hearing instrument to advantage. These cases can never be restored to normal hearing, but many of them (30% of my cases) can have some improvement and in most cases I believe the progress of the pathology can be stopped, and this is always well worth while because their hearing is likely to be entirely lost if something is not done.

=Psychologic Stages.=—There are three rather distinct psychologic stages in catarrhal deafness. The first, the period in which most patients refuse absolutely to admit that they are deaf even to the aurist upon whom they call for treatment. They insist that

they hear perfectly if people would only speak distinctly. This is partially true, because up to the third stage of deafness the voice can be fairly well heard if people would only articulate clearly. In the second stage patients admit that they don't hear well, but insist that they are going to recover normal hearing and often resort to various kinds of injurious treatment. In the third stage they give up all hope of ever regaining their hearing, become morose, and avoid company. These psychic stages do not always correspond with the pathologic stages given above.

=Diagnosis.=—The external auditory meatus, drum membrane and ossicular chain, constitute the apparatus whose function is that of conduction of sound waves to the perception apparatus of the inner ear. The function of the conduction apparatus varies inversely with the progress of pathologic change in these structures. The perception apparatus, the structures of the inner ear, are not necessarily affected by middle ear pathology, but on the other hand, sounds transmitted by bone conduction not only seem louder but they last longer because the "escape of the excess" of sound thus transmitted is hindered by deficient conductive mechanism. This explains why such persons hear well by telephone and why the tuning fork, whose base is held to the mastoid (provided there is no nerve affection) may be heard for a greater time than normal. Likewise the prong of the vibrating tuning fork when held near the concha is heard for a shorter time than normal, because of the deficient function of the conduction mechanism.

Tuning forks are known by their number of vibrations per second, such as 16, 32, 64, 128, etc. Three or more forks are required to make an accurate measurement of the conduction and perception functions—a low fork about a 32, for the low tones, 128 or a 512 for the medium tones and a 2048 for the high tones.

A good set of forks should be selected and standardized, i. e., the normal bone and air conduction of each fork determined by testing it on a number of persons whose hearing is known to be normal. For the general practitioner who cares only to get a general idea of the extent of the pathology, one fork of medium pitch such as a 128 or 512 will be sufficient.

To measure the function of hearing, the fork is set into maximum vibration, its base held against the mastoid and the patient is asked to state when he no longer hears it. This length of time in seconds is recorded as "bone conduction." The fork is then held near the concha and the patient again states when he does not hear it. This length of time in seconds is recorded as air conduction.

Normal Hearing

=Tuning Fork Test.=—The normal time rate in seconds set of forks is as follows:

Fork 32 64 128 512 2048 4096 B. C. 25 30 30 20 10 A. C. tone 70 90 90 40 20

The tuning fork test, carefully made, is the only known method of measuring the functions of the various structures concerned in audition.

=The Whisper Test= is made by producing a clear whisper from residual air only, which should be heard about twenty feet by a normal ear.

=The Watch Test= is made by using some loud ticking watch (I prefer an Ingersoll), holding it first near the ear until the patient recognizes the tone, and then taking it beyond the hearing distance and approaching the ear until it is heard. I prefer also to move away from the ear until the limit is reached and strike an average of this with the above results. The average eighteen size Ingersoll watch can be heard for from 100 to 150 inches by the normal ear.

The practical test for the patient is his hearing from the spoken voice, and is the most reliable so far as permanent results are concerned.

=Low Tone Limit.=—The lowest limit of hearing is about sixteen double vibrations per second, but the lowest practical limit is about thirty-two. There are few people with normal hearing and with musically trained ears who can recognize a definite tone lower than this, so I consider the thirty-two fork sufficiently low for all practical tests.

=Conduction Deafness.=—Low tones are lost in tympanic involvement or conduction deafness, and are diagnostic in such cases, but are of no particular value in nerve deafness except when that is complicated by catarrhal deafness.

=Practical Hearing Limits.=—The human voice varies from about 60 to 150 double vibrations per second, and most sounds that we really need to hear are less than 700 vibrations per second. This is the reason for using the low forks, 64, 128 and 512.

=Measurement of Nerve Force.=—To measure auditory nerve force, the fork (say the 128, whose normal B. C. is 30 seconds) is set into vibration and held gently and with even pressure against the mastoid and the patient is asked to tell or signal the doctor when he ceases to hear the tone. Two or more tests may be made to determine the patient's personal equation, but the use of control forks (the 64 and 512) will show any such error. Granting that there is no complicating pathology, tympanic or labyrinthine, the number of seconds of hearing over 30 will be the patient's auditory nerve force. For example, if he hears the fork 30 seconds his hearing will be thirty-thirtieths or normal. If his hearing is 25, 20, 15 or 10 seconds, his auditory nerve force will be respectively 25-30, 20-30, 15-30 or 10-30.

By means of this method an accurate measurement of the functions of hearing can be made and a definite prognosis can be given. I never use any of the various named qualitative fork tests for hearing, because they have no value to one who employs this system.

FOOT NOTE—In the chart T is used, meaning that tone is heard, while S indicates sound but no tone.

FOOT NOTE—It is not the purpose to give any detailed or differential methods of diagnosis because if one cares to treat these diseases he will of course, study a special text on this subject. The methods here given are only for the general practician who wishes a general idea of the condition present.

Summary of Diagnosis of Different Stages of Catarrhal Deafness

=First Stage.= 1. Fork 32 128 2048 B. C. 35 20 A. C. T 70 40

2. The drum is only slightly retracted but freely movable.

3. Whisper heard from five to twenty feet.

4. Ingersoll watch heard from 30 to 150 inches.

=Second Stage.= 1. Fork 32 128 2048 B. C. 40 20 A. C. T 60 40

Note that the tone of the 32 fork is heard, the 128 fork has increased in bone conduction and reduced in air conduction but that the bone-air ratio is direct, that is the patient hears longer by air than by bone conduction. Note also that the high fork is still normal.

2. The drum will be found retracted but that part to which the malleus is attached is still movable when tested with the auroscope.

3. The whisper is heard from two to ten feet.

4. The Ingersoll watch is heard from six to sixty inches.

5. Presbyacusia but not paracousia is present.

=Third Stage.= 1. Fork 32 128 2048 B. C. 45 15 A. C. S 20 30

The typical diagnostic points in third stage catarrhal deafness are: 1. Tone for the 32 fork is lost. 2. There is an inverted bone-air ratio for the medium fork. The drum is retracted and the malleus fixed. 4. The whisper may be heard at less than one foot or not at all. 5. The Ingersoll watch is heard less than six inches from the mastoid. 6. Paracousis Willisiani is present.

For the general practician this is important because he can make a rather definite prognosis.

=Treatment.=—The treatment will be given briefly because space would not permit of lengthy discussions of details of methods and technic.

FOOT NOTE—Note that the patient hears the tone of the low fork, that the 128 fork has its bone conduction slightly increased (30 to 35) that the air conduction is slightly decreased (90 to 70) and that the high fork remains normal.

A careful examination should be made for some source of focal infection about the nasopharyngeal tract. Chronic or subacute tonsillitis,

pharyngitis or sinuitis or root abscess are often a cause, and not much will be accomplished in improving the otitis media until these focal infections are found and properly treated. The original cause of these focal infections may have been some bony lesion, but to successfully correct such lesion now does not mean that the source of infection will be removed.

Auto-intoxication from gastro-intestinal disease is common. In my cases, 80% of the third stage have chronic constipation or other chronic gastro-intestinal affection.

In many severe acute affections of the nasopharynx the inflammatory process has left the Eustachian tube occluded or stenosed and the pharyngeal fossa filled with adhesive bands. It is not uncommon to find the epipharynx and pharyngeal fossa filled with partially atrophied adenoid tissue or if the curet method has been used for removing adenoids, there is often connective tissue adhesions and any or all of these may prevent the normal ventilation of the tympanic cavity by way of the Eustachian tube.

In such cases surgical removal of these obstructions and dilation of the tube is necessary. My practice has been to give a general anesthetic (nitrous oxide or somnoform will be sufficient in many cases) and by means of an adenotome (La Force or Cradle, I never use a curet) remove all adenoid tissue. Then by means of the finger I carefully remove any adenoid tissue in the posterior nares and pharyngeal fossæ that the adenotome may have failed to get and also dilate the pharyngeal portion of the tube by inserting the finger.

This operation if carefully and thoroughly done and if preceded and followed by the proper surgical cleanliness and supportive treatment, will when indicated, accomplish excellent results. The after treatment is even more important because if this is not well done, no results or even unfavorable results may occur. The after treatment consists of daily irrigations of the nasopharynx, thorough attention to upper thoracic, cervical and mandibular lesions, aspiration of the Eustachian tubes and other local treatment to the nasopharyngeal membranes. After the operation has been done it is best to do no digital manipulation of the pharynx for from three to six days. After this time digital treatment, gentle dilation of the Eustachian orifice to maintain its patency, stretching of the soft palate to reestablish proper nerve function and the application of deep pressure in the pharyngeal fossæ to stimulate the otic ganglion is important. This treatment is not massage in any sense but definite, purposeful, manipulation and if carefully done will be followed by excellent results.

Since the origin of this method of treatment, there has been much comment on its value and many have tried or at least they thought they tried it with unfavorable results. The causes of failure are, attempting treatment in cases impossible of cure, or poor diagnosis, improper technic of operator or incomplete operative procedure and inefficient supportive treatment.

It must be understood that not all cases of otitis media even in the beginning stages require the above method of treatment or will be benefited by it. Those cases which have resulted from other causes than acute pharyngitis seldom require such radical methods of treatment.

In every case, the cause must be found and consistent treatment given. In my experience, the radical method of treatment has not been found necessary in more than twenty per cent of cases of chronic otitis media. In the other cases the treatment consists of removing sources of focal infection (about forty per cent) and normalizing nasopharyngeal reflexes by osteopathic and local treatment (about forty per cent). In all cases, the treatment must be complete. To remove thoroughly all obstruction from the epipharynx and leave a source of focal infection in the tonsils will accomplish little, or to remove carefully all pharyngeal obstruction and all sources of focal infection will not restore normal functions of the middle ear structures if the osteopathic lesions and gastro-intestinal perversions are neglected. Surgery in itself, even though carefully and thoroughly done, is not efficient treatment and this is why the medical specialists fail in this disease. After the necessary surgery has been done, then normal tone must be restored to the various tissues involved. Normal reflex mechanisms must be reestablished and this can be done by thorough and efficient osteopathic corrective work and the proper local treatment directly to the structures affected.

Meniere’s Symptom Complex

This is a form of catarrhal deafness with all the characteristic pathology of the first or second stage, but in which, due probably to sudden tubal occlusion, there results a marked variation in the intralabyrinthine pressure and there are, therefore, the symptoms of conduction deafness combined with labyrinthine involvement somewhat resembling Meniere’s disease. There is dizziness or even vertigo, with head noises, but not the marked prostration and nausea which characterizes Meniere’s disease.

=Treatment.=—The treatment is the same as in the first stages of catarrhal deafness and the prognosis is always good. The labyrinthine symptoms are usually completely relieved as soon as the middle ear is ventilated.

Diseases of the Inner Ear

=Acute Suppurations.=—Acute suppurative diseases of the labyrinth occasionally result from the extension of infection from the tympanum but they are certainly very rare. Such conditions may result from acute suppurative otitis media in which there has been an excessive collection of pus without rupture of the drum or drainage through the tube but this very rarely occurs and after drainage has been established, labyrinthine infection is hardly possible.

=Diagnosis.=—Labyrinthitis is of several forms but in general, there are the symptoms of labyrinthine involvement such as: nystagmus, vertigo, nausea, vomiting, headache, earache, deafness and febrile symptoms. When labyrinthitis is suspected, an aurist of much experience should be called into consultation at once.

=Treatment.=—Suppurative labyrinthitis is not in itself a fatal disease but dangerous complications may result because of the close proximity to so many delicate structures. Threatened meningeal infection requires surgical drainage, but unless meningeal infection is imminent, surgery is contraindicated. Since the mortality, considering dangers of complications, is not high (about 10%) and since such operations are very complicated and require great surgical skill, we may conclude that surgery is generally contraindicated.

Non-surgical treatment consists of keeping the patient quiet in bed, liquid diet, and good elimination. Drainage through the middle ear or Eustachian tube must be maintained.

Deep manipulation of the cervical structures will help to maintain lymphatic drainage but any treatment which necessitates much movement of the head should be avoided until the symptoms of vestibular irritation have ceased.

Non-Suppurative Labyrinthine Diseases

=Meniere's Disease.=—This disease is caused by hemorrhage into the labyrinth with the following symptoms: There is sudden and intense vestibular irritation such as vertigo, marked tinnitus, nausea, vomiting and complete deafness on the affected side. There may also be cerebral disturbances and loss of consciousness.

=The Prognosis= depends upon the extent and severity of the pathology. It is probable that those cases in which recovery occurs quickly are not true cases of Meniere's disease but have some causes other than labyrinthine hemorrhage. Such cases are perhaps Meniere's Symptom Complex.

=The Treatment= consists of complete rest in bed, light diet, and good elimination until the marked irritation has passed. It has been my practice to carry out further treatment similar to that of the treatment of nerve deafness to be given later. Many of these cases will make complete recovery.

Nerve Deafness

The term "nerve deafness" is generally used very carelessly to apply to any chronic or non-suppurative process of the labyrinthine structures other than those mentioned above, which cause impaired hearing.

Nerve deafness is not an uncommon disease. In my cases of deafness there has been some involvement of the labyrinthine structures or auditory nerve in 27% of the cases examined. I think the reason for most authors putting the percentage of nerve deafness much lower than this is because of inexact methods of diagnosis. The above percentage is based upon the actual measurement of nerve force. See measurement of nerve force under non-suppurative otitis media above.

A careful study of cases by the method of actual measurement of nerve force, shows that there are two distinct forms of nerve deafness. In one there is only a deficient function of the structures of the labyrinth, due perhaps to some perverted physiologic function, and this form we may call auditory nerve deficiency. The other form of nerve deafness, due probably to an actual degeneration of the nerve or its end organs in the labyrinth, may be properly known as auditory nerve degeneration.

=Auditory Nerve Deficiency.=—A study of our case reports shows that in 64% of the cases in which the nerve force was 16-30 or higher (more than half) favorable results were obtained, provided that there was no complicating labyrinthine affection. These cases have been classed as "nerve deficiency" and the pathology as functional. A favorable prognosis (64%) may be offered.

Example of tuning fork findings: Fork 32 64 128 512 2048 4096 B. C. 18 20 20 20 10 A. C. T 50 60 60 40 20

In addition to the tuning fork findings the voice and watch test will be reduced to from one-tenth to two-thirds normal. The patient often complains of itching meati and dry nares. There are usually no signs or symptoms of labyrinthine affection.

=Treatment.=—The treatment consists of local treatment to the nasopharynx, tubes and meati as described under the treatment of chronic otitis media. Everything should be done to build up the patient's general health and improve the local nutrition. It is highly essential to search the entire system for sources of focal and general infection. Auto-intoxication from chronic gastro-intestinal disease was found in 90% of our cases. Any treatment therefore that will restore normal gastro-intestinal function is indicated. Recently we have had some excellent results from colonic irrigation and the proper adjustment of diet in such cases. Any source of focal infection must of course receive proper attention.

The osteopathic corrective treatment consists largely of careful attention to lesions of the splanchnic area because of the importance of normal digestion, metabolism and elimination. This is certainly a most important part of the treatment and should never be neglected. Upper cervical and mandibular lesions have much to do with the local nutrition to the ear structures and these must not be neglected. The fact that we almost constantly find evidence of deficient nutrition to the meati and drums in this disease together with lesions of the mandible, suggests a local osteopathic cause.

=Auditory Nerve Degeneration.=—In those cases in which there is a measurable deficiency of nerve function of less than half the normal we have found that very few respond to treatment. (See table above.) The cause has therefore been attributed to a structural pathology and the condition called auditory degeneration.

Example Table:

Fork 32 64 128 512 2048 4096 B. C. 10 12 8 5 2 A. C. S 20 25 15 7 5

There is usually very marked impairment of hearing for voice and all other sounds. The Ingersoll watch may be heard five or ten inches, but usually not at all, and the whispered voice heard only a few inches or not at all. There are nearly always signs and symptoms of labyrinthine deafness and evidence of tone islands. The deafness in these cases is usually progressive regardless of any treatment.

In this disease there is nearly always an associated affection of the labyrinth as shown by the high forks. The fractions represented by the high forks will agree in proportion provided there is no labyrinthine involvement.

Our results in auditory nerve degeneration have been measurable improvement in only 2% of the cases treated. The prognosis is therefore very poor and I believe we should always tell our patients frankly that there is almost no chance for improving their hearing in such cases. The treatment is the same as that given for nerve deficiency and because of the general good that may be had from treatment, that is, the improvement of the general resistance, it is often well for the patient to have such treatment to stop the progress of further special sensory degeneration.

It should always be our purpose to treat the patient rather than to treat some particular organ only and if this method is followed, our general results will surely be much higher.

Diseases of the Nose

=Method of Examination.=—For use in nasal examinations and treatment, a suitable chair with adjustable headrest is of much value because if the patient is not comfortable and in a convenient position, the work is very difficult. A few instruments, such as the following, are very essential: A sterilizer for instruments, head mirror and reflecting lamp, nasal speculum, tongue depressor, tonsil pillar-retractor, a nasal packing forceps and a few aluminum cotton applicators. These instruments are few and comparatively inexpensive, but are of more practical value than a lifetime collection of electrical apparatus. Any physician can readily learn the use of these instruments and the methods of examination by attending the clinical sessions of our conventions. Methods and technic of treatment, however, require much practice and experience to develop efficiency.

Acute Rhinitis

This disease, commonly known as a "cold in the head" is one of the most common, and because of the complications which so commonly result, a disease which really requires careful consideration.

=Etiology.=—The predisposing cause is reduced resistance and individual susceptibility to air-borne irritants and infective organisms.

Direct exposure of some insufficiently protected part of the body such as the feet in cold, damp weather, exposure of some unprotected part of the body to draughts or exposure of the whole body to slightly reduced temperature for a considerable time, are the common causes. In cold weather, it is very important that the proper indoor humidity be maintained, because the drying of the mucous membranes renders them susceptible to infection. This disease is not only contagious at times but may even become endemic from some specific and virulent organism.

The complications which may and often do follow such infections are laryngitis, bronchitis, pneumonia, etc. and any one or more of the focal infections, such as sinuitis, tonsillitis, or middle ear infection. A focal infection thus caused may become chronic and render the patient constantly susceptible to head colds. In fact in those persons who suffer from chronic head colds, there may nearly always be found some focal infection, such as the above named, and it is often impossible to get permanent relief until such sources of focal infection have been properly treated.

The influence of gross structural lesions, osteopathic lesions of the cervical and upper thoracic region, vertebræ and ribs must not be overlooked because they exert a powerful influence upon the blood supply, particularly the venous and lymphatic drainage and upon the autonomic nervous mechanism, which regulates the physiologic control of such functions.

Gross structural abnormalities of the intranasal chambers, such as deflected septum, enlarged turbinates or cellular turbinates, which cause deficient or abnormal breathing space, may cause and maintain head colds.

=Diagnosis.=—The diagnosis is usually easy. Nasal congestion with the usual “stuffy” feeling of the head, sneezing, headache, etc. are well known symptoms. On direct examination the nares are congested, there is a watery discharge and all of the membranes of the nasopharyngeal tract are congested.

=Treatment.=—If there is ever a demand for good, thorough and specific osteopathic work, certainly it is demanded in such cases. I am an advocate of thorough, deep relaxing treatment followed by specific adjustment in such cases.

Complete rest in bed with light diet and careful attention to the elimination are very essential. Perhaps the most difficult problem is to convince the patient that a head cold is really a serious disease and demands thorough and prompt treatment. Every ear, nose and throat specialist has had ample opportunity to know that most of the really serious complications of the head and neck result from the lack of prompt and proper attention to head colds.

The local treatment consists of irrigation of the nasopharynx followed by oil spray to protect from further irritation and the maintenance of proper drainage from the sinuses and middle ears. I am not an advocate of the so-called “antiseptic sprays” because they neither destroy bacteria sufficiently to be effective nor do they maintain drainage.

In all cases, the physician should be ever watchful for the complications and should not hesitate to call consultation of a specialist when such symptoms develop.

Purulent Rhinitis

Persistent inflammations of the nasal membranes are usually of a purulent nature or at least have had such a cause in the beginning.

=Etiology.=—Purulent rhinitis may be a result of an unsuccessfully treated infection of the nose or throat following some disease of childhood or early life. It may be due to infection at birth. Commonly there is a subacute or chronic sinus infection that maintains the infection of the nasal mucosa. Polyps, enlarged or cellular turbinates, adenoids or adhesions in the epipharynx, often retain the secretions and cause chronic rhinitis. In many cases I have found that osteopathic lesions of the cervical or upper thoracic region are effective causes of chronic rhinitis.

=The Pathology= consists of hyperemia, hypertrophy and exfoliation of the cellular membrane. The turbinates and all membranes become enlarged and thickened and the breathing space is usually greatly decreased.

=The Symptoms= are nasal obstruction, and mucous or mucopurulent discharge with usually hypersensitiveness, which causes sneezing and other symptoms common to “head colds.”

=Treatment.=—The same treatment as given above for acute rhinitis applies here. A thorough examination should be made for all of the various causes given above and the proper corrective treatment given for any or all such causes.

Chronic Hypertrophic Rhinitis

=Etiology.=—Chronic rhinitis is usually a result of an infective rhinitis and has for its cause any one or more of the various causes given above under purulent rhinitis.

=Pathology.=—The pathology in chronic rhinitis varies with the cause, but is usually characterized by a series of changes beginning with infection and hyperemia and followed by an actual and usually marked hypertrophy of the interstitial tissue. The posterior ends of the inferior or, less often, the middle turbinates are usually enlarged and extend backward into the pharynx.

=The Symptoms= are much the same as in purulent rhinitis, except that the purulent discharge is often not present. These cases usually suffer from chronic head colds, headaches and persistent nasal obstruction. The senses of smell and taste are usually impaired and there is a nasal twang to the voice.

=Treatment.=—In these cases, it is common to find osteopathic causes which prevent proper drainage from the head and neck and this is important because, if all the local causes are properly corrected, this is not sufficient to effect a cure.

Surgical treatment for the removal of polyps, synechia, adenoids, adhesions, correction of septum, or hypertrophied or cellular middle turbinates is often essential and certainly infected sinuses must be properly drained. We have had cases in which root abscesses seemed to be active causes, but it must not be thought that surgery and surgery alone is likely to cure chronic rhinitis, and I want to caution against the wholesale removal of turbinates for such conditions. The mere fact that the turbinates are enlarged is not sufficient reason for their removal. There has been a cause for this enlargement and turbinotomy or turbinectomy does not remove this cause. Cautery is worse, because it seldom accomplishes more than very temporary results and often leaves the membranes worse than before. Cautery destroys mucous membrane, leaving a dry and easily irritated surface which is often impossible to normalize.

The proper surgery, carefully done, followed by efficient osteopathic corrective work and thorough irrigation of the nasopharyngeal tract with the necessary oil spray protection after irrigation, will constitute efficient treatment. Treatment, thorough and long continued, will in due time restore nutrition, drainage and normal reflex nerve control to the tissues. Treatment after surgery is essential.

=Intranasal Treatment.=—Many cases are caused by the retention of secretions under the turbinates and in the superior vault. In all cases, therefore, it is essential to thoroughly free all possible retention cavities by means of a small cotton-wound probe before irrigation. The intranasal membranes are adrenalized and anesthetized and a thorough examination is made using a good reflecting lamp, nasal speculum and cotton tipped probe. Every part of the intranasal region is inspected for sources of purulent discharge, mucus collections, synechia and for hypersensitive areas. The probe is curved at the end and passed under each turbinate and drawn forward and backward with considerable pressure to insure that any collection of foreign matter is thoroughly removed. Every part of the intranasal region should be thoroughly treated in this way. The hiatus semilunaris must be kept well open to permit free antrum drainage and all other sinus openings should be kept free from any obstruction that may block the drainage. This particular technic requires great care and practice, but it is very effective and so commonly we have found that this work thoroughly done will reduce much and in some cases all of the turbinate hypertrophy rendering surgery unnecessary.

Atrophic Rhinitis

As the term suggests, this disease is just the opposite from hypertrophic rhinitis in that the membranes are shrunken, the nares are wide open and usually the membranes are coated with a mucopurulent discharge, accompanied by a bad odor. It is a chronic disease and progressive in nature.

=Etiology.=—Deficient nutrition, systemic or local, or some degenerative infective process constitutes the cause. Some cases may be traced to syphilis, but this is certainly not always the cause. Chronic sinuitis, the cause of which is some virulent infection, is often the cause. Too much or incorrect surgery and cautery is certainly a cause in many cases.

=Pathology.=—The marked atrophic appearance, the retracted turbinates, the excessive purulent or mucopurulent foul discharge are characteristic and diagnostic.

The tissues underlying the mucous membranes are shrunken, and atrophic and this tissue has usually been replaced, sometimes almost completely, by connective tissue, and thus the blood supply is markedly deficient.

=Treatment.=—In chronic cases, those in which the atrophy is well progressed, there is no hope of restoration to normal conditions, but I believe that the progress of practically every case can be stopped and that, in most cases, a permanent cure can be effected under proper treatment.

Every possible source of focal infection, such as sinuitis, pharyngitis, tonsillitis, etc. should receive proper attention promptly. After this has been done and sufficient time allowed for normalization, a blood count may reveal some other source of focal or general infection, which may be reducing the general resistance.

Auto-intoxication from some gastro-intestinal affection is commonly a cause and must receive proper attention. The general health of the patient must be restored and maintained.

Thorough osteopathic treatment must be given for any cause of lowered nutrition, local or general. The failure, I believe, in medical practice (They admit failure in this disease) is due to the lack of attention to the restoration of normal nutrition. Why drain a sinus and leave an atlas or upper thoracic lesion which decreases the local nutrition and leaves these membranes susceptible to further infection?

Before and after surgical drainage, irrigation of the nasopharyngeal tract. Thorough irrigation to cleanse every part. Hot irrigation (one gallon of salt mixture solution, salt 3 parts, borax 2 parts, and soda 1 part, a tablespoonful to the gallon at 118°F. to 123°F.) to cleanse, to free all parts from infection and to restore blood supply to the affected parts. Frequent irrigation, daily for a sufficient time to thoroughly sterilize and restore circulation. After each irrigation, an oil spray (any non-irritating petroleum oil) is applied freely to protect the membranes from irritation and further infection.

Before each irrigation a thorough probe treatment, as described under hypertrophic rhinitis, should be given that the membranes may be thoroughly freed from all retained secretions.

After the membranes are once clean, the sinuses free from infection and the blood supply reestablished, the treatment may be reduced in frequency to three times weekly, but the treatment must be continued for months or even years to effect a permanent cure. The patient can be taught to do his own irrigation after the disease is well under control. All irritating sprays, chemical cauteries, etc. must be avoided. The so-called “antiseptic sprays” do harm by irritating the membranes and certainly do no good, because they do not cleanse the parts. They only serve to deodorize, but actually accomplish nothing in the way of cure. It has been my experience that iodine and the silver salts in any of their various preparations are not efficient but that they actually do harm. My experience indicates that practically every case can be cured if the proper treatment is given for sufficient time.

Pharmacodynamics

If I may be pardoned for discussing things pharmacological in a text on practice, I want to urge that chemicals as such, are usually a failure in treatment. My results from various series of experimental work both laboratory and clinical, show quite conclusively that there are very few, if any, chemical substances that have actual value by virtue of their chemical properties alone. There are, however, cases in which chemical agents may be used to advantage to obtain desirable physical results and physiologic reactions.

The salt mixture mentioned above increases the solvent power of the water for mucus, pus, and other collected material and it also renders the water less irritating to the mucous membranes. Other than this, it has no value so far as I know. This solution is certainly not antiseptic or germicidal, further than that cleanliness may be considered an antiseptic procedure.

The phenol-glycerine (10% phenol and 90% glycerine) which we have recommended, is somewhat germicidal, non-irritating, except to the nasal mucosa, is a protectant to inflamed membranes in some instances and is also somewhat hygroscopic. These virtues to the limited extent that they may be of advantage, depend chiefly upon physical qualities.

Adrenalin in high dilutions (1 to 5000 to 1 to 10,000) is of value in retracting the erectile tissues of the nares for purposes of examination and for obtaining better drainage, etc. It also constricts the small blood vessels and thus reduces the chances for hemorrhage or absorption of narcotic drugs which may necessarily be used as local anesthetics. The effects of adrenalin are very temporary and it is, therefore, of little value in treatment.

Following irrigation I have used the petroleum oils (liquid petrolatum) to advantage as a protection to the mucous membrane. One-half gram each of menthol and camphor and two or three drops of cinnamon oil to the pint of this oil, is readily dissolved and produces a pleasant, soothing effect to inflamed membranes, but further than this, the added substances have no particular value. The above named chemical agents constitute, except in rare instances, my stock of “drugs” for treatment purposes.

Hyperesthetic Rhinitis—Hay Fever

There is perhaps no disease in which there has been more speculation concerning the etiology than in hay fever, and while osteopathy has accomplished a wonderful advance in the treatment of this disease, I am not sure that the cause or causes are yet thoroughly understood.

=Etiology.=—The theoretic causes of this disease may be expressed in the various names which have been given to it as follows: The term Hay Fever suggests that it is a febrile condition caused by hay pollen irritation. Peach cold, Rose cold, Rose fever, Rose catarrh, Rye fever and Ragweed fever suggest similar specific causes. Idiosyncratic coryza means nothing and this probably expresses what the theorists know about its cause better than any other name. Hysteric rhinitis suggests a probable psychic cause, which certainly does exist in some cases. If I may be pardoned, and I know I never will be, let me suggest just one more name—"Respiratory Reflex Inefficiency."

=Intoxications.=—Auto-intoxication from focal infections or from gastro-intestinal perversions certainly have an important influence either directly or as predisposing factors and should always be carefully considered in treatment.

=Osteopathic Lesions.=—Osteopathic lesions, such as interosseous, muscular and ligamentous, seem to function as predisposing causes by their general effects upon the system. It seems probable that their effects upon the organs of metabolism and elimination are of greater importance than any direct or specific effect in causing the immediate symptoms. In practically all cases lesions of the upper thoracic vertebræ and ribs and of the cervical region are present. It is my opinion that such lesions are more often secondary than primary.

=Respiratory Reflex Inefficiency.=—Measurement of nerve force in these cases shows that none are really possessed with "an excess of nerve force," but that practically all vary from two-thirds to four-fifths normal, showing that probably all cases are deficient in nerve force.

This instability of the nervous system can be explained, I believe, in the theory of peripheral reflex insufficiency. As evidence of this the following facts may be cited:

1. It is known that peripheral irritation of almost any nature, to the mucous membranes of the nasopharyngeal tract, will excite an attack in susceptible individuals.

2. That any treatment which tends to increase the resistance of these membranes will prevent or relieve an attack.

3. That peripheral inhibition to these surfaces will temporarily relieve an attack.

4. That complete normalization of these membranes will make the patient resistive to the so-called specific irritants, such as pollen, dust, etc.

5. That the mucous membranes of the entire respiratory and gastro-intestinal tract react to irritants to bring about "the hay fever state" and that any treatment which tends to normalize these membranes, renders the patient more resistive to hay fever attacks.

=Exciting Causes.=—There is no doubt that various air-borne irritants, such as pollen, dust, chemical fumes, emanations from animals, etc., act as exciting causes of acute attacks, and yet there are cases that develop acute attacks out of season or at a time when it seems that there could be no air-borne irritation. From evidence which will be offered later (see prognosis) I am led to believe that probably all susceptible cases can be made entirely resistive to the air-borne irritants.

Pathology

=Functional Pathology.=—Certainly in this disease there is ample evidence of marked perversions of function or functional pathology. Kyle believes that in many cases the cause of local irritation lies in "some chemical change in the constituents of the mucus-secreting glands," and "it is a well known fact that in many cases of hay fever the irritation is not limited to the nasal mucous membrane. The eyes and mucous membrane of the stomach and bladder, and even the intestines may be markedly irritated."

These chemical changes in the secretion of the mucous membranes, together with the excess of uric acid would seem to point either to a general perversion of the secretory mechanism or to a deficient elimination, or to both. The periodic occurrence may be accounted for by assuming that the systemic strain is sufficient to initiate the symptoms. The fact that the attack is actually delayed

or hastened in susceptible individuals by the late or early beginning of hot weather, and that these cases get relief by going to a more moderate climate is further evidence of this.

Again we are reminded of Dr. Still's teaching, that the body maintains its own chemical laboratory which adjusts or tends to adjust its work to the needs of that body, but under abnormal strain this adjustive mechanism may fail to meet all of the demands of function. It seems here that the osteopathic concept may easily include all environmental causes as well as internal causes in the predisposition to deficient function or disease.

=Structural Pathology.=—During the attack there is a general catarrhal inflammation of all nasopharyngeal membranes, accompanied by a watery discharge and marked swelling of the turbinates. Sensitive areas may be found on the middle turbinate and opposite wall of the septum. Probably it is this hypersusceptibility to irritation that causes the attack from the air-borne irritants.

The pseudo-membrane which may be found covering a part or all of the mucous membranes of the nares probably results from this irritation and is formed for the purpose of protection.

=Clinical Types.=—Clinically, three rather indefinite types of hay fever may be recognized, viz.: Vernal, those cases which have their attack sometime during May, June or July; Autumnal, in which the attack occurs in August or September and usually lasts until the beginning of cold weather, and an indefinite or pseudo form occurring at any time of the year, with no characteristic attack, as in the other forms, but with indefinite symptoms resembling hay fever.

=Symptoms and Diagnosis.=—Patients usually go to the physician self diagnosed. The characteristic sneezing, the watery discharge from the nose, and the irritation of all membranes of the nasopharynx and conjunctiva will serve to make a diagnosis in most cases. Direct examination will reveal the nasal congestion and other characteristic pathology as described above.

=Termination.=—Most cases of the autumnal form, unless successfully treated, continue with equal or increased severity until after the first or second frost, when they usually terminate in asthma, bronchitis or sinuitis, which lasts for several weeks or months. Each year the attack lasts longer and is more severe and the asthma occurs earlier and is more severe.

Treatment

=Intranasal Surgery.=—Intranasal abnormalities, such as deflected septum, spurs on the septum, hypertrophied turbinates, polypi, etc., which materially reduce the breathing space, usually demand surgery. Nasal surgery, carefully and properly done, is always a great aid and often absolutely essential to the successful treatment of hay fever and asthma, but nasal surgery carelessly done frequently does more harm than good.

The correction of a deflected septum or the removal of a spur on the septum by submucous operation often aids materially in the prevention of pressure irritation, increases the breathing space and normalizes drainage from the sinuses.

Surgery is therefore very essential in many cases of hay fever, but surgery is never the all essential part of the treatment, because if the proper after treatment is not given, the surgery alone will seldom result in either temporary relief or cure.

=Focal Infection.=—The importance of focal infection of the sinuses, tonsils, teeth and occasionally other parts, such as the nasal cavities, epipharynx, middle ear and mastoid cavities cannot be overestimated. Such conditions may be effective in causing hay fever, by causing direct infection of the membranes of the nasopharyngeal tract or by auto-intoxication.

=Digital Surgery,= for the removal of adhesions in the posterior nares and pharynx, is in my opinion, very essential, and this work should be done thoroughly. Massage of the soft palate or pharyngeal walls is of no particular value. All adhesions and adenoid tissue must be removed because this removes an effective source of constant irritation and focal infection and tends to normalize the direct and reflex nerve mechanism.

The practice of the radical intranasal technique as originated by J. D. Edwards, D. O., is indicated, I believe, in some cases in which the crushing of cellular middle turbinates, or the breaking of adhesions is indicated, but I am not yet ready to accept this theory of "curetting" the mucous membrane by radical digital technique. The fracture of the turbinates is not necessarily a bad technique provided they are properly readjusted as Dr. Edwards does it, but to fracture and not readjust is a dangerous practice. The efficiency and safety of any method depends upon the operator's definite knowledge of what needs to be accomplished and how it is to be done.

There are contraindications to digital, as well as any other kind of nasopharyngeal surgery, such as: (1) Acute infection of any part of the nasopharyngeal tract; (2) evidence of sinus involvement; (3) septal deflections, spurs and hypertrophied turbinates, which would not permit such work without undue trauma.

There are certain other precautions such as thorough cleanliness of the parts to be treated; aspiration of the sinuses before and afterward, and the use of a finger of sufficient size which will not produce undue trauma. In my opinion very few doctors have such fingers.

Failure in accomplishing results is due to three things, viz., (1) Insufficient knowledge of diagnosis and prognosis; (2) insufficient knowledge of what should be accomplished and the technique of doing it, and (3) the necessary additional or supportive treatment.

It is a great mistake to think that the removal of adhesions in the pharynx or nares is sufficient, because if this is not followed by the proper supportive treatment, no results or even bad results will frequently occur. This treatment is not a massage in any sense, but a definite operative procedure and requires as much care and skill as the removal of adenoids or tonsils.

Space will not permit an explanation of the digital technique and the radical treatment should not be attempted without some definite knowledge of the methods and technique.

=Intranasal Treatment.=—The intranasal method of treatment as explained above under hypertrophic rhinitis is very effective and if carefully and thoroughly done is in most cases just as efficient as intranasal digital surgery. This treatment followed by irrigation and oil spray and nasal packing will be found effective in most cases if the treatment is properly done.

=Nasal Packing.=—Thorough packing of the nasal cavities after all sources of focal infection have been removed and after thorough cleansing has been done, by means of long strips of absorbent cotton is effective in reducing the swelling and irritation.

=The Radical Packing Method.=—This method can be done best in a hospital. The nares are prepared as for surgical operation, by complete retraction of all erectile tissue, thorough cleansing by irrigation and the application of a local anesthetic. Anesthesia need not be complete. A careful examination is then made for any synechia, or focal infections. Packing should never be done until the doctor is sure there is no sinus involvement. The entire nasal cavity is then packed very firmly with sterile gauze. This is best done by means of a special packing instrument or long nasal packing forceps, using narrow gauze contained in tubes. In some cases the nasal cavity is lubricated before packing.

The packing should be done early in the morning and removed just before bed-time, so that the patient may sleep. This treatment is repeated daily until all signs and symptoms of nasal irritation are gone and then replaced by irrigation and oil spray.

If this treatment is properly done, there will be a complete sloughing of the pseudo-membrane followed by a restoration of normal and resistive tissue. The results of our two years' experience (we have tried this on only a few patients each year) are very encouraging. Relief from the symptoms are very prompt and seemingly more permanent than from other methods.

=Treatment of Auto-intoxication.=—All sources of focal infection are thoroughly treated. Sinus infection is very common and must receive proper attention before any other treatment can be effective.

Our experience shows that many cases have auto-intoxication of gastro-intestinal origin. The hospital care of such cases makes possible the thorough cleansing of the colon by irrigation and the reestablishment of an acid producing flora which seems to prevent fermentation.

=Osteopathic Corrective Work.=—Thoroughness of treatment for the removal of all causes is the secret of success. To successfully remove the immediate sources of auto-intoxication by treating a sinus infection or by thoroughly freeing the colon from fermentation products means only temporary results if the underlying causes are not corrected. A thorough osteopathic examination is necessary to determine such causes and certainly such treatment should not be neglected.

Correction of all cervical and upper thoracic lesions and particularly the clavicles and ribs is important. These lesions seem to be the result rather than the cause, but normal respiratory functions seemingly cannot be maintained unless such treatment is done.

Sinuitis

Acute or chronic inflammatory disease of the nasal accessory sinuses with or without suppuration is more common, I believe, and is responsible for more complications and chronic affections of the nose and throat than is generally known.

=Etiology.=—The cause in most cases lies in unsuccessfully treated acute infections involving the nose and throat. Abnormalities of the nasal respiratory passages such as deflected septum, enlarged or cellular turbinates, adhesions resulting from cautery or careless surgery, causing deficient drainage, constitute the local causes. Underlying some of these direct causes, lesions of the cervical region which impair the nutrition to and drainage from the head are to be considered.

=Symptoms and Diagnosis.=—Acute or chronic headaches and neuralgic pains of the head are common symptoms. Acute sinuitis of the frontal sinuses is accompanied by marked and persistent frontal headache and pain in the eyes. In infections of the maxillary sinus there is usually pain over the affected part, but there is often referred pain to other parts of the head. Sphenoidal sinuitis usually causes general headache with no definite location.

By direct examination of the nasal cavities a purulent or mucopurulent discharge may be seen and the source determined. In many cases, however, the pus may be retained or insufficient in amount to detect by direct examination.

Transillumination in a dark room by means of a good transilluminator will usually show a darkened area over the affected part. The average battery equipments commonly sold for this purpose are of little value. The X-ray plate when properly done, is more dependable than the transilluminator.

In some cases, all of these methods fail to locate the affected sinus and the cause can be found only by opening into the sinuses, aspirating with a catheter and making microscopic examination of the aspirated material. The microscope is indispensable for this work. Every suspicious discharge should be stained until pus is found and except in well defined cases, this is the only practical method of positive diagnosis.

=Treatment.=—Local treatment of the nasal cavities by retracting the turbinates and irrigation will be successful in many cases, but unless there is a large normal opening the pus will not drain sufficiently and probe treatment is required. In acute cases in which the pain is marked, osteopathic treatment of the cervical region, deep relaxation of the submaxillary structures and the application of heat over the affected part, together with the local nasal treatment should be given, but if this does not relieve the pain within twenty-four hours, the sinus should be opened and thoroughly drained. If efficient drainage is not established early the symptoms will usually increase until the pain is almost unbearable and serious complications may result.

In practically every case of acute sinuitis, I believe it is best to make a good, free opening into the affected sinus first and secure complete drainage by catheter aspiration. If this is properly done every case will recover much more quickly and without complications or danger of chronic infection.

Non-Suppurative Sinuitis

Cases of non-suppurative sinus involvement are not at all uncommon. The so-called “Vacuum sinuitis” which results from a closure of the normal opening, resulting in inflammation without pus formation, is responsible for many of the complicated cases of referred pain, which are so often improperly diagnosed. Chronic headaches and the various symptoms of fifth nerve affections, the neuralgias of the head, are frequently caused by non-suppurative sinus involvement.

=Treatment.=—The treatment consists of establishing good drainage and proper ventilation of the affected sinus or sinuses followed by thorough intranasal treatment as explained above. The osteopathic corrective work must not be neglected.

Syphilis of the Nose

In osteopathic practice syphilis is not a common disease. The occurrence of syphilis of the nose is still more rare but certainly should be recognized.

=Diagnosis.=—The local lesions of the nose are of two types, those of acquired syphilis and of congenital syphilis.

There are three characteristic manifestations of acquired syphilis as follows. The primary lesion or hard chancre is a firm, indurated ulcerated mass with only slight discharge. Chancre of the nose is exceedingly rare. In secondary syphilis there is the mucous patch, the result of mucous membrane necrosis. In tertiary syphilis the local lesion is the gumma or more commonly, the ulceration left from necrosis of the gumma. These lesions may appear from a few to many years after the initial infection, but they never follow immediately. The lesions may appear on almost any part of the intranasal structures. They resemble the lesions of atrophic rhinitis but in atrophic rhinitis there is never the extent of destruction that so frequently results from tertiary syphilis.

=Treatment.=—It has been my practice to refer all suspected cases to Dr. F. J. Stewart for differential diagnosis and treatment and his method of the use of salvarsan has proven efficient.

Epistaxis—Nose Bleed

The causes of nose bleed may be divided into two general groups, local and constitutional. The first group consists of trauma directly to the nose either external or internal, from nasal operations and other causes. The presence of a cluster of thin-walled veins on the anterior part of the septum which readily rupture from slight cause, constitutes perhaps the most common cause of nose bleed. The ulcers of atrophic rhinitis or syphilis occasionally cause bleeding. Malignant growths of the nose may cause frequent and profuse hemorrhage. The constitutional causes of epistaxis are, the acute fevers, cardiac and arterial diseases, which cause excessive tension; and cases of altered composition of the blood such as the anemias, malaria, purpura, chlorosis, hemophilia, etc.

=Diagnosis.=—Direct examination of the nose will usually reveal the cause. If there are no signs of trauma or rupture of the anterior group of vessels and the bleeding does not respond quickly to packing of the affected side, there is either a rupture of a large vessel, which requires long continued packing, or it belongs to the class of constitutional disease.

If there is evidence of some necrotic disease of the nose or if there are areas of exposed bone or cartilage from careless surgery, these may usually be seen and the point of bleeding located.

=Treatment.=—Cold applications, irrigation of the nares with cold normal salt solution and the application of an absorbent cotton or gauze pack is usually sufficient to stop the average case of epistaxis from any cause. The direct application of cold to the lower cervical region will cause capillary restriction.

There are many cases in which the membranes of the nose have lost their tone due to various irritants or from deficient nutrition to the parts. These are cases of a wholly different type from that of the well known necrotic diseases such as atrophic rhinitis and syphilis. Hay fever is a result of such a cause. The treatment in such cases consists of removing any local causes or osteopathic lesions and then normalizing the resistance of the membranes by the methods described under the treatment for hay fever.

The treatment for those cases of epistaxis due to constitutional disease depends wholly upon the causative factors and the proper treatment of these. Any local treatment in such cases will be expected to produce only temporary results.

Diseases of the Nasopharynx

The nasopharynx may be the location of acute or chronic inflammations, neoplasms, malignant or nonmalignant, processes of atrophy or hypertrophy, adhesions, etc. It is important to remember that the nasopharynx admits the Eustachian tubes and supports four superficially located ganglia of the fifth nerve.

=Acute Nasopharyngitis.=—Acute inflammatory processes of this region may result from rhinitis, infections of the lower pharynx, focal infections of these parts or from direct involvement of its own structures.

The symptoms are post nasal tenderness and mucus dropping. Some patients experience the sensation of a foreign body in that location. The thick, adherent collections of mucus are difficult to dislodge and sometimes are so persistent that they cause nausea. There is usually occlusion of the Eustachian tubes, resulting in partial deafness, tinnitus and often dizziness.

=The Treatment= consists of thorough cleanliness by irrigation and osteopathic corrective work to the cervical region. It is also essential to keep the anterior neck structures particularly those of the submaxillary region, thoroughly relaxed to maintain efficient drainage.

Chronic Nasopharyngitis

This is one of most common diseases of the nasopharyngeal tract, causative of many complications and yet perhaps the least recognized in proportion to its significance. The frequent occurrence of adhesions of the pharyngeal fossæ, hypertrophied membranes, enlarged spongy extensions of the inferior and middle turbinates (the posterior turbinate bodies) occlusion of the orifice of the Eustachian tubes and chronic, excessive secretion of thick mucus all show that this disease has either gone unrecognized or at least has not received proper treatment.

=Treatment.=—Complete surgical removal of all abnormal growths, adhesions, etc. as described under the treatment of chronic non-suppurative otitis media and this followed by thorough irrigation and other methods of local treatment described above are efficient. The successful treatment of this disease requires time. There has been a partial or, in some cases, almost a complete loss of the normal functions of the nerve reflex mechanism of these parts, peripheral reflex inefficiency and this must be restored. Efficient and long continued treatment of the lesions commonly found in the cervical and upper thoracic regions will do much to restore these normal functions, but this alone without the surgical treatment will never effect a permanent cure. Neither will the surgery and local treatment alone effect a cure. The whole treatment is required.

Adenoids

Adenoids are the hypertrophied lymphoid tissue of the nasopharynx. They occur commonly in children, as a result of acute inflammations. Possibly the suckling process of the child produces a partial vacuum of the epipharynx and thus causes excessive blood supply to the part and therefore excessive growth of these soft tissues.

Adenoids, however, are not confined to children but frequently occur in adults. In all cases they are a source of much annoyance and often the cause of acute and chronic disease.

=Symptoms and Diagnosis.=—Mouth breathing, head colds, partial deafness, etc. are the common symptoms. The flattened nose, the high arch of the hard palate and the stupid appearance of the face are diagnostic. By direct palpation to the nasopharynx the nature and extent of the adenoid mass can be determined and this is the best method of diagnosis.

=Treatment.=—Many methods of non-surgical treatment have been employed, but there is nothing as satisfactory as complete surgical removal. Adenoid tissue has no known function different from that of other lymphoid tissue and there is always sufficient to perform any necessary function without excess of adenoid growth. The excessive adenoid growth is in every case a detriment to normal development, because it impairs nasal respiration and usually causes chronic nasopharyngitis and thus reduces resistance against all diseases of childhood. There is therefore, no excuse, much less a reason, why excessive adenoid growths should not be removed surgically, provided it is properly and thoroughly done.

The operation for removing adenoids requires in children, a general anesthetic. In adults, a local anesthetic is used by some operators. I have found it best to first break the adenoid mass away from the side walls of the pharynx digitally. A LaForce or Gradle adenotome is then used to remove the adenoid mass. If either of these instruments is properly used it will always remove the greater part of the adenoid mass without undue trauma or injury to any of the pharyngeal structures. Curets should never be used because they almost never remove the adenoid mass properly, but they usually do injure the pharynx. Many cases of pharyngeal adhesions, Eustachian tube occlusion and nasopharyngitis result from direct injury caused by curets.

After the adenoid mass has been removed the finger is inserted into the pharynx and any adenoid growths in the posterior nares are removed. The pharyngeal fossæ are also thoroughly freed from adenoid tissue and adhesions and the orifices of the pharyngeal portions of the tubes are gently dilated. This method insures complete removal of all excessive adenoid tissue, and normal functions of the nasopharynx. Adenoids thus removed do not return.

After the surgical work has been completed the nasopharyngeal tract should be thoroughly irrigated with hot salt mixture solution. This thoroughly cleanses the membranes, hastens healing, prevents hemorrhage and avoids post-operative infection. Irrigation of the nasopharynx should be continued for some days or until all evidences of inflammation have ceased. The pharynx should then be examined to be sure that no adhesions have developed from inflammation, but if the operation is carefully done, complications will never result.

Diseases of the Oropharynx

Acute Pharyngitis

Acute inflammations of the pharynx alone or in common with inflammations of other parts of the nasopharyngeal tract are common. This disease is most common as a result of the acute infections affecting the nose and throat.

=Etiology.=—The predisposing causes are focal infections of the nasopharynx, such as tonsillitis, sinuitis, etc. Deficient nutrition or anemia of the pharynx or systemic anemia are common causes. Lesions of the cervical, upper thoracic and hyoid are common predisposing causes. Undue exposure of the neck in susceptible persons or too much or too tight clothing about the neck may also

predispose to inflammations of the pharynx.

The exciting causes are the acute infections, colds and focal infections. Perhaps the most common exciting cause is tonsillitis, acute or chronic.

=Symptoms and Diagnosis.=—The characteristic dryness of the pharynx, pain and persistent coughing are diagnostic. Upon direct examination, the reddened, swollen appearance of the pharynx and posterior pillars can be seen.

=Treatment.=—The treatment should be general and local and should be determined by the causes and conditions present. This disease is usually an acute infection and like other acute infections, the usual systemic treatment should be applied.

The local treatment consists of thorough cleansing of the nasopharynx (by irrigation if the patient can permit) and the frequent (or occasional as required) use of some gargle until the inflammation has subsided. Any cleansing nonirritative solution may be used for a gargle. Equal parts of peroxide, alcohol and glycerine, a tablespoonful to a half glass of very warm water or ten to fifteen drops of phenol-glycerine to a half glass of warm water will make a good cleansing gargle.

The osteopathic treatment consists of corrective work to the cervical, upper thoracic and hyoid and thorough relaxation of the submaxillary musculature to obtain good venous and lymphatic drainage. If sufficient care be taken to avoid trauma, digital stretching of the soft palate and pharyngeal muscles by the use of the finger internally, is very efficacious.

Chronic Pharyngitis

Chronic pharyngitis may be hypertrophic, atrophic or granular. In hypertrophic pharyngitis the pathologic changes have passed beyond the stage of hyperemia and there is always hypertrophy or hyperplasia, usually the latter, of the pharyngeal membranes. These changes in most cases, have extended to and involved all of the nasopharyngeal membranes.

Chronic granular pharyngitis, or so-called clergyman’s sore throat, has a similar pathology to that described above, but with swollen and inflamed lymph follicles. This condition seems to be a result of excessive use of the voice.

Chronic atrophic pharyngitis has a similar etiology and the diagnostic signs are also similar to atrophic nasopharyngitis with which it is usually associated.

=Etiology.=—The causative factors are similar or the same as those of nasopharyngitis. Lesions of the cervical and upper thoracic and chronic focal infections such as tonsillitis, sinuitis, etc. are the common causes.

=Treatment.=—The nature of the treatment should be determined by the causes found. The nature of the pathology requires long continued treatment and careful attention to all causes. Thorough osteopathic corrective work, the removal of all sources of focal infection, proper attention to any gastro-intestinal perversions which may be causing auto-intoxication and thorough cleanliness of the parts by gargling with some cleansing, non-irritating solution and by irrigation.

In most cases there is a considerable collection of adhesions in the nasopharynx or posterior nares or in both. Enlarged “posterior turbinate bodies” and the extension of the inferior turbinates into the pharynx are also common results of the hypertrophic process. Complete surgical removal of this excess tissue and the after treatment as described above under chronic nasopharyngitis are frequently required to obtain complete and permanent results.

These cases can be successfully treated if the proper attention is given to all possible causes in each individual case. It is the individualization, the specific and detailed attention to the cause or causes, and such treatment continued for sufficient time, that will obtain results.

In atrophic pharyngitis, normal nutrition to the parts and usually to the entire system must be restored. Many such cases are secondary to systemic anemia or to rheumatic intoxication. A careful examination should be made for evidence of systemic causes. In many cases, I believe that thorough osteopathic corrective work applied to the mid and lower spine is the most essential part of the treatment. Other than this the local treatment as described under atrophic rhinitis applies here.

Tonsillitis

There is perhaps no other organ of the body, diseases of which have caused a greater variance of opinion relative to treatment than the tonsils. There are those who believe that every hypertrophied, atrophied, or infected tonsil together with its fellow of the

opposite side should be removed. There are also those who believe that no tonsils, regardless of their pathology, should ever be removed. These are the radicals and their views are not at all in keeping with present day facts.

Those physicians and surgeons who have tried to arrive at some safe conclusion on this subject, believe that there are certain methods of non-surgical treatment which are effective in many cases and they also believe that in other cases, tonsillectomy is imperative.

=Functions of the Tonsils.=—Many and varied functions for the tonsils have been held by various theorists such as: the absorption of the products of salivary digestion; the secretion of an amylolytic ferment; that they are atavistic structures and therefore have no function; that they eliminate systemic toxins; that they serve as culture tubes for the production of vaccines; that they protect the deeper cervical tissues from bacterial invasion; the theory of internal secretion and a score of other theories which so far, have never been substantiated by either clinical or experimental evidence.

The hematopoietic theory or the theory of blood formation has a rather definite basis because such a function would be possible from the histologic structure. The formation of small lymphocytes has been attributed to tonsil tissue (Flemming) and this view has been generally accepted. Some of the lymphocytes however, find their way through the epithelial walls into the crypts and are discharged as “mucous plugs”, while others are carried by the efferent lymphatics into the circulatory system. In this respect, the tonsils, like other lymphoid tissue, produce lymphocytes which are essential constituents of the blood. This function is particularly marked during the growing period, but this function is also highly developed in all lymph nodules during this period, and in the growing child there is an abundance of such tissue and thus it seems that the tonsils, while important to the growing child, would not be at all indispensable structures.

Some physicians claim to have observed deficiencies in growth and development of children whose tonsils had been removed during the first ten or fifteen years of life, but this is not commonly accepted. The tonsils have their greatest cellular activity during the growing period and unless chronically hypertrophied they atrophy during adult life.

Tonsillectomy

We may safely conclude from this evidence, that in the growing child, it may be well to retain the tonsils providing they are not directly affected in such a way as to endanger the general health of the child, but that there is little, if any, danger in their early removal. In adults, there seems to be no reason why they should not be removed in cases in which there is evidence of involvement beyond restoration by treatment or those cases in which there is evidence of toxic absorption.

When surgical removal of the tonsils is indicated, the complete removal or tonsillectomy should always be done. A careful and complete enucleation of the tonsils when properly done will never be followed by any untoward results other than the temporary surgical sore throat. There is never any excuse, much less a reason, for partial removal of the tonsils or tonsillotomy, because such operations never accomplish the desired result and they nearly always require tonsillectomy later.

In association with a reputable vocal teacher I have studied the results of tonsillectomy on the voice. In none of the twenty cases studied was there any impairment following the operation, but on the other hand sixty per cent were improved either in range of pitch, quality or endurance, in addition to their being more free from laryngitis, pharyngitis, etc. for which the operation was done. Doctors Ruddy, Edwards and Reid of our profession have told me of similar experiences, so I am certain that tonsillectomy properly done will in selected cases, improve the voice.

Acute Tonsillitis

Acute tonsillitis is an acute infectious and often a contagious disease characterized pathologically by inflammation of the tonsils. Some authors differentiate between follicular tonsillitis in which the crypts or lacunæ are involved, and parenchymatous tonsillitis in which the parenchyma is involved.

=Etiology.=—The predisposing and exciting causes are the same as in other acute infections of the upper air passages except that there is usually a chronic tonsillitis as a result of some previous attack.

=Symptoms and Diagnosis.=—The symptoms also are similar to other acute infections of the nasopharyngeal tract, with sore throat, variable temperature, headache, etc. By direct examination of the pharynx, the protruding masses with white or yellow patches are readily seen.

=Treatment.=—Infection, drainage and elimination are three words inseparable in the therapeutics. The local treatment (I doubt if many will agree) in either acute or chronic tonsillitis is essentially the same—radical aspiration drainage. In all cases, except young children who will not permit it, I place a vacuum cup directly over the tonsil and apply as much vacuum as can be obtained. This treatment will, when properly done, empty the crypts of all pus. This accomplished, each crypt is probed with a cotton applicator dipped into phenol-glycerine.

Cervical and upper thoracic treatment and deep relaxation of the sub-tonsil tissues to increase the normal blood supply and to decrease congestion by drainage elimination are essential. The lower thoracic and lumbar should receive due attention for the purpose of increasing general elimination. The diet and other treatment are no different from that in other infectious fevers.

Peritonsillar Abscess

(Quinsy Sore Throat.)

Peritonsillar abscess results from the collection of pyogenic bacteria and pus formation between the tonsil and the pillars of the fauces. It is perhaps a result of the closing of an infected crypt causing deep penetration of the pus.

=Diagnosis.=—The symptoms are those of acute tonsillitis but usually more marked and with one tonsil decidedly more protruding than the other. In some cases the location of the abscess can be seen and it is comparatively easy to open with a knife or probe, but in many cases the abscess is so situated that it cannot be located except by exploratory probing.

=Treatment.=—Drainage by direct incision of the abscess pocket is indicated as early as a definite diagnosis can be made. There is no definite technic to be followed except to observe certain general principles. If the “pointing” of the abscess can be located, it is comparatively easy to make a good, free, direct incision and accomplish complete drainage. In many cases the only way to locate the pocket is to employ a probe or small, long, scalpel and explore between the pillar and tonsil until the pus pocket is found. As soon as this is located the pus pours out around the probe and this gives the location. Free drainage by means of a liberal incision should then be made. Aspiration of the pus pocket and filling with phenol-glycerine is effective after drainage has been obtained, but a liberal drainage must be maintained.

The non-surgical treatment as described under acute tonsillitis is to be applied here.

Chronic Tonsillitis

Chronic tonsillitis usually is the result of one or many attacks of acute infections of the tonsils. Occasionally cases of marked chronic tonsillitis occur in which the patient denies ever having had an acute attack.

The pathology consists of hypertrophy of the lymphoid tissue and connective tissue.

=Diagnosis.=—The purpose in diagnosis is not to determine whether the tonsil is hypertrophied but to determine whether the tonsil is causing any local or general physiological perversions and if so, whether local treatment or surgery should be applied.

The direct examination should be made very carefully, because otherwise a bad tonsil may be readily overlooked. The mere fact that a tonsil is large or has open crypts from which a whitish mass may be expressed does not mean that such a tonsil is directly responsible for local or systemic physiologic perversions.

The examination should be made by means of a tongue depressor, tonsil retractor and a good head mirror and reflecting lamp. Every part of the tonsil and surrounding pillars should be carefully examined. Firm pressure applied against the tonsil from in front and behind will often force material from the crypts or out around the capsular margin. Any such material thus expressed should be examined microscopically. By probing the crypts with a small pointed cotton-wound probe and staining the material obtained, the condition of the deep parts of the tonsil can be determined.

The symptoms in every case, are to be considered with the microscopic findings, but there are cases in which either of these, together with appearance on direct examination, is sufficient to determine the advisability of tonsillectomy.

In general, we may say that the following factors would indicate tonsillectomy.

1. Chronic, recurrent tonsillitis with or without complications, which does not respond to non-surgical treatment.

2. Positive evidence of arthritis of any form with microscopic evidence of some virulent organism, such as staphylococcus, streptococcus or long-chain pneumococcus, present deep in the tonsillar tissue.

3. Any persistent discharge of pus from the tonsil in which the microscope shows the presence of virulent bacteria and which will not be relieved by treatment.

4. Markedly hypertrophied tonsils which directly interfere with the voice, deglutition or respiration and which do not respond to treatment.

5. Persistent focal infections of the middle ears, or sinuses or root abscesses which do not respond to treatment and in which case there is a virulent infection of the deep parts of the tonsil, shown by microscopic examination.

The above are only general conditions and there are probably many other indications or groups of symptoms that would indicate tonsillectomy. In most cases, unless the findings show positively that tonsillectomy should not be delayed, we advise treatment. If treatment does not restore to normal, it will probably reduce the time of the surgical sore throat following the operation.

=Non-surgical treatment.=—The local direct treatment, as we practice it, consists of: 1. Direct aspiration by means of the tonsil cup, applying from fifteen to twenty inches of vacuum. 2. Application of phenol-glycerine by means of cotton applicator to the full depth of each crypt. 3. Irrigation of the crypts by means of a catheter and hot salt mixture solution. 4. Syringing of the crypts by means of the catheter and phenol 10%, alcohol 20% and glycerine 70%.

The digital treatment of the tonsil consists of: 1. Applying pressure against the anterior pillar thus forcing the contents out of the tonsil, the Ruddy method. 2. By the bidigital technic, the front finger of one hand inside, posterior and inferior to the tonsil and the fingers of the other hand outside exerting deep pressure and opposing the finger inside. In this way the tonsil can be lifted forward and upward and its contents expressed. The digital treatment is not as effective as that described above.

The osteopathic corrective treatment consists of adjustment of the atlas and axis and the mandibular articulation and the obtaining of free movement of the hyoid and the relaxation of the submaxillary musculature and other deep structures.

This treatment, if followed persistently, will relieve the local symptoms of a very high percentage of cases of chronic tonsillitis, and in many cases even the systemic complications will be relieved. Whether in cases of systemic absorption this is the preferable treatment I am not sure, because, once the local condition is improved the patient will usually refuse operation and even if the physician finds definite evidence of toxic absorption he cannot convince the patient that his tonsils require surgery.

MENTAL DISEASES

BY

L. VAN H. GERDINE AND A. G. HILDRETH.

INTRODUCTION

The subjects herewith presented, while including certain of the most important sections of mental disease, make no claim to completeness either in the subject matter presented or in the attempt to cover the entire field of the psychoses. They cover those portions, however, with which we have come in closest touch at the Still-Hildreth Sanatorium, and in which we have the most complete records. I have been aided in the compilation of the essential facts and statistics by the able staff of the institution and wish to acknowledge especially the valuable cooperation of Dr. C. M. VanDuzer in the Dementia Praecox group, Dr. H. P. Hoyle in the Manic Depressive group, Dr. B. L. Jemmette in the group entitled Delirium, Confusion and Stupor, Dr. J. C. Snyder in the Senile Dementia group and Dr. G. S. Elkins in the Involutional group. The opinions concerning each type held by Dr. A. G. Hildreth are appended under its appropriate heading. I wish to state emphatically that the sole treatment carried out in the Macon Institution is specific corrective work upon spinal lesions, and it is upon this treatment that the statistics are based which are to be found throughout the text. These records cover more than 700 cases, including complete histories of the patients with the physical and mental findings on examination; these represent, therefore, by far the largest body of statistics ever accumulated in the study of osteopathic results in mental disorders. While the results naturally vary in different types of mental disease the grand total shows that more than one-half of all patients admitted recovered. Details for each group will be mentioned under its appropriate heading. While adjuncts such as diet and hydrotherapy have been utilized; we certainly cannot attribute any curative value to their influence.

It should be further emphasized that in no case whatsoever has medicine been used as a curative agent. And the same may be said of surgery. It has indeed been conclusively proved even in the medical world that medicines and surgical procedures are absolutely ineffective; from the osteopathic viewpoint this of course is perfectly reasonable since the theory calls for definite lesions as causative factors and these lesions can hardly be reached other than by the osteopathic method of correction. The results obtained, therefore, could only be attributed to the genuine osteopathic principle enunciated by Dr. A. T. Still who kept in close touch with the work and gave it his approval up to the time of his death. He had always maintained that the osteopathic principle could accomplish remarkable results in this field and considering the previous inefficiency of any other method his confidence has been fully justified.

Dementia Praecox

This condition refers to mental disorders arising usually during the period of puberty or adolescence, therefore, between the ages of fourteen and twenty-five for the most part, although apparently similar cases may arise in later years. The term dementia refers to mental deterioration and enfeeblement, while “praecox” signifies adolescence, though some writers infer that the term praecox may be used to indicate the early or precocious development of the mental enfeeblement. Certain it is that in most cases deterioration, with its resulting symptoms of mental enfeeblement giving rise to the term dementia, usually occurs in time, though by no means always early. It is a chronic progressive disease which may terminate in a complete loss of mentality; in other cases it may become arrested in any stage and remain so permanently; in still others it may recover, though this is rare. By reason of the variability of the symptoms, three groups are generally recognized, first suggested by Kraepelin. Each is differentiated by more or less characteristic symptoms and referred to under the head of the Hebephrenic, Catatonic and Paranoid types, although all have certain symptoms in common and there are mixed types.

=Etiology.=—According to the authorities some form of hereditary factor can be found in some fifty per cent or more of all cases; this is supposed to create a predisposition, a natural weakness of the nervous system, which renders it unable to bear the ordinary storm and stress of life, so that the mechanism becomes according to the French expression, “wrecked upon the rock of puberty or adolescence;” in other words, a premature giving way of the nervous system, being inherently unable to stand the strain of life. Another suggestion is that it represents the outcome of abnormal types or reactions of the individual to the environment, with a failure of proper adjustment to surroundings and the formation consequently of mental problems which to the patient are incapable of solution. This may be called the psychological theory. The most commonly accepted idea, however, is the physical causation. According to this the disease results from auto-intoxication, the intoxicant arising from the disturbances of the glands with internal secretions, more particularly the sexual glands. This endocrine theory is supposed to be supported by the fact of the appearance of this disease most commonly at the time of puberty and shortly thereafter.

The osteopathic conception fits in very well with this latter view, inasmuch as the spinal lesions are quite capable of explaining not only a disturbance of innervation to the glands with the resultant interference in their normal secretion, but also could produce disorder of the circulation and nutrition to the brain.

=Symptomatology.=—Although each variety of Dementia Praecox has special symptoms characteristic of the type there are certain symptoms common to all forms, and these will be first considered. All the functions of the mind in the course of time tend to become disturbed and to be weakened, but in the earlier stages we find marked differences as regards the disturbance of different functions, thus memory and orientation in most cases seem good; on the contrary, attention and association of ideas somewhat poor. Emotional life is almost always markedly affected, even in the beginning. Very commonly at first there is depression to be followed later by expansive feelings and then by apathy in general. The will power is altered early and the conduct is apt to be peculiar. The judgment becomes impaired. All of these symptoms mentioned are deviations from the normal in the patient and therefore presuppose that the patient was formerly normal. This should sharply differentiate the praecox group from cases of defective development (imbecility or idiocy). In this latter group there is an arrest of development of the mind, whereas in praecox there is a loss in a developed intellect. We see a young patient, for example, who has lost interest in things about him, neglects his work at school or at home, remains alone for long periods of time and seems unwilling to mingle with other people. He gives the impression of one depressed and worried about something he is trying to solve, perhaps he mutters to himself or gives way to unprovoked laughter, he may refuse to eat, or to talk unless questioned and may even then not answer. When he does talk it will be discovered that he knows perfectly well where he is, and knows people around him and understands everything that is going on; his memory will be found good, he can usually recall past incidents and tell what he has been doing recently. As the condition progresses, however, while the patient may still for a long time retain fair orientation and memory for past events, his accumulation

of recent ideas will be found poor, so that he will recall them with difficulty. We notice that it is difficult to get the patient's attention and concentration seems to be impossible, he may answer a direct question, but immediately seems to be occupied with other thoughts and it takes some little effort to gain his attention again. If he continues to talk it is plain that the association of ideas is poor, giving rise to disconnected phrases which usually come forth sluggishly and without show of emotion. Dissociation of ideas occurs; that is, different ideas expressed may practically contradict themselves. For example, the patient may say he is a king and yet when asked to sweep the floor will do it perhaps without hesitation, not considering that is hardly the kind of work a king would do. The dissociation is also marked in the contradiction found between the content of the thought and its associated emotional idea, for example, the patient may speak of a near relative as dying recently, yet with no show of emotion, even with a meaningless laugh. This dissociation may ultimately result in complete incoherence, in which no sense can be found whatsoever in his speech. Emotional indifference is noticeable early and sluggishness of reactions to stimuli, even failure of such reactions; the patient will neglect himself, stay away from meals, express no desires and make no complaints. In the earlier stages, however, the patient who may have been for some little time apathetic, suddenly without apparent cause becomes angry, noisy, and possibly violent and destructive, again gradually relapsing into his quiet, apathetic state. The thought content is commonly associated with delusions, that is obviously false ideas, but which the patient is unable to perceive are false. Delusions of persecution are most common, the patient feeling in a dim way that everything is not right; and in attempting to explain to himself the reason, often attributes causes to people or forces outside of himself, and on account of the feeling of bodily discomfort, also by reason of the depression, he explains the external forces as unfriendly to himself. Hallucinations may be present and furnish the material around which the delusions form; on the other hand hallucinations may result from the delusions. By hallucination is meant a false sense perception, as the patient may state he sees someone before him who is not there, or that he hears voices from individuals who are not around him; he may also complain of receiving electrical shocks, or wireless messages, which he usually states come from his persecutors. Symptoms of this nature form a good example of the so-called split personality, or "schizophrenia," wherein certain idea complexes are split off from the main personality and address themselves to the main portion, the patient attributing these noises (voices), sensations (visceral and tactile), tastes and smells to an objective rather than a subjective source and subsequently forming delusions. However, unless we are dealing with the paranoid form the delusions are fragmentary, transient and absurd.

=Hebephrenia.=—This is a progressing mental enfeeblement, terminating usually in deterioration, and without showing marked peculiarities in thought or action aside from the progressing deficiency. The patient appears in general inactive, lacking in energy and ambition, indifferent, depressed, incapable of much concentration and hence the efficiency becomes progressively impaired until he is unable to accomplish anything. From time to time there may be periods of confusion, depression, passivity, at other times periods of excitement.

=Catatonia.=—In this form the general symptoms are similar to those of the simple type above described with the addition of the special symptoms referred to as catatonic excitement and catatonic stupor. The excitement period is manifested by an unrest and monotonous activity, stereotyped actions and speech, the patient constantly repeating some act, such as moving the hand, foot or head over and over again in the same way, or repeating the same word or phrase indefinitely. This occurs apparently involuntarily, the actions being automatic in character. The patient who has been in a semistuporous state may pick up a glass or chair and without show of emotion break it against the wall. In catatonic stupor the patient may show in the lighter degrees a simple loss of interest and feeling with sluggish reaction to stimuli, or a profound inactivity and stupor in which state he cannot apparently be reached by any stimuli; nevertheless, he apparently retains consciousness. In this type we observe the interesting symptom of negativism in which the patient always does the opposite of what he is requested, or refuses outright to obey any command. There may be a refusal of food so that the patient has to be fed by a tube, mutism may be present, the patient may go for weeks or months without saying a word; stereotype of attitude results in cataleptic poses and rigidity, in which the patient may maintain any particular pose for a prolonged period of time, and if placed in some other attitude may similarly retain the new attitude for a long time. This constitutes the so-called wax like rigidity, the patient reminding one of a wax figure. Pathologic suggestibility occurs in which the patient imitates movements, or repeats words and phrases that are spoken or performed before him.

=Paranoiac Form.=—In this type delusions predominate and are characterized by variability, inconsistency, illogicality and transitoriness on the one hand, with many gradations to the opposite extreme where they become more or less fixed, and often dovetail into each other forming apparently a systematic whole. They tend to be usually of a persecutory and hypochondriacal character and in later stages when the mind is distinctly weakened are often of a grandiose type. Sometimes the patients have some kind of explanations for them and at other times none whatsoever, and they are often curiously dissociated from the emotional accompaniment. The patient may state there is poison in his food, in an indifferent tone of voice or even with a laugh; he may claim that his teeth are all set in wrong and offer no explanations to these obviously false ideas. The patient commonly thinks

that somebody “has it in for him,” someone will do him mischief, will kill him, that people are talking about him and criticizing him, everything that he hears or reads he thinks has some bearing on himself, so-called “delusions of reference.” Hallucinations may be present, the patient hearing voices, or receiving impressions or ideas which he claims come from without. These external impressions he misinterprets as voices or forces which are accusing, threatening and slandering him. Later on, the patient tends to change from the depressed persecutory stage to an expansive one, when he claims he is some celebrated person, king or president, or pope. The impairment of the judgment is clearly demonstrated in these cases since the patient who may claim to be the king of England may beg the attendant to change his place at the table or for a postage stamp.

=Pathologic Anatomy.=—This is obscure. Since a certain proportion of cases recover, there can evidently be no degenerative changes at the outset, though some cases deteriorate fairly early, others only after several years. In some chronic cases there have been observed degenerative changes in the cortical cells.

=Diagnosis.=—First, the common age of onset during puberty and adolescence, fourteen to twenty-four in the vast majority of cases, this being the only common mental disease occurring during this age period. Second, the progressive character terminating in mental enfeeblement or deterioration, that is “dementia” proper. Third, the evidence of defect or deficiency symptoms indicating that the patient’s mind has altered in the sense of deterioration from its former normal condition, whereas, in imbeciles or idiots the mind has failed to develop in the first place. Fourth, in the earlier stages particularly the marked dissociation of the brain powers, some being well maintained as memory and orientation (that is knowledge of time and space), others being weakened, such as judgment, power of attention and the like. Fifth, the early appearance of the emotional defect, a remarkable indifference and apathy of the patient to people and surroundings, the patient being unsocial and taking no interest in anything. Sixth, all the peculiar motor reactions, which are mentioned above under the catatonic head, and which very rarely occur in any other mental disorder. Seventh, the delusional content nearly always refers to the patient’s exterior, forces outside of him, people or things which are exerting an unfavorable influence upon him, delusions of persecution and reference. The patient practically never accuses himself, as is the rule in cases of true melancholia, never blames himself, but always the other party or the other force outside of him. Eighth, the delusions of grandeur are usually indicative of a stage of deterioration.

=Prognosis.=—Some authorities are inclined to doubt if any case ever completely recovers, claiming that in apparent recovery it may have been a question of mistaken diagnosis, or that the recovery is more apparent than real, that the patient is not truly well, or will have a relapse, so that a permanent cure will be impossible. Other authorities admit the possibility of recovery though in a very small minority of cases. The statistics of the Still-Hildreth Sanatorium, covering more than two-hundred fifty cases show total recoveries of at least one-third. This includes all types and all stages of progress, many being advanced on entrance. Of the less advanced cases and those of not more than two or three years’ standing there have been some fifty per cent recovery. Many cases make improvement or become stationary in greatly improved condition, but are not included in the thirty per cent. Of the three types, the catatonic offers the best prognosis, the hebeprhenic the poorest, while the paranoiac occupies an intermediate position.

=Treatment.=—Of the etiologic factors above mentioned, that of auto-intoxication, resulting possibly from endocrine disturbances or other sources, is most generally accepted in the medical world and agrees excellently with the osteopathic point of view. Spinal lesions are regularly found more particularly in the dorsal region, which are quite capable of disturbing the innervation to the glands; therefore, their nutrition and activity. A correction of these before the disturbance has continued too long, and hence before deterioration has set in, should theoretically normalize the glandular condition and therefore prevent deterioration and enable the patient to recover. Such is the probable explanation of the results, and in many cases the recoveries were obtained in patients previously considered hopeless.

Remarks by Dr. Hildreth

In a great majority of the cases the cause lies in the interference between the fourth dorsal vertebra and the eighth, which analyzed means a disturbance of the great splanchnic nerves, through whose interference would be caused the toxic condition and even the sexual disturbance described in so many cases from standard authorities. The same lesion, if deep seated enough, could produce an interference with the vasomotors and reflexly interfere with the circulation to the brain. In many we also find a first, second or third cervical lesion. The effects of these lesions on the equilibrium of the circulation to the brain are easily traced through the superior cervical sympathetic ganglia. These lesions, namely, the mid-dorsal and upper cervical, especially when corrected in the earlier stages, have thus far proven to produce successful results. In a lesser number of cases we find the cause to be from the first to the fourth dorsal vertebræ; our reasoning here being that the interference or the physical disturbance must be so deep that it reaches and interferes with the deeper nerve currents, both downward and upward, thus disturbing the equilibrium of the circulation

to the brain. We have found this class to be the hardest to respond to treatment; however, that may be due to the fact that the physical defects at that point are harder to correct. Osteopathic treatment applied to the lesions above described without question offers therapeutics of intrinsic value to this class of patients.

Delirium, Confusion and Stupor

This clinical group has become well established, not only in its recognition from the dominant symptoms as indicated above, but also from rather definite causes. The immediate cause seems to be an abnormal blood state, or so-called toxemia, which may result from infectious diseases, or states of exhaustion, or autointoxications, or foreign poisons; the poison acts as an irritant to the brain. In states of exhaustion so-called “fatigue bodies” are formed and are apparently toxic in character. The autointoxicants may have various sources, such as chronic kidney disease, or diabetes, and the like. The most important of the foreign poisons are alcohol and morphine. This morbid group is further characterized not only by a toxic cause and dominant symptom complex of delirium, or confusion, or stupor, but by a similar onset and course. The onset is usually acute and the course somewhat wave like, gradually reaching a climax and subsiding, or resulting in death or becoming chronic. To emphasize the clinical symptoms of confusion which is so important the term “acute confusional insanity” has often been used, or “amentia,” according to the common German terminology. Hallucinations also play a prominent part, particularly those of vision; hence, another common appellation, “acute hallucinatory confusion.” Heredity is mentioned at most as creating a predisposition, though often the personal and family histories show no such evidence whatsoever. Intellectually there is a definite lack of orientation, the patient is unable to identify himself or his surroundings in time and space. He cannot clearly understand what goes on around him, that is, consciousness is “clouded;” the clouding may be of such extreme degree the patient’s mind becomes blank, due to complete psychic inhibition. This is referred to as stupor. The emotional life plays a secondary role subordinate to the intellectual content. The patient may be greatly excited for example, resulting from a frightful hallucination. The hallucinations are mainly of the visual type and are almost always present. The patient lives in a perpetual state of sense deception as if he were constantly dreaming; the hallucinations for the most part are of distressing, disagreeable or even frightful character. These may give rise to delusions, which are manifold, often fantastic and usually transitory.

Physical changes are always found associated with the disturbed mental status. If it arises during the active stage of an infectious process there is of course the high temperature and all other physical signs of fever. In a certain number of cases with temperature no definite signs can be found indicative of any of the well known fevers, hence has been called by various names, such as “Bell’s Delirium,” “Acute Mania Gravis,” or “Acute Febrile Delirium.” This ordinarily runs an acute rapid course with very high temperature, very marked delirium, followed by stupor and usually death from exhaustion. Even though no temperature be present the physical condition reminds one very much of that found in fever diseases. There is the lost appetite, resulting emaciation and malnutrition, insomnia, exhaustion, etc.

=Osteopathic Theory.=—While it may be admitted that the various factors mentioned above may take part as exciting or predisposing causes, it is obvious that in numerous instances mental disorders do not arise whatsoever, even when the patient is subjected to these factors. There must necessarily be other elements essential to produce the psychosis. The osteopathic theory comes in at this point to fill in and complete the chain of causes and to initiate the onset by the introduction of the idea of nutritional and circulatory disturbances resulting from the spinal lesions.

The records of the Still-Hildreth Institution show 18 of the toxic type, in which the poison is derived from without, who were treated, with 17 recoveries. There were 25 cases connected with the infection and exhaustion group, with 20 recoveries.

Remarks by Dr. Hildreth

In this group we have to do with blood disorders, resulting from the infections, conditions producing exhaustion, and the various toxins, or poisons, whether originating within the body or derived from without. These disorders are largely functional in character, resulting from brain irritation due to the toxemia or disturbance to the centers of nutrition. The main object of the osteopathic treatment, therefore, is to aid elimination and regulate and build up the nutrition. In most of the patients the physical lesions are found in the mid-dorsal area, chiefly from the 4th to the 7th, and in the cervical region, the 1st to the 3d. In aiding the kidneys in elimination the 10th and 11th dorsal vertebræ must be looked after. These conditions commonly respond very rapidly to the treatment and represent one of our most successful groups so far as results are concerned.

Manic Depressive Psychoses

The psychoses which are brought together under this classification include mental disorders which at first glance would appear to be of very wide variation, namely, conditions of maniacal excitement and those of depression. Further consideration, however, reveals the very evident reasons why they should be united as sub groups under the one head. The fact that these two mental states of seemingly opposite characteristics often appear alternately in the same individual, that in certain cases of each type there is a wave like feature in the nature of the attack and the frequency with which they tend to recur, together with other points of similarity in respect to duration, prognosis, etc., tend to point to their very close relationship. Kraepelin was the first to draw attention to these facts and advocate the present convenient and widely accepted classification of these disorders.

The outstanding feature is the disturbed emotional state which dominates and overshadows all other symptoms and is fundamentally the same whether expressed through the excitement of mania or the depression of melancholia.

=Etiology.=—Heredity is considered an important factor. Various authorities claim to have demonstrated direct hereditary influences in as many as eighty per cent and more of cases. Individual predisposition resolves itself into a matter of constitution and temperament in which there seems to be a greater tendency among those who are subject to the emotional extremes.

Early adult life is by far its most frequent period of onset, though it may arise also somewhat later. In certain cases the beginning of the disorder dates from some psychic or emotional shock. Just what importance these factors have as causes is little known since other cases develop in which the constitutional element alone seems responsible and no immediate exciting cause can be demonstrated.

The osteopathic viewpoint emphasizes the all important influence of spinal lesions as exciting factors. In individuals who have a tendency to this reaction their presence disturbing the cerebral circulation and nutrition may act as the direct causative factor.

=Manic Phase.=—The manifestation of this condition is brought about by the release of the inhibiting influences which normally govern all psychic function. Various terms as hypomania, acute mania, delirious mania, etc., have been used to differentiate the different degrees in which the symptoms appear.

In the milder types we find the following symptoms present. There is a marked feeling of well being. The patient, having lost sight of his personal limitations, feels a consequent exalted opinion of himself. His conduct is often rather boisterous, he talks a great deal, often swearing and using obscene language. He is inconsiderate of others and tries to impose his will upon those about him. There goes with this a certain unstability of the emotional tone as manifested by the quickly changing feeling of good humor, irritability and anger. There is a rapid flow of ideas with a marked loss in the ability to concentrate and direct thought. The ideas which pass through the mind do not coordinate themselves toward a definite goal, but deviate from the course of consecutive thinking by any passing association. Again there is a restlessness and activity beyond all normal bounds. The individual feels strong physically and mentally. The appetite is unusually good and if activity is not too extreme there may be a gain in weight. The period of sleep is diminished and the feeling of fatigue is reduced.

In the more exaggerated cases the flight of ideas becomes more marked, the associations are more rapid and superficial and the attention is focused but momentarily. Illusions and delusions may be present due to the imperfect preceptions from inability to concentrate attention and from abnormal associations. Rhyming speech, disconnection of phrases and even apparent incoherence are often present. The state of mind may be such that the patient tears his clothing, breaks up furniture, jumps, dances and shouts and often will not take time to eat. The most extreme cases which refuse food over some period of time progress rapidly to exhaustion and measures to conserve strength become imperative.

=Depressive Phase.=—In this phase of the disorder are encountered manifestations which are in direct contrast to those presented in the manic phase. In place of the exalted emotional state there is a depression. There is a tendency to worry over trivial matters of the daily routine and of instances in past life. Introspection is the predominant mental attitude and the whole outer world is colored by the inner feeling of worry and uncertainty. Replacing the rapidity of thought in the manic phase there is a distinct slowing of mental processes in the depressive phase. Thinking is more difficult and labored, questions are answered slowly and with an apparent effort and there is usually a tendency to avoid social life.

Again replacing the excessive activity in mania the depressions show a retarded action. There is disinclination or disability toward any effort either motor or mental. The patient feels weak and incapable of effort, the body assumes a bent attitude and the facial expression is one of despondency. The appetite is usually impaired with resultant loss of weight, the bowels are sluggish, the period of sleep reduced.

In the more exaggerated cases the retardation may be complete. Introspection is carried to the degree where the patient tries to take unto himself the responsibility for all the sin in the world. He himself is the arch sinner and he feels himself the subject of punishment by divine wrath in a manner in which no other individual was ever punished. Also the introspection tends to produce various hypochondriacal ideas. The patient may feel that he has contracted some incurable disease and that certain bodily functions have ceased operating.

Mental processes become not only retarded and difficult, but actually painful, a symptom which has been termed psychalgia. Suicidal tendencies are also quite frequently present.

In extreme conditions the patient may become so retarded in thought and activity that he apparently receives no stimulus from the outer world. He lives in a more or less stuporous state, even requiring that food be administered by tube.

=Circular Insanity and Mixed Forms.=—In addition to the conditions in which simply mania or melancholia are manifest there are certain cases which show variations and combinations of these forms. A common type is that in which there is an alternation of the manic and depressed conditions. The patient may pass directly from one state into the other, or there may be an intervening period of lucidity. The term circular insanity has been applied to this type. Other variations are those in which there are recurrences of the manic or depressive attacks often at more or less regular intervals, each recurrence being a practical repetition of the preceding.

There is also possible a considerable intermingling of the characteristics of the two types. In the manias may occur difficulty of thinking, passing feelings of depression and even almost stuporous conditions. In depressions there can exist a marked degree of restlessness and activity and a rapidity in the flow of ideas.

=Prognosis.=—The outlook for recovery from the individual attack is good. The attack may last from a period of days to one of a number of months and recovery comes with rarely any evidence of mental deterioration. There is a tendency to recurrence of the trouble. In fact recurrence is the rule rather than the exception. In the osteopathic handling of these cases it has been the endeavor to demonstrate that the correction of lesions had a tendency to lessen the duration of the individual attack and reduce the tendency to recurrence. Judging from the experience thus far gained in the observation of cases under treatment during the attack and the comparative few recurrences reported both of these aims have been attained.

=Treatment.=—The osteopathic measures are aimed at the correction of the spinal lesions, especially those located in the upper dorsal and the cervical regions. Some reflex effects from lesions in more remote areas may have their influence so that it is wise to look to the correction of any other structural variations when present.

Remarks by Dr. Hildreth

The mental disorders of this type are purely functional and may cover a broad scope as to causes; however, from the osteopathic viewpoint a great majority of them seem to have as their specific exciting cause, lesions in the upper dorsal and upper cervical regions. The treatment should be applied specifically to the cause which may range anywhere from the 1st to the 8th dorsal, or from the 1st to the 3d cervical, covering the nutritional and circulatory centers and thus controlling the nutrition and circulation to the brain. There can be no question but what the osteopathic theory of adjustment of physical defects forms the basis of permanent cure, since many of our recoveries had been previously under other methods of treatment without results. Our records cover over 200 cases with recovery in more than two-thirds, and very few recurrences up to the present.

Involutional Psychosis

In the mid years of life, between forty and sixty, a decline begins, which in the older years results in decay; it is especially true at this period of the sexual life and the organs underlying it. While these organs undergo a very definite change constituting the so-called climacteric period in women, it is not at first sight so evident in men; however, the evidence is that a somewhat similar process, though much slower, tends to occur in the male. Associated with the decay of the sexual organs is a disturbance presumably of the internal secretions; if this latter disturbance takes place slowly and evenly the body may not notice any marked changes; on the other hand, if it takes place more quickly, or unevenly, it may give rise to distinct symptoms which indicate a disturbance of the nervous system in general and often even of the mentality. Hence, the significance of the term, Involutional Psychosis. In a large majority of cases the mental disorder is marked by the dominance of depression and is frequently referred to as melancholia. For a long time it was considered that this represented a special mental disorder having little or nothing in common with other psychoses. In recent times Dumas has studied this group very carefully and shown that it in reality has very much in

common with the depressed phases of the Manic Depressive Group of psychoses. Kraepelin himself, who was the first to demonstrate the unity of the Manic Depressive Group, has accepted the conclusions of Dumas and incorporated the Involutional Depressions as a sub type of his Manic Depressive Psychosis. Among etiologic factors have been mentioned hereditary elements, which have been claimed to have been found in at least fifty per cent of all cases, forming presumably a predisposition; it is also stated that a predisposition may be acquired through various debilitating causes. Exciting factors are claimed to be present, such as mental shock, grief, worry and the like. The disease would then seem to occur when we have a combination of exciting factors and predisposition. Careful consideration will show, however, that no such mental disturbance occurs at this age in many people who show evidences of such predisposition and of exciting factors, therefore it would seem that still other causes were necessary; if we consider the suggestion above mentioned that there are atrophic processes taking place in the sexual glands leading to a loss of the internal secretions and if we further consider that this may take place unevenly and in an unbalanced way, thus aiding in giving rise to the symptoms, we will find a definite point of contact for the osteopathic conception. Osteopathically considered, we may say that the spinal lesions lead to a disturbance of innervation and nutrition to the ductless glands, and therefore produce disordered secretions in those patients developing the disease, whereas such a condition may not be present in others who at the same age period do not develop the psychosis.

Symptomatology

The emotional tone of depression dominates the picture. Associated symptoms are anxiety, fears, particularly of impending danger, the loss of interest in the external world, with a concentration of attention upon self; psychic distress is usually present, often to an extreme degree, leading apparently to real mental pain, so-called psychalgia. Delusions are usually present and manifold in variety; they mainly refer to the patient himself and are of a self-accusatory nature; they frequently refer to notions of sins having been committed, also unworthiness of the patient, of poverty, nihilistic ideas, either about his own body or external things. He may claim for example that he has no stomach or kidney, or heart, that the external world is unreal and the like. His motor reactions become retarded, or even in the more extreme cases inhibited, producing a form of stupor. The inefficiency which results along with the psychic pain and distress may determine suicidal tendencies which are very frequent. Orientation is usually good, the patient remaining aware of his own identity and that of his surroundings; the judgment of course is impaired so that the patient is unable to appreciate the unreality of his delusions; as a result he sees no hope in the future and on account of present sufferings prefers death to life. The patient may remain in a perfectly passive mood, giving the appearance of extreme depression, paying no attention to the surroundings, possibly mute, giving no regard to the necessity of the toilet, paying no attention to his clothing and the like. This may continue for hours or days. Food often has to be forced on him, possibly even by the tube; the result is usually more or less emaciation and may result in marked malnutrition; similarly the sleep may be seriously interfered with, even though the patient is quiet. The resulting loss of sleep and malnutrition sometimes lead to the death of the patient. On the other hand, the patient may moan and wring his hands in anguish, walking up and down, crying out that he is a sinner and that he wants to die and the like. This is the so-called melancholia agitata.

The physical symptoms of importance are sleep disturbances, poor appetite, with emaciation, cyanosis, often a subnormal temperature, low blood pressure, slowed heart action and weakened circulation. The hair may become gray, the skin dry and harsh and indeed any of the signs of senile decay may appear.

=Diagnosis and Prognosis.=—These depend partly upon the mental symptoms, partly upon the physical. On the mental side is to be emphasized marked depression, with the relatively clear orientation, resembling the depressed phase of Manic Depressive insanity; also the dominance of the self-accusatory delusions. On the physical side the age period, and the evidence of previous attacks, even though very slight. The prognosis from the study of the mental symptoms depends on the presence or absence of signs of defect, or deterioration, as for example foolish and silly delusions. On the physical side the presence or absence of conditions like kidney or arterial disease; in general, it may be said if the physical findings are negative and the mental symptoms show no deterioration there should be a good outlook, particularly if the condition has not become too chronic.

A favorable outlook is always possible if the disease is treated early and the lesions disturbing the activities of the glands and of nutrition and the circulation are corrected and if the other physical findings are negative and signs of deterioration absent.

Since this is probably only a sub-group of the Manic Depressive Psychoses, as has been mentioned above, the results obtained under osteopathic treatment are noted under the Manic Depressive group.

Remarks by Dr. Hildreth

Our experience with this class of cases invariably lead us to the nerve centers which regulate and control the process of nutrition and circulation; it is a matter of keeping up normal equilibrium of all organic life and especially the circulation to the brain. The basis of the treatment therefore is to be found in the nutritive centers, as well as those centers which control the circulation to the brain, the ductless glands, etc.

Senile Dementia

Senile Dementia may be defined as an abnormal weakening of the mind arising in old age. As the word dementia implies, the intellectual change is quantitative rather than qualitative, the prime characteristic of the disease being mental loss rather than mental perversion.

It is commonly stated that a most important cause of the disease is the general malnutrition incident to age. Since only a small proportion of the aged develop dementia, this is probably only a cooperating factor. Other causes mentioned are overwork, emotional strain, traumatisms, intoxications (especially alcoholism), cerebral arteriosclerosis and perhaps heredity.

=Pathologic Anatomy.=—The disease is organic, the brain exhibiting definite pathological tissue changes. There is an atrophy of many nerve cells and a proliferation of neuroglia fibers, so that the cerebrum becomes shrunken and hard, with thickened meninges and thinned cortex, and shows a loss of weight. The cerebral arteries may or may not exhibit sclerosis, thrombosis, or miliary aneurisms, with resultant areas of softening. The cells show pigmentary degeneration and many of the association fibers have disappeared.

=Onset.=—The onset of this dementia is usually very gradual, the condition not being recognized until rather marked. It occurs mainly in the seventies and later and in the late sixties, being rare before sixty. It often follows financial reverses, emotional shock, or various diseases. The earliest symptoms are a change in the person’s disposition, slight disorders of memory, and trivial lapses of various sorts.

As the disease progresses the symptoms become more marked and fundamental, involving not only the intellectual but also the emotional and volitional phases of consciousness. Interest in the outside world begins to flag, attention to wander, perception to be incomplete and inaccurate, association of ideas to be slow, memory to weaken and judgment to be impaired. Memory of the most recent incidents is the first to be lost, of recent years next, and then of middle age so that the patient may not recognize his own children or know, for example, that his wife is dead; finally the memory even of youth is lost and the patient is to all intents and purposes a child, his condition being an exaggeration and aggravation of that commonly known as “second childhood.”

Several forms of Senile Dementia exist, of which the most common is probably the simple or non-delusional type. Other forms are fundamentally the same as the simple, but with certain superimposed symptoms. Fairly early in this type it becomes unsafe for the patient to continue in business. Due to impairment of memory and judgment he is apt to lose his property. Soon his work is poorly done or neglected entirely. He becomes garrulous and annoys his associates with tiresome repetitions of childish reminiscences, continually wandering from one subject to another. His speech becomes incoherent and his sentences fragmentary. He grows untidy and indifferent to the ordinary niceties and conventions of life. His appetite is either poor or voracious; in the latter case the weight may keep up fairly well. He may be either apathetic or turbulent. If the former, he seems stupid, indifferent, and sleepy. He is credulous, docile, and very suggestible. Patients of the turbulent type are restless and always moving about, either depressed or elated, giving unreasonable orders and then contradicting them. Sleeping poorly, they are apt to get up and wander about the house at night. In men, prostatic disease may cause a recrudescence of sexual feeling. Patients of either type eventually become filthy, soiling their clothing, etc. Even in well advanced cases, however, senile dements are often able to perform well certain habitual activities, such as signing their names, or playing certain games, such as checkers or dominoes.

=Confusional Type.=—Another form of Senile Dementia, which may in severe cases usher in the attack, but which usually, when present, is sequent to the simple form, of which it is a more severe grade, is the confusional. The additional symptoms of this type are probably due to defective elimination and the consequent toxicity. Usually unsystematized delusions, and sometimes hallucinations are present. Except for a possible occasional period of remission the confusion is continuous. It varies greatly in degree, now being mild and passive and again active, perhaps developing into delirium. Orientation as to both time and place may be lacking. Such patients may ask for dinner a few minutes after a meal, go to bed at noon, be unable to find their own room, or to recognize their own children. They are apt to be obstinate and peevish. Delusions vary in type but both these and the hallucinations are usually painful and, being referred to the patient’s associates, give rise to the thought that they are trying to kill or otherwise

harm him.

=Delusional Type.=—A third type of Senile Dementia is the paranoid form. Dements of this type, owing to delusions of persecution and auditory hallucinations are sensitive and suspicious. Such cases may sometimes show good orientation, apparently unclouded minds, and little evidence of senility, requiring careful study to differentiate the condition from true paranoia. A patient may, on account of hallucinations of taste and smell, refuse food in the belief that it is poisoned. Members of his family who are devotedly caring for him are suspected of designs on his money, and this suspicious attitude frequently leads to unjust wills. The delusions and suspicions may be entirely concealed from the family. Wealthy paranoid elements are peculiarly apt to become the prey of scheming adventuresses, particularly in case of the above mentioned sexual recrudescence, and marry them. Opposition of the family is regarded as part of their general persecution or as due merely to their desire to get the estate. Some patients merely appear odd, suspicious, untidy, peevish, and childish. Some have expansive delusions and exhibit the euphoria so frequently found in syphilitic dements.

=Senile Delirium.=—A fourth type has been described by some psychiatrists under the title of senile delirium. This may appear as the initial form of the disease or as an acute attack in one of the above forms. It is characterized by great incoherence and restlessness, entire absence of orientation, and numerous rapidly changing delusions and hallucinations, the condition resembling delirium tremens. It is probably due to some somatic cause, such as nephritis, pneumonia, or cystitis, which is often fatal.

Complications may arise in Senile Dementia, such as apoplectic strokes, hemiplegia, epileptiform seizures and aphasias.

=Prognosis.=—It is evident from the pathology of the conditions that the prognosis is not at all good when the disease is well advanced. It is a chronic disease and usually progressive until death, which is due to one of the complications, malnutrition, or especially pneumonia. However, many cases have shown improvement, and in incipient stages recovery. A cure of advanced cases being impossible, the important consideration is prevention or arrest in its incipiency.

It is evident that this can be done only by preventing, or removing as far as possible, the predisposing causes. A glance at the list of these shows that much depends upon the cooperation of the patient by regulating his habits of life. Physical and mental overstrain must be avoided, deleterious habits, such as the use of intoxicants or narcotics given up. Much can be done by osteopathy to eliminate the effects of these upon the organism. Cardio-vascular and renal symptoms are very important and should be watched for in order that early treatment may check the process initiated. To this end the patient’s habits and diet must be regulated and treatment instituted to relieve toxicity and promote elimination. Lesions must be corrected, special attention being given to the lower dorsal that affect the kidneys, the upper dorsal that affect blood pressure, and both the upper cervical and upper dorsal that affect the blood supply and nutrition of the brain.

=Arteriosclerotic Dementia.=—This is a mental enfeeblement arising sometimes in the fourth, but chiefly in the fifth, decade of life, and associated with symptoms of arterial hardening.

The cause is arteriosclerosis, which may be secondary to some form of nephritis. The arterial hardening may be general or may be confined to the arteries of the cerebrum. It is likely that the arterioles supplying the cortical cells are especially involved in an atheromatous condition. The disease is organic, chronic and progressive. Hemorrhage, embolism, or thrombosis may occur, producing focal lesions and areas of softening, with hemiplegia, aphasia, etc.

The earliest symptoms may be headaches and dizziness. The blood pressure is usually found to be high but not invariably. An atheromatosis may be present in some one of the palpable peripheral arteries, such as the radials. Further symptoms on the physical side are quick fatigue, loss of energy, numbness and paresthesias of the extremities, and somnolence in the daytime or perhaps insomnia at night. Strokes may occur, usually slight and temporary, probably due to spasm in a degenerating artery or perhaps to serous effusion. Toxic symptoms appear, due to disorder in kidneys, liver, and other organs. Epileptiform seizures are possible. Mentally the patient shows impairment of memory, and perhaps some confusion and hallucinations. Rarely stupor occurs. He may be agitated and irritable or melancholy and depressed. Suspicious and persecutory ideas of the paranoid type may appear; also hypochondriacal ideas.

=Osteopathic Theory.=—In these psychoses of the older years of life the termination is usually dementia, which means mental enfeeblement, and which results from degenerative changes in the brain substance. As has been shown it is largely a nutritional question and the nutritional condition varies tremendously in different elderly people; it is well known that many old people preserve their brain powers fairly well to the end; on the other hand others fail relatively early, some even in the fifties; these cases of earlier

failure are referred to as the “presenile type.” The osteopathic conception would be to find out the source productive of the nutritional disorder and correct it at the very outset, therefore making it quite possible to prevent the disease process from taking place. The prognosis then in the earlier stages is very good.

Remarks by Dr. Hildreth

While many cooperating factors may be found in the causation of the mental disorder of elderly people, our experience shows there is always very definite disturbance of nutrition and the nutritional centers. We find chief physical interference between the 3d and 8th dorsal vertebræ, most definite as a rule at the 4th, 5th and 6th, with the corresponding ribs on the right side. Contributing causes may be found in other areas, associated with the disturbances of the heart and circulation and of the kidney. In the cardio circulatory disorders we find abnormal spinal conditions in the upper dorsal region and especially the 5th rib on the left side. In the kidney disorders we find the lesions usually at the 10th, 11th and 12th dorsal. The above mentioned areas in general represent the centers of control of the splanchnic nerves and therefore the important processes of digestion, metabolism and assimilation. Specific treatment applied to these points is very helpful and results in marked improvement and indeed in relieving the patient’s symptoms completely when in the earlier stages of the disease.

DEFECTIVE CHILDREN

By RAYMOND W. BAILEY

It is our purpose here to impress on osteopaths the almost unlimited possibilities in the study and treatment of mental conditions of children, which heretofore have been considered hopeless. Osteopathy has demonstrated that it has much to offer to this class of defectives but the profession has not thoroughly appreciated its great possibilities. It has been the custom to send these children to institutions where they have received care with some attempt toward education but with absolutely no effort being made through physical treatment to overcome their debility. We shall show that the osteopathic lesion is of prime importance in these cases, and that we have been slow to realize the efficacy of osteopathic treatment for such seemingly hopeless children. We cannot emphasize too strongly the importance of accepting and treating these cases wherever possible.

The mental diseases are considered under two general heads: (1) Inherited, and (2) Acquired Tendencies.

=1. Inherited Tendencies.=—In this class are those cases arising from poor endowment of the protoplasmic structure through lowered vitality of the parents or other progenitors. These taints may come from either parent, or both, and may exist in the offspring from some preceding generation. Such diseases are constitutional and are amenable to supporting treatment in direct proportion to the amount of endowed energy inherent in any given organism.

Of the inherited tendencies, we have two kinds:

=1. Congenital Diseases.= (a) From any influence of an inherited nature not directly acting on the environment of the parent while the fetus is in utero, and

(b) From any influence which directly affects the development of the ovum through imperfect fertilization coming through either parent or both.

=2. General Impairment.=—This condition exists (a) Where a similar defect has existed in foregoing generations and is strictly hereditary;

(b) Where general vitality is diminished from such causes as neuropathic parents, or where there have existed constitutional defects, such as tuberculosis, syphilis, epilepsy, alcoholism, abuse, overwork, strain, acute inflammatory diseases, and poor health of the mother during gestation; also consanguinity.

(c) Premature birth tends to impairment physically and mentally of growth of organism and frequently leaves its manifestations of marasmus, rachitis and other nutritional disturbances.

(d) Prolonged labor may leave its mark on the child where more or less asphyxia has occurred resulting in obstruction to cerebral circulation.

Causes acting after birth to the already impaired germ cell and resulting in many of the afflictions of early life, both mentally and physically, are

1. Traumatism. 2. Convulsions. 3. Rachitis. 4. Infectious fevers. 5. Meningitis.

All of these seriously affect the metabolism within the newly-born, a process which is begun, doubtless with difficulty, and susceptible to easy derangement, and the same effect magnified with growth into its subsequent mental and physical deformity.

=2. The Acquired Tendency.=—In this the second great class are those conditions arising subsequent to conception where germ plasm is healthy but growth is arrested by some external factor either intra- or extra-uterine. Thus the acquired tendency may be given to the fetus in utero and not be considered congenital as in case of injury affecting health and growth of otherwise healthy conception. In short, the acquired has its beginning at conception or subsequent to it while the congenital is previous to conception or already inherent in the germ plasm leading to conception.

Any influence which retards the

1. Inherent capacity of cell for growth or,

2. Adequate blood supply either in quantity or quality results in enfeebled offspring and these causes are enhanced by

(a) Traumatism or Injury (b) Drink or Abuse (c) Dirt or Unhygienic surroundings (d) Depravity or Ignorance

Factors entering into acquired tendencies affecting offspring direct are divided into three classes, those:

I. Before Birth such as

(a) Abnormal condition of mother’s health during pregnancy as in disease of any nature, mental or physical or

(b) Injury to fetus direct by blow, fall of parent, or instrument.

II. During Birth from:

(a) Abnormal labor from any cause.

(b) Primogeniture.

(c) Premature birth.

III. After Birth.

(a) Traumatism.

(b) Toxic causes such as scarlet fever, whooping cough, meningitis, measles, mumps and exanthemata.

(c) Convulsions.

(d) Nutritional disturbances.

Consanguinity or intermarrying of blood relations, or in-breeding results in:

1. Instability of the nervous system.

2. Intensifying of constitutional defects.

3. Decrease in size of offspring.

4. Predisposition to disease through lowered vitality.

5. Impairment of reproductive function.

Immediate consanguinous offspring may manifest a high degree of intellectual or physical attainment but successive processes tend to neurotic types and are prone to physical weaknesses and insanity. This practice is found among Quakers and Jewish peoples, inhabitants of the Islands north of Scotland, in isolated rural localities, and among African tribes.

Mental Deficiency in Children

=Synonyms.=—Amentia; feeble-mindedness.

There are three grades of amentia:

=1. Morons:= those whose mental age corresponds closely to their chronological age or is nearly normal.

=2. Imbeciles:= those in whom there is a wide disparity between the mental age and the chronological age.

=3. Idiots:= the lowest form of arrested mentality or those whom it is impossible to teach.

=Definition.=—Mental deficiency is a pathological stage in which the mind has failed to attain normal development.

=Various degrees of intelligence= or mental capacity in man lie between:

(=1=) =Genius= such as Bacon, Newton, Plato, Galileo, Shakespeare.

(=2=) =Lesser Ability= but still conspicuous in development such as our great leaders in science, literature, reform and the arts and medicine, furthering, each their respective causes. These merge easily into

(=3=) =Average= mass of mankind.

(=4=) =Dullards= or those of inferior intelligence.

(=5=) =Feeble minded=, merging imperceptibly into

(=6=) =Imbeciles= and by insensible gradation into

(=7=) =Idiots= and gross idiots.

The mentally defective is wholly incapable at maturity of adapting himself to his environment or local conditions in order to maintain existence independent of any external support.

=Dementia= is a disease of the mind or that which was once possessed, and by some neuronic disturbance is lost totally or partially.

=Insanity= is a disturbance of neuronic function which may or may not end in degeneration of brain tissue.

=Physiology.=—The normal brain begins its development shortly after fertilization of the germ cell, by the expansion of the anterior end of the rudimentary spinal cord into four primary cerebral vesicles. These develop into a series of elaborate infoldings, each with multiple cells around them. At or about the sixth month of fetal life this embryonic brain assumes the shape of the adult brain, minus the secondary fissures and convolutions which are characteristic of full development.

At birth there are sometimes many convolutions and the brain weighs from 280 to 330 grams. Growth is then rapid and at six months it weighs from 560 to 680 grams;

At one year, 750 grams. It continues to increase until

At 12 to 14 years it weighs 1150 grams in the female, and 1300 in the male;

At 20 to 21 years the weight is 1244 grams in the female and 1374 in the male.

Growth is slow from this time until at 25 to 35 years the average weight of the brain is 1269 grams (45 oz.) in the female, 1421 grams (50 oz.) in the male.

This growth of the brain is due, first to the rapid multiplication of nerve cells and, secondly, to the individual enlargement of each nerve cell. These cells arise from the floor of the four primary vesicles and are each similar to its fellow. They finally show differences in feature and become characteristic in size and shape which process continues throughout life. This process of differentiation of nerve cells results in the peculiar laminated appearance of the brain cortex. At the period of lamination, the nerve cells throw out delicate processes which pursue definite directions throughout the brain mass constituting a system of association fibers which link together in a most complicated manner all parts of the brain, and are called the association fibers of Flechsig.

Projections from these cells form the various pathways by which the brain is connected to the various parts of the body.

Nerve cells in the different parts of the brain mature at different periods, those areas which have to do with the highest intellectual functions, viz., the frontal and parietal regions, maturing last.

At the seventh month of intrauterine life the brain cell is a small round type of neuroblast, undifferentiated, lying in a matrix. The cells increase in size until about the second week (extra-uterine) of life, tiny processes begin to develop. At the third to fifth year these cells are mature and possess axons, dendrons and geminules. These communicate, forming the above named association system conveying impulses to and from all parts of the cerebrospinal system. They multiply and elaborate after puberty into a complicated system up into middle life after which growth ceases and they slowly diminish.

=Greatest Growth= is between the first appearance of the primitive brain and the end of the sixth month of life (extra-uterine), hence it is during this period that any adverse conditions relative to development of nerve cells may cause the greatest damage.

=Mind and Brain.=—Whatever may be the connection between these two, we know that the former develops with the growth of brain cells and fails with their decay. =Amentia= is associated with the incomplete development of brain cells and =Dementia= is coincident with their degeneration and death.

=Pathology=—=Brain.=—Structural abnormality of the brain tissue may exist without variation of mentality or defect. Early observers gave these gross defects as a cause for amentia. However, it has been demonstrated beyond doubt by microscopic examination of cerebral neurosis that cellular changes occur and that imperfect and arrested development exists and is an essential basis of amentia.

=Histology=—=Blood Cells.=—Cortical blood cells in the ament are

1. Numerically fewer.

2. Irregular in arrangement.

3. Imperfectly developed.

4. Microscope reveals changes proportionate to the deficiency during life.

=Blood-vessels in Amentia= show no marked changes from those of the normal brain. Hyaline degeneration may be present; also pigmentation. These conditions are not constant in amentia hence cannot be considered causal.

=Neuroglia in Amentia.=—Sclerosis and hypertrophy occur in a large proportion of cases. This is diffuse throughout the brain, with here and there certain circumscribed areas forming nodules.

=Nerve Fibres of Cortex in Amentia.=—Association system fibres are always diminished in number and not so complicated.

=Clinical Varieties of Amentia.=—There are two varieties of amentia and conventionally for sake of study we must arrange them into those from

(1) Congenital causes and (2) acquired causes.

Among those which arise from congenital causes we have the microcephalous and Mongolian types. In both cases there exist constitutional taints through successive or immediately forgoing generations of such diseases as syphilis, tuberculosis, epilepsy, and acute alcoholism affecting proper collaboration of germ cells previous to fertilization and hence impaired germinal endowment through a weakened nervous system.

Those arising from acquired causes are from injury to mother or fetus.

=Macrocephalus.=—A person whose skull measures less than seventeen inches in its greatest circumference. This class comprises less than 10% of all aments.

=Cause.=—The type is neither a freak reversion of the species to a lower grade of development nor accidental, but due to an inherited blight on the nervous system arising from constitutional disease, alcoholic and sexual excesses, consanguinous unions and too numerous latter-life pregnancies in undermined health states. They come entirely from neuropathic stock and their brothers and sisters are degenerates. Many dwarfs exhibit this type.

=Characteristics of Microcephaly.=—(1) Circumference of skull diminished; (2) Brain smaller; (3) Stature small (5 feet); (4) Rarely live to advanced age; (5) Die of tuberculosis; (6) Mostly imbeciles and idiots (few morons).

They have their sensory impressions intact and are generally vivacious and muscularly active, even restless. They have good sight and hearing and are highly initiative but have not the ability to any sustained effort. They are actively observant and the majority are affectionate and well behaved. Some are unsteady in walking, others are helpless, and about one-half are subject to epileptic fits.

=Mongolian Amentia= (Mongolism).—This type (Kalunk or Tartar variety) received its name from Dr. J. Langdon Down from their facial resemblance to members of the Mongolian race. They number about 5% of all aments including the semi-mongols who have only a few of the characteristics of this type.

=Cause.=—Eleven out of twenty-five are from syphilitic origin. Glandular or nutritional defects are suggested as a cause. They will show negative Wassermann test and positive tuberculin tests. Uterine exhaustion and ill health of mother during gestation are factors suspected of entering into this condition. The latter-born of large families are frequently affected.

=Pathology of Mongolian Idiocy.=—The brain of the Mongolian ament is considerably under-sized and has less convolutions and is more shallow. The pons, medulla, and cerebellum are about half the size of ordinary feeble minded types. The cells by microscopic examination show an immature condition. This lack of brain development results in deficient expansion of base of skull, hence the characteristic physiognomy. There is no glandular abnormality.

=Description of the Mongol Type.=—This type is distinguished by characteristics of skull, eyes and tongue and is usually observed at birth.

1. The skull (Brachycephalous) is rounded and diminished in size particularly through the antero-posterior diameter. The face is flattened, there being no recession of frontal and supra-occipital regions.

=Eyes.=—The palpebral fissures are narrow and slope obliquely downward and inward. Lids inflamed.

=Tongue= protrudes, is large and marked by large papillæ and scored by transverse fissures due probably to tongue sucking, predisposing to inflammation of the mucous membranes.

=Ears= are small and round and have poorly developed and irregular lobules.

=Nose= is short and flat and has triangular nostrils.

=Teeth= are soft and ill formed and tend to decay.

=Hair= is usually scanty and wiry and very dry.

=Cheeks= are flushed. Palate is high and narrow and mouth is open, and lips are cracked. Adenoids exist in all cases.

=Hands and Feet= are broad and clumsy. Flat foot and knock-knees are common. Skin is rough, coarse and dry.

=Abdomen= is large and mushy. Umbilical hernia often present.

=Circulation= is rarely good, causing blueness and coldness of extremities, with sores and chilblains. Heart lesions are frequent. Lesions of a chronic inflammatory nature in respiratory and digestive tracts exist. Nasal and bronchial catarrh and diarrhea are common. Mongols die early (about 14 years) usually of phthisis.

Available statistics show the various types and variations of these conditions in great detail; however, the above will enable the reader to classify and properly diagnose in given cases. It is not the writer's intention to portray here what is easily a treatise by itself.

=Osteopathic Consideration of Amentia.=—During a period of five years, observation of the various types has led me to believe that much can be done to correct circulation to cerebral structure with consequent development of brain tissue and function, where discoverable trauma exists. From all available sources there is traumatic interference in from 15 to 45% of these cases, according to different authors. Where history involves constitutional findings (syphilis, tubercular, glandular and chronic alcoholism) I have treated them with the intent of relieving only until the next phase of the condition would appear. Where trauma alone exists and the family history is good, I know the case is in the field of osteopathy alone, and can be developed to a degree limited only by the

intelligent care of those having the case in charge. Especial attention should be given to discipline, housing, sanitation, personal hygiene and general environment.

=Lesions.=—Atlas, generally rotated. Rarely posterior but frequently resting beneath a posterior occiput. Lateral mass on the posteriorly resting portion of misplaced atlas will become interlocked with transverse process of axis in a few instances, combining the amentia with a progressive inflammatory tendency to the middle ear which by successive abscesses ultimately destroys structure and function; possibly traumatic epilepsy, and surely catarrhal inflammations in all mucous membranes of the head.

Many bony and ligamentous irregularities exist in the various types of mental defective where the cause is inherited weakness, nutritional diseases or kindred sources. Spinal luxations exist singly and in series, causing various palsies, spastic muscles, and deformity. Postural defects, particularly of ribs and costal cartilages cause functional disturbance throughout the thorax and abdomen.

=Treatment.=—Invariably the care of aments entails wisdom of procedure. Reconstruction is the prime object in every instance, hence time and number of treatments must not be considered. Treat to =correct structure; teach= as far as possible; =train= always.

Deft and intelligently applied technique are certainly required in the correction of these cervical lesions. Treatment should be given thrice weekly (never less than twice for progress) with definitely established mental tests before, to discern the mental level, and at succeeding periods of three months each, noting progress, if any. The Binet-Simon scale or some other available mental test should always be made and record carefully kept of each case for your own benefit as well as the patient's. After six months, if no appreciable gain is shown treatment is discontinued and the case must be cared for in another manner as beyond your special field of effort. Usually it is apparent by the end of the third month if anything can be done to improve the mentality. The physical advantages, in some cases warrant continued treatment where there is no appreciable mental gain. Institutional care of these types is the only practical means of handling them properly from an osteopathic standpoint, as it requires some one properly equipped to make your tests and keep your record;—it is sufficient for the doctor to do the work demanded. They can thus be classified and progress systematically shown. The higher grades must be taught and though self dependence may never be attained they can in many cases by training be capable of useful pursuits and quite frequently remunerative work. It makes for happiness at least to keep them busy and forestalls the mischief that would otherwise result. Even imbeciles can help in routine work of an institution or home, and idiots may, by training, gain some power of self help and cleanliness. Training depends on the individual capacity for such in each case—his habits, and general character of his propensities. Prevention of their marriage should be positive and for prevention of their propagation this and their sterilization by operation are the only two measures at hand. Sterilization, however, is repugnant to some elements of society and could be abused, hence the segregation of aments would appear to be our only solution at present. The ultimate intention of treating any case is to use any measure tending to stabilize the nervous system. Corrective effort alone is not sufficient but these osteopathic endeavors in conjunction with proper discipline, good food, regular rest and personal hygiene both mental and physical and a scrutinizing restriction tending to any kind of excess is rendering the osteopathic procedure in such cases rapidly indispensable for the treatment of amentia.

POST-OPERATIVE TREATMENT

By GEORGE A. STILL

At the convention of the American Osteopathic Association held in Boston in 1918, I gave a short talk on the above subject, and during the day after I had given the lecture, two women and one man, graduate osteopaths, asked me if I really meant to convey the impression that we actually gave osteopathic treatments to recent surgical cases. I do not know whether I convinced them or not, but I do know that they convinced me that there are people practicing osteopathy who have absolutely no concept of its merits and underlying principles.

To my surprise I have found that a great many osteopaths who consider themselves absolutely "pure" are just a bit startled at the thought of handling post-operative complications by treatment. These are invariably fellows who have had most of their experience in office work, and who do not come in contact with acute cases. Still it is difficult to conceive how a man can believe that osteopathy is specific for certain diseased conditions and not for others. As a matter of fact osteopathic treatment has not proved itself more satisfactory in any field of therapeutics than it has in post-operative conditions.

The common post-operative conditions are pneumonia, pleurisy, backache and headache, nephritis, vomiting, neuritis, phlebitis.

Taking up these subjects and discussing the least serious first we would of necessity discuss pneumonia last, as it is the most serious, and is less influenced by other conditions. It will also serve to illustrate many of the details in treatment.

We will therefore briefly take up the other conditions and then discuss pneumonia more fully.

Vomiting

We believe there is no question that a good part of the prevention of anesthetic vomiting is in the preparation of the patient, including a good cleaning out of the bowels without debilitating cathartics. In other words, the vomiting is increased if the alimentary tract is loaded, or if on the other hand it has been irritated to the extent of losing its tone. Combining a careful preparation with a straight ether anesthesia and osteopathic treatment to the neck and splanchnics we have been able to eliminate any serious post-operative nausea. I do not recall a case in the last few years that vomited on the following day unless the condition for which they were operated was one that essentially in itself would cause vomiting; for instance if the patient had peritonitis and had been vomiting due to the toxic ileus. They might even vomit after the abdomen had been opened. This could hardly be called "post-operative" vomiting.

The improvement in our records in post-operative vomiting is in proportion to our increased faith and use of the osteopathic treatment. Time and again patients have told us that they had taken anesthetics before and were sick from three to five days and even a week. Invariably we have been able to surprise these patients by the fact that they were sick less than a day.

The usual treatment with bismuth sub-nitrate, cerium oxylate, sour wine and the other usual remedies were not used in any case or in any amount. No drugs whatever were employed.

Backache and Headache

There is practically no difference in the post-operative headache and the office headache. There is of course the usual multiplicity of causes, and as a matter of fact in this condition treatment can more nearly approach the ordinary office treatment, and the results are about the same. As for backache, we find that speed of operating and not keeping the patient under the ether too long has a marked influence. Also we have a four inch Seely mattress on the operating table which helps some. Treatment does the rest and does it effectively. For this complication even the ordinary nurse knows enough to give a treatment of some sort.

Neuritis

Nine times out of ten the post-operative neuritis is really a local osseous lesion, a slipped innominate, rib, vertebra, clavicle, biceps tendon or something of the sort, and responds quickly to a specific treatment.

Phlebitis

This complication usually comes on quite late after an operation and at first it is sometimes hard to differentiate it from a neuritis. Absolute rest of the involved part with lower spinal treatment gives relief, but under no circumstances should the affected part be freely moved while there is active inflammation. The reason for treatment of the lower spinal area is that practically always one of the saphenous veins is involved.

Nephritis

This complication is to a very big extent eliminated by a careful urinalysis prior to the operation, and careful preliminary treatment in indicated cases, and in other cases the postponement or if necessary complete elimination of the operation where it is not a case of life and death. Where the condition does appear we have found it the hardest of the post-operative complications to control. Indeed it is the only one that we have not found very easy to manage.

We do not vary the treatment for a post-operative nephritis from what we would use in any ordinary case of nephritis. We have observed treatment of this condition in many cases under medical management, and while we are satisfied with the osteopathic treatment comparatively we are not yet satisfied that we have it developed to its greatest efficiency.

Pleurisy

This condition in nearly every instance can be corrected with one or two treatments of a twisted rib unless it is the pleurisy of a beginning pneumonia. As far as the pain is concerned the simpler type hurts as much as the one that is going to develop a real complication. For this reason relief obtained by a single treatment often seems little short of miraculous to the patient.

Pneumonia

When I took charge of the surgical work at Kirksville, osteopathy was not used in post-surgical treatment. Post-operative vomiting was treated medically, as were other post-operative conditions, including pneumonia. Cases of a real major surgical nature rarely got an osteopathic treatment.

The idea seemed to be that osteopathic post-operative treatment had to be along the same lines as it would be for such an illness as lumbago, brachial neuritis, or ordinary pneumonia, and other non-surgical conditions where the patient could be placed for giving a treatment in a position that was not permissible following an operation, as it would work great harm to the wound.

It seemed to me that if osteopathy was effective in a case of ordinary non-surgical pneumonia, it should certainly be good for a case of pneumonia that was post-operative and that all we had to do to handle the condition was to apply a new technique of treatment that could be used on a patient who had a surgical wound. All we had to do was to so manipulate the spine that we would get the results locally, and yet handle it in such a manner as not to affect the wound.

Many laymen, and even some physicians of our own school, express surprise at the suggestion that we do much osteopathic work in the after care of surgical patients. But the fact is we have worked it out so that now, except for pain, during the immediate after effects of the operation drugs are absolutely not used in our hospital for any of the post-operative complications. The opiate immediately following the operation, is really a follow up of the anesthetic, and we use that as rarely as possible. Needless to say, there are cases such as un-united fractures, extensive adhesions, etc., where the emergency conditions positively call for some relief of the pain for a short while, but that is the only condition that we cannot control with mechanical treatment.

I am very glad that I had the confidence to give this an early trial and a thorough trial, without being afraid to leave off the drugs. The big field, however, where osteopathic treatment has won the most impressive success and proved itself a most absolute specific, is in the field of post-operative pneumonia with which I am proud to announce a one hundred per cent. success for combined osteopathic treatment in my fourteen years continuous surgical work. Not to have lost a single case is partly due to luck. In other words, with any series of serious cases, it is impossible but that there be some fatality finally.

Post-operative cases have one advantage along with their disadvantage. While they have the shock of the operation to contend with, and the weakened condition from the disease for which they were operated, still except in extreme emergency they would not have been operated on unless they had a good heart and good kidneys and a good blood pressure, so that in cases in which we are most concerned in combatting pneumonia, we usually start with a patient who has those organs in a healthy condition.

=First Post-operative Pneumonia Cases Treated Osteopathically.=—At the Chicago Convention in 1911, I reported the first post-operative pneumonia cases that had been treated osteopathically. I believe at that time that there had been only three cases. At that meeting I mentioned the fact that some of the doctors and some of the internes who treated those cases felt sure that they were not treating them properly because they could not get away from the idea that pneumonia needed strychnin and other drugs. One of these cases got well in three days from the developed lobar pneumonia symptoms. The results were so miraculous that the young man treating it began to doubt whether it could have been pneumonia. He could not understand how he, a senior student, could overcome this dreaded disease by merely working on the spine. He could not believe that osteopathy, a science that he had been able to learn himself, so easily could cure a condition that he had thought must be almost necessarily fatal.

One of the weaknesses of osteopathy is the fact that there is no mysticism about it. It is so simple that any person with ordinary intelligence can learn to use it, and yet it is so simple that it takes an unusual intelligence to be able to grasp the fact that it is the therapeutic discovery of the age. Many, many times I have had young internes and students cure genuine lobar pneumonia and do it with such obvious ease that it caused them to wonder, in a way, if it really could be pneumonia. It is bred in our very tissues to look for some mysticism, something impossible to understand, something supernatural, something connected with the Unknown associated with the treatment of disease and accordingly it is just human nature to find it difficult to believe, even when we see it, that a simple method of treatment can actually effect a cure.

Real pneumonia, as we understand it, is a consolidation of the lung tissues characterized by fibrosanguinous exudate into the pulmonary tissues and spaces, associated with one or more particular germs as exciting factors and proved by the physical tests

and the character of the expectoration. How many cases have been cured that had not entered consolidation I do not know because up until the time of actual consolidation there may be a question as to whether or not they would have had pneumonia. I know that many cases with marked symptoms of pneumonia have failed to develop under treatment or the case has been aborted.

Pneumonia lacks a great deal of being a self limited disease. The number of cases with beginning symptoms that fail to develop is too great to be ascribed to coincidence. Of course I know that some of these might have been only pleuritis, some only neuritis, etc. However, in giving the statistics of pneumonia cures we will give only those in which pneumonia developed and showed a hardening or consolidation of the lung tissue. In these cases there can be no argument as to whether there was pneumonia.

When we have an acute condition associated with the symptoms of consolidation, we can hardly be confused as to the diagnosis. We may make a mistake in our physical findings, but hardly after a little experience, and certainly when we are sure of the physical findings there will be no trouble in naming the disease.

=The Clinical Findings.=—Post-operative pneumonia is a little different from the common pneumonia. It always comes on a little more insidiously. One has to watch for post-operative pneumonia more closely than he would for the attack that we may meet in ordinary practice. A patient may have considerable pain from his wound, may have some pain in the back from the position he is in; there may be headache, and an upset feeling from ether; and the pain comes in the chest. All these symptoms are forerunners of pneumonia, but the pain in the chest is not noticed until it gets quite severe. In other words, there are other things to annoy the patient as well as the attendant, and at first, this condition does not cause complaint. A strong and healthy individual who feels a pain in his pleura, which is the forerunner of pneumonia, knows it at once, because that is the only distress he has. His entire attention is attracted and he asks for a physician's help. But in the post-operative case, the physician has to keep a look out in order to prevent a case from getting well under way before it is recognized.

As an example of this I had a case of a man who was with a party driving an automobile and they tried to cross the railroad track in front of a train. This patient I speak of was one of the survivors. He had a fracture of the femur, fracture of the skull, fracture of three ribs, and otherwise more or less bruised up. Naturally the preliminary work consisted in getting the ribs and legs attended to as well as possible and looking out for cerebral hemorrhage or meningitis.

This patient developed consolidation in both lungs in spite of regular treatment, and it precipitated on him very rapidly, partly masked by the disturbed breathing from other sources of irritation. We put him on hourly treatment, but after a few hours his condition from the injuries and the pneumonia was such that his wife asked us not to treat him any more. She put it this way, that she knew he would die in spite of all that could be done and as long as he was going to die he might as well die easy. Every time he was treated it had the effect of bringing him out of his stupor, and he would complain, and she thought it would be a kind act to let him slide off into the next world uncomplaining.

Pneumonia in a case of this sort cannot be handled with kid gloves if we wish to save the patient. We must give firm, strong treatment. Light treatment in this condition will do no good. Indeed light treatments in any sort of pneumonia are of little avail. Many times I have changed internes in a pneumonic case that was not responding and the results were immediate. That is, the turn for the better was obvious from the beginning of the good strong treatment.

The case above mentioned was treated a good part of each hour for twelve hours. He had no strychnin, no oxygen, nothing but treatments, but he got well and is now living, and aside from a limp has no evidence of either his injury or his illness.

Some cases, in private practice, may get well on a treatment a day, but I would hate to handle the kind of cases we get in that manner. I have had severe cases, especially hemorrhagic cases, where the treatment was almost continuous for hours preceding the crisis. Of course, after the crisis we can ease up. On the other hand, it is not infrequent that a few good strong early treatments, given at the beginning of a case absolutely stop it. I have seen cases where a consolidation area of the apex of the lower right lobe as large as the palm was easily outlined, and this together with the clinical symptoms would be cleared up in two or three days.

There is no possible medical method by which this can be done. Medical authorities agree that under their treatment pneumonia runs an unshortened course; in other words, a course in the individual case that has not been affected by the medication. Medically, even where the crisis occurs early, the consolidation persists for some time, but I have seen it cleared up time and again under osteopathic treatment in the length of time that could have been brought about only by osteopathic treatment.

I have previously called attention to the fact that many of the medical text books on physical diagnosis mention a point that is a very practical and very plain demonstration of the efficiency of osteopathy in pulmonary conditions. These books only mention this fact

without pointing any moral or drawing any conclusions. The point is this: that frequently when a professor is having a class or a section of a class examining a case of pneumonia, they will outline the size of the consolidation at the beginning, the instructor marking it off when he makes the first examination; then after the students have examined it, by percussion, palpation, etc., possibly a dozen or twenty of them, the later students will find that the area has shrunken perhaps an inch. This fact has been frequently noted. It is said, indeed, that if careful examination is made it will always be noted.

How Manipulative Treatment Benefits

Doubtless this proved that accidental manipulations of the ribs helps clear up the congestion about the real consolidation and reduces some of the dull area. Very likely this explains some of the cases of partial or real results from spondylotherapy. Naturally, scientific osteopathic treatment would necessarily magnify such results very much.

It is a great wonder with the obvious failure of medical treatment in pneumonia, that at least some crude from of manipulative treatment has not been devised by those practitioners. We have already mentioned that the treatment of post-operative cases varies mainly in the manner of applying it. In other words, when we raise the ribs we keep the patient on his back, in treating the spinal centers we treat with patient on his back, and the physician who has no grip in his hands will not be able to treat a post-operative pneumonia to any advantage.

In these cases one has to get at the patient's back by reaching under and the weight of the patient helps to give the treatment, but a strong grip is necessary. It is much safer for the wound to handle the patient in this way but not infrequently beginners wear their knuckles pretty nearly off before they get the finer technique; after which it is easy. In raising the ribs there is no more difficulty in treating in this position than there is with a patient who can sit up or turn from side to side and in some cases a patient can, of course, be partially turned.

Theory is all right but in these cases practice has been added to it in something over three hundred cases treated in this manner, and in this manner only. I have had no case die. None of my cases had oxygen and none of them had strychnin or alcohol unless it was a person who had used alcohol constantly or daily and in these cases I consider that the system has become sufficiently used to it that it is practically a food and that sudden withdrawal is apt to bring on delirium. It is not necessary in those cases that indulge deeply now and then, but it is advisable in those that take a small amount regularly, just as they take food. These patients are used to a constant heart stimulant and its withdrawal is also apt to be reflected in the heart action. These are the only cases in which I have ever authorized anything in the way of a chemical stimulant of the heart during pneumonia.

You will undoubtedly recall that in reading the newspaper accounts of men who are big enough and prominent enough to have bulletins in the newspapers when they are dying, that almost universally the next to the last bulletin was that oxygen is being administered. The last bulletin announces the time of death. You will also note that in case the patient lives that oxygen then is not mentioned, and a few days later the patient is all right. My observation is that the use of oxygen may attract the attention of the family, it may attract the attention of the patient, but as for any actual benefit on the patient I do not believe it is in the least helpful, and that the only treatment for pneumonia is osteopathic. I am so convinced of it that I am using only that method.

As to strychnin, some say strychnin must be given. Some say it must be given at the crisis, and others say it must be given from the inception of the disease. I do not believe the majority of cases will do as well under strychnin. I know they will not do as well under strychnin as under osteopathic treatment. I will not say they will not do as well as if under no treatment. It is possible that there would be an occasion for its use at the crisis, and I have seen such cases, and I have used it while studying medicine. I used it at the crisis, and I used it in cases where I am convinced that it helped them over the crisis, but I am also convinced now that by osteopathic treatment they would have done still better and the crisis would not have been so acute. In other words what strychnin does in favorable cases, osteopathic treatment does better in all cases.

In our post-operative cases study the charts and you will see that they do not have the acutely violent crisis that usually occurs under other treatment. They are under better control and if we can get them near the beginning, as we usually do, we can keep up the resistance so that where they would otherwise have a hard crisis they have an easy one. Instead of having a temperature of 105, pulse 165, respiration 70, or such a condition, they are more apt to run a temperature of 102, pulse 120, respiration 35 or 40 and they go through it without that suddenness and acuteness that is common under other methods of treatment.

In several instances, as an example of showing how this resistance is kept up, I had letters from boys in the camps. One letter told of a wide epidemic of severe tonsillitis. In one group of soldiers there were three osteopaths who treated all the men and this was

the only group that was not sent to quarantine. This group developed sore throat and was treated osteopathically and the sore throats checked so that quarantine was unnecessary.

Among the detailed reports in the A. M. A. Journal there will be nothing about this, nor about many other instances where osteopathic treatment, given by men forced to remain in the ranks, has done things that medicine cannot do. These examples are too frequent to be coincidents. If I had had three cases of post-operative pneumonia and they had all got well, it would not be surprising. If I had ten cases and they all got well, there are medical hospitals that have been this lucky. But there are no medical hospitals in the world that can report one hundred cases or two hundred cases or three hundred with developed pneumonia and all lived. The percentage of pneumonia cases that die now in medical hospitals, is much less than formerly. But the cause of this is not vaccine, antitoxin or drugs. It is due to the fact that pneumonia cases now, like typhoid, are given very little medicine and are turned over to general nursing treatment; that is, in the best medical hospitals.

The mortality is in inverse ratio to the drugs given. The advance medical teaching is against so much drugs in pneumonia, though of course the hick doctors use it because they are practicing medicine of the by-gone age, before Andrew Taylor Still forced on the world the idea partly started by homeopathy, that the less drugs the better. Homeopathy failed in not quite discarding drugs and in not having a substitute that reproved drugs.

As a matter of interest I wish to mention that while in medical college I had the advantage of being taught surgery by the greatest surgeon that ever lived, John B. Murphy. I only wish that circumstances could have permitted me to have shown him what osteopathy could do in post-operative conditions, because Murphy was a broad minded man and no man living ever thought less of orthodox medicine and old fashioned drug treatment than Murphy.

He and the Old Doctor would have been great friends had they ever met. Murphy, whom I considered a most wonderful surgeon, and whose skill I never hope to approach, stated to me many times while a student that he lost more cases from post-operative pneumonia than any other condition and that in upper abdominal conditions like gall bladder, stomach, and similar operations, post-operative pneumonia constituted the most of his mortality.

This great man was afraid of post-operative pneumonia, while I, a much less skilled surgeon, am no more afraid of post-operative pneumonia than I am of something occurring in a distant state because with osteopathic treatment, we have eliminated post-operative pneumonia as a fatal condition.

PART SECOND

INFECTIOUS DISEASES

Fever

=Fever= is due to various causes, so that a definite statement cannot always be given as to the cause of fever in every disease. Each fever case, like all other disorders, is a law unto itself; different causes are found in different cases. Moreover, often only theories, and not absolute facts, can be given.

Fever may be present when a local disease assumes a constitutional character or when the constitutional character is manifested from the beginning of the disease. Fever may be a systemic disorder or a symptom of disease, and is characterized by an increase of body temperature. Other symptoms are usually present, as an accelerated pulse, disturbances of distribution of the blood, increased catabolism, and disordered secretions.

=Etiology.=—In infectious diseases fever is due chiefly to the action of various toxic or harmful agents, produced by the disease, upon the fluids of the body and upon the nervous system. Disturbances of the thermogenic centers and nerves of the brain or cord by harmful agents, or by lesions of the anatomical structures affecting these nerves, are sources of fever. Also disturbances of the vasomotor centers (in the medulla and auxiliary centers along the cord) and nerves are causes of fever in many instances. A disturbed or lessened function of the nerves controlling sweating is an important factor. The multiplication of micro-organisms in the body, acting directly on the tissues or by producing toxic substances which affect the nervous system, is a fruitful source of fever. A few cases may be caused by direct affection of the nervous system, as is shown by appearance of fever in epileptic attacks, or by the passage of a catheter into the bladder. In a large number of all cases a demonstrable cause can be found upon careful examination, whether the fever be due to a necrosed mass of tissue, the introduction into the system of decomposed food,

infectious diseases, a lesion of some anatomical structure affecting a thermogenic, vasomotor or sweat center, a lesion to the innervation to the heart (vagi and cervical sympathetic) causing a rapid heart, or a lesion to the lymphatic system.

=Treatment.=—The treatment of fevers in a general way consists principally of thorough inhibition to the posterior spinal nerves of the upper cervical region in order that the center of the vasomotor system in the medulla may be affected, probably by the way of the superior cervical ganglion of the sympathetic. Thus the entire vascular system is equalized, for there is always a disturbance in the distribution of the blood in fever and if the center controlling the nerves that govern the lumen of the blood-vessels can be brought under control, there will result an equalization of the vascular system; if such occurs, health must ensue. Besides the vasomotor nerves to the blood-vessels being affected by this treatment, the nerves governing the lymphatics and the sweat glands will also be controlled. The sweat glands as a rule are rendered active by affecting directly the innervation of the glands, also the glands are controlled indirectly by the blood supply; this aids materially in lessening the temperature of the body. Treatment for a few minutes to the upper posterior cervical region would also affect the thermogenic centers and nerves of the brain reflexly in the same manner as the vasomotor and sweat centers and nerves are affected, thus tending to equalize the mechanism of the thermogenic system. Besides this action on the vasomotor, sweat, and the thermogenic nerves, there is produced an increased exhalation of moisture from the lungs, on account of an increase of vascular area in the lungs through vasomotor action. Also the large vascular area in the abdomen, under control of the splanchnic nerves, becomes constricted. Thus there is brought about a lessening temperature by evaporation, heat radiation, and perspiration; and an increased action of the general nervous system, a stronger cardiac force, an equalization of the vascular system, and a more perfect elimination of toxic properties by the skin, kidneys and lungs; consequently a reduction of the fever.

The foregoing treatment is successful to a limited extent, only in such cases where causative factors of the fever are involving the predominating centers controlling the heat production or dispersion and the vasomotor system directly; for if the lesion that is causing the disorder should be affecting an auxiliary center along the spinal cord instead of the predominating center, as is oftentimes the case, treatment of the predominating center would be useless as far as any permanent benefit is considered; although a temporary effect will be gained by lessening the fever at that point. Consequently, in many cases, the lesion lies within the jurisdiction of auxiliary centers which are situated at various points along the spinal cord. When such is the case, it will be of little benefit to give the cervical treatment. In such instances the lesion to the auxiliary center would have to be removed in order to cure. One cannot depend upon a set rule to reduce a fever; determine the cause, as in any other disease or symptom, and remove it.

In addition to the treatment to the cervical region and along the spinal column, as are indicated upon an examination, attention should be given to the heart's action. The equilibrium between the accelerator and inhibitory nerves (cervical sympathetic and vagi) should be maintained. The interchange of gases in the lungs should be rendered as nearly normal as possible; this is best accomplished by raising and spreading of the ribs from the second to the seventh dorsals, particularly in the region of the fifth and sixth. Also stimulation of the vagi will aid by increasing the motor power of the lungs. The kidneys and bowels should be kept active so as to favor a rapid elimination of various toxic properties; besides they have control over large vascular areas. Treatment over the ureters will prevent any clogging that might occur in them from a condensation of the urine. Attention, also, should be given the tissues at the fifth lumbar and over the iliac vessels to influence the circulation in the pelvis.

The =food= of the patient should be liquid—milk, soup, broths, etc., and almost any quantity of water allowed if called for, given little at a time and at frequent intervals. The room should be well lighted, ventilated, clean and kept at an even temperature.

=Two points= should always be remembered relative to fever:

First—That there are many causes of fever; and in order to reduce the fever the cause must be determined and removed, the same as in any disorder. A definite fever treatment cannot be given any more than a definite constipation treatment; the case must be seen in order to determine the cause.

Second—The reduction of fever is not necessary; the fever should be treated only as a symptom of disease when it exists as such. In fact, fever is beneficial, for it is one of nature's methods to relieve an over-burdened system from harmful agents, unless the temperature is excessive and continuous and is likely to cause more harm than the primary trouble.

Absolute =rest= in bed always is of decided benefit in lessening the temperature.

=Hydrotherapy= is of immense value in reducing a fever. It is an agent that has been greatly used, and if applied intelligently cannot but be of aid. There is much ignorance in regard to the principles and practice of hydrotherapy, not only among all classes of people, but among well informed practitioners in medicine. The most important function of the skin is as a heat regulator. Knowing this fact, the osteopath treats the vasomotor nerves that control the cutaneous circulation and the nerves that control the excretion of the skin; the nerve supply being from the cerebrospinal and sympathetic nerves. In many difficult and obstinate cases hydrotherapeutic measures should be used to aid the skin in regulating the temperature, as well as to enhance system functions for the same reason that osteopathic manipulations are given. Maintaining an equilibrium in heat production and heat dispersion is necessary in order that the standard of the body temperature may be kept; and the amount of the arterial blood circulating within a tissue determines its temperature.

The principal effect of water as a thermic agent when applied externally is due to the influence of the action of the water upon the cutaneous circulation. Lesser effects would be the mere extraction of heat from the body by evaporation and the equalization of temperatures of two bodies coming into contact. As the body is endowed with compensatory powers, this latter means would apply only to a limited extent. The temperature of the water used is important, as the colder the bath the less effective would its power be in reducing internal temperature. When a cold bath is used there is a driving of the blood away from the surface on account of the contraction of the peripheral vessels; consequently increasing the cutaneous circulation and cooling by radiation is prevented and less heat is lost. A collateral hyperemia occurs in the underlying parts which acts as a protection to the deeper tissues. The cold also inhibits the vasomotor nerves controlling the abdominal splanchnics, and thus a larger amount of blood passes to this immense vascular area. On the other hand, when a warmer bath is used the effect is opposite, and a lowering of the temperature is the result. The cutaneous vessels being dilated, the superficial blood is rapidly replaced by blood from the deeper vessels, thus allowing a cooling of the body to a large degree.

In the various fevers where hydrotherapeutic measures are employed, the object to be gained by such methods is not primarily an anti-thermic one but an anti-febrile reaction; consequently the use of cold water is employed. In mere heat reduction the warmer water would be more effective; but by the aid of the colder water the cause of the increased temperature, as in infectious fevers, is lessened; besides a refreshing and stimulating effect upon the entire system is gained. Thus the aim of the cold bath and friction, is not primarily to subdue the temperature by heat radiation or evaporation, but to correct disturbances governing the formation and the dissipation of heat caused by infectious fevers, and, moreover, to stimulate the nervous system, prevent heart failure, increase the eliminating power of the skin, kidneys and lungs, and to influence the corpuscular and chemical constituents of the blood to a more normal condition.

The full cold bath and friction (Brand Method) is commonly employed in infectious fevers. The half bath, wet pack, or sponging may be used. The modus operandi of each is given under the hydrotherapeutic treatment of typhoid fever.

Typhoid Fever

(ENTERIC FEVER)

In writing of these acute diseases which are self-limiting, it is understood that osteopathy aborts, overcomes symptoms and otherwise changes conditions frequently. When this occurs the case is not typical and it is a typical case which is here described.

=Definition.=—An acute, infectious disease caused by the bacillus typhosus. It is characterized anatomically by hyperplasia and definite lesions of Peyer’s patches and mesenteric glands, and enlargement of the spleen, and clinically by its slow onset, often diarrhea, abdominal tenderness, tympanites, fever, headache, and rose colored spots on the abdomen.

=Osteopathic Etiology and Pathology.=—Lesions to the lower dorsal and lumbar regions are always found, which impair the innervation and vascular supply of the intestines and cause defective nutrition. This is the most important predisposing cause, although general lowered vitality from overwork, improper food, unhygienic environment, and insanitary surroundings, are also of great importance. It is possible that one’s vitality may be so lowered that the bacillus of Eberth, if of sufficient numbers or virulency, will find a suitable medium wherein to multiply and grow, and thus the spinal lesions found in these cases are the result of reflex irritation. But the most probable underlying cause is the spinal lesion, and given two individuals with equal likelihood to infection, one with the spinal lesions and the other not, the former within all probability will be the more likely to suffer an attack. The severity and extent of the osteopathic lesion undoubtedly bears a direct ratio to the probability of attack from an infectious disease. Typhoid fever usually occurs between the ages of fifteen and thirty years. Some families are more susceptible than others. The autumn months, especially after a dry, hot summer, favor the disease. One may be reasonably certain that whenever there is a case of

typhoid the individual has not been careful as to diet, or drinking water, or some rule of health, and wherever there is an epidemic it can always be traced to insanitary surroundings, the water supply, contaminated garden truck or other food, sewage, etc.; although this does not preclude the probability that the osteopathic lesion or lowered vitality of Peyer's patches and mesenteric glands from other causes are important and many times primal etiological factors. The specific poison may be so virulent that practically no one escapes and again those of lowered vitality only will succumb to an attack.

The =exciting cause= is a special micro-organism, the bacillus of Eberth. The contagion may be carried through the air from one person to another, but this is rarely the case. Though the water is the most common mode of conveyance, the bacillus has been found during epidemics in both water and milk. The water may be contaminated by the intestinal discharges which have not been properly disinfected. Extreme cold does not destroy the typhoid germs. Milk may be infected from the milk-can being washed with the contaminated water or the unclean hands of the milker. In fresh milk the germs multiply rapidly. Salads, celery, ice and fruits may be contaminated. Oysters have become infected while being fattened or freshened. It is thought by some that the poison is not eliminated from the sick in a condition capable of transferring disease to a healthy person, but must undergo changes in the soil before it is able to cause the disease in another. Typhoid fever may be caused, however, by direct contact with the stools. Filth, sewers, or cesspools do not directly cause the disease, but they form a suitable medium for the preservation of the typhoid germs.

=Pathologically=, the characteristic lesions in typhoid fever consist of changes in the lymphoid elements of the bowels. These changes are most striking in the solitary glands and Peyer's patches. The alterations which occur may be divided into four well

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Baths and bathing

Various

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Health Primers.

[Illustration]

Health Primers.

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BATHS AND BATHING.

CHAPTER I.

THE PHYSIOLOGICAL ACTION OF BATHS.

Since the influence of baths is exerted primarily upon the skin, and through the medium of the skin, upon the deeper-lying tissues and organs of the body, it is an absolute necessity for the reader at the outset to be made aware of the structure of the skin and its functions, as well as the relations which it bears to deeper-lying organs.

If the skin, say of the thumb, be looked at with a lens of moderate power, its surface is seen to be arranged in ridges and furrows, like a ploughed field; and at frequent intervals along the ridges are little depressions, which are known as the pores of the skin. These pores are the openings of the sweat ducts, and it is through these pores that the perspiration exudes. They are exceedingly numerous, and it has been calculated that there are as many as 2,800 to every square inch of surface, or about seven millions of them altogether. The ridges are seen to be divided into a series of minute hillocks, or _papillæ_, which are arranged in lines. These papillæ are the organs of touch, and are probably as numerous as the pores. They contain in their interior either loops of blood-vessels or nerve-endings.

These nerve-endings in the papillæ are of three kinds, which are readily distinguishable, and are known as tactile corpuscles, pacinian bodies, or end bulbs, according to the form which they take. Between the superficial and deep layers of the skin, the so-called cuticle and cutis, is a layer which partakes somewhat of the character of both. This is called the rete mucosum, and it is here that the pigment, found in the skin of the negro and in certain parts of the skin of white races also, is located.

Beneath the skin, in the subcutaneous tissue, are situated the sweat-glands, which are microscopical bundles of tubing, having one end running through the skin to terminate in the pores. These tubes are, or rather would be, if straightened out, about a quarter of an inch long; and it is estimated that the length of them in the entire body is about 28 miles! They pass through the upper layer of the skin or cuticle spirally, so that, although it is an easy matter for fluid to pass _out_, the passage in the opposite direction is by no means so easy. Each sweat-gland is plentifully supplied with blood-vessels, and is surrounded by a thin muscular coat, which is presumably able to exert, by its contraction, a certain amount of pressure, and so drive the secretions of the gland onward towards the pore, or external aperture.

The hair follicles, like the sweat-glands, are situated in the subcutaneous tissue. They are hollow receptacles, from the bottom of which the hairs grow. Alongside of each of these hair follicles is a pair of glands, called the sebaceous glands, which provide that small quantity of natural grease with which our hair is supplied. These glands resemble little bunches of grapes. The hair follicles are also furnished with a couple of small muscles, which, by their contraction, can cause a sensible erection of the hair. In certain parts of the skin there are glands which furnish a special odorous secretion. These are most plentiful in the arm-pits and between the toes. In the skin itself, and immediately beneath it, is a network of “lymphatic” vessels, whose function, it would seem, is mainly to drain the tissue of waste products. These vessels run towards the “lymphatic glands,” which, when enlarged, are often recognisable at the side of the neck, and which are very generally distributed throughout the body. In certain parts of the skin are special cells containing pigment.

Thus we see that the skin, which to the casual observer is an almost structureless membrane, is in reality a most complex and elaborate organ, richly supplied with blood-vessels, lymphatic vessels, and nerves, having its millions of papillæ and pores, and its miles of sweat-ducts. The hair follicles, with their sebaceous glands and muscles, are also to be reckoned by the million, and its odoriferous glands and special pigment-bearing cells probably by the thousand.

What are the various uses of this elaborate organ? In the first place, it serves as a protection to the softer parts beneath. Secondly, it serves to regulate the temperature of the body, by preventing, on the one hand, the too rapid radiation of the natural heat, and, on the other, by providing a very large surface for the evaporation of the constantly exuding perspiration, it prevents the overheating of the body. Thirdly, it is constantly removing from the body certain effete materials. These are the scales of the cuticle (which we remove whenever we wash and rub the surface), the perspiration, and the sebaceous, or greasy secretion. The amount of sweat varies immensely; it may be almost nil, or as much as a pint in an hour. The secretion of sweat is influenced by the temperature of the air, by exercise, by the drinking of fluids (especially warm fluids), and notably by the emotions. There can be no doubt that the secretion of a certain amount of sweat is necessary for perfect health; and it is the common experience of all that the checking of perspiration is very liable to be followed by dangerous internal congestion.

It has been demonstrated on some of the lower animals that, if the skin be shaved and varnished, death speedily ensues. This has been spoken of as a sort of cutaneous suffocation, death taking place owing to the charging of the blood with matter which should have been removed by the skin. It has been asserted, however, that death is due to cold in these cases; and it has certainly been demonstrated that animals so treated live much longer provided they be kept warm by a layer of cotton wool. Sometimes the skin is superficially destroyed by accidental burning or scalding, and it is well recognised that a burn or scald is dangerous to life in proportion to its superficial extent, rather than to its depth or severity.

The blood-vessels of the skin vary much in size under different circumstances, and the different degrees of pallor or redness of the skin are due to the condition of these superficial blood-vessels. The phenomenon of blushing is well known; and this should serve to remind us that the emotions can not only influence the amount of perspiration, but the size of the cutaneous blood-vessels. The intimate relations existing between the skin and the great nerve-centres should never be lost sight of.

The cutaneous blood-vessels enlarge in certain fevers, as scarlet-fever and measles; they can be made to enlarge also by the application of warmth, or irritants, such as mustard, or the stroke of a whip. Contraction of the blood-vessels is most marked in conditions of fear, or as the result of the prolonged application of cold.

Not only have the nerve-centres a great influence on the skin, but the skin is capable of exerting a great influence on the nerve-centres. This is not to be wondered at, when we bear in mind the myriads of nerve-bearing papillæ with which the skin is beset. When the soles of the feet are tickled, the legs are involuntarily moved; and when the arm-pits and sides of the chest are tickled, loud laughter is the result. These two phenomena are examples of what is known as _reflex action_, i.e., the tickling produces an effect upon the nerve-endings in the skin, and this effect travelling to the nerve-centres (the spinal cord or brain) is _reflected_ to the muscles, and produces movement of the leg or laughter. When the body is suddenly immersed in cold water, a not uncommon result is a shivering and a chattering of the teeth; and when cold water is sprinkled on the forehead or chest, deep inspiration and a catching of the breath is produced. These are examples of “reflex movements,” due to impressions made upon the nerves of the skin; and since many of the results of bathing are undoubtedly due to this kind of reflex action, it is very important to bear it constantly in mind. The connection between the nervous centres (the brain and spinal marrow) and the skin is shown also in the occurrence of what is known as goose skin, or _cutis anserina_, which is caused not only by the application of cold to the surface of the body, but even more readily by the mental states which make the “Hair of our flesh stand up.” The rationale of this phenomenon is the contraction and shortening of the little muscles which we have seen to be in intimate relationship with the hair follicles. There can be no doubt also that the pigment cells, which are scattered thinly throughout our skins, are subject to the control of the nervous centres, and it is well known that the tint of the complexion will sometimes vary with emotional states, as it certainly does with physical states. These considerations are sufficient to show that the skin plays a most important part in the animal economy, as a protective, a secreting, a vascular, and a nervous organ.

An all-important point to be determined with regard to the skin is its power of _absorption_--that is, its power, if any, of allowing substances to pass through it, and so reach the interior of the body. It is well ascertained that, if the surface of the skin be broken, absorption takes place with great rapidity, and that even when the skin is not broken, it is comparatively easy to get absorption of certain matters, such as mercurial ointment or extract of belladonna, provided they be applied with a certain amount of friction. We saw that the ducts of the sweat-glands perforated the skin spirally, and the friction has the effect of opening the mouths of these little ducts, so that the greasy or sticky preparation gets lodged within them and absorbed.

It has been proved with tolerable certainty that gases, such as carbonic acid and oxygen, are capable of penetrating and permeating the skin in small quantities, but it is extremely doubtful if water is ever absorbed through the skin. It has been attempted to settle the question by weighing the body before and after a prolonged immersion in the water, but such experiments are so beset

with fallacies that they are almost worthless. The fact that shipwrecked sailors are in the habit of successfully lessening their thirst by immersion of the body in water, or by wetting their clothes, is well known, but this effect may be due to the arrest of the cutaneous evaporation, or by an effect upon the nerves.

At all events it seems safest, in the present state of our knowledge, to assume that water is not absorbed through the skin; or if it be, that it is absorbed in such extremely small quantities that the effect of baths can in no sense be due to the absorption of the water in which the body is immersed. As to the absorption of the various salts contained in sea-water or mineral waters, there is no evidence whatever that these are ever absorbed even in the most minute quantities. If the salt dissolved in sea-water were absorbed through the skin, it is tolerably certain that sea-bathing, far from being the luxury which it is, would be regarded as a highly dangerous and most unpleasant practice.

Baths of all kinds serve, or may be made to serve, as vehicles for temperature, and by their aid we are enabled to surround the body with a temperature which is different to its own. Before we can fully understand the effect of hot and cold baths on the economy, it is necessary to enter into some discussion of the nature and source of the natural heat, of the body. The natural heat of the human body is between 98° and 99° of Fahrenheit's scale; and this temperature, roughly speaking, is uniformly maintained by the healthy body under all the varying circumstances to which it may be subjected. In the arctic regions, and in the tropics the temperature of the body rests at 98·6°; or, if variations occur, they are so slight in amount as to be hardly noticeable. In a cold atmosphere, therefore, the body has the power of maintaining its heat; and in a warm atmosphere it is equally able to maintain its coolness. This is a remarkable fact, and is due to the power possessed by the human body of adjusting the production and loss of heat. Heat is produced in the body by the combustion of food and tissues, exactly as heat is produced in a fireplace by the combustion of coal. The amount and rapidity of this combustion necessarily varies with the amount and nature of the food consumed and the activity of exercise and other vital processes. The most active tissue in the body is the blood; through its agency most of the combustion processes are carried on, and by its rapid circulation to all parts of the body the most distant points of the human frame are kept at the same temperature. The temperature of the blood is due to the amount of combustion taking place in the tissues, and the amount of combustion taking place in the tissues is due to the amount and energy of their blood supply, which last depends upon the force of the heart's action and the size of the blood-vessels which have the power of contracting and dilating, and which are subordinated to the regulating influence of the nerve-centres. If that part of the nerve-centres (the upper part of the spinal cord) which controls the size of the vessels be injured or destroyed, the combustion processes going on in the body seem to get beyond control and the temperature may be dangerously increased or decreased, the exact reason of one or the other phenomenon not being known. The limits of body temperature which are compatible with life are not very wide; for if the temperature rise to 109° or sink to 76° death will inevitably result, and a rise or fall of 7° from the natural temperature is decidedly dangerous. Seeing how narrow are the limits of temperature within which life is possible, we cannot but be amazed at the marvellous arrangements for maintaining the normal level of animal heat. The body is cooled by the evaporation going on from the lungs; by the more important evaporation going on from the skin (every one who has covered a portion of the skin with spirit and has encouraged its evaporation by blowing upon it knows practically the cooling effect of evaporation), and by the radiation of heat from the surface of the body, and the conduction of heat from the body by things in contact with it.

The _immediate_ effect of a cold bath is to chill the _surface_ of the body, the temperature of which, as tested by a thermometer, may fall several degrees. At the same time there is produced a pallor of the surface and goose-skin. While the surface is cooled, however, the blood itself undergoes an increase of temperature, due to an increase of the combustion processes going on in the body, of which we get additional evidence in the increase of the rate of the pulse and respiration, and an augmented discharge of carbonic acid from the lungs. There is a sudden sense of chilliness, and this impression, made upon the nerves of the skin, produces, by its action on the brain and spinal cord, some slight mental excitement and shivering of the limbs. After the bath has been continued some little time the temperature of the blood falls (sometimes as much as three or four degrees), the pulse and respiration get slow, the shivering gives place to lassitude, and the mental excitement to listlessness. On removal from the bath the phenomenon of "reaction" sets in. The vessels of the skin enlarge, the chilliness gives place to warmth, and the feeling of uneasiness is succeeded by a sense of comfort. This reaction follows most quickly when the bath is of short duration, and when its effects are suddenly induced. The shorter the bath the less is the ultimate depression of the temperature of the blood. The shorter the bath the greater is its power of _stimulating_ function; the longer it is continued the greater is the effect of _cooling_.

The effect of a _warm_ bath is to raise slightly the temperature of the surface and the temperature of the blood. The pulse and respiration are both quickened, and the escape of carbonic acid from the lungs is also increased. The blood-vessels of the skin get dilated, and the surface is reddened in proportion to the heat of the water. Warm baths of a moderate temperature can be borne for

a longer time than cold baths; but if the temperature be too high, and the bath too long-continued, faintness is liable to occur. On removal from the hot bath the skin is in a very delicate and susceptible state, and the vessels are liable to “re-act” in the direction of extreme contraction, in which case dangerous internal congestion may occur. If, however, the skin be protected, and the patient be placed in a warm room, or in bed, a violent perspiration will ensue. In the cold bath the muscles are liable to become stiff; but in the warm bath a stiff and fatigued muscle will resume its suppleness. After a hard day’s hunting a warm bath is a well-known and agreeable luxury.

The phenomenon which is popularly known as “reaction,” and which occurs after both hot and cold baths, is a most remarkable one, and seems to show that our bodies resent any interference with their function. Thus experiments have shown that if the temperature of a healthy man be raised or depressed by any artificial means, such as hot or cold baths, the subsequent reaction in the direction of the depression or exaltation of the temperature is such that the mean temperature of health is accurately maintained. A German observer, Jurgensen, found by a series of accurate observations on a patient who submitted to a series of baths of a temperature of 50° Fahr., each bath lasting twenty-five minutes, that notwithstanding the rapid abstraction of heat, which gave rise to shivering, lasting for several hours, the diminution of bodily temperature which occurred during the bath was followed, after an interval of four or five hours, by an elevation which precisely compensated it, so that the mean normal temperature was maintained in spite of the interference of the physiologist.

It will have been observed that the ultimate result of both hot and cold bathing, if conducted in moderation, is about the same, viz., an increased circulation of blood through the skin. In both cases also, the combustion going on within the body is increased, as evidenced by the escape of an increased quantity of carbonic acid from the lungs. In the case of the cold bath, this increased combustion is due to the stimulating effect of the cold water, while in the hot bath it is due to the artificial heat facilitating the natural combustion processes of the body. The effects of the hot and cold bath upon the combustion processes going on in the body may, not inaptly, be compared to the effect produced upon a furnace by the hot and cold blast, both of which encourage combustion and increase the heat given off by the furnace; but the hot blast so facilitates combustion that the same work is done by its aid, with an expenditure of 2-1/2 tons of coal, that is done by the cold blast with an expenditure of 8 tons of coal. If we want a fire to burn well, we have several courses open to us; the first is to poke it, which may be regarded as simple stimulation; the second is to supply it with a cold blast, in which case we supply large quantities of oxygen, but at the same time counteract the heating effect by the coldness of the blast. By employing a hot blast, the combustion is facilitated without any counteracting chilling. By each of these methods we hasten the ultimate extinguishing of the fire, unless fresh fuel be added. The employment of the hot blast entails the most economical use of the fuel.

It has been said, with regard to the use of baths, that _cold stimulates, but heat facilitates function_. “Between the two therapeutic opposites,” says Braun, “a similar relation exists, as between winter and summer life, and between sea and mountain air. The physician who has, to a certain extent, acquired an insight into the diseased side of mankind, divides the chronically sick into two groups, the one consisting of individuals whose organism has sufficient capital to afford the strong reaction required, the other consisting of persons needing nice management, and whose own power cannot be exposed to any great demand. For the one there is the system of exercise, cold treatment, cold baths, sea baths, and sea air; for the second, indulgence, warm treatment, warm climate, warm baths, mountain air.”

Seeing that both hot and cold baths increase the natural combustion of the body, it will be evident that persons undergoing a course of treatment by either method should be exceedingly careful that during the progress of their course of treatment the best fuel only is placed on the human furnace. They should eat the simplest and most nutritious food, and breathe nothing but the purest air.

CHAPTER II.

THE VARIETIES OF BATHS.

The _tepid_ bath has a temperature of from 85° to 92° Fahr., the _warm_ bath a temperature between 92° and 98° Fahr., and the _hot_ bath a temperature of from 98° to 112° Fahr.

The _cool_ bath has a temperature from 60° to 75° Fahr., and the _cold_ bath is of a temperature below 60° Fahr., downwards to the freezing point of water.

Hot or cold water may be used locally. We are familiar with the hip-bath and foot-bath, and occasionally we meet with baths of a special shape, made for the reception of the arms or hands, in cases where their local treatment has been deemed necessary.

Various plans have been devised for increasing the stimulating effect of water. One method of attaining this object is by keeping the water constantly in motion, as is done in the so-called _wave bath_, common in some parts of the Continent. Another way is by so increasing the size of the bath that the patient is able to move freely in it. In a big bath, not only is the good effect of exercise able to be added to that of bathing, but the concussion of the water on the surface of the body, and the constant change of the stratum of water in contact with the body vastly increases the power of the bath in influencing the temperature and stimulating the skin.

The best of all baths is the _swimming bath_, for in it the bather can indulge in a free exercise of his limbs, such as is hardly attainable under any other circumstances. Swimming is a very valuable exercise, because it employs the arms equally with the legs, and leads to a healthy development of the muscles of the chest. Nearly all good swimmers are big chested.

The _douche_ is a name given to a stream of water, either hot or cold, which is made to fall heavily or with force upon a part. It acts partly by the force of mechanical impact, and partly by its temperature. It is a very exhausting method of treatment, and must on no account be used too long. A column of water 12 feet high, allowed to fall upon the head, is so painful that Esquirol, who submitted to it, described it as resembling the continued breaking of a column of ice on the head, followed by a feeling of stupefaction, which lasted an hour afterwards. The douche was formerly much used in lunatic asylums, and was regarded as a specific against delusions, the unhappy creature possessed by delusive ideas being held beneath the douche until he recanted; and such was the agony thus caused, that the mere threat of the douche was often sufficient to control the wildest of maniacs. Those who have undergone the process of “shampooing the head,” as practised by the hair-dressers of our time, will remember the effect of a stream of cold water allowed to flow upon the head for too long a time.

The most powerfully stimulating action is obtained by the use of the _Scottish Douche_, which consists in the alternate use of streams of cold and hot water. By the hot stream the “reaction” after the cold stream is greatly encouraged. In most of the swimming baths to be found on the Continent, a pump is provided, in order that a patient may himself apply the douche to any joint requiring it, and at the same time encourage his reactive glow, by the exercise of pumping.

In most great bathing establishments two douches at least are provided, one called the _descending douche_, which may be applied to the head, shoulders, trunk, or limbs; and the other called the _ascending douche_, which is designed for throwing a stream of water into the bowel, a method of treatment which is advocated for conditions which it is unnecessary to discuss in this place.

Hot and cold affusion are merely mild forms of the douche.

The _shower bath_ differs from the douche only in the division of the stream of water by causing it to flow through a suitable colander. This method of treatment is severe and exhausting, and must be used with caution, especially with weakly people.

The _needle bath_ is merely a general shower bath. The bather stands within a coil of pipes which are finely perforated, and the water impinges in finely divided streams simultaneously upon every part of the body. It is a powerful general stimulant.

The _rain bath_ consists in the letting fall of large drops of water from a great height upon the part which it is wished to affect.

Packing with the wet sheet is a mode of applying water to the body which is the very reverse of some of the methods which we have been considering, since the stimulating action of the water is reduced to a minimum, and we get the refrigerating action only. It makes very little difference whether the sheet used be moistened with hot or cold water, since the temperature of the skin and the sheet very rapidly approximate in any case, and the more rapid evaporation of the hot water speedily induces a degree of cold quite equal to that of the cold sheet. The patient should be stripped naked and should lie upon a single blanket, the bed being protected by a mackintosh sheet placed between the blanket and the mattress. He is then enveloped in the wet sheet. If a maximum amount of refrigeration is desired he is left uncovered so that evaporation may be encouraged. If, on the other hand, we wish to encourage the action of the skin, several blankets are placed over the sheet.

Having discussed the various methods of using water as such for the purposes of bathing, we may next turn our attention to the _vapour bath_, which is a favourite method of making use of warmth and moisture. Here and there throughout the world there are to be found natural vapour baths; but, as generally employed, the vapour bath is a very simple contrivance indeed, merely consisting of an apparatus for conducting the steam of a kettle into a confined space in which the patient sits. The head of the

patient may be either placed in the bath or not, and the effects of the bath may be expected to differ according as the steam is inhaled into the lungs or not. The domestic vapour bath may consist of a flannel steam-proof cloak, which is worn by the patient, while beneath the chair on which he sits is placed a small portable kettle heated by spirits of wine for the formation of the steam. If the bather is unable to sit up, the steam may, with very great ease, be conducted beneath the blankets of a bed. The vapour bath can be borne much hotter than the water bath, the temperature varying between 120° Fahr. and 150° Fahr. The loading of the atmosphere with vapour, checks, or rather prevents, the natural evaporation of the perspiration, so that while the body is very strongly heated by the steam, the natural methods of cooling the body are arrested. From this it will be gathered that the power of the vapour bath to raise the body heat is very considerable, and indeed the temperature of the blood has been known to rise as much as 5° Fahr. during a bath. This power of raising the temperature of the body causes a very profuse perspiration, so that the vapour bath is recognised as one of the quickest and most effectual means of producing a copious action of the skin. The vapour bath can be locally applied in a very manageable way, and there is no difficulty in contriving an apparatus, by means of which the legs alone, or one arm, or one leg, may be subjected to the action of the vapour. If a quick reaction is desired a cold douche may be added to the steam, and the so-called _Russian vapour bath_ consists of a vapour bath of high temperature followed by a cold douche.

Air baths are baths from which we never escape except when we are taking a water bath, our bodies naturally being always surrounded by a layer of the atmosphere. _Cold-air baths_ are not much employed, although they have been recommended; and we have heard of persons who have sought to stimulate their skins and circulation by running naked in the open air. The _hot-air bath_ has always, at least since the days of ancient Rome, been a favourite luxury and means of treating disease; these baths, which are also called Russian or Turkish baths, consist really in a succession of processes, which, in the best establishments, are as follows: The bather is received at a barrier, where he is relieved of his boots and provided with check napkins in which to swathe himself while bathing. Passing the barrier he arrives at the tepidarium, a room of Eastern design, which attracts him by its coolness, quietness, and cleanliness. A marble basin, filled with water, into which a jet of water from a fountain falls with a soothing splash, occupies the centre, while all round are divans for reclining and conveniences for dressing and undressing. Through a Moorish arch at the end a glimpse is caught of the sudatorium, separated by a plate-glass partition from the tepidarium. Stripping himself naked and donning his checks, the bather passes into the sudatorium, an apartment with a domed roof, and having a marble floor and red-brick walls. The temperature of this room is about 120° or 150°, and here the bather sits, reading or otherwise amusing himself until perspiration is fully advanced. If perspiration is not free it may be encouraged by a draught of cool water, which will be tendered him by an attendant. If perspiration is slow in its advance, the heat of the room causes discomfort. Some burning of the skin, quickness of the heart’s action, and occasionally a throbbing tensive headache. A drink of water generally has the effect of causing the whole surface to bead with moisture, and then a sense of comfort succeeds to discomfort. Perspiration being fairly started it may be still further encouraged by removing into a still hotter apartment (of which there are three) varying in temperature from about 150° Fahr. to 210° Fahr. In these hot rooms (where it is necessary to wear thick list slippers to prevent the feet being scorched by the hot marble) the perspiration, in some persons, streams off the body, and when sufficient perspiratory action has been allowed, the bather returns to the body of the sudatorium, and, reclining on a marble slab, he is shampooed by an attendant. Next the whole surface is thoroughly washed with hot soap and water and the skin rubbed with a horse-hair glove; lastly, the process is finished by the application of cold water, which is done in one of two ways, either by the application of the cold douche, or by diving beneath the glass screen which separates the sudatorium from the tepidarium into the marble basin which fills the centre of the latter apartment. This done the bather is rubbed dry, and then indulges for half an hour in the _dolce far niente_, while he reclines on a divan, reads the paper, sips a cup of coffee and smokes a cigarette. As to the value of the Turkish bath we will speak hereafter, and we will content ourselves in this place by warning the bather not to “overdo” it. He should be guided by his sensations, and should not be tempted to go into this room or that room, or submit to this or that process merely because a friend does so with benefit, or without harm. He must remember that constitutions differ, and if the bath is followed by headache, or a feeling of faintness or lassitude or a want of appetite, he should take this as a warning that the treatment has been too heroic. The strongest Turkish bath is that in which the bather spends his time in the hottest room and finishes with the douche (a process which few can stand); the milder bath is that in which the highest temperature submitted to is about 140°, and the dive into the basin is taken in lieu of the douche. Those who take a Turkish bath for the first time should limit themselves to its milder form.

Mineral Baths are baths composed of water in which a considerable quantity of mineral matter has been dissolved, either by natural or artificial processes. It must be remembered that ordinary water is very far from pure, and that even rain-water, the purest of all natural waters, contains a considerable number of saline ingredients dissolved in it. Spring-water or river-water is very largely impregnated with matter which it has dissolved. The water of London contains from 18 to 20 grains of chalk in solution in each

gallon, besides other ingredients. The chief of all “mineral waters” is sea-water, and it is necessary that we should examine its composition somewhat closely. The specific gravity of sea-water is 1027, and the quantity of salt dissolved in it ranges from 3·5 to 4 per cent., being least in the Black Sea and the Baltic, and most in the Mediterranean. The following is the composition of the water of the English Channel:--

Water 963·8 Chloride of sodium (common salt) 28·0 Chloride of potassium 0·8 Chloride of magnesium 4·0 Sulphate of magnesia (Epsom salt) 2·0 Sulphate of lime 1·4 Bromide of magnesia } Carbonate of lime } Iodines } Traces. Ammonia } Oxide of iron } ------- 1,000·0 -------

Sea-bathing is a very popular form of the natural bath, and it is preferable to bathing in river-water or spring-water, because the sea is seldom so cold as are the latter. A sea-bath has also another great advantage over all other forms of bath, and that is that it is taken in the purest air possible; and in considering the effects of sea-bathing it is impossible to separate the effects of sea-air from that of the sea-water. The sea-bather is also constantly inhaling the spray of the sea-water, and thus obtains whatever benefit is to be got in this way. If he can swim he enjoys all the benefit of exercise. The motion of the water and the buffeting he gets from the waves act as a powerful excitant to the skin, and lastly, the salt in the water adds considerably to the stimulating action. Reaction more readily occurs after a sea-bath than after a river-bath, and thus the liability to “catch cold” is less, although the popular belief that it is impossible to take cold from a wetting with salt water is far from being true. Besides the water of the sea, there are many other _natural salt waters_ which have a great reputation both for bathing and drinking. These salt waters, which may be got of all strengths, from a strong natural brine to a water in which the salt is scarcely recognisable, all owe their stimulating power, as does sea-water, to the chloride of sodium (common salt) and other chlorides which they contain. Salt-water baths, or sool baths as they have been called, act as powerful stimulants to the skin, and have a very great reputation in Germany and other places, where the only seaboard is the ungenial northern coast.

There are many _natural mineral waters_ which contain ingredients other than common salt, and all of these are much used for bathing. We shall give some details of these when we come to speak of bathing resorts, and at present we shall content ourselves by giving merely a rough classification of them.

1. Many waters issue from the ground at a temperature sufficiently hot, or even too hot (e.g. the geysers in Iceland) for bathing. Some of these natural hot waters contain very small quantities indeed of mineral matters, and these are known as _indifferent thermal springs._

2. Mineral waters containing common salt have been already alluded to. They are known as _salt springs._

3. The so-called _alkaline springs_ contain as their chief ingredient carbonate of soda. These waters are more used for drinking than for bathing. The alkali which they contain helps undoubtedly to soften the skin of the bather, and acts probably also as a stimulant to the surface.

4. The waters containing bitter _purgative salts_, such as Epsom salt or Glauber’s salt, owe their reputation almost entirely to their power when taken internally. When used for bathing it is probable that these natural solutions of purgative salts are more stimulating to the skin than ordinary water.

5. The natural _chalybeate waters_, or waters containing iron, are but little used for bathing, and it is exceedingly unlikely that the iron contained in the water has any effect upon the bather.

Although we have classified the waters, and have used that classification which is generally adopted, it must be remembered that the ingredients of waters are always multiple, and we usually find that they contain alkaline salts, purging salts, iron salts, and brine salts mixed together, so that it is difficult sometimes to determine which is the predominating ingredient, and therefore to which class a mineral water properly belongs. All water contains gas of some kind dissolved in it, and it is well known that a glass of ordinary spring water may be seen to contain bubbles of gas which adhere to the sides of the glass, or come “winking at the brim.” The gases which waters principally contain are atmospheric air, nitrogen, carbonic acid, and sulphuretted hydrogen, and great stress has been laid upon the presence in bathing waters of the three last-named gases.

The action of bubbles of gas contained in water is, in part at least, easy to understand. These bubbles give great mobility to the water, and thus the particles of water in contact with the skin are incessantly changing. Gas is soon driven out of water by the application of heat, and it is only the cooler of the thermal springs which remain charged with any considerable quantity of gas after the natural pressure, to which they have been subjected in the earth, has been removed.

The bubbles of gas, contained in the various gaseous waters, resting upon the surface of the body, produce an agreeable sensation of mild stimulation not unlike that which we feel when the surface of the body is gently tickled. The gaseous baths belong necessarily to the category of cool baths, and it is important to remember that waters which have been boiled no longer retain any gas, which is all expelled during the process of ebullition. When a gaseous water issues from the earth at a temperature too low for bathing purposes, it is very important that the water should be heated only to the temperature required for bathing, which is generally between 60° Fahr. and 98° Fahr. This is effected usually by means of a coil of hot water or steam-pipes beneath the bottom of the bath, and, by turning a tap, the bath attendant can produce any temperature which may be desired in a very short time. Water which has been previously _boiled_ or _heated to a high temperature_, and has been allowed to cool to fit it for bathing purposes, contains very little or no gas, and cannot be regarded as constituting a gaseous bath. Intending bathers should inquire very carefully into the manner of heating baths at these establishments. If the natural gaseous water be collected in reservoirs, and be allowed to lie in these reservoirs for any length of time before being used for the baths, the greater part of the contained gas will escape, and there will be a great discrepancy between the actual condition of the water used and the published analysis of such water.

It is exceedingly unlikely that either carbonic acid or nitrogen contained in water is absorbed by the skin. The effect of these gaseous baths is due to their physical condition only (at least we have no satisfactory evidence to the contrary), and in no way to the absorption of the contained gases. Carbonic acid is only absorbed by the skin under the influence of great pressure, and when thus absorbed it produces a poisonous effect.

At some bathing establishments, so-called baths of pure carbonic acid are administered, the patient being made to sit in a reservoir of the pure gas, but, of course, with his head out. We have also seen arrangements for directing a jet of carbonic acid gas upon different regions of the body, but we should be sorry to hazard any opinion as to the _modus operandi_, or the results of such a practice.

In an ordinary water-bath, strongly impregnated with carbonic acid, there is occasionally some danger of too much gas escaping, and being consequently inhaled in undue quantities by the occupant of the bath.

Sulphur baths, or baths impregnated with sulphuretted hydrogen gas, and having the well-known and offensive odour of rotten eggs, have been used as remedies in disease from time immemorial. It must be remembered that the so-called “sulphur waters” are of a very complex nature, and contain many saline ingredients, in addition to the sulphides of lime or soda, to the decomposition of which the presence of the characteristic gas is due. Most of these waters have also a high temperature, so that they must be considered as hot salt waters, with the addition of sulphuretted hydrogen, and it becomes a difficult matter to determine to which of their ingredients any good effect which they may produce is due. It must be borne in mind, also, that the amount of sulphuretted hydrogen contained even in the strongest of these waters, notwithstanding that it is amply sufficient to offend the sense of smell, is in reality very small, and there is no evidence that this gas is ever absorbed through the skin from the bath. People who visit sulphur baths generally drink the water, and while bathing they certainly inhale an atmosphere more or less charged with sulphuretted hydrogen. The general opinion at present is, that the effect of sulphur waters, when used for baths, is the same as that of other hot and saline springs, and that the sulphuretted hydrogen in the water is inoperative. At some of the sulphur baths the attendants point to a peculiar eruption on the skin, called La Poussée, as evidence of the peculiar effect of sulphur, but this eruption does not differ from that which so often results after a prolonged use of baths of any kind.

There is no end to the varieties of baths which have been used at one time and another for the relief of sickness, and we shall content ourselves by a short allusion to some of the best known.

Mud baths, or moor baths, are much used in some parts of Germany. They consist of water mixed with moor earth, or the mud deposited by some of the mineral springs. The resulting compound is thick and stodgy, and, like loosely-made farinaceous puddings. They cool unequally, and retain their heat for very long periods in the middle. Chemically they are composed of the various matters, soluble and insoluble, animal, vegetable, and mineral, of which mud or moor earth is formed. Much of their virtue has been ascribed to _formic acid_, a volatile body formed by ants, having a very pungent odour and considerable stimulating power. These baths are generally supposed to exert a very powerful action upon the skin.

Pine baths are in great repute in regions where pine-trees are plentiful, as in the Black Forest, the Harz Mountains, and elsewhere. A decoction is made of the fragrant tops of the pine-trees, and this is added to the baths in varying quantities. It is also largely exported in a concentrated form from the regions in which it is made. The smell of the pine extract is most delicious, and the

resin which it contains has an undoubted stimulating action upon the skin.

Blood, milk and whey, as well as various broths and decoctions of meat, have been used in the belief that they imparted strength to the bather. It is indeed a practice in some northern countries, even in the present day, to envelop a weak or dying patient in the skin of a freshly killed animal, the invalid thereby being supposed to imbibe some of the vital power of the recently slaughtered beast.

On the banks of the Nile, _slime_ has been used as a bath, and in some places _sea-mud_ has been used for the same purpose. _Sand baths_, or arenation, belong to the remedies which are hallowed by antiquity. The patient is buried in the sand, and exposed to the full rays of the sun, and the combined effect of the heat and the surface irritation produces a copious perspiration. At some sea-bathing establishments _baths of sea-weed_ are given, under the name of ozone baths, from the belief, right or wrong, that sea-weed is impregnated with ozone. In some old works we find baths of _dung_ strongly recommended; and even at the present day it is the practice, among some of the half-civilised Eastern nations, to smear the body with dung for the cure of all varieties of ailments. Various refuse matters have been used as baths, among which we may mention the _husk of the grape_, in countries where the vine is largely cultivated, and the _refuse of the olive_ in oil-making countries.

Medicated baths may be artificially prepared, and many such are in common use in medicine. Among these we may mention--

1. The group of so-called _emollient_ baths, which have the following composition: To thirty gallons of water, there may be added from two to six pounds of _bran_; or a pound of _potato flour_; or a couple of pounds of _gelatine_; or a pound of _linseed meal_; or four pounds of _marsh mallow_, or other herbs.

2. _Alkaline baths_ are made by adding to thirty gallons of water, from four to six ounces of carbonate of soda or potash, and occasionally an equal quantity of borax.

3. _Acid baths_ contain an ounce or more of muriatic, nitric or nitro-muriatic acid, to each thirty gallons of water.

4. Iodine or Bromine may be added to baths.

The medicated vapour baths are of two kinds, _mercurial_ and _sulphur_, both being contrived by evaporating flour of sulphur or calomel in an iron pan. The sulphur bath thus administered emits the pungent and suffocating vapour of sulphurous acid, the effects of which must be exerted solely upon the body of the patient, since the inhalation of any quantity, if not fatal, would prove a very serious annoyance. We must not forget to mention the old domestic remedy of a bath of _mustard and water_, which is among the most powerful stimulants to the skin which we possess.

The _Galvanic Bath_ has been much talked about of late years, and it becomes necessary that we should discuss its merits. It consists merely of a bath of water, through which a galvanic current is passed. It can be easily administered in the following way:--Place an ordinary bath upon a sheet of mackintosh, which, being a non-conductor of electricity, has the effect of insulating the bath, as it is termed. Then fill the bath with warm water to a convenient height, and to the water add a handful of salt or a wine-glassful of vinegar in order to increase its conducting power. Next get a galvanic battery, one having 30 or 40 Leclanché Elements is sufficient, and place it on a chair or on the floor beside the bath. To each of the poles of this battery, positive and negative, affix a suitable length (3 or 4 yards) of insulated telegraph wire, having its extremities freed from the gutta-percha or other insulating material. Place a length of stout broom-handle across the bath, resting on its two edges, and round the middle of this twine the bright metal end of the wire in connection with the positive pole of the battery, covering it with a piece of flannel, or wrapping it round with a sponge. The bather then gets into the bath, and takes hold of the centre of the broom-handle, previously moistened, so that his hands are out of the bath. The end of the negative wire is then placed in the bath itself, and as this is done the bather will feel the shock of the electric current. The current in this case travels from the positive pole of the battery through the wire to the broom-handle, down the patient's arms, through his body to the water of the bath, and so to the negative pole. This form of bath is a very powerful stimulant to the skin, but beyond its action on the skin we know nothing. It is said that by its aid it is possible to extract metallic bodies, such as mercury or lead, which may be lurking in the body and causing harm. Of such a power there is no evidence whatever. We have heard it said that at some galvanic baths visitors have been shown discolorations on the side of the bath as evidence of deposits of mercury, &c., but this is merely a quackish imposition, and it is well that persons should be on their guard against it.

The _electro-magnetic_ bath is given in the same way as the galvanic bath, an electro-magnetic battery being substituted for the galvanic battery.

It will be well to close the chapter by offering a few hints to bathers, and by laying down a few rules for their guidance. Bathing, in all its forms, increases the internal work of the body; it increases the action of the heart, the rate of respiration, the rapidity of circulation, the rate of tissue change, and, in the case of hot baths, the rate of perspiration through the skin. This necessarily makes a call upon the vital forces, and causes a certain amount of exhaustion. From this it follows that baths are best not taken at a time when the body is much exhausted, and that exhausting exercise should not be indulged in after a bath until a considerable period of time has elapsed.

Again, since bathing invariably affects the distribution of the blood, causing, as the case may be, either a degree of bloodlessness in internal organs, or, if the bath be cold, an undue congestion of them, it is important not to overtax those organs during the period of bathing. It is, therefore, never advisable to bathe directly before or directly after a meal, since in both cases a want of digestion of the material in the stomach is likely to result.

Ancient writers are most explicit in their directions for bathers. Thus Hippocrates, the Father of Medicine, writing some four centuries before the Christian era, says: “The person who takes the bath should be orderly and reserved in his manner, should do nothing for himself, but others should pour the water upon him and rub him; and plenty of water, of various temperatures, should be in readiness for the _douche_, and the affusions quickly made; and sponges should be used instead of the strigil, and the body should be anointed when not quite dry.... And a man should not be washed immediately after he has taken a draught of Ptisan, or a drink; neither should he take Ptisan as a drink immediately after the bath.” These directions are for the use of invalids, such as are acutely ill, and the writer seems fully to recognise that bathing in itself is an exhausting process. This allusion to Ptisan is interesting, as showing how some of our commonest domestic remedies come to us from a remote antiquity. The Greek word πτισ■νη signifies peeled (or “pearl”) barley, and the drink made from it, the barley-water of to-day.

As we have before mentioned incidentally, the proper ventilation of the bathroom is a matter of prime importance; for since the respiration is quickened by the act of bathing, it is evident that a foul atmosphere in the bathroom is very liable to produce an ill-effect upon the bather. Many of the swimming baths in London are very defective in this respect, and we have been forcibly struck, in more than one of them, by the ammoniacal odour proceeding from those sanitary offices which are a necessary adjunct to every bathing establishment. It is a very common custom in private houses to place the bath and the water-closet in the same apartment. That this is an undesirable arrangement is evident, for the water-closet is, of all places in a house, that in which a foul atmosphere is most likely to be encountered. Although a bathroom should be well ventilated, it should certainly not be draughty, for currents of cold air blowing upon the moist skin of the bather are likely to give “cold,” and produce internal congestions of various kinds. In summer there is no difficulty in providing a sufficiency of fresh air, but in winter it is not so easy. The best way, perhaps, to provide for a constant renewal of air is to admit air by means of vertical tubes, and to have in the room an open fireplace, in which a brisk fire should be burning while the bath is being administered.

In order to ensure a proper reaction after a cold bath, and to prevent chill after a hot one, it is customary to provide the bather with a supply of hot linen. This is a great comfort and a luxury, and may even be looked upon as an absolute necessity for delicate persons. It is a very general custom on the Continent for the bather, after removing the greater part of the moisture from his body, to don a hot calico Peignoir, or bathing-gown, which protects from chill, and at the same time allows of the limbs being rubbed with towels. It is not necessary to say much about towels. They are to be got of all qualities, from those as soft as a cambric handkerchief to those which, in roughness, approach the qualities of a curricomb. The bather may please himself in this matter, and will choose a soft absorbent towel to remove the moisture, and a hard one to rub the surface and produce the necessary reaction. Horsehair gloves and various rubbers made of indiarubber, &c., are in use, and require only to be mentioned.

Friction and shampooing are valuable accessories to bathing, and serve, as it were, to take the place of exercise in those diseases in which the patient is unable to exercise his body thoroughly for himself. Friction is applied to the skin merely to rub off the surface layers of epithelium, to encourage the dilatation of the superficial vessels, and the transudation of the sweat. Shampooing is a deeper and more forcible kind of friction, in which the rubber kneads the muscles and allows his fingers to press steadily upon and between them. This acts as a stimulant to the muscles themselves, much in the same way, but in a far milder degree, as an electric battery acts upon them. It must be borne in mind, however, that friction and shampooing are both exhausting, and must not be used to excess. While a patient is being shampooed, he involuntarily resists the pressure of the shampooer, and we have seen a patient reduced to a state of considerable exhaustion, after having been for twenty minutes in the hands of a professional rubber.

It is not necessary to make any remarks on the subject of soaps. Their name is Legion, and the bather, guided by the light of common sense, may make his choice. The ancients were accustomed to anoint their bodies with a variety of smegmata, unguents

and oils, both during and after bathing.

As to the temperature of the bath and its duration, although these are both very important questions, it is impossible to lay down any exact rules, for they must be settled according to the condition of the bather. A physician, in ordering a course of baths for an invalid, should state, in writing (in the form of a prescription) the frequency, variety, temperature, and duration, as well as the time of day at which they are to be taken.

After a hot bath it is sometimes necessary to arrange that a weakly patient shall go to bed for a couple of hours or more. To slake the thirst, both during and after a bath, there is nothing better than pure water.

CHAPTER III.

BATHING LOCALITIES.

In considering the various bathing localities it is only natural that we should begin with London. We have no intention of speaking in detail of the various baths with which private enterprise has provided the inhabitants of London, for such a course would be quite foreign to the intentions of this little work, which is intended merely to furnish the reader with a few general principles which shall be of use to him in selecting a bath. There is no kind of bath which cannot be got in London, and between a dip in the Serpentine and the elaborate process of the Turkish bath the bather has a wide choice. In proportion to its size and the number of its inhabitants, however, the bathing accommodation is very bad. The Thames is still a foul stream, and few care to plunge into the sewage which flows down from Richmond and surges back again from Barking. It is true that we have one large swimming bath floating close to Hungerford Bridge, the water of which is filtered in an ingenious way; but it may safely be said that, were the water of the river cleaner, we should have fifty such baths instead of one. We have often thought that a bathing establishment on a really grand scale would be a success in London, and we hope some day to see baths in our great metropolis, which should remind one of the palatial establishment of Caracalla. A combination of a swimming bath, private baths, Turkish baths, &c., with a first-rate gymnasium, reading-room, lecture hall, and refreshment room, would surely meet with sufficient patronage to pay, and we even believe that the introduction of sea-water for such a purpose (an undertaking which has been started more than once) would be sufficiently appreciated to ensure a dividend to the promoters.

England is naturally very well supplied with sea-bathing resorts, and it is possible to get a sea-bath in our island combined with any variety of climate, from the cold and bracing to the mild and relaxing. Sea-air, the great value of which is well understood as a curative agent, has certain peculiarities. It is necessarily the purest air that can be got, and when the breeze is off the sea the air comes to the shore practically uncontaminated and free from the exhalations of animals or furnaces. It is said to be very rich in ozone, and it certainly contains fine saline particles supplied to it by the sea-spray, and possibly small quantities of iodine, which give to the sea-breeze that peculiar odour which it undoubtedly possesses. Sea-air is dense, and the barometer stands at its maximum at the sea-level. Sea-air is warmer than the air of inland places, and it is more equable in its temperature owing to the comparatively slight changes in temperature which the sea itself undergoes. The effect of sea-air is very stimulating, and sojourners by the sea have their appetites increased and their vital functions quickened. While speaking of sea-air we must remind the reader that the air of the seaside places is often far from good, owing to the defective sanitary arrangements. There are not a few towns on our coasts, the sewers of which are taken out on to the beach where visitors most do congregate, and the smell of sewage at low tide is often far from pleasant. In selecting a sea-bathing place it is of importance to attend, not only to the aspect and general situation of the town, but to inform oneself whether or not it be thoroughly drained, the sewers being carried either inland to a proper sewage farm or far out to sea well beyond low-water mark; whether the water supply for drinking purposes be good and abundant, and whether the general cleanliness of the town is properly attended to. Climate is a very local phenomenon, and it is of as much importance to see that the bedroom and sitting-room which an invalid has to occupy are well ventilated and have a good aspect, as to attend to the latitude and general aspect of the locality chosen. It is of little use to send a patient to the sea if he has to spend the greater part of his time in small rooms made unbearable by gaslights or the defective drainage of the house; and an invalid with delicate lungs will derive but little benefit from a sojourn in the south if his windows face the north and he is afraid to open them.

As to the time of year at which sea-baths should be taken, that of course depends upon the locality visited. On the east coast, in situations which are exposed to winds from the north and east, bathing is only advisable during the three summer months of June, July, and August. On the west coast it is possible to begin a little earlier, and continue a little later; and in some situations in the south, the season may be said to extend from the middle of April to November. In these latter places, the temperature at

midsummer is often unpleasantly high, and the bathing season falls into abeyance for a time. There are many considerations which influence people in their choice of a bathing station, such as the size of a town, or whether it be gay or quiet; its distance from London, its accessibility, the accommodation, the expense, &c. A more important point, perhaps, is the nature of the bottom, whether it be sandy or shingly. The great popularity of the bathing resorts on the north coast of France and the Belgian coast is due to the great expanse of fine sand of which the bottom is composed.

In selecting a bathing place it is advisable, if reliable information is not forthcoming from those who know it well, to look at the Ordnance map of the town and district, and learn from an inspection of it, not only the direction in which the locality looks sea-ward, but the nature of the immediate surroundings of it; the position and height of cliffs and hills, and the amount of protection against cold or heat. The nature of the soil should also be ascertained, and the prevailing character of the vegetation, and, if possible, the amount of rainfall and the mean temperature of summer and winter.

Many watering places possess, in a very restricted area, many climates. Let us look at such a watering place as Bournemouth, and we shall be able to explain what we mean. Bournemouth is a town of some six or seven thousand inhabitants, built on a sandy soil, surrounded by pine woods. It faces the south; the average rainfall is 30 inches per annum; the temperature is equable, and frosts are comparatively rare, the mean night temperature in the month of January being 35·6. The town is built upon two bold cliffs, with a dip between them, and the surface of the soil being very uneven, it is thus possible to get almost any climate. In the dip between the cliffs are situations exposed only to the south, and protected from all cold winds; and others facing only to the north. On the east cliff one may live in a pine-wood, with the advantages of moderate elevation, a southern aspect, and the protection of trees which have the double advantage of being evergreen, and possessing a foliage which does not rot and decompose in autumn. On the west cliff, again, one may live in a house exposed to every wind that blows, in a climate which may very justly be spoken of as bracing.

It seems unnecessary to catalogue the various sea-bathing resorts in Great Britain. They are numberless, and intending visitors are influenced mainly by questions of accessibility and accommodation. Those on the east coast are mostly bracing, those on the west are more relaxing, while those on the southern coast are mostly warm and available during the winter months. We must refer our readers to the various guide-books and gazetteers for detailed information.

We have next to consider the various mineral baths scattered about Europe, and it must be admitted that the arrangements for bathing at the various sources of mineral waters are much better carried out on the Continent than in this country. In any course of treatment bathing is generally only one element of the regimen to which an invalid is directed to submit. Diet, climate, rest, and exercise, and the internal administration of medicine or of mineral water, often are called into requisition to perform their share in the cure; and while a patient is bathing, and by bathing is stimulating or facilitating his animal functions, it is of the greatest importance that he should live the healthiest life imaginable. At most of the German baths a somewhat strict surveillance of the bathers is maintained, and at those which have the greatest reputation, it is almost impossible to get, in the shape of food, anything of which the local physicians would disapprove. It is too often the habit of the Englishman to go to a bath without taking any advice as to his general mode of life while bathing, or even whether he may expect benefit or harm from the treatment he is prescribing for himself. The foreigner, on the other hand, submits in all things to authority, and while “undergoing a cure” he is content to have his time of rising and going to bed, his meals, his exercise, his baths, and other treatment, all accurately regulated for him. It is on this account, no doubt, that the German and French baths have so great a reputation, for while visiting them the guests live by rule just as athletes do in this country when they wish to bring themselves to the highest pitch of health attainable in view of some muscular contest. When the Englishman is told to visit this or that continental spring, he may well ask, as did the captain of the host, “Are not Abana and Pharpar, rivers of Damascus, better than all the waters of Israel? May I not wash in them, and be clean?” He must remember, however, that, as in Naaman’s case, obedience to the directions of the prophet resulted in a cure, so he must seek out a spring where he will find a prophet; to whose dictation he must be willing for a time in all things to submit.

When people visit a mineral spring they generally do so with the double object of drinking the water and of bathing in it; with the drinking of mineral water we have, in this volume, nothing to do, but merely with bathing, and the reader will have gathered from the previous chapters, that, when bathing only is concerned, the exact composition of the water is not a matter of very great importance; since all baths act in the same way, by stimulating the skin, and the water of the bath is probably _never absorbed_. It is important to insist upon this point, because we find in several bath-puffs the assertion that their effect is due to the absorption through the skin of the material dissolved in the water of the bath. Such an assertion is contrary to the teaching of our leading physiologists. At all sea-bathing places the climate is, in one respect, the amount of barometric pressure, similar. The advantage of mineral baths over sea-baths very greatly lies in the fact that we are not only able to choose our water but also to choose our

climate, and to have either a mountain climate with low barometric pressure, or a sea-level climate with a high barometric pressure, or a climate where the barometric pressure is intermediate between these two extremes.

We must, in order to bring the effects of mountain climates vividly before the mind of the reader, refer again to the comparison which we have made elsewhere between the burning of fuel in a furnace, and the combustion which is constantly going on in our bodies. Experiments made by Professors Tyndall and Frankland on the combustion of candles at different altitudes, seem to give the clue to the explanation of the effects of mountain air upon our bodies. These gentlemen burnt candles of equal weight, and under similar conditions at Chamouni, and also on the top of Mont Blanc, which is 12,000 feet higher. They found that the amount of candle consumed in equal periods of time was the same in both situations, but that on the top of the mountain the candle gave out considerably _less light_ than it did in the valley. The diminution of the light was attributed with justice to the _completeness_ of the combustion, for the light emitted by a flame is mainly due to the unconsumed particles of carbon in a state of incandescence. Mountain air, being much more rarified than the air of low-lying valleys, contains much less oxygen in proportion to volume, but its lesser density seems to enable the oxygen to assume, as it were, a greater activity.

It has also been found that bodies lose heat less rapidly in rarified atmospheres, so that presumably there is less need for heat-production on the mountain than on the plain; so that in mountain climates the body is saved a certain proportion of the combustion necessary for the generation of heat.

Mountain air is pure, and removed from miasmata and exhalations, whether from marshes or (being usually sparsely inhabited) men. It is usually still and seldom foggy. The variations of temperature are very great and very rapid, the visitor having often to undergo, within a few hours, a tropical and an arctic climate. These rapid variations serve probably to stimulate vital processes, and there can be little doubt that they are important factors in the general effect produced by mountain climates.

The following notes made during a sojourn at Davos in Switzerland may serve to bring some of the above facts in a more concrete form before the reader. “The height above sea-level is between 5000 and 6000 feet, and the barometer stands at about an average of 620 millimètres, instead of 760, which is its average height at the sea-level, so that the weight of the atmosphere is only 620/760, or rather more than three-fourths of what to most of us is its normal weight. The result of this is that under the influence of the sun’s rays evaporation is marvellously rapid. The dew is gone in an instant, and the vapours of the early morning seem to vanish at the first touch of the solar heat. Thus it follows that although the rainfall is considerable, the dryness of the air is, during the main part of the day, nearly absolute. The range of temperature is apt to be very great, and the thermometer, even in the height of summer, is frequently below freezing point in the early morning and in the shade, while in the sunshine, towards midday, the heat is simply scorching. For the most part, however, the temperature is very pleasant in summer; and even invalids, if properly provided with wraps, may spend almost all the hours of daylight out of doors. The obvious results on a healthy person of living in such a climate are (1) a slight increase in the rate of pulse and respiration; (2) a craving for and an ease in performing muscular exercise; and (3) a marked increase of the appetite, with a general feeling of exhilaration. The air acts, in fact, as a powerful stimulant. Ladies, and those who are not able to take much exercise, often have a difficulty in sleeping, but this is never of long continuance. Owing, it is said, to the diminished atmospheric pressure, the cutaneous blood-vessels dilate, and the complexion becomes (with the help of the sun) exceedingly ruddy, a fact which is particularly noticeable in the inhabitants, whose red cheeks strike a stranger with astonishment.”

There are of course many things to be considered in making selection of a bath besides the height above sea-level. Attention must be paid to the local configuration of the district, and the sanitary condition of the town or village in which the healing spring is situated. It is manifestly unadvisable for an invalid who has been sent to the Alps for the benefit of a mountain climate to settle down in some narrow gorge, exposed perhaps, only to one wind, into which the sun only peeps at midday, where the climate knows no medium between the two extremes of heat and cold, where the river perhaps has been converted into an open sewer by the inhabitants, and where the population is a mixture of the Goitrous and the Cretinous. Such localities are to be found, and it may well happen that the invalid may go to the bath to be cured of his gout, and return with typhoid or ague. Some few years back the writer was travelling in the Vosges mountains, and stopped a night at a well-known watering-place, taking up his abode in the Bad-haus. The situation of the town was extremely picturesque; the valley in which it lay was verdant, the hills were well clothed with foliage, and the mineral springs of the district were such as might well be recommended to many patients. The inhabitants, however, had seen fit to turn the lovely stream which meandered through the valley into a sewer. Into it abominations of every kind were thrown, and its pebbly bottom had become obscured by broken crockery, old tin pots, old boots and shoes, and other refuse. The swine were driven into it every morning as if on purpose to defile it, and what should have been one of the chief attractions of the district had become a pestilential nuisance, exhaling filthy odours, and fit only to be bridged over and hidden absolutely from the light. It is

not sufficient in making choice of a bathing place to consider only those dry facts which are capable of being stated in figures, but the intending bather should seek reliable information as to the sanitary condition of the town, as well as of the hotel or lodging-house which he proposes to inhabit. This information is only to be got from disinterested patients who have made a sojourn in the locality. Guide books are seldom to be trusted, and special treatises on the virtues of this or that bath are to be regarded as the works of a fervid imagination in the absence of confirmatory evidence. The most potent cause in establishing the popularity of this or that bathing place has been the heat of the water, and there is perhaps no hot spring in Europe which was not used for bathing by the Romans, or which has not been used from times of remote antiquity by the inhabitants of the district. It is so convenient and so cheap to have hot water ready to hand without the necessity of huge furnaces, enormous chimneys, expensive boilers, and endless pipes, that it is not surprising that such a valuable natural gift should be appreciated.

The best known hot bath in this country is the one at _Bath_, in Somersetshire, the water of which proved so attractive to the Romans that they founded the city of _Aquæ Solis_ here, in the 1st century of the Christian era. It is needless for us to dwell upon the popularity of Bath. There are four hot springs here which vary in temperature between 120° Fahr. and 104° Fahr. The supply of water is ample and abundant, and the accommodation for guests such as can hardly be surpassed. The corporation of the city have lately erected a magnificent suite of baths, and if they will but turn their attention to the condition of the river Avon, and rigidly enforce the provisions of the Pollution of Rivers Act, Bath may again become as popular as it was in the days of Beau Nash. The elevation of Bath above the sea-level is only about 100 feet. The constituents of the Bath water are chiefly sulphate of lime with a little carbonate of iron, together with some free carbonic acid and nitrogen. It has been called an earthy water, but perhaps it is better to regard it as a simple hot water, the chief virtue of which is its warmth.

Buxton, in Derbyshire, is situated nearly 1000 feet above the sea-level in an open hollow surrounded by hills. There is good reason to believe that the water of Buxton was known to the Romans. The temperature of the Buxton water is 82° Fahr. The amount of saline ingredients is but small. The water is, however, impregnated with a large quantity both of carbonic acid and nitrogen gas. The town is amply provided with accommodation both for bathing and lodging.

At _Clifton_, near Bristol, there are springs having a temperature of 74° Fahr., and at _Mallow_, in Ireland, is a spring having a temperature of about 70° Fahr., and containing, like the water of Buxton, a large quantity of free nitrogen gas. A great deal has been written about the virtues of free nitrogen in water, but without, as it seems to us, sufficient evidence.

There are many hot springs in Europe which are very largely frequented by invalids. We can, however, do little more than tabulate the chief, indifferent, and earthy thermal springs, giving the chief facts concerning each.

At _Leuk_, in Switzerland, situated at the foot of the Gemmi Pass, we find a water possessing a natural temperature of 102° Fahr. to 120° Fahr., situated 4600 feet above the sea-level. The water is indifferent, and it is the custom here for bathers to remain many hours consecutively in the water. Ladies and gentlemen bathe in the same bath, and it is no uncommon thing for the bathers to be seen taking their luncheon or playing dominoes upon floating tables.

At _Pfaffers_ and _Ragatz_, near the town of Coire, in Switzerland, are found indifferent springs, situated between 1500 and 2000 feet above the sea-level, and having a temperature of 100° Fahr.

Gastein is a much frequented and very fashionable bath in the Austrian Salzkammergut, some twelve or thirteen hours' drive from Salzburg. The height above sea-level is 3300 feet, and the temperature of the water varies from 96° Fahr. to 114° Fahr.

Bormio, at the foot of the Stelvio Pass, on the southern slope of the Alps, has an altitude of over 4000 feet, and water of a temperature of 104° Fahr.

Wildbad, in the Black Forest, has been for many years a favourite bath with the English. The elevation is 1300 feet, and the temperature of the water a little over 100° Fahr.

Wiesbaden, the capital of Nassau, possesses both hot and cold springs. The former have a temperature of 160° Fahr., and contain a fair amount of chlorides. The town is beautifully situated among the Taunus Hills, and has an elevation of 300 feet above the sea-level.

Teplitz, in Bohemia, is a fashionable bathing resort. The town is well ordered, and healthfully situated, being 600 feet above the sea-level, and supplied with natural thermal springs, having a temperature ranging from 78° Fahr. to 120° Fahr.

Schlangenbad, among the Taunus Hills, is a quiet bathing-place, with a natural tepid water having a temperature ranging between 80° and 90° Fahr. The Schlangenbad water only contains 2-1/2 grains of solids to the pint, so that it may safely be regarded as an “indifferent” spring. Sir Francis Head, the author of the ‘Bubbles from the Brunnens of Nassau,’ visited Schlangenbad in 1836, and we feel constrained to make the following extract from his work, as typically illustrating the kind of belief which gathers round a natural spring:--

“In the history of the little Duchy of Nassau, the discovery of this spring forms a story full of innocence and simplicity. Once upon a time there was a heifer, with which everything in nature seemed to disagree. The more she ate the thinner she grew; the more her mother licked her hide, the rougher and the more staring was her coat. Not a fly in the forest would bite her; never was she seen to chew the cud, but, hidebound and melancholy, her hips seemed actually to be protruding from her skin. What was the matter with her no one knew; what could cure her no one could divine. In short, deserted by her master and her species, she was, as the faculty would term it, ‘given over.’ In a few weeks, however, she suddenly reappeared among the herd, with ribs covered with flesh, eyes like a deer, and skin sleek as a mole’s; breath sweetly smelling of milk, saliva hanging in ringlets from her jaw! Every day seemed to re-establish her health, and the phenomenon was so striking that the herdsman, feeling induced to watch her, discovered that regularly every evening she wormed her way in secret into the forest, until she reached an unknown spring of water, from which, having refreshed herself, she quietly returned to the valley. This trifling circumstance, scarcely known, was almost forgotten by the peasant, when a young Nassau lady began to show exactly the same incomprehensible symptoms as the heifer. Mother, sisters, friends, father, all tried to cure her, but in vain, and the physician had actually

‘Taken his leave with sighs and sorrow, Despairing of his fee to-morrow,’

when the herdsman, happening to hear of her case, prevailed upon her at last to try the heifer’s secret remedy. She did so, and in a very short time, to the utter astonishment of her friends, she became one of the stoutest and roundest young women in the duchy.” Sir Francis Head goes on to describe how he was conducted along subterranean passages to the source of the baths, and was astonished to find serpents swimming in the water, and still more astonished to hear his cicerone declare, “_C’est ce qui donne la qualité à ces eaux!_” Schlangen, or serpents, are very common in this part of the duchy of Nassau, and hence the name Schlangenbad.

Baden-Baden is at once one of the most frequented and most picturesque baths in Europe. The temperature of the water varies from 115° Fahr. to 144° Fahr, and the elevation above the sea-level is 616 feet. The waters contain only 22 grains of solid ingredients to the pint, the chief of which is common salt (16-1/2 grains).

The celebrated hot purgative water of _Carlsbad_, although formerly used for bathing, is now chiefly employed for drinking.

Bathing is carried on to a very large extent at _Vichy_ (in the Department of Allier, in France), although these waters are chiefly used as internal remedies.

Plombières, among the Vosges Mountains, has an elevation of 1310 feet. The water contains only 2 grains of solid ingredients to the pint, but the temperature is high, varying from 80° Fahr. to 160° Fahr.

Some of the hot springs at _Ems_, such as the Fürstenbrunnen, with a temperature of 95° Fahr., and the Neuequelle, with a temperature of 117° Fahr., are used for bathing.

At _Aix-les-Bains_, in Savoy, 768 feet above the sea-level, will be found two hot springs, varying in temperature from 106° Fahr. to 116° Fahr. These waters contain less than 4 grains of solid ingredients to the pint, but one of them, containing an appreciable amount of sulphuretted hydrogen, is known as the sulphur spring. Aix was known to the Romans, and in the modern town will be found every bathing appliance which art can contrive.

At _Mont Doré_ and at _Bourboule_, in the department of Puy de Dôme, in France, at an elevation of 3400 feet above the sea, are thermal springs having a temperature of 104° Fahr. to 114° Fahr.

Having enumerated the chief warm baths in Europe, we will proceed to catalogue some of the best known of the salt baths.

Droitwich, in Worcestershire, is perhaps the only place in England where concentrated salt baths can be obtained. The brine of Droitwich is said to contain as much as 2760 grains to the pint. The town is uninteresting.

At _Ischl_, in the Salzkammergut, is a concentrated brine containing 1900 grains to the pint. It is 2000 feet above the sea-level, and the country is charmingly picturesque.

Kreuznach, not far from Bingen on the Rhine, has a strong salt spring, and is much resorted to by scrofulous patients. The mother-lye of Kreuznach is said to contain 2400 grains to the pint. These strong brines are only used after proper dilution.

The water of _Soden_, in the Taunus hills, contains 160 grains to the pint; and at _Homburg_ are found several springs which have about 90 grains to the pint.

Kissingen is a fashionable watering place in the north of Bavaria, with an elevation of about 800 feet above the sea-level. Here will be found all the accessories of bath life. The water contains about 60 grains of solid ingredients to the pint.

The _Wood Hall Spa_, near Lincoln, is a salt spring containing as much as 160 grains to the pint.

Rehme, in Westphalia, is situated on the Cologne and Minden railway. The water has nearly 250 grains of salt to the pint, and is very highly charged with carbonic acid. The natural temperature of the water is 92° Fahr. There is every facility at Rehme for administering baths of all kinds and of all degrees of concentration.

Nauheim is not far from Homburg, among the Taunus hills, and possesses a water very similar to that of Rehme, having from 170 to 291 grains to the pint, being highly charged with carbonic acid, and having a temperature of from 80° Fahr. to 94° Fahr. The elevation of Nauheim above the sea-level is 450 feet. The salt baths of Rehme and Nauheim enjoy a very wide reputation.

Although sulphur waters are not so much used for bathing as formerly was the case, this little book would not be complete without some notice of the chief sulphur springs.

Harrogate, in Yorkshire, has been well known for more than three centuries, and although the sulphuretted hydrogen, by its predominant smell, gives the chief character to the Harrogate springs, they have an equal claim to be called saline or chalybeate, for they are strongly impregnated with salt and with iron, so that the taste has been compared to a mixture of rotten eggs and the scourings of a gun. The old sulphur spring contains 137 grains of solid contents to the pint, and is strongly impregnated with carbonic acid and sulphuretted hydrogen. Harrogate is now a fashionable watering place, with every accommodation for visitors. The situation of the town is open and airy, and the climate is decidedly bracing.

Gilsland, in Cumberland, has a sulphur spring of some repute.

The Pyrenees is the district _par excellence_ of sulphur springs. _Baréges_ is the most famous of the Pyrenean baths, situated 4000 feet above the level of the sea. Its water, which has a natural temperature of 86° Fahr. to 111° Fahr., contains only 1·657 grains to the pint, of which ·360 grain is sodium sulphide. This becoming decomposed on exposure, forms the sulphuretted hydrogen which gives the character to the spring. These sulphur waters contain a peculiar gelatinous organic substance which has been called barégine, and which has been supposed by some authorities, but on insufficient grounds, to give the peculiar virtue to the water.

Cauterets, in the Pyrenees, 3000 feet above sea-level, with a sulphur water having a natural temperature of 98° Fahr. to 130° Fahr.

Bagnères de Luchon, 2000 feet above sea-level, with a natural hot sulphurous water.

Eaux Bonnes and _Eaux Chaudes_, 2000 feet above the sea.

At _Aix-les-Bains_, in Savoy, one of the springs is strongly impregnated with sulphur.

Aix-la-Chapelle, in Rhenish Prussia, is 450 feet above the sea. The water contains about 30 grains of solid contents to the pint, and is strongly impregnated with sulphuretted hydrogen.

Any water may be used for bathing purposes, and it is almost always the custom for visitors who go to a spring for the purpose of _drinking_ the water, to take some _baths_ as well, the baths often being composed of the same water as that used for drinking. It is not generally believed that there is any particular virtue in baths composed of alkaline waters, such as those to be found at Vichy, nor in purgative waters, like those at Carlsbad, nor in iron waters like those at Tunbridge Wells, Spa or Schwalbach. Hot bathing, however, may be expected to help the effect which it is sought to bring about by taking the water internally, and it has not unfrequently been the case that the effect of drinking has been attributed to the bathing.

It is worthy of remark that, at some places where miracles are claimed to be wrought by the effect of water (as, for example, at Malvern), the water used is remarkable merely for its great purity and almost absolute freedom from mineral ingredients.

It is not a little remarkable that some waters, which were formerly used almost exclusively for _bathing_, are now used almost as exclusively for drinking. Carlsbad affords an instance of this. The word _bad_, when used as an affix, generally indicates that the water is or has been used mainly for bathing. The word _brunn_, or _brunnen_, however, usually implies that the spring has been mainly employed for drinking purposes.

CHAPTER IV.

THE USES OF BATHS.

We do not propose to enter at all fully into the question of the place which baths ought to occupy as remedies for disease; but we shall merely indicate some of the chief conditions for which bathing might reasonably be expected to be of service. It has been generally claimed for baths that they cure everything; and, in fact, the many unfounded assertions as to the remedial powers of hot and cold water, which have been made by professed hydropathists and others, have done much to bring these very useful agents into disrepute.

It proved very puzzling to the acute mind of the author of the ‘Bubbles from the Brunnens,’ that the baths and waters which he encountered in his travels seemed capable of curing everything; and it was difficult to understand how patients whose conditions were in no way similar should apparently derive equal benefit from precisely the same treatment; and perhaps we shall not be wrong in assuming that the very healthy mode of life which is pursued by visitors to baths has much to do with the good results of treatment.

The most common purpose for which baths are used is the cleansing of the skin, and the importance of this, of course, cannot be over-estimated. When we speak of a clean skin we mean a skin with clean pores as well as a clean surface. The indolent and luxurious man, whose skin is spotlessly clean, but whose sense of the proprieties is such that he never indulges in a good vulgar sweat, has not, in reality, so healthy and clean a skin as the navvy, whose myriad sweat-ducts are constantly being flushed by the hardness of his work; but whose skin surface, possibly, is soiled with the various grimy particles with which his labour has brought him in contact. A clean skin is an impossibility without perspiration; and if the necessary perspiration be not brought about by the ordinary business of life, it is advisable to encourage it by artificial means. Hence bathing is more necessary to the man of sedentary occupation than to one who knows the daily luxury of physical exertion. For the purposes of cleansing, the bath should be warm, the skin should be well soaped, and a subsequent thorough friction with a rough towel should be indulged in. This process has the effect of removing the outer layer of the cuticle, of softening the secretion lying in the mouths of the sweat-ducts, and by the action of the heat dilating the blood-vessels of the skin and encouraging perspiration. Its utility and its comfort are so well known that there is no necessity for making any formal remarks thereupon.

Perhaps there is no better form of exercise than that to be found in a good swimming bath, always provided that an open river or the sea is not at hand. The swimmer exercises every muscle in his body; and, if swimming be vigorously kept up, there is nothing which more speedily induces fatigue. For an athlete in training a daily swim ought to be a part of his course of exercise. We wish there were more swimming baths in London than there are. Such as exist are all overcrowded in the summer, and in many of them the ventilation is not of the best. To take violent exercise in a close, badly-ventilated room must be wrong, and we would advise no one to patronise a bath which smells in the least degree stuffy. Swimming should be practised not more than once a day, and about midway between two meals. The bather, at the commencement of his course, should not remain more than five minutes in the water; and if his bath be not followed by a healthy glow, he will recognise that even that is too much for him. The time of the bath may be gradually extended.

The cold bath in the morning is a luxury of which most of us know the value. It cleanses, stimulates, and braces; and, if used in moderation, conduces to health. A word of caution is necessary to those who use their “morning tub” too heroically. The best criterion as to the advisability of continuing its use is the readiness and completeness of the reaction; and, if there is any feeling of chilliness, languor, or want of appetite, with an inability to eat breakfast, it is as well to ask whether, possibly, the cold bath had better be moderated. Persons who suffer from rheumatic pains, or sciatica, or neuralgia, ought also to be careful about continuing a practice which may be too severe for them. It is always easy to add a small quantity of warm water to the bath. There can be no doubt that a daily bath is absolutely necessary for the health of children who are tender-skinned and too young to attend to their

personal cleanliness.

There are certain diseases in which cold bathing is of acknowledged service:--

Foremost among these is _fever_, and it is not too much to say that many lives have been saved by the timely use of the cold bath. The use of it, however, requires great judgment and knowledge, and it is not applicable to every case, and is not without danger. In this country its use is restricted almost entirely to those cases in which the fever runs a very severe course, in which the bodily temperature rises above 105° Fahr., and the patient attains what is technically known as a condition of hyperpyrexia. The use of cold baths in fevers has been known from time immemorial, although it has only attracted the attention of modern physicians during the last ten or fifteen years. The usual method of employing this treatment is to immerse the patient in a bath of about 90° Fahr., or 95° Fahr., and by means of removal of hot water and its renewal by cold, gradually, in about 20 minutes, to reduce the temperature to 60° Fahr. In this way the temperature of the patient may be reduced as much as four or five degrees, and his sufferings are usually very much diminished. Cold bathing cannot be said to _cure_ the fever, but it prevents some of its worst results, and may enable the patient to pass through a trying ordeal unscathed. All forms of fever may, occasionally, be treated with cold baths; but this method of treatment in no case shortens the course of the fever.

Cold bathing is of considerable use in some nervous affections, such as hysteria, St. Vitus's dance, and spasmodic croup. These affections often, if not always, depend upon a depressed condition of health, and a cold bath of short duration (before a fire in winter), and followed by a brisk rubbing, is a very efficient means for their relief.

Rickets is benefited by cold bathing; but for the relief of this and other conditions of weakness the greatest moderation must be observed.

Cold water is sometimes of use when locally applied, and seems to act as a wholesome stimulant to parts which have become stiffened by want of use, such as strained and sprained joints. In some skin diseases benefit will be derived by the use of cold water. This is particularly the case in itching of the skin or _Prurigo_, and _Acne_.

Warm baths are far more generally useful in diseases than cold baths. For the removal of the thickenings around joints, which have been caused by gout or rheumatism or "rheumatic gout," bathing in tepid or hot water is justly considered as a powerful means of alleviation, and as a valuable accessory to treatment by diet and regimen. The hot water of Bath and the tepid water of Buxton have long enjoyed a great reputation for gout and rheumatic gout, and there are many baths on the Continent, which have a reputation, equally high, in the treatment of these affections, such as _Teplitz_, _Gastein_, _Wiesbaden_, and _Wildbad_. The treatment of gout by bathing is usually aided by the internal administration of mineral water, but into this question we are unable to enter, notwithstanding its great importance.

For exudations round joints, which have arisen from causes other than gout and rheumatism, warm bathing is of very great service, as well as in relieving the stiffness and thickenings which sometimes occur as the result of severe wounds.

For _paralysis_ warm bathing is often of great use, provided the cause of the paralysis be a removable one. Formerly, the principal method of treating cases of lead paralysis occurring in the cider counties of the West of England, was the sending of the patient to the warm springs at Bath, and the results were generally very good. There are many forms of paralysis which could not be benefited by treatment with hot water or anything else; but it is impossible, in an elementary treatise, to enter into a question requiring a high degree of medical knowledge for its proper appreciation.

For neuralgia, sciatica, lumbago, and many forms of muscular rheumatism, hot bathing may be employed with advantage.

For Bright's disease of the kidneys, warm baths, vapour baths, and Turkish baths, are all employed with benefit.

An occasional Turkish or hot bath is a very great aid to the well-being of dwellers in cities who get an insufficiency of air and exercise, since it produces an activity of the skin which can only be brought about by such means or by violent exertion.

A common cold may sometimes be cured by means of a Turkish bath. To bring about this result, however, the treatment must be applied in the very earliest stages of the disease, when the slight tension in the head, or a trifling feeling of chilliness, is warning the patient of his coming trouble, and before the running of the eyes and nose has thoroughly set in. A Turkish bath in this very earliest stage of a cold will sometimes cut the disease short, but such a result is, unfortunately, by no means invariable.

Warm baths, as aiding the action of the skin, have been regarded as of some value, when combined with proper diet and regimen, in the treatment of diabetes.

In diseases of the skin warm bathing is occasionally of service. For _psoriasis_ a soaking in hot water has the effect of removing the scales from the body, but it has probably no real curative influence on the disease. In acne, chloasma, and diseases which are fostered by a want of attention to cleanliness, warm bathing is of great service, especially when aided by a liberal supply of soap and the rigorous use of the flesh-brush and rough towel.

Although we are all ready, perhaps too ready, to recognise the great value of water applied externally, we are not always so quick at recognising the evil effects of an excessive use of baths.

Professor Hebra, of Vienna, one of the greatest authorities living on the diseases of the skin, speaks in very decided tones of the occasional harmful action which water exerts upon the skin. “It is,” he says, “almost universally believed that the frequent use of vapour and shower baths, frequent bathing in warm or cold water, frequent washing and scrubbing, are healthful operations which can never do any harm.

“Against this opinion I must enter my decided protest. On the one hand, we know that there are millions of human beings who have never bathed in warm or cold water all their lives long, who, at the utmost, give their hands and face a superficial rinse once a week, and nevertheless enjoy up to old age a state of health which may well be envied. On the other hand, none can prove by statistics that the frequent use of the various kinds of baths protect people from sickness, or that washing in cold water strengthens the body against catarrh and rheumatism and catching cold. So long as bathings are accompanied by a feeling of comfort, and are not followed by any eruptions on the skin, they may, no doubt, be allowed as a pastime, an amusement, an aquatic sport; but whenever the skin thus repeatedly irritated begins to react--as soon as itching, more or less severe, follows; as soon as persistent redness or wheals, or pimples or watery heads make their appearance--it is high time to leave off bathing and washing if we do not wish to produce diseases of the skin, which often take months and years before they disappear, and give the patient unspeakable misery.”

Simple baths do not irritate the skin so much as when combined with shampooing and wet packing and shower-baths, or when a vapour bath is made more efficient by friction and by the various manipulations of the Turkish or Russian bath. The result of such attacks upon the skin are seldom long to wait for. Sooner or later a continual redness appears, followed by burning or itching; then come pimples, boils, and pustules; and though in past times these eruptions were regarded as critical and beneficial we must now look on them in their true light, as simply the injurious results of the action of water.

Hebra has used the warm bath with success in alleviating the pain and misery arising from extensive burns of the skin, and he has also used it for some of the more troublesome of the scaly and itching diseases of the skin. Although he seems more alive than most authors to the evil effects produced by the irritation of water in cases which are unsuited for it, he has, on the other hand, surpassed every one in the extensive and continuous use of warm water. He says, “I began with two hours, then advanced to days, and at last extended the duration of the warm bath from one to nine months. I find that people can eat, drink, and sleep just as well in a continuous warm bath as out of it; that nutrition, respiration, and excretion go on as before.”

Hebra asserts that in the external use of water it is a matter of small moment whether we apply the water hot or cold to the part; that the water soon approximates in temperature to that of the part to which it is applied; and that in this matter the wishes and inclinations of the patient need alone be consulted. With regard to _salt baths_, we may remind the reader that they may be used either cold or hot, and that they may thus be used in almost all those cases (some skin diseases excepted) in which baths of hot or cold water are found useful. When salt is added to the water, the stimulating effect upon the skin is increased, and the bath may be considered by so much the more powerful. Sea water, natural salt waters, and even crystals of sea-salt, or common salt added to ordinary water, have so firm a place among popular remedies that it is almost superfluous to make any formal remarks upon them.

It is perhaps in the treatment of scrofulous affections that sea bathing and salt water have their greatest reputation. The sea-bathing infirmary at Margate is too well known, and its work too highly valued to need any words of approbation from the author of this Primer. It is probable that the inhalation of sea-air has more to do with the successful treatment of scrofula than the bathing in sea water, although we have no wish to cast a doubt upon the efficacy in the treatment of such diseases of a systematic stimulation of the skin.

Dr. Jacob of Cudowa, in Silesia, has made a series of experiments on the power of stimulating the skin which is possessed by various kinds of baths. He has proved that mud and bran baths of the same consistence produce the same alterations in the circulation, which are to be regarded as the real expression of the amount of skin-stimulation. It has been ascertained also that mud baths retain the heat of the bather more effectually than simple water baths. A carbonic acid bath is said to have the greatest stimulating action on the skin; a saline bath the next greatest, and mud and pure water follow next. A carbonic acid bath is also said to have the greatest power of causing general stimulation and excitement. As to the cooling effect of these varieties of baths, Dr. Jacob has noted that a water bath of an hour's duration, and of a temperature of 91·4°, lowers the bodily temperature of a healthy man about ·9°; the mud bath of same duration and temperature 1·5°; the salt bath 2°, and the carbonic acid bath about 2·6°.

Sulphur baths in former times enjoyed a very great reputation in the treatment of skin diseases, gout, rheumatism, and the effects of metallic poisons, especially lead and mercury. There is, however, probably nothing peculiarly beneficial in the sulphur, and the good effect of these baths is due more to the heat of the water than to anything else. Many of the sulphur springs may rightly be regarded as salt waters also, and they have a great power of skin-stimulation, a power which adds immensely to their therapeutic efficacy. The bather in sulphur water is constantly inhaling the vapour of sulphuretted hydrogen, and this fact may have not a little to do with the good effects of the water. A course of bathing at a sulphur spring is generally combined with the internal administration of the water, and it is consequently a very difficult problem to determine whether the internal or external administration of the water has the greater effect in producing the desired cure.

Steel baths, or baths containing iron, have fallen almost entirely into disuse, and any effect which was formerly attributed to the chalybeate water is now with more probability ascribed to the water and its temperature. The change in this respect is scarcely greater than that which has taken place at Carlsbad, where purgative waters, formerly used chiefly for bathing, are now almost exclusively employed for drinking.

The author of the 'Bubbles from the Brunnens' thus describes his feelings while taking a steel bath at Langen Schwalbach, some forty years ago:--

"As soon as the patient was ready to enter his bath, the first thing which crossed his naked mind, as he stood shivering on the brink, was a disinclination to dip even his foot into a mixture which looked about as thick as a horse-pond, and about the colour of mulligatawny soup. However, having come as far as Langen Schwalbach, there was nothing to say but '_en avant_,' and so, descending the steps, I got into stuff so deeply coloured with the red oxide of iron that the body, when a couple of inches below the surface, was invisible. The temperature of the water felt neither hot nor cold, but I was no sooner immersed in it than I felt that it was evidently of a strengthening, bracing nature, and I could almost have fancied myself with a set of hides in a tan-pit. The half-hour which every day I was sentenced to spend in this red decoction, was by far the longest in the twenty-four hours, and I was always very glad when my chronometer, which I regularly hung on a nail before my eyes, pointed permission to me to extricate myself from the mess. While the body was floating, hardly knowing whether to sink or swim, I found it was very difficult for the mind to enjoy any sort of recreation, or to reflect for two minutes on any one subject; and as, half shivering, I lay watching the minute-hand of my dial, it appeared the slowest traveller in existence."

In the delightful book from which the above quotation is taken, no mention is made of the disease, if any, for the relief of which the author underwent the unpleasant ordeal of the iron bath. The reader, however, will have no difficulty in surmising that the good he derived at Langen Schwalbach was due more to the change of air and scene and occupation than to the disagreeable bathing process to which he submitted daily. There is, or has been, a great deal of superstition in medicine, and the public have, or used to have, a surprising amount of faith in nasty medicines. In old dispensatories will be found the records of prescriptions into the composition of which there entered hideous and nameless abominations, and we are very much inclined to think that the lingering belief in steel baths, sulphur baths, and mud baths is but the remnant of a dying faith in nasty prescriptions, and the necessity of doing penance.

CHAPTER V.

A VISIT TO A BATH.

When the doctor's fiat goes forth that his patient is to visit this or that bath for the benefit of his health, far more is implied in the injunction than the mere use of water, whether mineral or indifferent, hot or cold. It means that the sufferer is to leave his usual place of abode, and the climate which may perhaps have been instrumental in working him ill; to forsake the numerous causes of

mental worry and bodily fatigue which may be connected with his occupation or his family cares; to bid adieu for a while to the cook--good, bad, or indifferent--who perhaps has tickled his palate to the ruin of his stomach, and the cellar which has daily furnished those wines which, gravitating to the toes, have necessitated the big boot and the stout staff; to turn his back for a season on all that is implied in the words “good society,” and exchange all these for something else. Whether that exchange will be beneficial or otherwise will depend upon the knowledge of the patient possessed by the adviser--knowledge, not only of his constitution and his ailments, but of his pocket and his inclinations. The man of cultured mind, like Sir Francis Head, whose diary of life at Langen Schwalbach forms so charming a volume, who is able to find amusement in the contemplation of human nature, or of natural phenomena, who

“Finds tongues in trees, books in the running brooks, Sermons in stones, and good in everything;”

whose resources are within himself, will find his recreation everywhere, and provided the place to which he is sent be wholesome, he will get all the benefits which are derivable from change of scene and air. It would be cruel and useless, however, to send the votary of pleasure to a resort where art provides nothing for the amusement of the guests, and equally useless to condemn a man accustomed to a simple country life to mingle all day long in a fashionable crowd, intent on artificial joys. There is no doubt that on the Continent the arrangements for the comfort and amusement of guests visiting a bath are more perfect than they are in this country; and the invalid who crosses the “silver streak” which separates us from the rest of Europe will find a greater difficulty in continuing in that groove of existence which, mayhap, has been prejudicial to him. On the other hand it must not be forgotten that to many persons foreign travel is exceedingly distasteful. There are many who know no language but English, and whose prejudices are so in favour of English manners and customs that they cannot be induced to fall in with Continental habits. We remember seeing a gentleman at a fashionable bath abroad, whither he had been sent for the relief of his gout, who was evidently most grievously bored by the process of cure. He associated with none, dined alone, and day after day partook, in a solitary corner of a restaurant, of a fried sole, a mutton chop, stilton cheese, and a pint of dry sherry.

A man who thus carries his own atmosphere with him, and who persistently goes against the stream, wrapping himself in insular prejudice, will find very little benefit in foreign travel or in change of scene.

There are few bathing places, either in this country or on the continent, where the drinking of water does not hold a position in the “cure” which patients are prepared to undergo, at least equal to the bathing. Drinking of mineral water and bathing go everywhere hand in hand, although at different spas the one or the other method of treatment will be found to preponderate. With the drinking of water we have, as we have before said, nothing, at present, to do; but, although in theory it is easy enough to separate the effects of bathing from those of water drinking, it is found less easy to do so in practice.

What Epidaurus was in the palmy days of Greece when thousands flocked to seek health and recreation at its renowned temple of Æsculapius; what Baiæ was to the luxurious Romans who came to its famous warm springs, impelled equally by fashion and disease; what Bath was when at the zenith of its popularity; such is the Badstadt of the present time. The throng in the town in the height of the season (July and August) is very great, and the crowd of visitors is as fashionable as it is cosmopolitan. Here are German petty potentates, Russian princes, English nobles, and wealthy Americans, by scores; and there can be no doubt that the charm of a fashionable watering-place like this is by many found in the fact that all men are, more or less, upon an equality where there is only one fountain from which they all must drink, and one source in which they all must bathe. The duke, whose pedigree reaches back to the Dark Ages, must equally wait his turn with the merchant whose wealth is of yesterday’s creation; and in waiting-rooms of bath-houses, at tables-d’hôte, and at the brink of healing fountains, blood which is of the bluest tint comes into very close contact with that which is of other shades.

The town of Badstadt is most charmingly situated upon an elevated plateau, some 600 or 700 feet above sea-level, and in the midst of delightful scenery, which is to be found among the mountains which surround the town on every side but one. The mountains are clothed to their summits with pine, and these pine woods are amongst the most favoured places to which the “cure guests” of Badstadt resort. In the depths of the pine forest there is always, even in the hottest day, a refreshing coolness and an invigorating aroma, and to wander here with a book, or a companion and some luncheon, is a most pleasant method of killing the sultry hours of noon. One day is pretty much like another at Badstadt, although here is just sufficient variety to obviate any feeling of irksomeness. What will the fashionable Londoner think when, at six o’clock in the morning, he finds that he can no longer sleep because every one in the hotel is already stirring? There is nothing for it but to go with the stream, to get up and dress oneself (in the nattiest of lounging coats if of the male sex, in the most bewitching of light summer costumes if of the female), and away with the rest of the world to drink the water at the Betsinda Quelle, the most fashionable spring in all Europe. It is not seven o’clock, we

are nearly four hours earlier from our beds than is our wont, the fresh morning air is bracing and delightful, the sun has not yet dissipated the dew, and yet the whole world of Badstadt is alive. Here beneath the trees of the Cur-garten are some 2000 or 3000 fashionables, all sauntering and talking, so that the hum of conversation is audible at a great distance, and forms a not inharmonious obbligato to the music of the orchestra in the Kiosk which is hard by. Few prettier sights than this can be seen or imagined. The avenue of limes offers in either direction, a most attractive vista; the sunlight comes glinting through the fret-work of leaves upon the gravel, creating little dancing shadows and lighting up the many and varied colours of the ladies' costumes; the roses in the neighbouring flower-beds lend their bright colours to give the eye additional pleasure, while their aroma tickles yet another sense; and the ear is pleased by a performance, by an excellent band, of the best compositions of the best masters. The focus, as it were, of all this gaiety is the Betsinda Quelle, and most of the guests may be seen to advance to the edge of the health-giving fountain, which is enclosed in a sunken ornamental basin, and tender a glass for the prescribed dose of the water. The water contains a good deal of common salt and not much else, and is nearly as nasty as sea-water; but it is surprising to see how methodically and with how little fuss the _habitués_ get through their allotted portion. The physician probably said to this or that patient: "You are to drink two glasses of the Betsinda, and you are to walk for twenty minutes after each glass;" and one may see hundreds, who, watch in hand, carry out their directions to the letter. He who frequents the springs regularly will soon recognise that, morning after morning, the same people arrive at the same time, consume the ordained number of glasses and disappear. The majority of these, it must be confessed, do not appear to be very ill, although here and there may be seen some whose faces bear evidence of disease, whose limbs are crippled with gout or rheumatism, and who accomplish the morning promenade with the aid of sticks or crutches, or, in place of walking, perform a cruise upon wheels in an invalid chair. Badstadt is above all things a pleasant place, and everything has been done that money can accomplish to charm the senses and make life agreeable. The notables of society are its chief patrons, and there can be no doubt that the majority of the visitors come here for the season, strange as it may seem, that they may meet the same persons that they have been meeting earlier in the year in the "Row," upon the lawn at Goodwood, or in the salons of Paris. "Good Society," by which term we mean those wealthy and noble individuals who prefer an artificial to a natural existence, annually makes itself ill by attending too assiduously to its duties. Having risen from its bed some eight hours later than the sun; having dined largely every night on a mixture of all that is rich and unwholesome; and having freely partaken with its meals of all manner of liquids other than water; having danced night after night in rooms reeking of androsmia (which is polite Greek for the "smell of humanity"), and rendered stifling by wax lights or gas; having retired to bed just before sunrise, and, in short, having shown an unaccountable dislike for the light of heaven, and an equally unaccountable preference for those wretched and poisonous substitutes which our dark northern latitudes have rendered necessary, Society takes itself to Badstadt to try the experiment of undoing all the mischief which has been brought about by its own folly. The morning promenade is an integral and most important factor in the Badstadt cure; and the potations of salt water have not only a cleansing and "alterative" effect, but they damp the appetite a little, and help to prevent Society from taking too much food. The Badstadt breakfasts are very simple repasts; one cup of coffee and delicious bread, butter is not allowed except to a favoured few who can find some good excuse for being treated exceptionally; eggs are a luxury which the local doctors regard with manifest dislike; and as for the chops, devilled kidneys, fried bacon, bits of fish, cold grouse, dabs of marmalade, and other "necessaries," which Society takes at home, they are not to be thought of.

After the frugal repast of coffee and bread has been disposed of, a novel or the newspaper serves to wile away an hour or so, and then the all-important time for bathing is at hand. The baths are of all kinds here, and are made of mineral water or simple water, according to the fancy of the patient or the prescription of the "Bad-artzt" (as the local practitioners are called). Both before and after the bath the patient scrupulously observes the directions of Hippocrates, and is careful to keep both body and mind in a state of complete rest, so that sufficient power may be left to thoroughly digest the mid-day meal, which the English call luncheon and the Germans dinner. With those who are wise this meal is as simple as it can be made, and consists of a portion of braised or stewed meat, vegetable, and some simple farinaceous pudding. As for wine, half a bottle of weak Rhenish or Moselle is all that is allowed; visitors being especially warned to avoid even the stronger of the Rhenish wines, such as Rüdesheimer or Steinberger, vintages, towards which those English who have well-filled pockets are very apt to gravitate. In the middle of the day the Germans habitually take their heartiest meal, and towards one o'clock a stream sets in the direction of the 'Adler' or the 'König Wilhelm,' where possibly the same sixty or eighty persons meet day after day at the table d'hôte. These repasts are often regulated by the advice of the local physicians, and one great advantage of patronising them lies in the fact that it is impossible to get viands which are at all difficult of digestion, or which are likely to disagree with the waters. After dinner comes an open-air concert beneath the trees, in the garden of the Cur-haus, and the process of digestion is allowed to complete itself in the fresh air, while the ears are tickled by the sound of first-rate music.

For those who wish to read, the salons of the Cur-haus are always open, and every journal of note which is published in San Francisco or St. Petersburg, or any of the intermediate cities, is freely placed at the disposal of the guests. When we say freely placed we mean freely to those who pay the “Cure tax,” a small sum which is levied from all who come to participate in the enjoyments which are provided by the Badstadters for their guests.

The afternoon is devoted to a drive or a leisurely walk to the neighbouring forest; and at six o’clock the English return to dine; and at seven or half-past seven the Germans come home to supper. The _cuisine_ at the Cur-haus, being modelled on Parisian lines, attracts many of the guests who cannot submit to the Spartan _régime_ of Badstadt in its entirety; and there may be seen occupying the small tables on the terrace snug parties of three or four having just one of those very “little dinners” which have been the main cause of that indisposition which has made a “cure” necessary. The evenings are usually occupied by promenading in front of the Cur-haus, and occasionally a display of fireworks, or an illumination is provided. There is a theatre too, at which the best actors and singers appear during the season; but these after-dinner amusements are mostly of short duration, and, as a rule, Badstadt retires to bed not later than ten o’clock.

Thus it will be seen that life at a bath is spent largely in the open air, that the amusements and the routine of each day are regulated mainly with a view to health, that the diet is restrained within the limits of prudence, and that “early to bed and early to rise” is a wise maxim, to which a rigid adherence is expected of all who come in quest of health to the baths and springs of Badstadt. It is not surprising that the Badstadt waters should be regarded as a panacea throughout the whole of Europe.

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